1962

The Effect of Pronunciability, Familiarity, and Mode of Presentation on Acquisition of CVC Trigrams

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THE EFFECT OF PRONUNCIABILITY, FAMILIARITY, AND MODE OF PRESENTATION ON ACQUISITION OF CVC TRIGRAMS

A thesis

Presented to

The Faculty of the Department of Psychology

The College of William and Mary in Virginia

In Partial Fulfillment

Of the Requirements for the Degree of

Master of Arts

By

John Marion Williams

May 1962

APPROVAL SHEET

This thesis is submitted in partial fulfillment of

the requirements for the degree of

Master of Arts

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ACKNOWLEDGMENTS

The author wishes to express his appreciation to Dr. Peter L. Derks, his research advisor, for his guidance and encouragement in the preparation of this paper. The writer is also grateful to Dr. Stanley B. Williams and Dr. E. Rae Harcum for their careful reading and criticism of the manuscript. The writer would finally like to thank his wife, Nancy, for her valuable assistance in the collection of data for this paper.

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ABSTRACT

Will aural and visual presentation methods give varying rates of learning depending on the pronunciability of the material to be learned? Other studies have shown pronunciability to be a factor governing ease of learning and different modes give different amounts of aid to pronunciation.

Ninety subjects each learned one of three lists: 1) low pronunciability, 2) high pronunciability, and 3) three letter words. Each list was presented by three methods: 1) visual, 2) auditory, or 3) combined simultaneous aural-visual, each S learning by only one method. The lists were learned by the paired associate method to a criterion of two perfect recitations or 12 trials.

Nonsense syllables with high pronunciability were learned faster than low pronunciability syllables; except when presented aurally. The high pronunciability syllables were also learned faster when presented by the visual or combined method than when presented by the auditory method.

Three letter words were learned faster than high pronunciability syllables when presented aurally or visually. They were also learned better by the combined method than by the auditory method. Combined presentation showed a nonsignificant advantage on all three types of material.

Pronunciability is an important factor when learning nonsense syllables presented visually, but not when learning syllables which are presented aurally.

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INTRODUCTION

Consonant-vowel-consonant (CVC) nonsense syllables have been used in many verbal learning experiments where they have been presented either visually, aurally, or by a combination of the two modes. Underwood and Schulz (1960) have shown pronunciability to be an important variable governing ease of learning. Since aural and visual presentation methods give varying amounts of aid to pronunciation the mode which results in the fastest learning may depend upon the pronunciability of the material to be learned. Conceivably, the difference between modes might disappear due to the lack of ambiguity when familiar material, which is easily pronounced, is learned.

In a review of the literature on combined aural and visual presentation up to 1949 Day and Beach (1950) conclude that the combined method leads to more efficient comprehension. More recent studies have also found the combined method best for vigilance tasks (Loveless, 1958; Buckner and McGrath, 1961) and for learning tasks (Gerjuoy, 1961). (See Appendix A)

The purpose of this experiment is to determine the effectiveness of pronunciability ratings as predictors of ease of learning, when learning takes place under different modes of presentation. Although pronunciability was found to predict learning of three letter groups quite well (Underwood and Schulz,

1960), its effectiveness will now be tested using only the more commonly used verbal learning materials, CVC syllables. Auditory presentation would be expected to aid pronunciation more than visual presentation, and therefore should be relatively more efficient for learning low pronunciability syllables than high pronunciability syllables. To test for this both high and low pronunciability syllables will be learned by both methods of presentation. Since familiar three-letter words are even easier to pronounce and less ambiguous than high pronunciability nonsense syllables, they will also be learned by both methods as an upper limit of pronunciability for CVC syllables.

A comparison of the relative efficiency of three modes of presentation was also a purpose of this experiment. Either auditory or visual presentation is usually found to be less efficient than a combination of the two modes. This experiment will test this finding for syllables of varying degrees of difficulty, including CVC three-letter words.

METHOD

Subjects in the experiment were 90 introductory psychology students who served to fulfill a class requirement. They were divided randomly into three groups and required to learn one of three lists: 1) low pronunciability syllables, 2) high pronunciability syllables, and 3) three letter words. The lists were each composed of 12 pairs of CVC syllables taken from the pronunciability ratings obtained by Underwood and Schulz (1960) for three letter groups or from Archer's (1960) list of 100% association value CVC trigrams. Appendix B contains the syllable lists used.

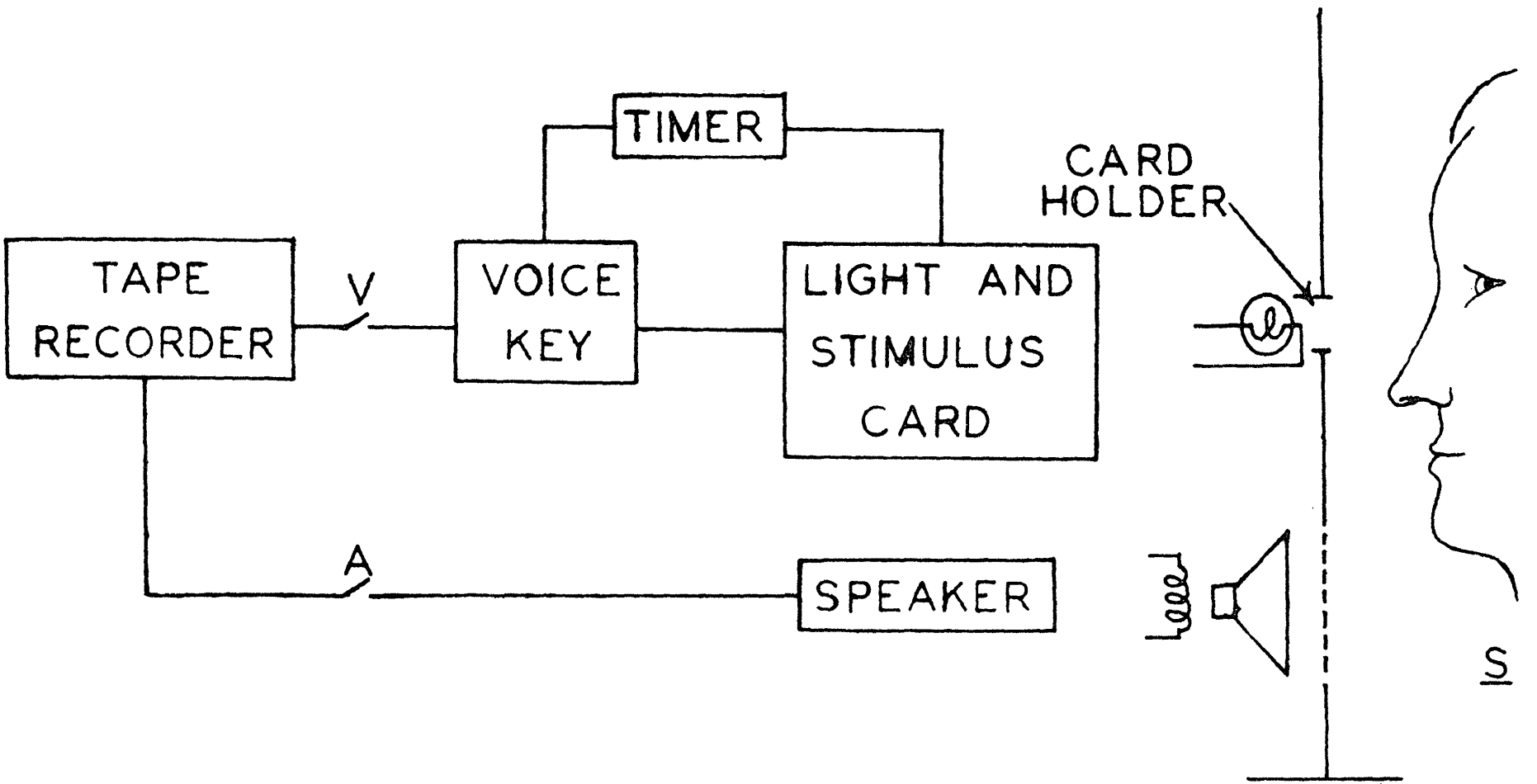
Each group was divided into three equal subgroups which learned by one of three presentation methods: 1) visual, 2) auditory, or 3) combined simultaneous aural-visual. All Ss were first given six trials on a practice list composed of six pairs of intermediate pronunciability syllables presented by the same method under which they then learned the experimental lists. For visual presentation the syllables were typed on 3x5 cards, and for auditory presentation they were recorded on magnetic tape. These stimuli were presented by means of a card holder and speaker directly in front of the S. The visual stimuli were visible only when a light behind the card holder was on. As shown in Fig. 1, this light was turned on by a voice key activated by the tape recorder, and turned off by a timer adjusted to the

average time for pronouncing a syllable pair. For visual presentation the speaker was disconnected at A, while for auditory presentation the voice key was disconnected at V. Both were connected to the tape recorder for the combined presentation.

The syllables were learned by a modified paired associated method where the pairs were presented at 4-sec. intervals. Then the stimulus syllables were repeated at the same rate, but in a different order. The Ss responded by pronouncing the response syllables. This was considered to be one trial; it was repeated 12 times, or until a criterion of two perfect recitations was reached.

The Ss were instructed, "This is an experiment in paired associate learning. You will be presented a list of pairs of three letter nonsense syllables here. (Point to appropriate place) Then you will be presented with the first syllable of each pair and asked to give the syllable that was paired with it. The list will then be repeated, again giving you the correct responses. Then the first syllable of each pair will be presented to test for learning. The syllables will be in a different order each time. This will be continued until you learn the correct response syllable to each stimulus syllable. The syllables will be presented every four seconds, with an eight second interval between lists. The timing is prerecorded, so I can not repeat any of the syllables. Just do the best you can with the pronunciation of them. Do you have any questions?"

Fig. 1. Diagram of apparatus.


TIMER
CARD
HOLDER
TAPE
RECORDER
V
VOICE
KEY
LIGHT AND
STIMULUS
CARD
A
SPEAKER
S

RESULTS

Two of the nine subgroups showed skewed distributions of scores, and the results of Bartlett's test of homogeneity were significant at the .001 level, hence the use of medians rather than means. (The median score for each group is shown in Fig. 2.) The three lists and the three modes of presentation were compared by means of Mann-Whitney "U" tests and the results are shown in Table 1. The individual error scores are shown in Appendix C.

As shown in Fig. 2, the nonsense syllables with high pronunciability were learned significantly ($p < .001$) faster than low pronunciability syllables; except when both were presented aurally. The high pronunciability syllables were also learned significantly ($p < .01$) faster when presented by the visual or combined method than when presented by the auditory method. (For a possible application of these results see Appendix D.)

Three letter words were learned faster than high pronunciability syllables when presented aurally ($p < .001$) or visually ($p < .05$). They were also learned significantly ($p < .05$) better by the combined method than by the auditory method.

Table 1

Difference between median scores for lists

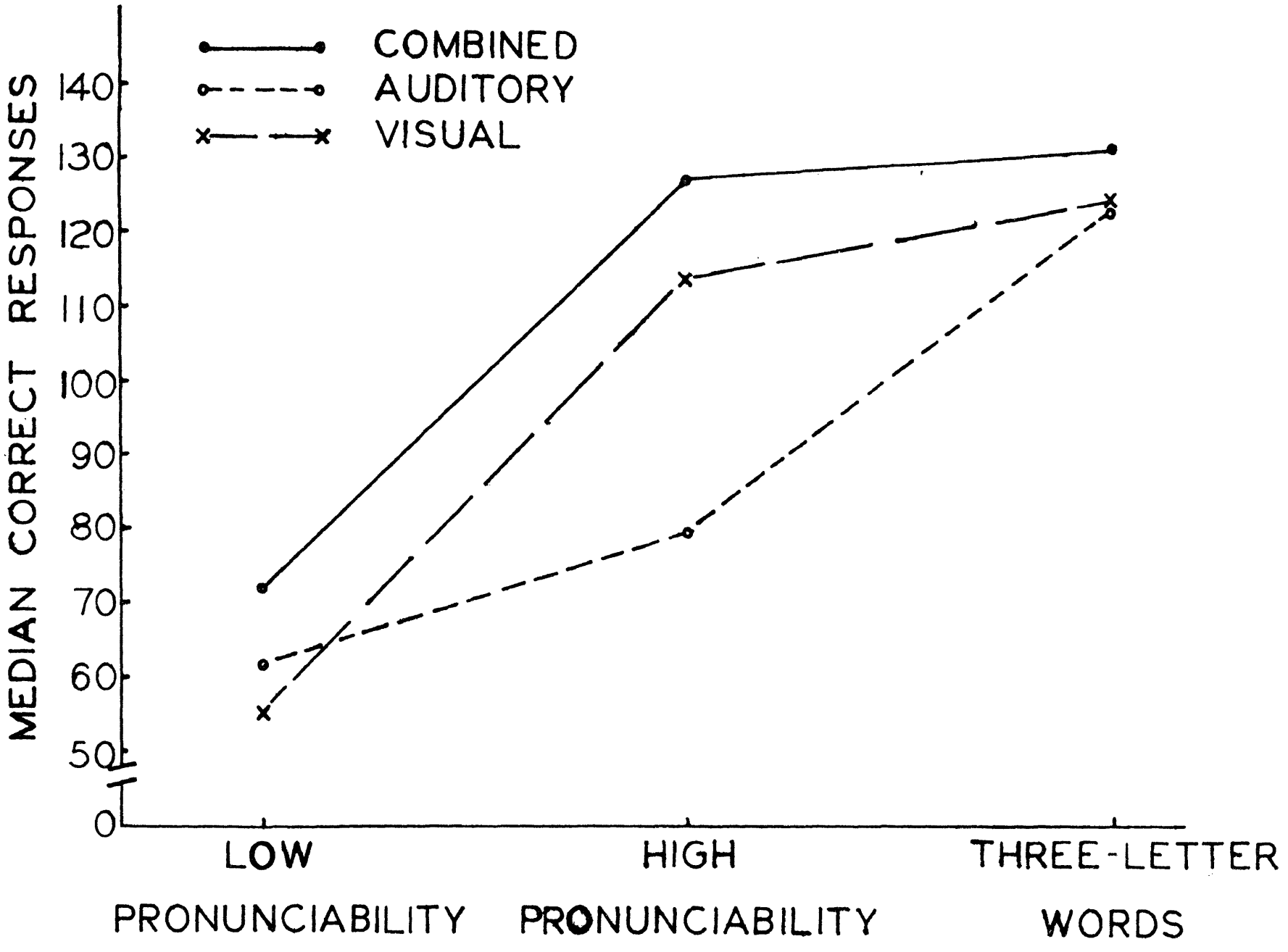
Mode of Presentation	Low Pronunciability and High Pronunciability	Low Pronunciability and Familiar Words	High Pronunciability and Familiar Words
Auditory	18.0	61.5*	43.5*
Visual	58.5*	69.0*	10.5+
Combined	55.0*	59.0*	4.0

* = $p < .001$
+ = $p < .05$

For high pronunciability auditory differs from visual ($p < .01$) and from combined ($p < .001$).

For familiar words auditory differs from combined ($p < .05$).

Fig. 2 Correct responses as a function of type of material learned and mode of presentation


COMBINED
AUDITORY
VISUAL
MEDIAN CORRECT RESPONSES
140
130
120
110
100
90
80
70
60
50
0
LOW PRONUNCIABILITY
HIGH PRONUNCIABILITY
THREE-LETTER WORDS

DISCUSSION

As predicted from the findings of Underwood and Schulz (1960) the lists constructed from (pronunciability) ratings so as to vary in pronunciability produced different rates of learning, when presented by either the visual or the combined method. However, pronunciability was not found to be an important factor in learning nonsense material presented by the auditory method. When more familiar material, three letter words, was learned, no difference was found between visual and auditory presentation; but learning by both methods was faster than that for high pronunciability syllables. Thus there seems to be no difference between auditory and visual presentation of low pronunciability syllables or familiar material; but, for high pronunciability syllables visual presentation gives significantly faster learning. When pronunciability was difficult auditory presentation gave the S an acceptable pronunciation and this aid produced slightly, but not significantly, faster learning than visual presentation. Then when pronunciability was high and the S needed no aid with it, auditory presentation produced significantly slower learning than visual presentation. Here the S could easily integrate the letters presented visually into a pronounceable syllable acceptable as correct, even though his pronunciation might be different

from that of the E; while with auditory presentation he still had to imitate the way he heard the syllables pronounced. This is probably a harder task because the acceptable pronunciation is forced upon him and the aural stimuli are more ambiguous than the visual stimuli. When familiar material is presented by either mode the S recognizes the syllables as common words, and they are pronounced for the S the same way he would pronounce them if he saw them in print. Thus, there is no difference in learning rate for the two modes of presentation of three letter words.

No significant differences were found between visual and combined presentation methods for any of the three lists. However, the absolute scores (shown in Fig. 2) show the combined method to be best for all three types of material, even though not significantly so. This consistent advantage of combined presentation is probably real in light of similar findings by other investigators (Day and Beach, 1950; Loveless, 1957; Buckner and McGrath, 1961; Gerjuoy, 1961).

The combined method was the only one that did not show a significant increase in correct responses from high pronunciability syllables to three letter words. This may have been because the absolute number of errors was already very low, with a median of 16.5 errors to learn 12 nonsense-syllable pairs. In any case, meaningful material seems to benefit less than nonsense material from the combined mode of presentation.

With auditory presentation familiar material is learned much faster than high pronunciability nonsense syllables. Visual presentation shows less improvement from high pronunciability

syllables to three-letter words; and the rate of learning words by visual presentation is not significantly different from auditory presentation. The curves obtained for visual and auditory presentation shown in Fig. 2 are remarkably similar to the theoretical curves generated by Underwood and Schulz (1960) to show the relationship between pronunciability and frequency. These curves show very little increase in frequency from 0% to about 50% association value, while at the same time pronunciability increased rapidly over the same range of association value. Then pronunciability increased little from 50% to 100% association value while frequency increased rapidly, the two curves ending at the same place. Their curve for frequency corresponds to the curve obtained for auditory presentation. This might be what would be expected if auditory presentation cancels out the pronunciation factor in verbal learning, leaving the frequency factor as the major determinant of ease of learning. It would be necessary to assume, as Underwood and Schulz do, that frequency and pronunciability are the major factors governing ease of learning; but their studies do seem to support this.

APPENDIX A

HISTORICAL BACKGROUND

Underwood and Schulz (1960) report six experiments in which they correlate pronunciability with ease of learning trigrams. A high correlation was always found. In their concluding chapter they note that these correlations ranged from .76 to .87 and predictive accuracy for individuals was quite high. Pronunciability was better than frequency as a predictor of learning in every case. All this in spite of the fact that they started out by saying that pronunciability is barren of theoretical potential and only a special case of response integration resulting from frequency.

Their pronunciability values were obtained by having 181 Ss scale 178 different three-letter combinations on a 9-point scale. One hundred of these three-letter combinations were CVC nonsense syllables which had been scaled by Noble, Stockwell, and Pryer (1957).

In their review of the literature from 1894 through 1949 comparing visual and auditory presentation, Day and Beach (1950) offer as their first conclusion that "a combined visual and auditory presentation of material leads to more efficient comprehension than the presentation of either auditory or visual material alone." They point out that their conclusions are based on the results

found most often in the studies they reviewed, and these results are by no means unanimous. For example, O'Brien (1921) found no one of 12 modes of presentation to be consistently superior to any other. Kemsies (1900) found either visual or auditory presentation to be superior to a combined presentation; while Hermon (1912) found auditory presentation to be slightly superior to combined presentation and much better than visual presentation. He states that these results agree with those of Pohlmann (1906) for combined presentation, although Pohlmann found visual presentation more effective than auditory presentation for nonsense syllables, as did Whiteman (1896). Von Syble (1909) was one of the first to report an advantage for the combined presentation method. Later, Koch (1930) also found the combined method best, but consistently better than visual presentation only after five or six trials. In this well controlled experiment the responses were recorded as to speed and accuracy. Similar results were obtained by Loveless (1958) for a vigilance task. Buckner and McGrath (1961) also found simultaneous signals on auditory and visual displays to give the best detection performance; and another recent study by Gerjuoy (1961) supports the superiority of the combined method for learning nonsense syllables.

Mowbray and Gebhard (1956) were so impressed with the evidence favoring combined presentation that they state in their review of the subject that "In all cases, optimum comprehension and retention of verbal material results from combined visual and aural presentation of the same test."

Day and Beach (1950) conclude that "meaningful familiar material is more efficiently presented aurally, whereas meaningless and unfamiliar material is more efficiently presented visually. However, they also state that the "greater the intelligence level or reading ability of the receiver the relatively more effective is a visual presentation. These conclusions again represent the most frequently found results. Pohlmann (1906) found auditory presentation best for familiar meaningful material, as did Hemmon (1912). Goldstein (1940) also found an advantage for auditory presentation that was greater for the less intelligent and for the slower readers. However, Krawiec (1946) found the visual method best for learning three-letter nouns as well as nonsense syllables, but he still concludes that "the visual method is best for learning difficult material."

The results of vigilance studies have shown that Ss tend to do consistently better on either visual or auditory signals (Buckner and McGrath, 1961). However, a recent study by McGrath (1962) shows that this difference in signal detectability is not due to a preference for one sensory modality over the other. The S responds to the most easily detected signal at the moment. As Day and Beach (1950) and Henneman and Long (1954) point out, the superiority of one mode of presentation over the other depends upon the particular circumstances under which the comparison is made. The previously cited studies seem to predict little if any difference in ease of learning between visual and auditory presentation of familiar material if it is equally well perceived by both methods.

APPENDIX B

APPENDIX B

Lists of Trigrams Learned Under Each Presentation Method

Practice List	Low Pronunciability List	High Pronunciability List	Familiar Word List
DOK - VIT	TUW - JCK	DAL - BOY	BAY - HEN
ROC - GAW	ZAV - LIR	COM - REC	WIG - NOD
MEF - WQM	JUX - VOZ	BUT - DIR	FUN - JAM
KIV - TOZ	NIQ - XAT	FAC - VOL	PET - GIN
HEG - SUL	GUD - ZOJ	PIM - SUD	COW - RUM
CES - PID	CAK - WUQ	VAD - LOX	NAP - BEG
	XOL - GIH	GEL - PUS	RIB - SON
	RAJ - NUW	HOB - FET	HUT - LAB
	WIH - QAD	KIX - CUB	MEN - KIT
	VUF - YOX	SOG - ZIN	DOG - MUD
	YIR - BUV	LAR - MOP	GAS - WEB
	QAZ - PEH	TIS - HUM	ZIP - FOR
Range of Pronunciability Value	3.03-3.86	4.0-6.8	1.8-2.9	
Mean Pronunciability Value	3.35	5.22	2.40	
Range of Association Value (%)	22 - 94	3 -80	39 - 100	100
Mean Association Value (%)	53.5	31.67	81.67	100

APPENDIX C

Errors per Subject

List 1 — Low Pronunciability Syllables

	Visual Presentation			Auditory Presentation			Combined Presentation	
S #	Practice List	Experimental List	S #	Practice List	Experimental List	S #	Practice List	Experimental List
1	4	58	11	30	83	21	24	85
2	19	103	12	28	96	22	12	94
3	11	82	13	14	52	23	8	35
4	23	96	14	19	41	24	9	79
5	28	110	15	21	59	25	10	99
6	5	39	16	21	53	26	11	88
7	8	95	17	25	84	27	5	54
8	18	107	18	19	92	28	9	42
9	2	35	19	22	113	29	3	57
10	11	80	20	24	81	30	5	64

Errors per Subject

List 2 — High Pronunciability Syllables

	Visual Presentation			Auditory Presentation			Combined Presentation	
S #	Practice List	Experimental List	S #	Practice List	Experimental List	S #	Practice List	Experimental List
31	5	14	41	26	51	51	4	6
32	20	65	42	27	68	52	6	9
33	16	33	43	30	77	53	10	21
34	11	9	44	21	52	54	3	14
35	20	41	45	29	75	55	8	14
36	13	32	46	23	60	56	8	19
37	20	40	47	26	71	57	23	40
38	6	12	48	18	21	58	7	14
39	17	28	49	30	115	59	18	74
40	20	26	50	23	51	60	13	19

Errors Per Subject

List 3 — Three-letter Words

S #	Visual Presentation Practice List	Visual Presentation Experimental List	S #	Auditory Presentation Practice List	Auditory Presentation Experimental List	S #	Combined Presentation Practice List	Combined Presentation Experimental List
61	7	13	71	28	26	81	7	4
62	4	25	72	30	15	82	11	6
63	5	8	73	31	16	83	11	28
64	20	26	74	28	25	84	18	22
65	13	19	75	26	16	85	25	86
66	21	13	76	27	25	86	6	12
67	6	20	77	21	17	87	22	13
68	24	21	78	21	14	88	12	15
69	32	40	79	28	24	89	13	9
70	8	2	80	24	25	90	5	9

APPENDIX D

This study did not find the expected increase in learning rate with increased ease of pronunciation when the auditory method of presentation was used. One possible application of these results would be in other learning experiments using nonsense syllables. When different lists of syllables of equal difficulty are desired they should be presented by the auditory method. In this way the differences in difficulty of pronunciation would be eleminated. Pronunciation has been shown to be an important factor in verbal learning and it varies for syllables in the same range of association value. Therefore, if the pronunciation factor is eleminated by auditory presentation association value should be a better basis for equating syllables.

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