

EXACT MEASUREMENTS
OF THE SPOKEN WORD

1902 - 1936

COLUMBIA BROADCASTING SYSTEM

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485 MADISON AVENUE, NEW YORK CITY

Foreword

This little book—which took 21 scientists 34 years to write—is on your desk, not nearly so much to ‘sell’ radio broadcasting, as to help explain just why radio is what it is.

True, it gives a considerable weight of evidence on this matter of the ear *versus* eye. But its purpose is not competitive.

From cover to cover, here is pure (but not dull) research. All of it is exact measurement of the spoken word. And much of it dates back before the day radio was no more than a young thought in Marconi’s mind.

That the conclusions of these experiments are consistently in favor of the ear should surprise no one. (What salesman, after all, would think it news if a corps of psychologists were to tell *him* he is better off when he can talk to a customer than when he must write him?)

But we do not carry these conclusions too far.

In these and other instances, talking may well be better than writing. Which hardly implies that words on paper haven’t a firm place in the scheme of things. What of the words you are now reading?

A systematic search through the literature on exact measurements of the spoken word uncovered a wealth of material. Because of their obvious value to those who use radio, seventeen of these psychological investigations have been abstracted on the following pages. In each instance brief notes have been included on the materials and methods of these experiments. A complete file of the studies listed here is available at the Columbia offices in New York.

In 1902, Dr. Pearce observed:

That auditory suggestion is stronger than visual.

MATERIALS AND METHOD—Subjects were instructed by visual and auditory suggestion to orient themselves with reference to a stimulus. Their adjustments were observed, as influenced by the different types of suggestions.

RESULTS—The adjustments of the subjects to the visual and auditory suggestions were quantified. They indicate that auditory suggestion influenced the subjects 9% more than visual.

SUBJECTS—A small group, ranging in age from children (7 and 8 years old) to graduate students, was used for intensive experimentation.

*Pearce, Haywood J., "Experimental Observations Upon Normal Motor Suggestibility", *Psychological Review*, IX, 4 (July, 1902), pp. 329-356.*

In 1906, Dr. Schuyten found:

“De ce qui précède, on peut déduire qu’une notion de nombre pour être perçue et retenue avec fruit par l’esprit, doit être présentée de la façon la plus concentrée possible.”

“From what has gone before, (a comparison of numbers presented auditorally vs. visually *and* auditorally) we are able to deduce that the conception of a number, in order to be understood and retained by the mind most advantageously, must be presented in the most ‘concentrated’ manner possible.” (i.e. by auditory method, alone).

MATERIALS AND METHOD—A series of digits was presented orally and then orally-and-visually to the subjects.

RESULTS—Immediately after presentation the students were instructed to reproduce the numbers which had been exposed by the auditory and auditory-and-visual methods. An auditory superiority in excess of 43% was shown by a comparison of correct recalls of material presented by the two methods.

SUBJECTS—The subjects were 59 high school students of Anvers, France.

Schuyten, M. M.-C., "Sur la validité de l'enseignement intuitif primaire", Archives de Psychologie, V, 1906, pp. 245-253.

In 1908, Dr. Kuhlmann observed:

“Visual presentation of meaningless verbal material is always better than auditory presentation. But auditory presentation of meaningful verbal material is better than visual with . . . school children.”

Note:

Dr. Kuhlmann based his observation, not on experimental work of his own, but on a review of all the work done in this field at the time of his monograph,

“The Present Status of Memory Investigation”.

Kuhlmann, F., “The Present Status of Memory Investigation”, Psychological Bulletin, V, 9 (September 15, 1908), pp. 285-293.

In 1908, Dr. Bell observed:

“... we may conclude that... the auditory suggestion is more effective than the visual...”

MATERIALS AND METHOD—In this study the subjects were directed to reproduce a design on paper. During reproduction, auditory and visual suggestions were given regarding the task.

RESULTS—The conclusion is based on objective measurements of the subject-reactions to the auditory and visual conditions of suggestion.

SUBJECTS—Adult university students.

Bell, J. Carleton, “The Effect of Suggestion Upon the Reproduction of Triangles and of Point Distances”, American Journal of Psychology, XIX, 4 (October, 1908), pp. 504-518.

In 1912, Professor Henmon concluded:

“Auditory presentation is clearly superior to visual presentation in immediate memory of adults. 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.”

MATERIALS AND METHOD—Three types of material were presented visually at a constant rate by an exposure device and orally by reading the material to the students. The material was made up of ten four-letter concrete nouns, ten two-place numbers and ten three-letter nonsense syllables.

RESULTS—The findings are based on retention after one, two and three presentations. The following figures reveal the percentage of auditory superiority: (after one presentation) nouns 27%, syllables 42%, numbers 17%; (after two presentations) nouns 12%, syllables 15%, numbers 20%; (after three presentations) nouns 7%, syllables 26%, numbers 21%.

As greater opportunities are given for mastery, the differences become smaller because retention by both modes approaches perfection.

SUBJECTS—Adult students of the University of Wisconsin served as subjects during the years 1908-09.

Henmon, V. A. C., "The Relation between Mode of Presentation and Retention", Psychological Review, XIX, 2 (March, 1912), pp. 88-94.

In 1919, Rev. Lacy concluded:

“Under the conditions of our experiments, questions of fact, inference, or moral discrimination can be answered more adequately, immediately and upon delayed recall, when the narrative material has been presented by a story-teller . . .”

MATERIALS AND METHOD—(Silent) motion picture, “Hoosier Schoolmaster” was shown, with equivalent material in printed and story form. The printed material was read silently by each student. The auditory presentation was made by an untrained story-teller.

RESULTS—The measurements consisted of test questions on matters of fact, inference and moral discriminations. The results are based on immediate and delayed tests. Averages of all age groups follow:

Immediately after presentation:

“Superiority of presentation through reading matter to presentation

through the (silent) motion picture, 7.053%; of oral presentation (story-teller) to presentation through the motion picture, 9.012%; and on oral presentation to presentation through printed reading matter, 1.958%.”

Three to five weeks after presentation:

“Superiority of presentation through reading matter to presentation through the motion picture, 0.917%; of oral presentation to presentation through the motion picture, 4.575%; and of oral presentation to presentation through reading matter, 3.65%.”

SUBJECTS—315 school children, ages 11 to 17 years, New York City.

Lacy, John V., “The Relative Value of Motion Pictures as an Educational Agency”, Teachers College Record, XX, 5 (November, 1919), pp. 452-465.

In 1925, Professor Worcester reported:

“In general, it would appear that there is an intrinsic superiority for retention in the auditory method of presentation.”

MATERIALS AND METHOD—One hundred-word prose selections from the works of Arnold and Huxley were learned by the subjects. Visual learning consisted of silent reading while in the auditory learning the passages were read to the subjects.

RESULTS—The conclusions are based upon tests for retention given one, two and seven days after learning. One day and two days after learning, 11 out of 13 subjects made higher auditory scores than visual while after seven days 12 out of 13 remembered better the material heard than that read.

SUBJECTS—Thirteen adults, ranging in age from 20 to 58 years, served as subjects.

Worcester, D. A., "Memory by Visual and Auditory Presentation", Journal of Educational Psychology, XVI, 1 (January, 1925), pp. 18-27.

In 1925, Dr. Burt and Miss Dobell found:

Material presented orally is recalled and recognized better than similar material presented visually.

MATERIALS AND METHOD—The experiment was *not* designed to measure the value of auditory and visual modes of presentation although both methods were used. This was an investigation of the effects of advertising follow-ups on the curve of forgetting. The material consisted of 100 pairs of commodity and brand-names which were presented visually by a projector and orally by the senior experimenter.

RESULTS—Recall and recognition tests were used to measure retention. These tests administered immediately, 3 days, 10 days, and 17 days after initial and follow-up presentations revealed an auditory superiority in 9 out of 9 comparisons for *aided recall*, with an average difference of 28%; and an auditory superiority in 8 out of 9 (tied one) comparisons for *recognition*, with a mean difference of 4%.

SUBJECTS—The subjects, 58 advanced students of the Ohio State University.

Burt, H. E., and Dobell, E. M., "The Curve of Forgetting for Advertising Material", Journal of Applied Psychology IX, 1 (March, 1925), pp. 5-21.

In 1925, Professor Worcester observed:

“It is seen that the auditory method seems to be slightly but consistently the better method of presenting directions of this sort. It is to be remembered, too, that any advantage of method was in favor of visual presentation.”

MATERIALS AND METHOD—The directions for 11 exercises of Test 1, Form 5, of the Army Alpha intelligence examination were presented orally and visually to separate groups.

RESULTS—Out of a perfect score of 11, the visual group had a median score of 8.81 and the auditory group had a value of 9.47, giving the auditory method a 7.5% superiority.

SUBJECTS—Two hundred twenty students of Kansas State Teachers College were used as subjects.

Worcester, D. A., “The Ability to Follow Oral and Written Directions”, Educational Research Bulletin, Ohio State University, September 9, 1925.

In 1931, Dr. Reed concluded:

“...in a comparison of the learning scores under two conditions
...the auditory method is shown to be decidedly the better.”

MATERIALS AND METHOD—One part of this study was devoted to a comparison of learning “paired” associates visually and auditorally. The material was presented systematically until the subjects could reproduce it without error.

RESULTS—The findings in this section of the study are based upon the number of presentations necessary for one errorless reproduction. The results show that it took 23% fewer trials to learn auditorally.

SUBJECTS—One hundred and twenty-one university students were used as subjects.

*Reed, Helen J., “The Influence of a Change of Conditions Upon the Amount Recalled”, *Journal of Experimental Psychology*, XIV, 6 (December, 1931), pp. 632-649.*

In 1931, Dr. Hartmann discovered:

That material presented auditorally could be recognized much better than similar material presented visually.

MATERIALS AND METHOD—Words were presented at a constant rate visually and orally and immediately thereafter the same words mixed with an equal number of new words were re-exposed for testing purposes.

RESULTS—The comparison is based upon the recognition scores for the two groups of material. The recognition scores for the material presented auditorally is 19% ahead of the visual results.

SUBJECTS—636 university students were used as subjects.

Hartmann, George W., "The Relative Influence of Visual and Auditory Factors in Spelling Ability", Journal of Educational Psychology, XXII, 9 (December, 1931), pp. 691-699.

In 1932, Dr. Grant wrote:

“It is interesting to find that the highest coefficients are those obtained with material presented in an auditory fashion...”

MATERIALS AND METHOD—In this investigation a series of 12 tests involving several types of material was presented visually and auditorally. The materials included words, short essays, etc.

RESULTS—Intercorrelations between the visual delayed recall scores and the auditory scores reveal a higher correlation exists among the auditory tests. The auditory coefficient of correlation is 75% greater than the visual one.

SUBJECTS—A total of 409 university students served as subjects for the various parts of this research.

Grant, Marion E., “Some Theories and Experiments in The Field of Memory”, Journal of Educational Psychology, XXIII, 6 (September, 1932), pp. 511-527.

In 1933, Dr. DeWick discovered:

“Auditory presentation of advertising copy is distinctly superior to visual presentation when the problem involved is the recall of products and their trade names after a delay of from five days to five months.”

MATERIALS AND METHOD—Fictitious advertising copy was presented visually by printed booklet and auditorally by loudspeaker. The copy was constant in length and the product and trade-names were mentioned three times in each advertisement.

RESULTS—The results are based on pure recall tests made immediately, 1 day, 5 days, 7 days and 5 months after the original presentation.

The auditory superiority immediately after exposure ranges from 2% to 10%; after 1 day from 4% to 25%; after 5 days, 63%; after 7 days, 35%, and after 5 months, 174%.

SUBJECTS—A group of 73 students at the University of North Carolina took part in this experiment.

DeWick, Henry N., "The Relative Recall Effectiveness of Visual and Auditory Presentation of Advertising Material", Journal of Applied Psychology, XIX, 3 (June, 1935), pp. 245-264. This study was the basis of Dr. DeWick's Ph.D. thesis (1933).

In 1934, Dr. Stanton discovered:

“The auditory method of presentation is superior on each test-day for all three types of tests.”

MATERIALS AND METHOD—Fictitious advertising copy was presented visually by means of printed booklets and auditorally by an announcer and public address system. The ad copy was of constant length (70-75 words) and contained 3 product-trade-name mentions. Eight pieces of copy were used for each medium.

RESULTS—The superior mode of presentation was determined in terms of the subject's retention of commodity and trade names, as measured by pure recall tests, aided recall tests and recognition tests. These were conducted one, seven and twenty-one days after presentation. The *pure recall* tests showed auditory superior by 33% after 24 hours; 118% after 7 days, and 76% after 3 weeks. The *aided recall* results gave the auditory method a superiority of 22% after 24 hours; 87% after 7 days, and 61% after 3 weeks. *Recognition tests* also proved the auditory method better by 3%

after 24 hours; 8% after 7 days, and 15% after 3 weeks.

SUBJECTS—One hundred and sixty summer school students of the Ohio State University served as subjects.

Stanton, Frank N., "Memory for Advertising Copy Presented Visually vs. Orally", Journal of Applied Psychology, XVIII, 1 (February, 1934), pp. 45-64.

In 1936, Mr. Elliott wrote:

“Experiments on memory for trade names in advertisements presented on a screen and by radio showed superiority for the auditory mode in 19 out of 20 situations.”

MATERIALS AND METHOD—Thirty-six pieces of fictitious advertising copy each 22 words in length were presented visually by means of a translucent screen and projector and auditorally by an announcer and public address system.

RESULTS—Testing took place immediately after presentation and consisted of aided recall and recognition forms.

Composite scores reveal an auditory superiority of 5% for the university group and 23% for the non-university group.

SUBJECTS—Two main groups of people were used; 67 university students

at Columbia University with a median age of 25 and 76 non-university adults with a median age of 35.

Elliott, Frank R. (Material to be published in The Archives of Psychology and the Journal of Applied Psychology).

Appendix A:

"The Harvard Findings" (1934-1935).

18 months of psychological experiments, at the Psychological Laboratory of Harvard University, resulted in a comprehensive study: *"The Psychology of Radio"* by Dr. Hadley Cantril and Dr. Gordon W. Allport.* A brief summary of this basic work on auditory and visual impressions was published by Columbia early in 1935, and is reprinted here for your convenient reference.

What Harvard Found:*

1. Harvard found *facts* better understood and more interesting when heard over the radio than when read on a printed page.

*Cantril, H., and Allport, G. W., *"The Psychology of Radio"*. New York: Harper & Brothers, 1935, x + 276 pp.

*Throughout this summary, we have taken the liberty of using the term "Harvard found" in the same spirit in which it had been used in press comments on these same experiments. We refer, literally of course, to the findings of Doctors Allport, Cantril and Carver. It should also be noted that in their own reports many of these findings are stated, with due scientific precaution, as tentative, and subject to further confirmation.

2. Harvard found *narrative* better understood and more interesting over the radio than when read on a printed page. And—

3. Harvard similarly found *abstract material* better understood and more interesting when heard over the radio than when read on a printed page.

In the same set of experiments, Harvard found political talks and “exposition” better understood and more interesting when *heard* than when *read*. Harvard reversed the groups of people who were tested, and found radio ahead again. The voice *added* to the comprehension of various kinds of material for 56% to 89% of all people tested. Dr. Cantril’s summary of this work contains the following statement: “The present status of the work points to the following conclusions: first, each of the ten passages (two of each kind) considered separately, was *more comprehensible* and *more interesting* when presented over the *radio*.”

(The further conclusions of Dr. Cantril and Dr. Allport at this point did not involve visual-auditory comparisons.)

4. Harvard found that after twenty-four hours, people recalled *advertising trade names* better, when they were heard over the radio than when read on a printed page.

Harvard also found that people *recognized* a trade name better (as distinct from “recalling” it) when they had heard it over the radio than when they had read it—provided such recognition was prompted

by an "auditory stimulus."

Recognition was somewhat better for the same material presented visually when the stimulus was also visual.

5. Harvard found, in eight groups of tests, no "significant" difference between printed and radio advertising—in *interest*.

Out of eight groups of tests for "*persuasiveness*", radio rated higher in *five*, printed advertisements rated higher in *three*, but Harvard concluded that this differential was not significant.

6. Harvard found that *numbers* were remembered better when presented over the radio—but that nonsense syllables were remembered better when presented visually.

7. Harvard found that lists of simple *words* (such as ruler, pod, star, ink) were remembered better when they had been heard over the radio than when they had been read in print,

—and found no advantage for either method on words of average difficulty (formula, trinket, serenade, canteen, bondage, canine, etc.). But words as difficult as "incipiency, canonical, duodenum, labyrinth" were remembered better when read than when heard.

Similarly, such difficult words as "metamorphose, gestation, geodetic, esoteric" could be defined better when they were read than when they were heard.

8. Harvard found that *sentences*, short or long, specific or general, were recalled better when heard over the radio,

—but subjects were more critical of material presented visually, and showed more tendency to discriminate against incorrect sentences.

9. Harvard found that *short prose passages* were preferred orally instead of visually by the majority of subjects,

—but found that short historical passages were better understood by average people when read in print. (Even on this test, college students ranked higher when they *heard* . . . “Napoleon’s system of war was admirably adapted to draw forth and augment the military excellence and to strengthen the weakness of the national character, etc.”)

10. Harvard found that *fairly complex types of sentences* (such as “*A growing child is constantly forming more bone, more muscle and more blood*”) were remembered better, in “recognition” tests, when heard over the radio,

—but *abstract* and *complicated* passages were better comprehended when read than when heard. Some idea of how abstract and how complicated these passages were, and how far removed from the practical problems of advertising, may be gained from the following brief extract from one of the passages used:

“The objective method, as they call it, the impartiality of judgment, the depersonalization of events, the tolerance and realism in facing facts, these belong to the category of science, and these, with experi-

mental research into the natural order, have made the modern world. Applied to the purposes of human life and society they have made 'modernism'. To the frontiers of science modern students have come; and whether the limits of scientific penetration of the universe have been reached, or the threshold of a new learning"... etc.

11. Harvard found that *humorous material* was preferred through the ear instead of through the eye,

—and found that the *response* to humorous material when heard was greater than the response to humorous material when read.

12. Harvard found that people remembered *directions* better,* and understood them better, when they heard them than when they read them . . .

Actual examples used: "In every Banner Box of Winter's Chocolates you will find a green and yellow coupon. Save them, and when you have eighteen, send them to the Winter's Candy Company at Keyport, Ohio. You will receive a five pound box of Winter's famous candy free." "To secure one of the many prizes offered by The Martin Syrup Company the following directions must be followed: 'Remove the

*For "comprehension of directions," all four tested groups recorded an advantage for the spoken word over the printed page. For remembering directions, two of the groups rated the spoken word higher, the other two showed no advantage for either method.

blue label from a quart can of Martin's Pure Corn Syrup. On the back of this label state in exactly twenty-five words why you consider this syrup superior to all other brands. Mail your statement directly to The Martin Syrup Company, Sooville, Iowa or to station KBJ."

13. Harvard found that the human voice tends to make auditory presentations *more personal*—and found that caution was more exercised toward printed than toward spoken material.

When we submitted our summary of the Harvard experiments to Dr. Hadley Cantril, he pointed out we had overlooked one radio advantage which appeared in the results of Dr. Carver's work. It was found that—

14. Material presented over the radio has *greater power of suggestion* than material read on a printed page.

To this important conclusion Dr. Cantril adds the comment, "Since advertising is so largely dependent on suggestion, rather than on pure logic and analysis, a medium which enhances the power of suggestion should be particularly valuable for the advertiser."

A Note from the Original Presentation of This Material

Through the courtesy of Doctors Cantril, Allport and Carver, the Columbia Broadcasting System was privileged to be informed of the progress of their work during its period of development. We have tried to present here a valid and complete summary of the wealth of material to which we were

given access—insofar as this material revealed differentials between visual and aural impressions.*

Inclusive reports of their experiments are published by Doctors Cantril and Allport, in their book, "*The Psychology of Radio.*"

In bringing a summary of this work to the attention of advertising agencies and advertisers, we believe that it contains not merely relative indices of value about advertising media, but important data bearing on the technique by which both printed space and radio time may be effectively employed.

** All of these differentials are contained, we believe, in the foregoing summation. With one or two pertinent exceptions, no attempt has been made here to discuss further phases of the Harvard experiments which (a) found no difference between the effectiveness of the printed and the spoken word, (b) compared various cultural levels with each other, or (c) involved comparisons between radio and the lecture platform as educational techniques. Neither have we included any comment on the interesting work of Doctors Cantril and Allport in the field of voice and personality, etc.*

Appendix B:

Why Are We Ear-Minded?

The conclusive results of the experiments reported on the previous pages do not, in themselves, rest the curiosity of scientists; nor, perhaps, of the lay readers of this book. "*Why are we ear-minded?*" becomes, therefore, a natural, as well as a scientific question, to raise at this point.

The answer is at hand, from two interlocking sources.

One is physiological, rooted deeply in the human nervous structure. It has been exactly measured and succinctly stated by Dr. Richard T. Beatty.*

"The smallest intensity perceptible (to the ear) is less than 10^{-9} microwatt per square centimetre . . . In the green region of the spectrum to which the eye is most sensitive, the minimum intensity for visibility is 10^{-8} microwatt per square centimetre, so that the ear is a more efficient receptor than the eye."

The other half of the answer also comes from science. Psychologists reason that a simple explanation for the better retention of communicative material perceived auditorally rather than visually may well be summarized in one word: *use*.

The human organism uses the auditory mechanism earlier and more fre-

*Beatty, Richard T., "*Hearing in Man and Animals*". London: G. Bell and Sons, Ltd., 1932, xi + 227 pp.

quently than the visual for communicative behavior. We learn to talk before we learn to read. And all through the life of the normal person the auditory system predominates in communication. The extent to which this is true has been measured in a recent experiment.

Dr. Rankin* made an intensive study of the communicative behavior of sixty adults in which he had them keep a record of how much they (1) talked, (2) wrote, (3) listened and (4) read each day. The averages for the group follow. The percentages are based on the total time devoted to communication.

<i>Writing</i>	9%
<i>Reading</i>	16
<i>Talking</i>	30
<i>Listening</i>	45

100% = Total time per day devoted to communicative behavior.

Listening and talking (behavior in which the ear plays a vital part) occupied 75% of the time these 60 individuals gave to communication. Obviously, with the ear used three times as much as the eye, there would be nothing in the results of the experiments cited in this book to surprise the psychologist.

*Rankin, Paul T., "Listening Ability", *Proceedings of the Ohio State Educational Conference, 1929. The Ohio State University, 1929, pp. 172-183.*

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