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THE RELATION BETWEEN MODE OF PRESENTATION AND RETENTION

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The relative value of the various methods of presenting material to be learned is a problem of considerable pedagogical and psychological interest. Presentation may be visual auditory, visual-auditory combined, visual-auditory-motor (articulatory or graphic), visual-motor (articulatory or graphic), or auditory-motor (articulatory or graphic). In view of the possible practical application of the results in teaching, the problem has been frequently taken up, particularly the comparison of the values of visual and auditory presentations for immediate memory and the influence of motor factors. Experiments on visual and auditory memory have been reported by Münsterberg and Bigham (18) (method of reconstruction); by Kirkpatrick (12), Hawkins (9), Quantz (21), Smedley (25), Calkins (3), Wissler (29), Netschajeff (19), Kemsies (11), Lobsien (15), W. A. Lay (14), Pohlmann (20), Aliotta (2), Schuyten (23) (method of amount retained or the method of memory span); and by Whitehead (28), Fränkl (7), Segal (24), and von Sybel (29) (committing method). The results of the experiments are not in accord. It is generally claimed that with younger children auditory presentation gives the better results, except for meaningless material, while in older children and adults visual presentation is better than the auditory. This result is attributed to the fact that young children are less familiar with written than with spoken language, that oral methods of teaching

are gradually superseded by methods that make appeal to vision and visual imagery, and that auditory presentation induces greater concentration of attention. The change in relative value of auditory and visual presentation may also be due to an actual change in image type with age. Meumann (16), however, states that visual presentation is far easier for learning both for children and adults and that this rule holds for all material, though more especially for nonsense-syllables.¹ The rule is limited only by type of imagery. Elsewhere, Meumann (16) states that a single method of presentation for all cases can not be declared to be most advantageous.² The value of a method of presentation varies with the nature of the material, the type of imagery of the learner and the procedure in presentation.

Less attention has been given to the effect of simultaneous presentation to several senses and to the relation of methods of presentation to secondary memory. On general psychological grounds it might be expected that combining simultaneously various methods of presentation would be an advantage, particularly with stimuli, such as words, which could, if necessary, be learned naturally through visual or auditory presentation. There would supposedly result an increase in the number of associations, which would facilitate retention and recall. If the visual cue is lacking, the auditory or the motor cue might be effective. On the other hand, too great an increase in the number of possible cues may be distracting and reduce the force of associations. This might be expected where the natural appeal is to one sense, as in colors or tones.

The results of experimental investigation are inconclusive. Münsterberg and Bigham (18), found that "a series of presentations offered to two senses at the same time is much more easily reproduced than if given only to sight or only to hearing." The percentages of error in reconstruction of series of numbers and colors were as follows:

¹ P. 25.

² P. 121.

	Per Cent.
10 numbers heard.....	14.1
10 numbers seen	10.5
10 numbers seen and heard at the same time	3.9
10 colors named.....	29.3
10 colors seen.....	17.9
10 colors seen and named at the same time.....	4.9

There is thus a significant superiority in the combined method. When taken alone "visual memory excels strongly the aural."

Quantz (21), however, determined the visual and auditory memory-spans for words and notes that "the use of eye and ear together, the words being read aloud by the subject, is little advantage over either separately, when the words are read to him or silently by him." In fact, the combined presentation may be a hindrance.

W. A. Lay (14), in several researches on methods in teaching spelling, has studied the influence of kinesthetic factors (articulatory and graphic) combined with visual and auditory presentation in apprehension and retention of nonsense syllables and numbers. In all cases the suppression of articulatory movements increased the errors, while the use of graphic or articulatory movements reduced the errors, an effect which might be due to the indirect influence on attention rather than the direct influence of the kinesthetic factors themselves.

Fuchs and Haggenmüller (8) and Itschner (10) repeated Lay's experiments under more constant conditions and did not find that articulatory or graphic movements played the important part in learning which Lay attributed to them. Abbott (1) in a study of memory consciousness in orthography finds that "irrespective of the method of presentation and the manner of learning, the typical mode of recall for all observers was through the visual imagery of the letters." Vocalization is always used and aids in learning the spelling of a word by determining the correct pronunciation of it and thus arousing auditory imagery and by facilitating accurate visual perception.

Cohn (4) tested the coöperation of visual, auditory and

motor factors, with especial reference to motor factors, in the memorizing of lists of twelve consonants. In one set of experiments subjects read the consonants aloud, in the second speech movements were suppressed, and in the third numbers or vowels were pronounced during the reading of the consonants. All the subjects remembered most by the first method and least by the last. Cohn's results are thus similar to those of Münsterberg and Bigham.

Smedley (25) in tests of immediate memory for digits on Chicago school children found auditory-visual memory better than either alone, that the visual-auditory-motor (articulatory) was better than the auditory-visual, and that the visual-auditory-motor (graphic) was inferior to both the auditory-visual and the visual-auditory-motor (articulatory).

Kensies (11) tested auditory, visual and visual-auditory presentations of Latin words and nonsense words with school children and found the auditory presentation to be best in all cases. The combined method usually gave poorer results than with visual or auditory presentation alone.

Finzi (6) noted that in visual presentation of letters, numbers and nonsense-syllables the subjects might employ for retention visual images alone, or the auditory and articulatory images combined, or the articulatory images alone. He found that retention by means of visual images gave the most reliable results.

Pohlmann (20), in the most complete investigation of sensory modes of presentation thus far by the method of amount retained, studied the effect of visual, auditory, visual-auditory and visual-auditory-motor presentations of objects, words, nonsense-syllables and numbers on school children from 9 to 14 years of age. He found that auditory presentation is better than visual with significant material (words) but that the visual presentation is better with nonsense material (numbers and syllables). The value of visual presentation for words increases with age and finally surpasses the auditory. The combined visual-auditory presentation shows on the average in all cases a slightly better result than with the auditory or the visual alone. The visual-auditory-

motor presentation gives poorer results with three repetitions and with one presentation very much poorer results. His percentages of amount retained, omitting the results on objects, are as follows:

	Auditory	Visual	Visual-Auditory	Visual-Auditory-Motor
Words	55 1/6	50 4/6	56 1/2	49 1/2
Nonsense syllables . .	42	53 32/60	53 51/60	52 5/16
Numbers	47 1/4	54	54	51 5/12

Fränkl (7) using the committing method with eight syllable series tested the values of auditory, auditory-motor, visual-auditory-motor and visual presentations. He found that the visual presentation was better with visual types, auditory with auditory types.

Schuyten (23) in class experiments with eight two-place numbers found auditory presentation better than visual-auditory.

Segal (24) found that visual presentation was best for those of visual type, auditory presentation for the auditory types. Meumann (17) concludes from his own observations and those of Segal that, in learning, reliance upon the natural type of imagery is better than the use of a combined method. He points out that it is not the number of associations but the strength of associations that determines retention and recall.¹

Von Sybel (27) in a recent study compared visual, visual-motor, auditory, auditory-motor, visual-auditory and visual-auditory-motor presentations using a combination of the committing method and the method of right associates. The experiments were made on seventeen subjects with nonsense-syllables. He finds that reading aloud (visual-auditory-motor) is better for learning in almost all cases than silent reading (visual). This result holds even with those of visual image type except with slow rates of presentation where silent reading gives best results. The number of right associates, however, is practically always greater with silent reading, regardless of image type.

¹ P. 88.

Visual-auditory presentation is almost without exception better for learning than the visual but retention is better with visual presentation. All subjects considered visual-auditory presentation to be distracting and expected poorer results, an expectation which was not borne out. Visual presentation with articulation gave slightly better results for learning than without articulation but right associates were more numerous when articulatory movements were suppressed. Auditory presentation with articulation gave practically the same result as without articulation. Auditory presentation gave without exception better results than the visual. This was true both for auditory types and also for the dominantly visual.

This summary of the available evidence bears out the statement that the results on the effect of methods of presentation on learning and retention are not in accord.

The early experimenters apparently assumed that tests with various methods of presentation measured the efficiency of the visual, auditory and motor memories. However, it is clear that the method of presentation is not necessarily an index of the imagery employed. The method of learning depends in part on the method of presentation, in part on the sort of material and in part on the imagery of the learner. A list of words may be read to three subjects and if they represent three distinct types of imagery the audile will recall the list by auditory images, the visual will translate the words into visual images and the motor will speak the words internally. Since the great majority of individuals are of the mixed type of imagery, using now one form of imagery and now another, the memory-images employed will vary with the sort of stimuli used, the mode of presentation and the degree of dominance of one form of imagery in this mixed type. Visual stimuli will, other things being equal, be better remembered visually, auditory stimuli by auditory images. The mode of presentation may thus determine the method of learning. Similarly the nature of the material may determine the method of learning.

In view of these considerations it is necessary to distinguish

between the psychological and the pedagogical problems involved. Pedagogically the problem is largely quantitative. How much can be retained by each method of presentation and how accurate is the retention? The interest is in the results of the presentation rather than in the processes by which the presented material is retained. Psychologically the problem is largely qualitative. How is the material apprehended, retained and reproduced and how does the nature of apprehension, retention and reproduction vary with the type of imagery, the mode and rate of presentation and the sort of material used. In experiments, as Meumann (17) points out, we may approximate as closely as possible actual school conditions but in such cases we are not in a satisfactory position to study the processes employed in learning. Or we may instruct subjects to use auditory imagery with auditory presentation, visual imagery with visual presentation, etc., but then we may be interfering with the natural method of learning. In the first case we discover how the various modes of presentation actually affect learning but the analysis and explanation of the results is difficult. In the second case we get definite results of interest to psychology but the practical application to school conditions is doubtful.

EXPERIMENTS AND RESULTS

The following experiments were designed to test the influence of visual, auditory, visual-auditory and visual-auditory-motor (articulatory) presentations on retention. Since the value of a method of presentation may vary with the kind of material used, with the number of repetitions, and with different individuals, the experiments were made with three sorts of material, concrete nouns, two-place numbers and nonsense-syllables, with one, two and three repetitions and on six subjects. Precautions were taken to secure, as far as possible, uniformity in the material. The nouns were all of four letters each, arranged so as to avoid placing words in succession that were similar in sound or appearance. No word began with the same letter which was found either at the beginning or end of the word preceding it.

In the lists of numbers no consecutive numbers began or ended with the same figure. The same figure was not used twice in any one number; the zero was not used at all; and all multiples and divisors of a number in any list were avoided. The usual precautions were taken with the lists of nonsense-syllables. To avoid difficulties in the case of auditory presentation syllables beginning or ending with c, q, and h, and syllables beginning with x, were rejected. The syllables were all of three letters.

The method employed was that of amount retained (*Methode der behaltenen Glieder*). Each series consisted of ten members, typewritten on strips of paper which could be fastened around the drum of a kymograph. The rotation of the drum behind the screen before which the subjects were seated was kept at a uniform rate and permitted the exposure of each member of a series for three quarters of a second with an interval of one and one half seconds between successive members. In the visual presentation the subjects read the stimuli directly from the rotating drum and immediately wrote down as many members as could be recalled and in the order presented. The subjects were asked to repress movements of articulation. In the auditory presentation the experimenter read the stimuli from the drum, the subject keeping his eyes closed and repressing movements of articulation. In the visual-auditory presentation the subject both saw the stimuli and heard them read by the experimenter. In the visual-auditory-motor presentation the subject himself read the lists aloud. A double fatigue order was observed in number of presentations and in order of materials and in modes of presentation.

Six subjects took part in the experiment. All had had a year or more of laboratory training in psychology. I am particularly indebted to Mr. Carl L. Rahn, sometime instructor in psychology at the University of Colorado, for his assistance both as subject and as experimenter, and to Miss Mary E. Lakenan, assistant in psychology, at the same institution, for aid both as subject and in the calculation of the results. The experiments were made during the year

TABLE I
ONE PRESENTATION

Subjects	Nouns								Syllables								Numbers							
	V.	m.v.	A.	m.v.	V.A.	m.v.	V.A.M.	m.v.	V.	m.v.	A.	m.v.	V.A.	m.v.	V.A.M.	m.v.	V.	m.v.	A.	m.v.	V.A.	m.v.	V.A.M.	m.v.
A	42.7	9	59.5	10	53.3	8	56.4	6	17.4	9	36.0	8	32.1	11	30.5	9	19.9	7	27.4	3	31.3	5	33.2	8
B	48.0	8	60.0	11	59.7	14	57.3	6	38.2	6	37.4	9	34.6	7	34.1	4	56.0	17	54.2	11	53.8	12	58.0	15
C	45.3	8	57.2	5	50.5	10	61.6	7	25.5	5	35.1	9	41.3	9	38.9	6	40.7	7	45.7	11	44.3	10	44.0	9
D	50.7	9	60.9	9	68.1	13	68.7	12	28.8	6	37.1	6	35.9	9	40.1	5	25.6	7	33.6	7	36.6	5	33.3	9
E	23.8	5	35.1	4	36.7	5	30.4	5	13.6	6	18.1	5	19.4	5	15.8	4	28.2	7	38.9	10	32.6	5	32.8	5
F	41.7	10	47.8	4	56.5	10	50.1	9	26.9	8	35.5	4	35.7	8	36.2	8	47.8	11	56.1	14	49.5	8	44.9	9
Av.	42.0	8.1	53.4	7.2	54.1	10.0	54.0	7.5	23.4	6.7	33.2	6.8	33.1	8.2	32.6	6.0	36.3	9.3	42.6	9.3	41.3	7.5	41.0	9.1

TWO PRESENTATIONS

A	56.8	17	72.3	13	70.0	8	67.4	14	31.3	7	50.1	12	43.6	10	34.7	8	22.6	9	35.7	7	28.4	6	33.7	7
B	62.8	13	71.1	14	70.0	11	74.8	14	39.7	11	40.7	9	45.0	15	41.1	14	57.5	15	66.0	11	69.4	15	60.1	12
C	45.6	11	64.7	3	62.0	9	60.6	8	32.0	8	38.6	9	35.3	10	39.3	7	45.7	12	54.2	12	47.4	12	52.1	11
D	77.9	17	73.9	15	90.9	9	74.1	13	30.9	11	31.6	6	35.6	8	45.6	10	32.4	6	41.3	11	44.9	8	38.7	7
E	38.4	8	43.7	6	48.9	7	39.3	9	19.0	7	22.5	10	17.9	4	17.1	5	34.1	7	35.0	7	39.8	8	36.8	7
F	61.1	12	59.5	17	75.5	12	68.9	10	37.2	4	36.0	6	41.5	5	40.6	7	48.9	7	55.8	14	55.5	11	54.6	20
Av.	57.1	13.0	64.2	11.3	71.2	9.3	64.1	11.3	31.7	8.0	36.5	8.7	36.4	8.7	36.4	8.5	40.2	9.3	48.0	10.3	47.5	10.0	46.0	10.6

THREE PRESENTATIONS

A	64.1	12	70.0	10	84.4	8	79.8	11	32.2	13	44.8	11	41.2	14	45.4	10	26.2	10	36.1	9	33.5	9	34.9	9
B	81.5	11	78.2	11	80.8	13	80.9	13	43.8	11	44.8	8	45.6	12	54.3	18	67.3	15	78.2	12	75.1	16	76.0	14
C	50.3	10	68.7	10	63.4	7	64.0	11	28.9	7	45.7	10	41.2	6	44.7	5	50.6	11	60.9	8	54.6	9	52.9	9
D	84.3	10	71.9	10	85.9	14	80.2	17	43.3	18	39.5	14	42.4	19	59.5	13	49.8	11	46.5	13	46.7	13	44.9	7
E	40.6	7	51.1	12	51.5	5	41.9	7	16.0	4	29.0	6	25.0	7	23.2	6	38.4	11	58.8	14	37.8	6	43.7	8
F	63.9	15	71.4	12	66.6	10	71.4	14	31.5	12	41.5	9	45.3	8	42.7	12	55.8	8	68.0	12	58.4	10	55.4	9
Av.	64.1	10.8	68.6	10.8	72.1	9.5	69.7	12.2	32.4	10.7	40.8	9.7	40.1	11.0	43.4	10.7	48.0	11.0	58.0	11.3	50.5	8.8	51.3	9.3

1908-1909. All of the subjects were of the mixed type of imagery, *A*, being markedly auditory-motor, and the remainder very markedly visual.

The gross results of the experiments appear in Table I. It gives in summary the average percentages of the series retained for one, two and three presentations, for the three sorts of material used, and the six subjects, *A*, *B*, *C*, *D*, *E*, and *F*, the mean variations and the general averages for the six subjects. Each figure in the table, except the general averages, represents an average from 10 experiments. The figures, therefore, possess a high degree of reliability, the maximum probable error being .056 and the minimum .008, with an average probable error of .027.

I. COMPARISON OF VISUAL AND AUDITORY PRESENTATIONS

The most striking result of the experiments is the marked superiority of the auditory over the visual presentation. This result holds in all but six of the fifty-four cases shown in the table, *B* giving a slightly better average for visual presentation of syllables and numbers with one presentation, and *D* giving a better average for visual presentation of all materials with three presentations. *B* and *D* are markedly visual in image type. All of the remaining subjects, except *A*, are also visual. The result is, therefore, surprising and not easily accounted for.

The fact that subjects of the visual type retain more with auditory presentation indicates either that image type is not a significant factor in determining the value of the mode of presentation, or that visualization and retention are more accurate when stimuli are heard than when read. The latter alternative seems the more probable. The introspections show that many subjects of the visual type tend always to visualize the stimuli and that greater freedom in visualization is possible with auditory presentation. Visual presentation is distracting and puts a constraint on visual imagery. This is especially true when stimuli are presented on a rotating drum, which increases the difficulty for the

visualizer of arranging a series quickly and without confusion. If the stimuli were exposed successively in different locations in the field it seems likely that the visual presentation would show to better advantage. This appears to me to account in part for the superiority of auditory presentation in my results and in those of von Sybel. The method of presentation ordinarily employed in memory experiments, for visual presentation is more artificial than for the auditory, and hence tends to favor auditory presentation. Moreover, the influence of the constant practice acquired by adult students in retention from auditory presentation is an important factor.

2. COMPARISON OF VISUAL AND AUDITORY PRESENTATION WITH DIFFERENT MATERIALS

The superiority of the auditory presentation over the visual holds for all the materials used, being quite as great for nonsense-syllables and numbers as for nouns. This result does not accord with that of Pohlmann, who found, as indicated above, that the visual is much superior to the auditory presentation with nonsense-syllables and numbers but inferior with nouns. He found, moreover, that even with nouns the relative value of auditory presentation decreases with age and that ultimately visual presentation surpasses the auditory with nouns also.

Pohlmann used three presentations only with nonsense-syllables. The stimuli were presented at intervals of two seconds. His experiments were class tests on school children who had no familiarity with nonsense-syllables. Moreover, the syllables included diphthongs and digraphs and hence were more difficult of utterance and more difficult to apprehend from oral presentation. This difference in conditions no doubt accounts for the difference in results.

Class tests, such as those of Pohlmann, seem to me to have little value. Pohlmann points out the obvious reasons why the experiments throw little light on the psychological processes involved, but suggests that they may have a pedagogical value. But the pedagogical value of methods of presentation must be determined not by a single test on groups

of individuals but by repeated tests on the same individual. From a pedagogical point of view we are interested in the best and most economical mode of presentation shown after practice and in the long run. A single test with nonsense-syllables on school children, to whom such stimuli are unfamiliar, may show visual presentation to be superior, with ten tests or more the auditory may be superior and pedagogically this would be the fact worth knowing. It seems likely from some brief experiments which I have made with children of the same age as in Pohlmann's experiments that the superiority of auditory presentation would be shown with them also.

Kuhlmann's (13) review of the evidence leads him to the conclusion that "visual presentation of meaningless material is always better than auditory presentation." However, the careful study of Kemsies (11) showed the superiority of auditory presentation quantitatively and qualitatively both for Latin words and nonsense-words. Hawkins (9) found auditory presentation of words superior with children. Von Sybel (27), likewise, found that the number of repetitions required for learning was less for auditory presentation. My own results point clearly to the superiority of auditory presentation.

3. VISUAL-AUDITORY PRESENTATION

The visual-auditory mode of presentation, where the stimuli are presented simultaneously to the eye and the ear, is superior to the visual presentation alone in all but seven out of the fifty-four cases, or 87 per cent. In the general averages the superiority holds in all cases. The combined method is superior to the auditory alone in but twenty-five of the fifty-four cases, or 46 per cent. In the general averages the combined method gives better results with nouns but with syllables and numbers there is practically no difference, the combined method being slightly inferior. This result is in substantial agreement with that of Pohlmann and other recent investigators. Von Sybel found that the number of repetitions required for learning was less with visual-auditory

presentation than with visual presentation but that the number of right associates (Treffer) was greater with visual presentation. His data do not enable him to compare visual-auditory with auditory presentation. His subjects noted the distraction arising from the twofold division of attention, from the fact that the visual and the auditory presentations were not simultaneous, and from the differences in pronunciation of the syllables. In spite of these distractions, which led most of the subjects to feel that visual-auditory presentation was less effective than the visual alone, the results showed an advantage in favor of the visual-auditory method.

4. VISUAL-AUDITORY-MOTOR PRESENTATION

Visual-auditory-motor presentation, in which the subject himself reads the stimuli aloud, is inferior to the visual-auditory in thirty-two out of fifty-four cases, or 59 per cent.; to the auditory alone in thirty cases, or 55 per cent.; and to the visual alone in eight cases, or 15 per cent. In the general averages the differences between the visual-auditory-motor, the visual-auditory, and the auditory presentations are very slight, while all are superior to the visual alone. Simultaneous appeal therefore to the several senses is no advantage for retention. This result is in agreement with that of Pohlmann. Pohlmann, however, apparently attributes the inferior results to the distraction caused by the simultaneous speaking of the pupils in the class and not to the lack of reinforcement by motor factors. That this is not the true reason is shown by the fact that in my experiments the subject alone read the stimuli aloud, and this possible factor is eliminated.

The studies made by Cohn, Smedley, Lay, Smith, Aliotta and von Sybel have all shown the superiority of the visual-auditory-motor (articulation) presentation over other methods, and it is generally claimed that vocalization of what is to be learned is an aid to memory. Pohlmann, Colvin, Fuchs and Haggmüller find the value of articulation to be slight. Colvin (5) concludes that "the importance of motor

imagery, both for the hand and for the vocal organs, appears to be much less than has generally been supposed. . . . Except in pronounced cases where the child is extremely motor in his way of thinking, children seem to depend but little on their motor imagery; indeed, the kinesthetic sensations from the throat and hand may be a hindrance rather than an aid in learning." This conclusion the writer would extend to adults so far as immediate memory in relation to articulatory sensations is concerned. Vocalization may be an aid in inducing attention when there is a tendency for it to wander and may bring about clearness of perception of details with unfamiliar material. Where this is unnecessary vocalization is distracting and of no assistance in memorizing.

5. INFLUENCE OF REPETITIONS

The relative value of the different modes of presentation remains unchanged for one, two and three presentations.

The auditory presentation is superior to the visual in all cases. The difference in amount retained for nouns are 11.4 per cent., 7.1 per cent., and 4.4 per cent., respectively; for syllables, 9.8 per cent., 4.9 per cent., and 8.4 per cent.; and for numbers, 6.3 per cent., 7.8 per cent., and 10 per cent. It seems, therefore, that the value of the auditory presentation is greater for one presentation with nouns and decreases with an increase in repetitions while with numbers the reverse is the case.

With all of the other forms of presentation there is practically a uniform increase in amount retained with an increase in the number of presentations, and the relative values are constant for all materials. There is no evidence in support of Hawkins' conclusion that the second presentation gives a poorer result than one. In seven cases out of seventy-two a slightly better result was obtained with one presentation than with two.

6. INDIVIDUAL DIFFERENCES

The individual differences in amount retained are considerable even in such a highly selected group, the range

being approximately as 2 : 1. The differences are practically constant for the various modes of presentation contrary to expectations. If one averages the percentages retained for visual, auditory, visual-auditory and visual-auditory-motor presentations separately, combining the results with the different materials and with the three presentations, which would serve as a rough measure of the individual's performance, or better still, if one averages the ranks attained under these conditions, the stations of the six individuals are practically identical for the four methods of presentation. In other words, the correlations in abilities with the different forms of presentation are practically perfect. Superiority with one form of presentation means practically the same degree of superiority with others. This result is contrary to a common belief that superiority with one form of presentation is correlated with inferiority or a much lower degree of superiority in others. The closeness of the correlation is no doubt due largely to the fact that with practiced adults the natural method of learning is the same no matter what the form of presentation may be. Image type is a factor of some influence as is shown by the record of subject *A*, who is auditory-motor in type and whose station is relatively better with the auditory than with the other presentations.

The correlation between abilities with different materials are not as close as might be expected, for, after all, the differences for learning between nouns, syllables and numbers are not great. The main facts can easily be seen from a table of the ranks, for the different individuals, based on the average of all percentages for nouns, syllables and numbers separately, or on an average of the ranks attained in the different experiments.

	Nouns	Syllables	Numbers
<i>A</i>	3	5	6
<i>B</i>	2	1	1
<i>C</i>	5	4	3
<i>D</i>	1	2	4
<i>E</i>	6	6	5
<i>F</i>	4	3	2

The correlations between syllables and numbers and between nouns and syllables is high, the coefficient of correlation by the method of rank-differences being in each case $+.77$. The coefficient for nouns and numbers is $+.20$. The number of cases is too small to attach much significance to the figures but they represent roughly the amount of correlation. Subject *D* is clearly of the so-called ingenious type and her record with nouns is much superior to that with nonsense-syllables and numbers, the absence of associations with numbers causing especial difficulty.

7. CONCLUSIONS

The following summary sets forth the main conclusions of this study:

1. Auditory presentation is clearly superior to visual presentation in immediate memory of adults, a result attributable to the greater ease and freedom of visualization with auditory presentation and the greater effort of attention required.

2. This superiority of auditory over visual presentation holds for all materials (nouns, nonsense-syllables, numbers), for all subjects irrespective of image type, and for one, two and three presentations. This result is not in accord with the opinion commonly held that visual presentation is superior, especially with meaningless material.

3. Combined visual-auditory presentation is slightly inferior to the auditory alone and decidedly superior to the visual alone. The advantage of a combined method is very much less than that shown in earlier investigations.

4. Visual-auditory-motor presentation is slightly inferior to the auditory and the visual-auditory presentations and superior to the visual alone. Articulation or vocalization is of little value for immediate memory.

5. The correlations of abilities with different forms of presentation are positive and very high, superiority with one indicating practically the same degree of superiority with another.

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