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AN INVESTIGATION OF THE INTERACTION OF
PRINTED AND SPOKEN WORDS

Thesis for the Degree of Ph. D.

MICHIGAN STATE UNIVERSITY

Keith D. Cox

1965

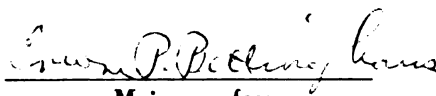


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AN INVESTIGATION OF THE INTERACTION
OF PRINTED AND SPOKEN WORDS

By
Keith D. Cox

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ABSTRACT

AN INVESTIGATION OF THE INTERACTION
OF PRINTED AND SPOKEN WORDS

by Keith Cox

This study investigated the hypothesis that subjects would learn a list of foreign words in fewer trials if printed and spoken forms of the words were presented together instead of singly. Paired-associate and serial learning techniques were used.

This hypothesis assumes that the referential meaning of the printed word is mediated through the spoken word. Experimental evidence supporting this may be found in studies of vocalization and sub-vocalization in good adult readers. Linguistic evidence comes from sound/symbol correspondences. Each letter in the printed word stands for a sound segment of the spoken word.

The variables studied were the contrast between printed and spoken words and between audio and visual modes of presentation. These variables are significant in second language learning. They are of special concern because of the extensive development of the oral "audio-lingual" method and of the language laboratory.

In the experiment Ss were asked to learn a list of eight foreign words, printed in arbitrary symbols. The experiment was conducted in two phases. In Phase I Ss learned to read the words. In Phase II Ss learned to repeat the words.

In Phase I Ss were given three types of trials: reading training, reading practice, and a test of reading proficiency. The major independent variable was reading training, varied four ways: letter training, word training, phonetic training, and non-phonetic training.

It was hypothesized that Ss with phonetic training would learn to read in fewest trials. This hypothesis was not supported by evidence, which showed a non-significant advantage favoring word training (simple conditioning trials).

In Phase II SS learned to repeat the words as items in a serial list or as response members in a paired-associate list. It was hypothesized that the PA list would be learned in fewer trials and with fewer errors than the serial list. A slight non-significant advantage favored the PA learning.

Presentation was either audio alone or combined audio-visual. It was hypothesized that Ss would learn in fewer trials and with fewer errors under the combined presentation. Instead, the audio alone presentation proved most effective.

Part of the Ss receiving the combined audio-visual presentation had been given phonetic training. It was hypothesized that they would learn better than those without phonetic training. No significant differences were found.

It was concluded that under the conditions of this experiment phonetic training does not seem to be significant in learning to read or in memorizing verbal materials. Further research with more extensive materials and extended periods of time is suggested.

It was concluded that an audio alone presentation of verbal materials was more effective than a combined audio-visual presentation. Further research on the phonetic significance of the visual symbols is suggested.

It was concluded that verbal materials are learned equally well serially or as paired associates. A critical area for further research is the nature of the stimulus in serial learning and the total amount of learning involved.

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"No man is an island," and certainly no man's work stands alone. "I am a part of all that I have met"; the concepts developed in this study and their implementation reflect the views and the insights I have acquired during the past several years from members of the Department of Communication and the College of Education.

Specifically, I would express appreciation to Dr. David Berlo, Chairman of the Department, who introduced me to a new way of looking at the world; to Dr. Erwin Bettinghaus, who insisted that this was the right way of looking; and to Dr. William Stellwagen, who kept my nose to the calculator until I was willing to look at it that way.

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CHAPTER I

RATIONALE AND HYPOTHESES

The purpose of this investigation was to determine to what extent printed words interact with spoken words in a foreign language learning situation. The principal hypothesis investigated was that Ss would learn a list of foreign words in fewer trials if both the spoken and the printed forms of the words were presented simultaneously. Both serial and paired-associate learning techniques were employed in the study. A description of these two learning techniques will be found in Appendix R.

Two aspects of the hypothesized interaction need to be noted. One is the relationship between each of the two forms of the word and the meaning or referent. The other is the correspondence between the sounds of the spoken word and the letters of the printed word.

Fig. 1 shows this set of relationships.

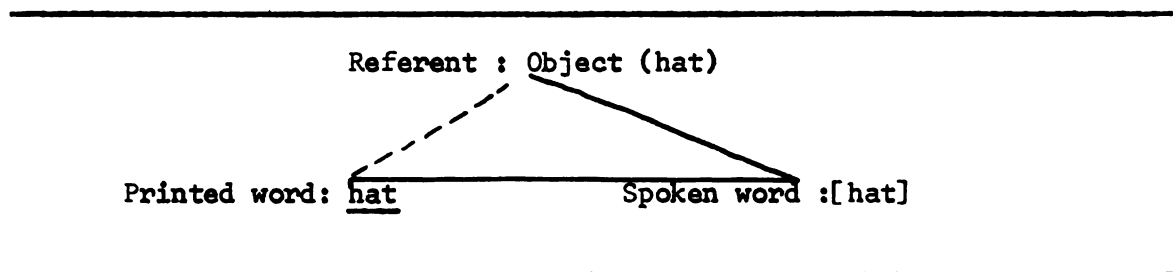


Fig. 1. Relationships between printed and spoken forms of a word and its referent

Certain aspects of these three relationships are of special significance. (1) According to linguistic theory, the spoken word is understood to stand for the referent. (2) In any system of writing, alphabetic or non-alphabetic, the printed word stands for the spoken word. (3) Many theorists, both linguistic and psychological, would tend to believe that the meaning of the printed word may be mediated through the spoken word.

Evidence supporting this last suggestion may be found in the study of lip movements by native speakers during silent reading. McDade (1937) failed to establish a direct relationship between the printed word and the referent without such mediation. He had taught elementary students in Chicago to read by a completely non-oral method. However, Buswell (1945) reported that McDade's students used lip movements in reading by the time they reached the sixth grade, almost as much as students taught by conventional oral methods.

More recently, Edfeldt (1960) reported that even good adult readers tended to initiate lip movement in reading under conditions of stress. McGuigan, Keller, and Stanton (1965) have also reported evidence in support of this. Vocalization or subvocalization appears to be present in much reading, even at the adult level.

Evidence for the relationship of the printed word to the spoken word is theoretical rather than experimental. The spoken word is composed of a series of sounds, just as the printed word is composed of a series of sounds, just as the printed word is composed of a series of letters. Yet the spoken word as a whole stands for the referent

as a whole. One part of the spoken word hat does not stand for one part of the object (hat). On the other hand, each letter, or cluster of letters, of the printed word hat does stand for one part of the spoken word hat. These one-to-one sound/symbol correspondences are sometimes spoken of as the alphabetic principle.

This alphabetic principle is basic to linguistic science. Bloomfield (1933) emphasized the fact that language is always oral, and that printed symbols are only a convention for recording and preserving speech. Bloomfield (1942) developed a system of reading instruction for his own children, based on this principle of sound/symbol correspondences. After his death, his materials were collected and expanded and finally published in book form by Barnhart (1961).

The examples of the implementation of the alphabetic principle cited above are drawn from native speakers of a language. This investigation, on the other hand, is concerned chiefly with second language learning. The variables to be considered are aspects of the above model that apply to learning a foreign language. In addition to the matter of sound/symbol correspondences, the contrast between audio and visual modes of stimulus presentation also seem to be significant.

Today much importance is attached in this country to communication in a second language. This can be seen in the current increase in students, teachers, and expenditures. Walsh (1965) reported that the percentage of high school students enrolled in foreign language courses climbed from 14% to 24% in a period of fifteen years. Hocking (1964) indicated that Illinois had 600 FLES (Foreign Language

in Elementary School) programs under way, with 22,000 elementary school children in Chicago enrolled in a foreign language program. Allen (1964) cited federal expenditures of over seven million dollars each year for the additional training of foreign language teachers. Locke (1965) reported that from six to eight thousand language laboratories were in operation by the end of 1964 in the secondary schools and colleges of the United States.

The language laboratory and the audio-lingual approach are the key to much of this increased interest (Faldman, 1964). Angiolillo (1947) noted the importance of aural-oral work in the war-time Army Specialized Training Program. Meras (1954) stressed the importance of the oral aspects of language in the direct method. Huebner (1960) listed speaking as a "prime essential in acquiring a foreign language." Mathieu (1961) and Childers (1964) both stress the need for an oral approach first. This is in sharp contrast to the grammar-translation method which was used almost exclusively before World War II (Carroll, 1953).

In spite of the emphasis on the audio-lingual method and the use of the language laboratory, criticisms have been levelled at this approach to language learning, criticisms which serve to highlight the variables studied in this investigation. Keating (1963) made a critical evaluation of the language programs in a number of schools in the metropolitan area of New York City. His findings were not particularly favorable to the use of the language laboratory. He reported that students who had been trained without the language

laboratory performed as well or better than those who had used it. Subsequent research by Lorge (1964) included a number of variables which had not been part of the Keating study. Her findings were favorable to the use of the language laboratory, but they did not fully answer the questions raised by Keating.

Other areas of concern have been noted in regard to the use of the language laboratory. Hocking (1962) reported that a considerable number of students were developing foreign language speech pathologies when they were trained by the language laboratory and the purely audio-lingual method. Carroll (1965) goes on to say, "The audio-lingual habit theory . . . is no longer abreast of recent developments." Carroll does not cite research evidence in support of this statement, but earlier (Carroll, 1960) he had noted the need for sounder research in foreign language teaching.

The "audio-lingual habit theory" relies on the spoken word. It attempts to produce in the learner a set of purely oral habits which are not at all related to the visual form of the printed word. Carroll contrasts it with the "cognitive code-learning theory," which includes the printed word and is basically the old grammar-translation method. The variables being tested in this study are those that deal with this relationship between the spoken and the printed word.

Of the research reviewed for this study, very little deals with specific variables in the language learning process. Most of the research is of a more general type and has to do with the results of methods of instruction and comparisons of different approaches to foreign language learning. Scherer and Wertheimer (1964), for example,

compared the results of the audio-lingual method with a traditional grammar-translation course in beginning German. In response to Keating's (1963) findings, Lorge (1964) carried out a comparison of various methods and materials in both audio-lingual and grammar-translation courses. Cooper (1964) reported on some of the factors that might be used to predict success in foreign language study. Investigations such as these constitute the bulk of foreign language research.

Considering these facts, Carroll (1960) called for a stronger research basis to establish a sound policy for foreign language instruction. One type of such research has been studies of verbal learning procedures. Several studies in this category should be noted.

Studies of Verbal Learning

Experiments with verbal learning have identified some of the variables pertinent to foreign language learning. Among these have been studies contrasting audio and visual presentations of verbal learning materials. A number of studies have had Ss learn material in one modality and relearn it in the other. Lifton and Goss (1962) found that stimulus materials presented orally were both learned and relearned in fewer trials than stimulus materials presented visually. Pimsleur (1961) also found faster learning with an oral presentation of simulated foreign language words as stimulus items in a paired-associate experiment. Postman and Rosenzweig (1956) reported positive transfer from visual to audio presentations. Weissman and Crockett (1957) reported positive transfer from audio to visual. Hocking (1962)

indicated positive transfer from one modality to the other, but faster relearning in the same modality. All of these studies indicate positive transfer effects from one modality to the other. Investigations of audio and visual presentations of reading materials in English have also added depth to this area of research. (Sebesta, 1964; Budoff and Quinlan, 1964; Katz and Deutsch, 1963).

Other experimenters have made a presentation using both modalities together. VanMondfrans (1963) compared the results of presenting verbal learning materials in each of the modalities alone, with a compound audiovisual presentation. He found no advantage for the latter. At higher speeds of presentation, the two modalities even seemed to interfere with each other. He explained this in terms of Broadbent's model (1958) which describes the perceptual system as a single channel receptor, able to process material from only one sense modality at a time.

Travers (1964) used both modalities simultaneously to present literary materials for reading. The audiovisual presentation showed no advantage over the single modes at slower speeds. At higher speeds, the Ss often blocked out one channel by covering the eyes or ears. This would seem to indicate that the Ss themselves preferred the single modality presentation. At the same time, results were superior to the single channel reception. Travers concluded that each S was choosing the channel that was most efficient for him.

The audio-visual presentation was a type of compound stimulus. Travers' conclusion was that each S selected only that part of the total stimulus which was most effective for him. Other experimenters have

identified similar examples of cue selection when the compound stimulus was presented in a single modality, e.g., a trigram and a word (Spear, Ekstrand, and Underwood, 1964).

Additional experiments have used color as one of the elements in a compound stimulus. One of the earliest and best known of these was carried out by Weiss and Margolius (1954). They presented each pair of items on a colored card. Later they carried out a set of retention tests, in which some of the groups were given only the verbal stimuli and other groups the color stimuli. Retention was best for the group which was given the compound stimuli, second best for the group which received the color stimuli alone. This might indicate the effectiveness of the compound stimulus, but it might also indicate that each subject was selecting that part of the total stimulus which was most effective for him.

Other experiments in this general area have been carried out by Underwood, Ham, and Ekstrand (1962), Hill and Wickens (1962), Jenkins and Bailey (1964), and Spear, Ekstrand, and Underwood (1964).

Saltz (1963) used a design which included color in both learning and test trials under some conditions and in only one under other conditions. He found learning most efficient when color was present in both, least efficient when it was present in the learning trials but not in the test trials. He also found that if color was present in the test trials and absent in the learning trials, results were better than when no color was used in either set of trials.

Stimulus compounding has been investigated largely in the paired-associate learning situation. However, Young and Clark (1964)

investigated the possibility that in serial learning a compound stimulus occurs. They suggested that the compound was made up of several of the items preceding each response. Their results did not give firm support to this hypothesis. Rather they indicated that Ss were using position as a cue. Schulz (1955) and Lippman (1963) also identified position as the functional stimulus in serial learning. Ebenholtz (1964) found that sequence as well as position may serve as a cue.

Several conclusions stand out in regard to the nature of the stimulus in verbal learning. (1) It may be presented in either the audio or the visual sense modality. (2) It may use both modalities together as a compound stimulus. (3) A compound stimulus may also be presented in a single modality, e.g., a color and a word are both visual. (4) It may be that Ss tend to select part of the compound stimulus as the functional stimulus. (5) Finally, it may be that the stimulus in serial learning is position or sequence or a combination of both.

This verbal learning experiment was designed to investigate some of the variables suggested above. Subjects were asked to memorize eight words in a foreign language, using either paired-associate or serial learning techniques. The words were printed in a set of arbitrary phonetic symbols. Both audio and audiovisual presentation of the words was used. The purpose was to investigate three aspects of the verbal learning situation: (1) the value of phonetic training; (2) the value of a compound audiovisual presentation; and (3) the contrast between serial and paired-associate learning.

The experiment investigated the following hypotheses:

1. Ss will learn to read the list of foreign words in fewer trials and with fewer errors if they are given phonetic training, that is, if they are taught what spoken sound is represented by each printed letter.
2. Ss will learn to repeat the list of foreign words in fewer trials and with fewer errors if they are given phonetic training.
3. Ss will learn to repeat a list of foreign words in fewer trials and with fewer errors if both the spoken and the printed forms of the words are presented simultaneously.
4. Ss learning under paired-associate learning techniques will learn in fewer trials and with fewer errors than those using serial learning techniques possibly because of stimulus specificity in PA as opposed to serial techniques.

Specific Rationale

Hypothesis I. Ss will learn to read the list of foreign words with fewer trials and with fewer errors if they are given phonetic training.

The theoretical background for this lies in the sound/symbol correspondences which have already been noted. Research evidence may be found in studies of methods of reading instruction. Agnew (1939) reported that third grade students who had received thorough training in phonics had better mastery of reading skills than those who had not. Gurren and Hughes (1965) have summarized research studies on the value of phonetic training, beginning with Agnew's study and continuing to the present time. Of the 22 studies they consider statistically

rigorous, 19 favor intensive phonetic instruction in beginning reading. Bishop (1964) reported an experiment in which Ss were asked to learn to read a set of Arab words. Part of the Ss were given letter-training in which they learned to associate letter sounds with printed symbols. Other Ss were given word training in which they learned to associate whole spoken words with whole printed words. Results indicated that letter training was superior to word training.

Hypothesis II. Ss will learn to repeat the list of foreign words with fewer trials and with fewer errors if they are given phonetic training.

This is derived from Hypothesis I on the assumption that if Ss can read the words better, they can learn to repeat them better. Research evidence is lacking in this area, but there is strong theoretical evidence. Marty (1962) and Pimsleur (1964) both stress the fact that if a student is not given the spelling for a spoken word, he will create his own spelling. Pimsleur (1964) made use of this principle in his investigation. He used low-discrepancy words, which are spelled as they would be pronounced according to English pronunciation standards. For example, the spelling oh for the sound [o] would be a low discrepancy word, while the French spelling eau for the same sound would be a high-discrepancy word. Likewise hoot in English would be low discrepancy, while the German spelling hut for the same sound would represent high discrepancy.

Pimsleur found that learning of paired-associates took place with fewer errors with the low-discrepancy words. One might interpret this to mean that the words are learned more readily if the Ss understand the sound/symbol correspondences that are being used.

Hypothesis III. Ss will learn to repeat a list of foreign words in fewer trials and with fewer errors if both the spoken and the printed forms of the words are presented simultaneously.

Evidence for this may be derived from several sources: (1) theory, (2) sound/symbol correspondences, (3) transfer effects from one sense modality to the other, and (4) stimulus compounding. Linguistic evidence has already been cited (Bloomfield, 1933, 1942) to show that the printed word symbolized the spoken word. Research studies indicate the value of phonetic training (Gurren and Hughes, 1965), which allows the reader to utilize both the spoken and the printed forms of the word. Transfer studies (Postman and Rosenzweig, 1956; Weissman and Crockett, 1957) show that one modality supports the other in relearning. Studies of compound audiovisual presentations by Travers (1964) showed better results than with a single modality. Other types of stimulus compounding, particularly with color, have also indicated superior results.

Hypothesis IV. Ss learning under paired-associate learning techniques will learn in fewer trials and with fewer errors than those using serial learning techniques.

Research shows that there is no evidence of transfer from one type of learning to the other. Young (1963) found no transfer from paired-associate to serial learning. Erickson and Young (1963) found that the direction of transfer was determined by the degree of association between the items. Jensen found that transfer from paired-associate to serial would occur if he established a set in favor of such transfer. He suggests that the two types of learning use different techniques.

The nature of the stimulus in serial learning is hard to identify. Evidence has already been cited (Ebenholtz, 1964; Schulz, 1955) which identifies both sequence and position as possible stimulus items. On the other hand, the stimulus in paired-associate learning is clear-cut and apparently more stable. This would seem to make it more likely that subjects will learn in fewer trials under that procedure, given low meaningfulness in the serial list.

The purpose of this experiment was to investigate some of the variables that operate in a foreign language learning situation. It was hypothesized that Ss would learn foreign language materials more readily if they knew the phonetic meaning of the symbols, that is, if they knew what sound each symbol stood for. It was also hypothesized that the materials would be learned more readily if they were presented visually and audially together. Still another hypothesis was that the use of paired-associate learning techniques would be more effective than serial learning patterns. The following procedures were designed to test the above hypotheses.

CHAPTER II

PROCEDURE

This experiment was designed as a verbal learning experiment to compare serial (S) and paired-associate (P) learning under three different modes of presentation: audio (A), audio-visual (AV), and audio-phonetic (AP). This produced six experimental groups. Fig. 2 shows the distribution of these groups in the cell matrix.

<u>Type of Learning</u>	<u>Mode of Presentation</u>		
	Audio	Audio- Visual	Audio- Phonetic
Serial	Group SA	Group SAV	Group SAP
Paired-Associate	Group PA	Group PAV	Group PAP

Fig. 2. Distribution of groups in cell matrix

The experiment was conducted in two phases. In Phase I the subjects were taught to read the foreign words printed in a special alphabet. The dependent variable was the number of trials required to learn to read the words. Four training procedures were used and analysis was by means of a simple randomized analysis of variance.

In Phase II, which came two weeks later, Ss were asked to memorize the words in one of two ways: (a) as items in a serial learning list, or (b) as response members in a paired-associate list, with

"meaning" as the stimulus member. Each of the variables, serial techniques and paired-associate techniques, was varied in three ways to produce a 2 X 3 factorial design. The dependent variable was the number of trials required to memorize the list to a criterion of two perfect recitations of the list.

Subjects were members of a beginning psychology class at Michigan State University who participated in the experiment to meet a course requirement. Ss were assigned randomly to the different treatments of the research design.

Presentation of the verbal learning materials was made by means of an MTA 100 Teaching Machine and a Sony Photo-Sync tape recorder which could be synchronized with the teaching machine. The visual presentation was made on a continuous paper sheet on the teaching machine. The machine was thus able to repeat the list of words an indefinite number of times. The audio presentation was made by the tape recorder, which also activated the teaching machine and advanced it to the next presentation.

Placing of words and synchronization on the tape recording was timed by means of a spring-powered metronome, set to beat at .75 second intervals. Timing of stimulus item and/or reinforcement was 1.5 seconds for each presentation. Response period for both types of learning was 3 seconds in length.

Phase I: Reading Training

Familiarization Training Trials. Before learning to read the foreign words, the subjects were given a series of five training trials to familiarize them with the sounds of the words and the symbols used

to represent those sounds. Four types of training trials were used:

- (1) Letter training, (2) Word training, (3) Phonetic training, and
(4) Non-phonetic training. A description of each follows.

(1) Letter training. Each letter was presented visually, followed by its pronunciation. Then it was presented again, and the subject repeated it aloud. Stimulus presentation was 1.5 seconds; response period was 3 seconds. This was done for each of the eight letters, and the list was repeated for a total of five times. The pattern for the letter training trials is presented in Fig. 3. The five letter training trials were followed by five reading practice trials as outlined in Fig. 4. The full schedule for both types of trials is found in Appendix B. Verbal directions are given in Appendix C.

Visual	Audio	Oral
	"ah"	....
	....	"ah"
	"ee"	....
	....	"ee"

Same procedure to be followed for each of the eight syllables in the list.

Fig. 3. Letter training trials using letters in an artificial alphabet as stimulus items

(2) Word Training. Each word was presented visually, followed by its pronunciation. Then it was presented again and the subject repeated it aloud. Period of stimulus presentation was 1.5 seconds; response period was 3 seconds. This was done for each of the eight words in the list, and the list was repeated for a total of five times. These same word practice trials were then repeated five times as reading practice trials. The pattern for these trials is given in Fig. 4. The full schedule for these trials is found in Appendix D. Verbal directions are given in Appendix E.

Stimulus		Response	
Visual		Audio	Oral
 		dimi	....
		....	dimi
 		muga	....
		....	muga

Same procedure to be followed for each of the eight words in the list.

Fig. 4. Word training and reading practice trials using words printed in an artificial alphabet as stimulus items

(3) Phonetic Training. Each letter was presented visually, with a description of its appearance, followed by its pronunciation. Then it was presented again and the subject repeated it aloud. The period was 3 seconds. This was done for each of the eight letters, and the list was repeated for a total of five times. The five phonetic training trials were followed by five reading practice trials, as outlined in Fig. 4. The pattern for the phonetic training trials is given in Fig. 5. The full schedule for these trials is found in Appendix F. Verbal directions are given in Appendix G.

Stimulus		Response
Visual	Audio	Oral
	The square stands for the sound of "ah"	....
		"ah"
	The triangle stands for the sound of "ee"	....
		"ee"
	The circle stands for the sound of "oh"	....
		"oh"
	The open square stands for the sound of "oo"	....

Fig. 5. Phonetic training trials using letters in an artificial alphabet as stimulus items

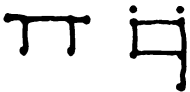
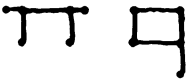
(4) Non-Phonetic Trials. Each letter was presented visually, with a description of its appearance. It was followed by the sound of one of the letters, but not necessarily the one that belonged with the visual symbol. A different sound was used each time the letter appeared. Each time, the subject repeated the sound he had just heard. The period of stimulus presentation was 1.5 seconds; the response period was 3 seconds. This was done for each of the eight letters in the list, and the list was repeated for a total of five times. The five non-phonetic training trials were followed by five reading practice trials, as outlined in Fig. 4. The pattern for the non-phonetic training trials is given in Fig. 6. The full schedule for these trials is given in Appendix H. Verbal directions are given in Appendix I.

Stimulus		Response	
Visual	Audio	Oral	
	One of the letters is a square	"ee"	....
	.....	"ee"	
	One of the letters is a triangle	"oh"	....
	.....	"oh"	
	One of the letters is a square	"oh"	....
	.....	"oh"	

Fig. 6. Non-phonetic training trials using letters in an artificial alphabet as stimulus items

Reading Practice Trials. The second step in the training procedure was the reading practice trials. Each word was presented visually, followed by its pronunciation. The word was then presented a second time and the subject was asked to repeat it aloud. Timing was the same as for the other practice trials. This was done for each of the eight words in the list, and the list was repeated for a total of five times. The pattern for the reading practice trials has already been given in Fig. 4. The full schedule for these trials is given in Appendix D. Verbal instructions are given in Appendix E.

Reading Proficiency Test Trials. The third step in the training procedure was reading test trials. Each word was presented visually, and the subject was asked to pronounce it. Then the word was presented a second time, followed by its pronunciation. Response period was 3 seconds; reinforcement period was 1.5 seconds. This was done for each word on the list and the list was repeated until the subject reached a criterion of two perfect recitations of the list. The list was presented up to a maximum of 15 times. If the subject did not reach criterion in 15 trials, he was given an arbitrary score of 15 trials. The pattern for the reading test trials is given in Fig. 7. The full schedule for these trials is given in Appendix J. Verbal instructions for the reading test trials are given in Appendix K.

Stimulus		Response	
Visual		Audio	Oral
		....	dimi
		dimi	....
		....	muga
		muga	....

Same procedure to be followed for each of the eight words in the list

Fig. 7. Reading Proficiency Test Trials using words in an artificial alphabet as stimulus items

Phase II: Serial and Paired-Associate Learning Procedures

Serial Learning. Two weeks later Ss returned to complete the experiment. Each subject was given a list of the words and symbols and asked to match them with their phonetic spellings. The purpose of this test was to evaluate the effectiveness of the training procedures and to re-acquaint Ss with the symbols and words used in the foreign language materials. Also included were several questions of an introspective nature regarding experimental procedures. A copy of the test will be found in Appendix L.

Half of the subjects, chosen at random, were then asked to memorize the list of eight words in serial order. This was the procedure:

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The list of words was repeated in order twice. Then each word was presented, followed by a pause, during which the subject was to give the next word. The tape then pronounced the word and the procedure was repeated for each word in the list. The list was repeated until the subject reached a criterion of two perfect recitations. Ss who did not reach criterion in 30 trials were given an arbitrary score of 30 trials. The pattern for the serial learning trials is given in Fig. 8. The full schedule for these trials is given in Appendix M. Verbal instructions were given the Ss as part of the tape recording. These are presented in Appendix N.

Audio Presentation		Audio-Visual Presentation			
Audio	Oral	Visual		Audio	Oral
bomi	....	b ∇		bomi	....
....	mada	.....		....	mada
mada	....	□ □		mada	....
....	dimi	.....		....	dimi
dimi	....	◁ ∇		dimi	....

Same procedure to be followed for each of the eight words on the list.

Fig. 8. Serial learning trials using words in an artificial alphabet as items in the series

Paired-Associate Learning. Half of the Ss, chosen at random, were asked to memorize the eight words as response members in a paired-associate list. Two different serial orders of the list were prepared, and these were alternated to avoid serial position effects. This was

the procedure: First the two series of words, with their meanings, were presented to the subjects. Then each meaning was presented singly and the S was asked to respond with the correct word. Then the meaning was shown again, and the tape pronounced the correct response. For the audio-visual presentations, the visual symbol accompanied the second appearance of the meaning. Response period was timed at 3 seconds; reinforcement at 1.5 seconds. The list was repeated until the S reached a criterion of two perfect recitations of the list. If the S did not reach criterion in 30 trials, he was given an arbitrary score of 30 trials. The pattern for the paired-associate learning trials is given in Fig. 9. The full schedule for these trials is given in Appendix O. Verbal instructions are presented in Appendix P.

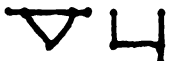
<u>Audio Presentation</u>			<u>Audio-Visual Presentation</u>		
Visual	Audio	Oral		Audio	Oral
corn	....	dimi	corn	.....	.... dimi
corn	dimi	....	corn		dimi
tree	....	migu	tree	.....	.... migu
tree	migu	....	tree		migu
Same procedure to be followed for each of the words on the list.					

Fig. 9. Paired-associate learning trials using words in an artificial alphabet as stimulus items

Stimulus Materials

The learning materials were eight words derived from Kirundi, a Bantu language of central Africa. The words were shortened and

modified to give them phonetic regularity for the purpose of the experiment. The meanings were adjusted to control the semantic range of the stimulus members of the paired-associate list. Finally, each word was transcribed by means of a set of arbitrary symbols which had been assigned phonetic meaning. Fig. 10 gives the list of words with their meanings and phonetic transcriptions. Appendix A gives a list of the words in sentence context, showing the phonetic and semantic modifications that were made.

Meaning	Word	Symbol
corn	dimi	Δ Δ
boy	muga	┐ ┐
pen	gado	□ □
cow	mada	┐ ┐
book	bida	Δ Δ
eye	bomi	○ ○
heart	guda	┐ ┐
tree	migu	Δ Δ

Fig. 10. Modified Kirundi words used in experiment with meanings and phonetic symbols

CHAPTER III

RESULTS

This experiment was designed to test four hypotheses regarding the relationship between printed and spoken words in a verbal learning situation. The experiment included a comparison of phonetic and non-phonetic training, audio and visual presentations, and paired-associate and serial learning techniques. Performance under the experimental conditions was measured by the number of trials required to reach a criterion of two perfect recitations of the list.

Several sets of data were accumulated. Tables showing the statistical treatment of each of these sets of data are given, along with a statement of the hypothesis being tested.

An analysis was also made of the results of several other relationships which seemed pertinent to the major hypotheses. Tables showing the statistical analysis of these relationships follow the treatment of the specific hypotheses.

Effectiveness of Phonetic Training in Aiding Reading

Hypothesis I stated: Ss will learn to read a list of foreign words in fewer trials and with fewer errors if they are given phonetic training--that is, if they are taught what spoken sound is represented by each printed letter. The data did not appear to support this hypothesis. Table 1 shows the means and standard deviations of the number of trials to criterion in learning to read the foreign words after four types of training. Table 2 shows the F-ratio for this data.

Table 1. Means and standard deviations of the number of trials to criterion in Phase I

Measure		Type of Training				
		Word Trning	Letter Trning	N. Phon Trning	Phon Trning	Total
Reading Trials to Criterion	Mean	6.77	9.18	9.71	9.72	9.13
		4.80	3.88	4.23	4.60	4.51
N		9	11	17	18	55

Table 2. Analysis of Variance of the number of trials to criterion in Phase I

Measure	Source of Variation	df	MS	F
Reading Trials to Criterion	Training Conditions	3	20.59	.99*
	Within (error)	51	20.75	
Total		54		

* $F_{.05} = 2.79$

Effectiveness of Phonetic Training in Aiding Learning

Hypothesis II stated: Ss will learn to repeat a list of foreign words in fewer trials if they are given phonetic training in learning to read the words. The data did not appear to support this hypothesis. Table 3 shows the means and standard deviations for two different learning measures after four types of training conditions.

Table 4 shows the F-ratios for both learning measures. A t-test was made to compare the number of correct responses made by Ss who were given word training with the number of correct responses made by Ss who were given phonetic training. Results of this test are shown in Table 5.

Table 3. Means and Standard deviations of two learning measures in Phase II

Measure		Training Conditions				
Learning Trials to Criterion	Mean	Word Trning 15.57	Letter Trning 18.30	N.Phon Trning 19.73	Phon. Trning 19.31	Total 18.69
	S.D.	7.34	5.08	5.78	5.52	5.98
Correct Responses 5 Trials	Mean	25.29	21.80	19.87	18.57	20.63
	S.D.	8.64	6.00	8.67	8.10	8.29
	N	7	10	15	16	48

Table 4. Analysis of Variance of the learning measures in Phase II

Measure	Source of Variation	df	MS	F
Reading Trials to Criterion	Training Conditions	3	30.38	.82*
	Within (error)	44	36.91	
	Total	47		
Correct Responses 5 trials	Training Conditions	3	81.00	1.18*
	Within (error)	44	68.45	
	Total	47		

* $F_{.05} = 2.82$

Table 5. Effect of word training and phonetic training on number of correct responses in five trials

Kind of Training	N	S.D.	Mean	t
Word training	7	8.64	25.29	1.723
Phonetic training	16	8.10	18.57	

Effectiveness of Compound Audio-Visual Presentation

Hypothesis III stated: Ss receiving a compound presentation in both audio and visual modalities in paired-associate and serial learning will learn in fewer trials than those receiving a presentation in a single modality. The data did not appear to support this hypothesis. Table 6 shows the means and standard deviations for the number of trials to criterion under single and compound presentations. Table 7 indicates that the F-ratio is not significant for this measure.

Table 6. Means and standard deviations of the number of trials to criterion in Phase II

Type of Learning		Mode of Presentation			
		Audio	Audio Visual	Audio Phonetic	Total
Serial	Mean	15.50	20.88	21.00	19.13
	S.D.	7.35	5.69	6.72	6.85
Paired-Associate	Mean	16.58	20.75	17.63	18.25
	S.D.	6.07	4.83	4.24	5.23
Total	Mean	15.94	20.81	19.31	18.69
	S.D.	6.53	5.10	5.70	6.04

Table 7. Analysis of Variance of number of trials to criterion using three modes of presentation in two types of rote learning

Source of Variation	df	MS	F
Mode of Presentation	2	99.75	2.85*
Type of Learning	1	9.19	.23**
Mode X Type	2	19.75	
Within (error)	42	34.96	
Total	47		

* $F_{.05} = 3.22$

** $F_{.05} = 4.07$

Hypothesis III also stated that Ss receiving a compound presentation would learn with fewer errors than those receiving a presentation in a single modality. The data did not appear to support this hypothesis. Table 8 shows the means and standard deviations for the number of correct responses in five trials under single and compound presentations. Table 9 shows a significant F-ratio for this measure, favoring the single rather than the compound presentation.

Table 8. Means and standard deviations of the number of correct responses in five trials in Phase II

Type of Learning		Mode of Presentation			
		Audio	Audio Visual	Audio Phonetic	Total
Serial	Mean	25.13	17.25	17.50	19.96
	S.D.	10.15	7.83	9.26	9.49
Paired- Associate	Mean	25.13	19.13	19.63	21.29
	S.D.	6.13	6.92	7.85	7.24
Total	Mean	25.13	18.19	18.56	20.63
	S.D.	8.10	7.20	8.37	8.38

Table 9. Analysis of Variance of number of correct responses in five trials in Phase II

Source of Variation	df	MS	F
Mode of Presentation	2	243.56	3.86*
Type of Learning	1	21.33	.32**
Mode X Type	2	5.40	
Within (error)	42	66.19	
Total	47		

*F_{.05} = 3.22

**F_{.05} = 4.07

Hypothesis IV stated: Ss using paired-associate learning techniques will learn in fewer trials and with fewer errors than those using serial learning techniques. The data did not support this hypothesis. Tables 6 and 8 show the means and standard deviations for both learning measures. Slight differences seem to favor paired-associate learning, but not significantly. Tables 7 and 9 indicate that the F-ratios are not significant for these two measures.

In addition to the total number of correct responses, the percentage of correct responses for each word and each position in the list were tabulated. Fig. 11 is a graph showing the results of this tabulation.

The serial list was presented with no inter-trial interval. The only clue to position came on the first trial at the beginning of the experimental procedure. Yet the words in the first half of the list were learned with fewer errors than the words in the second half of the list.

The paired-associate list used two different orders of presentation, to minimize the possibility of serial order effects. It was necessary for the Ss to shift manually from one order to the other, thus marking the initial position of each list. Combining the total number of correct responses for the equivalent positions in both lists, the percentage of correct responses for each position was determined. The graph shows no positional effects for the two paired-associate lists. This would seem to indicate that two different orders of the pairs were adequate to eliminate any such effects.

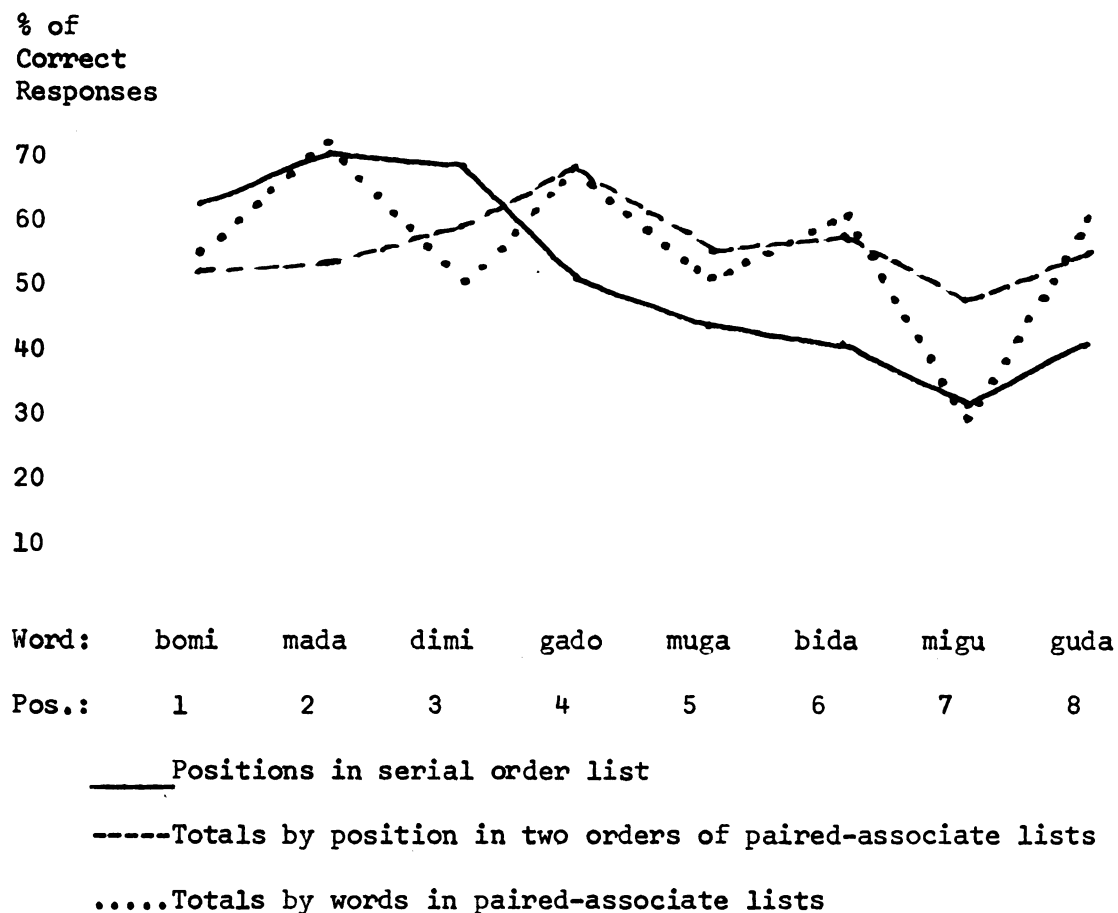


Fig. 11. Comparison of learning curves for serial and paired-associate learning

Other Relationships

An additional factor was measured by determining the effect of previous language training on learning trials to criterion. Many of the Ss had studied foreign language for three or four years in high school. A t-test was made to compare their scores with those of Ss who had studied little or no foreign language. Table 10 shows the results of this test.

Table 10. Effect of previous language training on the number of trials required to reach criterion

Amount of training	N	Mean	S.D.	t
Three or more years of a Romance language	27	16.74	5.35	2.69*
Less than three years of a Romance language	21	21.19	6.07	

*p < .01

Each of the two groups above was further subdivided into male and female subjects. The mean learning scores for each of the four groups were then tabulated. Table 11 shows the mean learning scores for each of the groups.

Table 11. Effect of previous language training on the number of trials required to reach criterion by male and female subjects

Measure	Female Considerable Language	Male Considerable Language	Female Little Language	Male Little Language
Reading Trials	6.18	<u>10.10</u>	10.40	<u>11.75</u>
Learning Trials	<u>17.00</u>	<u>16.30</u>	<u>21.00</u>	<u>21.25</u>
Correct Resp.	<u>22.53</u>	<u>22.70</u>	<u>17.20</u>	<u>18.35</u>
N	17	10	5	16

Table 11 shows that the female subjects with considerable language training learned to read in fewer trials than any other group. A t-test was made to compare their mean score with that of the male subjects with considerable language training. The results of this test are shown in Table 12, which indicates that the difference is significant. All the other differences between groups are based on amount of language training rather than the sex of subjects.

Table 12. Effect of sex differences on the number of trials required to learn to read words written in an artificial alphabet

Sex	N	Mean	S.D.	t
Female	17	6.18	3.94	2.48*
Male	10	10.10	3.69	

*p < .05

Summary of Results

Hypothesis I, which stated that phonetic training would aid in learning to read foreign language materials, was not supported. Hypothesis II, which stated that phonetic training would aid in memorizing foreign language materials, was not supported. Hypothesis III stated that a compound audio and visual presentation of verbal learning materials would be more effective than an audio alone presentation. This hypothesis was not supported. On the contrary, the audio alone presentation was found to be most effective. Hypothesis IV

stated that paired-associate learning techniques would be more effective than serial learning techniques. No significant differences were found, although a slight advantage favoring paired-associate learning was observed.

Several additional relationships were measured by the experimental procedures used. It was found that Ss with considerable previous foreign language training learned the verbal materials more readily than those without such training. It was also found that female Ss learned to read these materials more readily than male Ss with the same background, but did not memorize more readily than the male subjects.

CHAPTER IV

DISCUSSION OF RESULTS

This experiment was designed to investigate the effect of assigning phonetic value to a set of arbitrary symbols, which were used to transcribe a list of foreign language words. It was hypothesized that this would be helpful in two ways: (1) in learning to read the words written with these symbols; (2) in memorizing words written with these symbols.

Presentation of the words was made using the audio modality alone, or combining the audio and visual modalities. It was hypothesized that (3) the combined audio-visual presentation would be more effective in memorization than the audio alone presentation.

Learning techniques included both paired-associate and serial procedures. It was hypothesized that (4) paired-associate techniques would be more effective than serial techniques.

The results of the experiment did not support the hypotheses in this area. In interpreting the results we need to consider for each hypothesis why the findings were not significant in the direction expected, what conclusions the findings might suggest, and the types of further research which might be fruitful. The first of these concerns is in the area of reading, as specified by Hypothesis I.

Reading as Conditioning: Hypothesis I

In this experiment it was hypothesized that reading is a process of translating printed symbols into spoken sounds. Learning to read

would then seem to be a process of consciously learning what sound each symbol stood for, and consciously putting together these sounds. Instead, the data of this experiment suggest that learning to read is a process of conditioning whole spoken words to whole printed words.

Both experimental evidence and theoretical formulations recognize the place of conditioning in verbal behavior. Skinner (1957) identifies linguistic units as possible elements in a conditioning paradigm. He stresses operant conditioning as the mechanism by which the child learns to speak. He also recognizes imitative speech, or "echoic" behavior as a form of conditioning. Studies of verbal conditioning among adults (Krasner, 1958) have confirmed the theoretical position of Skinner.

Visual linguistic units such as printed words and phrases have also been suggested as elements in a form of conditioned behavior. Anderson and Dearborn (1952) indicate that learning to read represents a form of conditioned behavior. Smith and DeChant (1961) outline the process in greater detail. The same point is made by Osgood (1957) when he uses the process of reading as an example of the development of "assigns." In fact, this is the basis of the look-and-say or "whole word" method (Anderson and Dearborn, 1952), in which the visual form of the word is conditioned to the audio form and thus is able to substitute for it in a reading situation.

The data of this experiment suggest that learning to read is a process of conditioning whole spoken words to whole printed words. Two training conditions in particular led to this conclusion: word training in contrast to phonetic training. Word training consisted

of ten conditioning trials in which the sound of the foreign syllables was conditioned to the visual symbols of the foreign syllables.

Phonetic training included five practice trials in which the sounds of the alphabet were taught. These five practice trials were followed by five conditioning trials. Thus the ten conditioning trials of the word training group were matched with the five practice plus five conditioning trials of the phonetic training group.

Subsequently, the word training group learned to read in fewer trials than the phonetic training group, although the difference did not reach significance. It was observed by the experimenter that the Ss with phonetic training used several of the test trials for a phonetic analysis of the words. They did not begin to approach criterion until their responses became automatic, that is, until conditioning was nearing completion.

This would seem to suggest that reading instruction should stress conditioning. Phonetic training should perhaps be used for other purposes: stabilizing the conditioning, learning new words, storage of verbal material. Replications are needed to confirm the results of this experiment. Studies of transfer using an artificial alphabet could help determine the value of phonetic analysis in "figuring out" new words.

Learning a Foreign Language as Conditioning: Hypothesis II

It was hypothesized in this experiment that learning to read a foreign language phonetically would make it easier to memorize oral materials in that language. The data did not support this hypothesis.

On the contrary, they seemed to support the practice of the modern language laboratory, which is to present materials for oral learning before they are presented visually at all. This practice is carried to great length, for example, in materials such as those prepared by Morton (1960). It is further supported by such writers on foreign language instruction as Stack (1960), Huebner (1960), and Childers (1964).

The rationale of such a position has been that the learning of a foreign language should proceed in the same order as learning a native language: listening, speaking, reading, writing. This seems to overlook the concept that as each of the four communication skills is learned, it becomes part of the individual's linguistic technique. For the literate person, child or adult, a word is no longer simply an audio unit, it is also a visual unit. Marty (1962) points out: "...THE ONLY PERSONS WHO CAN LEARN A LANGUAGE AUDIO-ORALLY ARE THOSE WHO DO NOT KNOW HOW TO WRITE. As soon as a child goes to school, the secret is out; he finds out that sounds can be represented by letters; from now on he is going to see a visual image for every word he hears."

In stressing the importance of the visual component of a linguistic unit, Marty (1960) suggests that a student will soon create his own spellings for the words he is learning if he is not shown the correct forms. Even when the oral form of the word is given first, a short time-lag between it and the appearance of the printed form is important (Marty, 1962). Stack (1960) also supports this position.

Further evidence of this relationship between printed and spoken forms of a word is to be found in an experiment by Pimsleur (1964).

In a paired-associate learning experiment he used two lists of nonsense syllables. One list was spelled phonetically in English (low discrepancy); the other was spelled in a way that was non-phonetic in English (high discrepancy). He found that words from the low discrepancy list were learned faster than words from the high discrepancy list.

The data of this experiment showed no differences in learning effectiveness between those who had learned to read phonetically and those who had learned through straight conditioning trials. Further investigation of these relationships is needed. The additional stimulus support added by the visual symbols, apart from their phonetic significance, will be considered in the next section of the discussion.

Stimulus Compounding in the Audio and Visual Modalities: III

It was hypothesized in this experiment that subjects would learn the list of foreign words in fewer trials if they received a compound audio-visual presentation rather than audio alone. The data did not support this hypothesis. The audio alone presentation resulted in fewer trials to criterion.

This conflicts with the findings of Van Mondfrans (1963). In a verbal learning experiment, he found no differences in the effectiveness of single or compound presentations except when the materials were difficult. With difficult materials, as these were, the audio presentation was less effective in his experiment, while in the current experiment the audio was more effective. Here, however, the response as well as the stimulus was audio, while in his experimental situation

the audio stimulus was followed by a written response. Difficult sound/symbol correspondences and the necessity to shift from one sensory mode to the other might account for unsatisfactory results.

The nature of the visual phonetic stimulus is somewhat complicated. The subject translates it into an audio stimulus. Perhaps it should be treated as an audio as well as a visual stimulus. Further investigation is needed.

Travers (1964) found an advantage for the audio-visual presentation of literary materials, but he interpreted it on the basis of cue selection. He felt that Ss tended to choose the single channel that was best for them. During rapid presentation, his Ss covered either eyes or ears to shut out stimuli from the other sensory mode.

An alternative interpretation might be made on the basis of reading ability. Slow readers would tend to cover the text and just listen. Fast readers would tend to shut out the audio and read at their own rate.

This does not preclude the fact that a compound presentation might be more effective than a single stimulus. Compound stimuli in the form of trigrams and colors have seemed to produce superior results. (Weiss and Margolius, 1954; Hill and Wickens, 1962; Underwood, Ham and Ekstrand, 1962) Spear, Ekstrand, and Underwood (1964) used trigrams and words as a stimulus compound, and achieved about the same results with the same interpretation.

These methods of stimulus compounding, however, used a single modality, the visual. Travers (1964) believes that a subject can receive stimuli only through a single modality at a time, and therefore rejects

the value of stimulus compounding in two sensory modalities. However, he indicates that switching from one modality to the other seems to require only .2 seconds. With a one or two second presentation, the subject would have time to switch from one modality to the other without loss of effect.

It should be noted that the subject in this experiment received knowledge of results in both modalities, but that his response was always in the oral alone. Perhaps this forced him to attend only to the audio presentation, even when the visual was present. Moreover, the additional stimulus resulted in a slower rate of learning. A replication of the study might take into account retention over a longer period of time.

Investigators in this field have also found that learning in one modality facilitates re-learning in the other. (Postman and Rosenzweig, 1956; Weissman and Crockett, 1957; Lifton and Goss, 1962; Pimsleur, 1961; Hocking, 1962).

The use of audio and visual modes of presentation has special significance for language laboratory situations. The Keating report (1963) suggests that language laboratory procedures in the New York City area have not produced superior results. Hocking (1962) has found that a considerable number of students do not do well in reproducing audially perceived language materials. Carroll (1965) suggests that visual materials are more easily learned than audio materials, although he does not offer any research evidence for the statement.

The variety of the above research efforts indicates that the matter of audiovisual presentations, particularly in the foreign

language field, is in need of further investigations which will take into account such variables as retention and comprehension, as well as the rote learning procedures of this experiment.

Paired-Associate and Serial Learning: Hypothesis IV

The results showed no significant differences between paired-associate and serial learning. This is consistent with other findings in this area. However, this experiment differs in one important way from many other such investigations. Studies of transfer from one type to the other have used both the stimulus and the response items of the PA list as items in the serial list. (Horowitz and Izawa, 1963; Jensen, 1963; Young, 1963). Serial relationships have been sought between the stimulus and response members. Young (1961), for example, used the same items as both stimuli and responses. McCormack (1961) studied backward transfer between the stimulus and response members.

In this experiment, however, the items in the serial list were used only as response members in the PA trials. It was hypothesized that the total amount of learning would be the same in this case. If sequence or position is the effective stimulus in serial learning, (Schulz, 1955; Lippman, 1963; Ebenholtz, 1964) then each item in the serial list is a response only. To equate this with the PA list, it was necessary to introduce a new set of stimuli equivalent to the sequential effects in the serial trials. This was done by assigning meanings to the words and using these meanings as stimuli.

Since the words used in the serial learning were foreign words and therefore equivalent to nonsense syllables to the subjects, it

was necessary to reverse the usual PA technique, and use the more difficult term as the response term. In most cases the response term is the easier term. Spear, Ekstrand, and Underwood (1964) used number. Weiss and Margolius (1954) and Mattocks (1963) used common words as response items. In this experiment the common words were the stimulus items and the foreign words were the response.

The fact that there were no significant differences between the two techniques would seem to indicate that the amount of learning was equivalent in the two patterns. This appears to have significance for modern foreign language instruction. Audiolingual methods tend to favor a serial learning technique, while grammar-translation methods follow a PA pattern. Current writers such as Carroll (1965) and Pimsleur (1964) feel that there is not evidence to favor one method over the other, nor to favor the use of one sense modality over the other in the presentation of foreign language materials. The findings of this study seem to support this position.

Other Relationships

Students who had had three or more years of language training performed better on the two phases of the experiment than those without so much training. This was to be expected, since the same skills are important in both types of learning.

One significant set of scores was that of the female subjects in learning to read. The male subjects with considerable language training learned to read at about the same rate as both male and female Ss with no language background, while the female subjects with language

background learned in significantly fewer trials. However, in learning to repeat the words, both male and female subjects were consistently better than the male and female subjects with no language background. Differences were very slight between male and female subjects with language, and between those without. On the other hand, differences were large between those subjects with language and those with no language.

The significant fact is that the girls with language skill learned to read faster than the boys with language skill, but did not memorize faster than the boys. This is an aspect of this experiment that needs further investigation. It sheds additional light on academic differences between boys and girls in the early school years.

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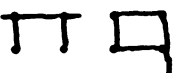
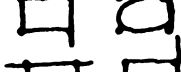
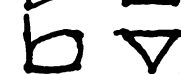
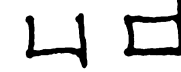
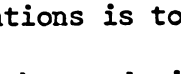
APPENDIX A

Materials of Learning Task

Kirundi Sentences:

1. Amashurwe aramera mu ndimiro.
"Flowers grow in the field."
2. Umugabo yabonye ingwe mw ishamba.
"The man saw a leopard in the forest."
3. Inka ntizikamwa amata menshi.
"Cows do not give much milk."
4. Umwana akunda gukinisha akayabo gato.
"The child likes to play with the small cat."
5. Ntidufise ibitabo vyinshi.
"We do not have many books."

Modification of words for experiment:

Original Meaning	Modified Meaning	Kirundi Word	Modified Word	Visual Symbol	Phonetic Modifications
field	corn	<u>mdimiro</u>	dimi		
man	boy	<u>umugabo</u>	muga		
small	pen	<u>gato</u>	gado		t > d t > d
milk	cow	amata	mada		
books	book	ibitabo	bida		t > d
saw	eye	yabonye	bomi		n > m ; y > i
likes	heart	akunda	guda		k > g ; nC > C
leopard	tree	ingwe	migu		in > mi ; we > u

NOTES: 1. The purpose of the phonetic modifications is to reduce the total number of sounds to a minimum and to fit the words into a regular syllabic pattern.

2. The purpose of the modifications in meaning is to confine the range of meanings to nouns with relatively common referents.

APPENDIX B

Letter Training Trials

Visual	Audio	Oral
□	"ah"	....
□	....	"ah"
△	"ee"	....
△	....	"ee"
□	"oh"	....
□	....	"oh"
┐	"oo"	....
┐	....	"oo"
∇	"be"	....
∇	....	"be"
┐	"due"	....
┐	....	"due"
⊖	"go"	....
⊖	....	"go"
⊞	"ma"	....
⊞	....	"ma"

APPENDIX C

DIRECTIONS FOR LETTER TRAINING

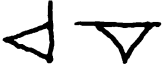
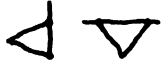
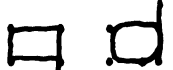
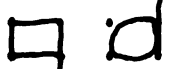
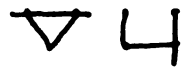
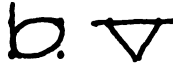
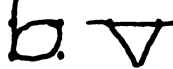
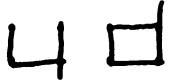
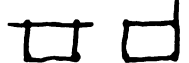
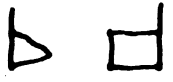
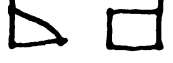
This experiment is not any kind of intelligence or achievement test. We are simply trying to find out some facts about learning to speak a foreign language.

You will be asked to learn to say eight words in this language. These words will not be hard to say, but they will not sound like English words. They will be spelled with letters you have never seen before.

In this first part of the experiment you are to learn the sounds of these letters. This will be the procedure: First you will see a letter and hear the sound of it. Then you will see the letter again. This time you are to say the sound of it. Then you will go on to the next letter.

Let me repeat the procedure: First you will see a letter and hear the sound of it. Then you will see the letter again. This time you are to say the sound of it. Then you will go on to the next letter. The list will be repeated a number of times. There are eight letters in the list.

APPENDIX D
Word Training Trials

Visual	Audio	Oral
	/dimi/	....
	....	/dimi/
	/muga/	....
	....	/muga/
	/gado/	....
	....	/gado/
	/migu/	....
	....	/migu/
	/bomi/	....
	....	/bomi/
	/guda/	....
	....	/guda/
	/mada/	....
	....	/mada/
	/bida/	....
	....	/bida/

APPENDIX E

DIRECTIONS FOR WORD TRAINING

This experiment is not any kind of intelligence or achievement test. We are simply trying to find out some facts about learning to speak a foreign language.

You will be asked to learn to say eight words in this language. These words will not be hard to say, but they will not sound like English words. They will be spelled with letters you have never seen before.

In this part of the experiment you are to learn to pronounce these words. This will be the procedure: First you will see a word and hear the sound of it. Then you will see the word again. This time you are to say the sound of it. Then you will go on to the next word.

Let me repeat the procedure. First you will see a word and hear the sound of it. Then you will see the word again. This time you are to say the sound of it. Then you will go on to the next word. The list will be repeated a number of times. There are eight words in the list.

APPENDIX F

Phonetic Training Trials

<u>Stimulus</u>		<u>Response</u>
Visual	Audio	Oral
	The square stands for the sound of "ah"	....
	.....	"ah"
	The triangle stands for the sound of "ee"	....
	.....	"ee"
	The circle stands for the sound of "oh"	....
	.....	"oh"
	The open square stands for the sound of "oo"	....
	.....	"oo"
	The line on the left stands for "b"; this is "bee"	....
	.....	"bee"
	The line on the right stands for "d"; this is "due"	....
	.....	"due"
	The vertical line down stands for "g"; this is "go"	....
	.....	"go"
	The horizontal line stands for "m"; this is "ma"	....
	.....	"ma"

APPENDIX G

DIRECTIONS FOR PHONETIC TRAINING

This experiment is not any kind of intelligence or achievement test. We are simply trying to find out some facts about learning to speak a foreign language. You will be asked to learn to say eight words in this language. These words will not be hard to say, but they will not sound like English words. They will be spelled with letters you have never seen before.

In this first part of the experiment you are to learn the sounds of the letters. This will be the procedure. Each letter will appear on the machine. At the same time you will hear an explanation of its sound. Then the letter will appear again. This time you are to say the sound of it. Let me repeat. The first time the letter appears you will hear the sound of it. The second time it appears, you are to say it. Then the next letter will appear and the same procedure will be followed. This will be done for each letter in the list. The list will be repeated a number of times. There are eight letters in the list.

(After the list was presented three times in this way, it was presented without explanations in a series of two test trials. The following directions were used.)

Now we will see how well you have learned these sounds. When the letter appears the first time, tell what it is. When it appears the second time, the tape will repeat it and you can see if you were right. Do this for each letter as it appears. Here is the first one.

APPENDIX H

Non-Phonetic Training Trials

<u>Stimulus</u>		<u>Response</u>	
Visual	Audio	Oral	
	The square is one of the letters	"ee"	....
	.....	"ee"	
	Another of the letters is a triangle	"oh"	....
	.....	"oh"	
	The circle is another of the letters	"oo"	....
	.....	"oo"	
	Another of the letters is an open square	"ah"	....
	.....	"ah"	
	A vertical stem is part of this letter	"go"	....
	.....	"go"	
	A vertical stem is part of this letter	"bee"	....
	.....	"bee"	
	A vertical line down is part of this letter	"ma"	....
	.....	"ma"	
	A horizontal line represents part of this letter	"go"	....
	.....	"go"	

APPENDIX I

DIRECTIONS FOR NON-PHONETIC TRAINING

This experiment is not any kind of intelligence or achievement test. We are simply trying to find out some facts about learning to speak a foreign language. You will be asked to learn to say eight words in this language. These words will not be hard to say, but they will not sound like English words. They will be spelled with letters you have never seen before.

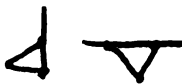
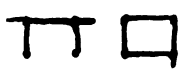
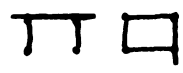
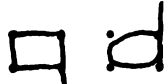
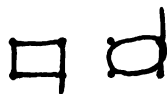
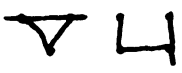
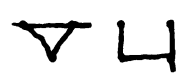
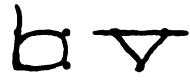
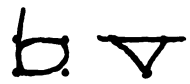
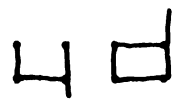
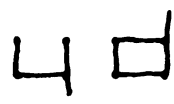
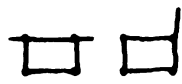
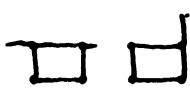
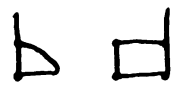
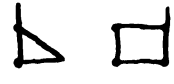
In this first part of the experiment you are to become familiar with the letters and also with the sounds of the words. This will be the procedure. Each letter will appear on the machine, and you will hear a description of it. Then you will hear one of the sounds of the words. You are to repeat this sound. It will not necessarily be the sound represented by the letter. Each time you see a letter, observe its appearance. Each time you hear one of the sounds, repeat it. Do this for each letter and sound. The list will be repeated a number of times. There are eight items in the list. Here is the first one.

(After the list was presented three times in this way, it was presented two times without explanations. The following directions were used.)

In these next trials, you will not hear a description of the letter. Simply observe the letter when you see it; repeat the sound when you hear it.

APPENDIX J

Reading Test Trials

<u>Stimulus</u>	<u>Response</u>	
Visual	Audio	Oral
	....	dimi
	dimi	....
	....	muga
	muga	....
	....	gado
	gado	....
	....	migu
	migu	....
	....	bomi
	bomi	....
	....	guda
	guda	....
	....	mada
	mada	....
	....	bida
	bida	....

APPENDIX K

DIRECTIONS FOR READING TEST TRIALS

Now you will be tested to see how well you have learned these words. This will be the procedure: First you will see one of these words. Then there will be a pause. Then you will see the word again and hear it pronounced. Try to say the word during the pause whether you are sure what it is or not. Each time you see a word, try to say it before it is repeated. Then listen to hear if you said it correctly. Do this for each word in the list.

Let me repeat the procedure: First you will see one of these words. Then there will be a pause. Then you will see the word again and hear it pronounced. Try to say the word during the pause whether you are sure what it is or not. Each time you see a word, try to say it before it is repeated. Then listen to hear if you said it correctly. Do this for each word in the list. The list will be repeated a number of times. There are eight words in the list. Here is the first one.

APPENDIX L

Verbal Learning Experiment
Review of Word List

Circle the symbol for each of the following sounds:

ah					be				
ee					due				
oh					go				
oo					ma				

Circle the correct symbol for each of the following words:

mahdah								
beedah								
deemee								
moogah								
meegoo								
goodah								
bomee								
gahdo								

What was most helpful in learning these words?

What was hardest about learning these words?

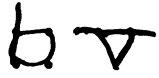
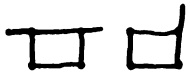
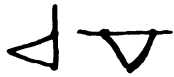
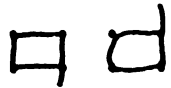
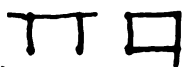
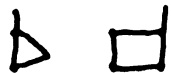
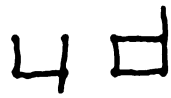
Would (or did) learning the sounds of the letters help? How?

Other comments.

Name _____

APPENDIX M

Serial Learning Trials

Audio Presentation		Audio-Visual Presentation		
Stimulus	Response	Stimulus	Response	
Audio	Oral	Visual	Audio	Oral
bomi	....		bomi	....
....	mada	.....	....	mada
mada	....		mada	....
....	dimi	.....	....	dimi
dimi	....		dimi	....
....	gado	.....	....	gado
gado	....		gado	....
....	muga	.....	....	muga
muga	....		muga	....
....	bida	.....	....	bida
bida	....		bida	....
....	migu	.....	....	migu
migu	....		migu	....
....	guda	.....	....	guda
guda	....		guda	....
....	bomi	.....	....	bomi
etc.			etc.	

APPENDIX N
DIRECTIONS FOR SERIAL LEARNING TRIALS

In this phase of the experiment you are to learn to repeat the words in a specific order. After each word in the list there will be a pause before the next one is heard. During this pause, say the word you think will come next, whether you are sure or not. Each time you hear a word, try to say the one you think will come next. Then listen to hear if you are right.

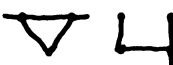
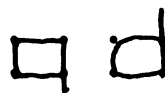
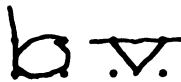
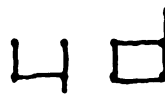
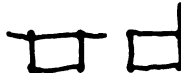
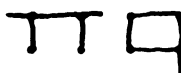
Let me repeat the procedure. During the pause after each word, say the one you think will come next, whether you are sure or not. Then listen to hear if you are right. Do this for each word in the list. The list will be repeated a number of times.

This is the order the words will be in: bomi mada dimi gado muga bida migu guda bomi mada dimi gado muga bida migu guda. Now we are ready to begin. Here is the first word.

.

APPENDIX O

Paired-Associate Learning Trials

Audio Presentation			Audio-Visual Presentation			
Visual	Audio	Oral	Visual	Audio	Oral	
corn	....	dimi	corn	.....	....	dimi
corn	dimi	....	corn		dimi	....
tree	....	migu	tree	.....	....	migu
tree	migu	....	tree		migu	....
book	....	bida	book	.....	....	bida
book	bida	....	book		bida	....
pen	....	gado	pen	.....	....	gado
pen	gado	....	pen		gado	....
eye	....	bomi	eye	.....	....	bomi
eye	bomi	....	eye		bomi	....
heart	....	guda	heart	.....	....	guda
heart	guda	....	heart		guda	....
cow	....	mada	cow	.....	....	mada
cow	mada	....	cow		mada	....
boy	....	muga	boy	.....	....	muga
boy	muga	....	boy		muga	....
etc.			etc.			

APPENDIX P

DIRECTIONS FOR PAIRED-ASSOCIATE LEARNING TRIALS

In this part of the experiment you are to learn the meanings of the words. Each meaning will appear on the machine, followed by a pause. Then the meaning will appear again and you will hear the word. During the pause, try to say the word that goes with that meaning, whether you are sure what it is or not. Then listen to hear if you are right.

Let me repeat the procedure. During the pause after each meaning appears, try to say the word that goes with that meaning, whether you are sure or not. Then listen to hear if you are right. Do this for each word in the list. The list will be repeated a number of times.

The first time through the list, the correct words will be given. After that you are to give them. Here is the first one.

APPENDIX R

Serial and Paired-Associate Learning

In serial learning techniques, subjects are asked to memorize a list of items, e.g., words or nonsense syllables, in a specified order. Under the anticipation method of training, when one of the items is given, the subject is expected to respond with the item that is next in the list. The correct item is then given and the subject responds again with the next one.

This experiment used a list of eight modified foreign language words. The words were presented by a tape recorder with a pause after each word. During the pause the subject was expected to respond with the next item.

This was the pattern of presentation:

Tape: bomi mada dimi gado muga

Subject: mada dimi gado muga etc.

In paired-associate learning techniques, two items are presented together, a stimulus item and a response item. Under the anticipation method of training, the stimulus item is given and the subject is asked to respond with the response item. Then the pair of items is given together. This is followed by the stimulus item of the next pair, and the same procedure is followed again.

This was the pattern of presentation:

Tape: corn corn-dimi; tree tree-migu; etc.

Subject: dimi migu

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