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SUMMARY OF  
INVESTIGATIONS RELATING  
TO READING

*By*

WILLIAM SCOTT GRAY



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THE UNIVERSITY OF CHICAGO • CHICAGO • ILLINOIS

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WILLIAM SCOTT GRAY



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## PREFACE

The summary contained in this monograph was made possible by a subvention from the Commonwealth Fund. The preparation of the report was a part of the work assigned to the subcommittee appointed by the Research Committee of the Commonwealth Fund, which was charged with the duty of inquiring into the possibilities of reorganizing the administrative units of the American school system. This subcommittee undertook to collect and summarize the scientific studies in arithmetic and reading. The present monograph is a summary of reading investigations. An earlier monograph summarized the studies in the field of arithmetic.

May, 1925

W. S. G.

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## CHAPTER I

### THE PROBLEM

*Purpose.*—The purpose of this monograph is to summarize for the use of teachers, supervisors, and investigators the results of scientific studies relating to the problems of reading instruction. Such a report should provide school officers and teachers with the facts and principles which must be considered in any serious effort to reorganize courses of study in reading or to improve the technique of teaching. In addition, it should indicate the extent to which progress has been made in the scientific study of reading and should suggest additional problems for investigation.

*Sources of material.*—The materials on which this summary is based are the published reports of most of the reading investigations made in America and England prior to July, 1924. Reference is also made at times to studies carried on in Germany and France that contribute to a clear understanding of the problems under discussion. Unfortunately, it was impossible to secure copies of all the studies to which reference was found in a preliminary survey of the field. For example, a large number of magazines and bulletins which contain suggestive titles are out of print.

*Method.*—A word of explanation is included concerning the procedure followed in the preparation of this monograph. As reports of investigations were secured, they were read carefully for the purpose of determining whether they contained valid conclusions or facts which could be used in the summary. A list was also made of the specific problem or problems which were studied. These statements, together with the appropriate bibliographical references, were then classified and filed. Finally, a summary was prepared of the facts and conclusions concerning various important problems of reading instruction. On account of the limitations of space, fewer critical discussions of the technique used in the various studies are included than was originally planned.

*Organization of report.*—The chapter which follows presents a brief historical sketch of the development of scientific interest in reading in Europe and America. It also presents a bird's-eye view of the problems that have been studied and describes the tendencies that have developed as investigation has gone forward. The remainder of the monograph summarizes the results of investigations that relate to fifteen major problems or phases of reading instruction.

## CHAPTER II

### HISTORICAL SKETCH OF SCIENTIFIC INVESTIGATIONS OF READING

*Introductory statement.*—The scientific study of reading problems began in the laboratories of Europe about the middle of the nineteenth century. The motive for these studies was the interest in the psychological processes involved in reading. Prior to 1900 most of the investigations were made in Germany and France. Since that date scientific interest in reading has increased so rapidly in this country that the United States now surpasses all other countries in productive work in this field.

In the brief historical sketch that follows, the developments in Germany and France will be summarized as a unit because the studies made in these countries were carried on contemporaneously and related to essentially the same problems. The investigations made in the United States and England will also be discussed together because they relate for the most part to similar problems.

*Scientific studies in Germany and France.*—Interest in the scientific study of reading began in Germany and France about 1850 and increased very slowly for a period of thirty years. The problems which commanded most attention related primarily to perception and eye-movements in reading. By 1855 investigations of these problems were under way in most of the leading universities in each of the two countries. During the twenty years that followed, a large number of important studies were completed and published by such well-known scientists as Cattell, Erdmann, Dodge, Goldscheider, Mueller, Zeitler, Messmer, Landolt, Lamare, and Javal. Since 1905 important studies have been made in both countries. However, the period of greatest productivity preceded that date.

*Studies of visual perception.*—As early as 1844 Valentius became interested in studies of the perceptual processes in reading. His investigations led to the conclusion that a reader perceives from three to four letters simultaneously in from 100 to 270 thousandths of a second. It was his judgment, however, that each letter is perceived separately. By 1886 Cattell's extensive studies began to appear. From the results of experiments in which letters, phrases, and sentences were exposed by means of a fall chronometer, he concluded that in ordinary reading perception



proceeds by words, frequently by phrases and sentences, rather than by letters. These conclusions were later confirmed by the work of Erdmann and Dodge, who showed that words may be recognized at times even when individual letters are too small to be identified. The experiments of Goldscheider and Mueller followed shortly, supplying evidence that reading takes place not solely by letters or by word-wholes but rather by phrases, words, or letters, according to the reader's familiarity with the reading matter and the difficulties which he encounters.

Studies of the problems which have been described stimulated interest in a whole series of perceptual problems of which the following are examples: the most desirable grouping or arrangement of visual impressions, the value of different letters in the perception of words, the relation of the forms of letters to perception, and the fluctuation of attention during perception. The scientists who participated actively in the study of these problems were Goldscheider and Mueller at Berlin, Erdmann and Dodge at the University of Halle, Zeitler at the University of Leipzig, and Messmer at the University of Zurich. Their investigations are important because they contributed significant facts concerning the processes involved in reading, the best form and arrangement of units of perception, and desirable methods of primary reading. They also laid the foundation for much of the work along related lines which has been carried on recently in the laboratories of this country. The investigations made by these scientists have been summarized at considerable length by Dearborn (77), C. T. Gray (124), Huey (185), and Schmidt (329).

*Studies of eye-movements in reading.*—While studies of perception were going forward, scientists in both France and Germany were keenly interested in studies of the behavior of the eye in reading. About 1879 Javal made the important discovery that eye-movements in reading are discontinuous, consisting of a series of alternate movements and pauses. This fact was highly significant and directed the attention of subsequent experimenters to detailed studies of the path of the eye's fixation point and to the nature, function, and relation of fixation movements and pauses.

Erdmann and Dodge were the first to discover that the first and the last fixations are located within the limits of the line. They also estimated that from  $\frac{1}{3}$  to  $\frac{2}{3}$  of the time of the eye's passage from left to right along the line is spent in fixations. The great rapidity at which the eye moves led to wide discussion concerning the possibility of vision during inter-fixation movements and to detailed experiments later both in Europe and in America.



The early experiments concerning the fixation pause related primarily to the number of pauses per line and to their duration and location. Javal inferred that there is uniformly one pause to every ten letters. The results of Landolt, Dodge, and Erdmann differed somewhat and suggested the possibility of individual differences as well as differences due to the nature and difficulty of the material read. Dodge made detailed studies of reading pauses and discussed at length how the complex interpretative processes could occur during very brief intervals. Erdmann and Dodge also studied eye-fixations to determine their location with respect to syllables, words, and phrases. Their conclusion, that the fixation is usually near the middle of a word, was not supported by later experiments in which more refined laboratory methods were used.

*Results of early European experiments.*—There were at least three notable results of the early studies of perception and eye-movements in Europe. First, facts were secured which presented a new and significant view of the processes involved in reading. This, in turn, suggested additional problems for investigation and stimulated keen interest in America in the scientific study of reading problems. Furthermore, rapid progress was made in the development of experimental technique and mechanical devices for securing accurate records. For example, the work of Lamare and Javal at the University of Paris and of Ahrens at the University of Rostock on devices for studying eye-movements paved the way for the work in American laboratories by Lough, Delabarre, Huey, Dodge, Dearborn, Judd, Freeman, Schmidt, C. T. Gray, and Buswell and led ultimately to highly refined methods of photographing eye-movements.

*Scientific studies in the United States and England.*—An extensive bibliographical study of investigations of reading in the United States and England resulted in references to 436 studies which are more or less scientific in character. Of these, more than 95 per cent were made in this country. By tabulating the studies published during each period of five years since 1880, facts were revealed concerning the development of interest in this field of research. These facts are summarized in Table I. One study included in the bibliography which bears no date of publication was omitted from this table.

Table I shows that prior to 1896 only four studies were reported. From 1896 to 1910, inclusive, considerable interest developed in the study of reading problems. Between 1911 and 1915 there was a notable increase in the number of investigations reported. Since 1916 this country has witnessed an interest in the scientific study of reading problems which has never been equaled. A study of the investigations referred to in the table

shows that the period since 1880 divides somewhat naturally into three divisions, namely, the early period from 1884 to 1910, the transition period from 1911 to 1915, and the current period, which began about 1916.

*The early period (1884-1910).*—The first study in the early period was made by Romanes and was concerned with the rate of adult reading. By the end of 1910 at least thirty-four studies had been published. It is both interesting and significant that more than one-half of these investigations were laboratory studies relating to problems in the psychology and physiology of reading. This is not surprising, however, when it is recalled that laboratory studies were pursued vigorously in continental Europe. The reports of such studies published in this country clearly recognize

TABLE I  
NUMBER OF SCIENTIFIC STUDIES OF READING MADE  
IN ENGLAND AND AMERICA SINCE 1880

Period	Number of Studies
1884-85.....	1
1886-90.....	1
1891-95.....	2
1896-1900.....	10
1901-05.....	6
1906-10.....	14
1911-15.....	49
1916-20.....	151
1921-24.....	201
Total.....	435

their relation and indebtedness to various investigations in Germany and France. The scientists who contributed most generously during this early period were Huey, Dearborn, Dodge, Dockeray, Franz, Griffing, Quantz, Sanford, Secor, and Whipple.

Other problems which were studied prior to 1911 relate to children's interests in reading, vocabulary tests, rate of adult reading, rhythm in oral reading, and the historical development of school readers. Although several classroom studies were made during this period, most of the contributions are directly traceable to the interest and laboratory work of educational psychologists. Two important results of these studies form the basis of present-day reforms in reading. They are the clear-cut distinction between oral reading and silent reading and the recognition of individual differences in reading habits.

*The transition period (1911-15).*—The period from 1911 to 1915, inclusive, is rightly characterized as a period of transition. It marks the beginning of a broader interest in scientific studies of reading and a larger recognition of the importance of applying scientific methods to the study of classroom problems. For example, between 1911 and 1913 most of the studies which were made related to such problems as methods of learning to read, the relative merits of different methods of primary reading, the need of phonetics, the course of study, and the amount and quality of reading in various schools and grades. The explanation of this wide interest in classroom problems is found in the fact that the results of studies made in the early period challenged the validity of traditional methods of teaching reading and suggested numerous practical problems for investigation.

A second fact which explains the transitional character of this period was the introduction of a new instrument of investigation. During 1914 and 1915 two-thirds of the studies reported related to the organization, standardization, and application of reading tests. Through their use it became possible to study, under classroom conditions, the reading habits, achievements, and difficulties of large groups of children. As a result, studies were undertaken on a scale which had been impossible under the restrictions of laboratory technique. By the close of 1915 scientists, administrators, and teachers were measuring the results of instruction in reading, comparing achievement in oral and silent reading, determining the factors which make for rapid progress, studying the errors and difficulties of individual children, and measuring the progress of pupils taught by different methods. These examples indicate only a few of the new problems which began to command attention about 1914 and 1915. The transition from the somewhat exclusive study of laboratory problems to scientific inquiries into practically every phase of reading is due largely to the contributions of the earlier laboratory studies and to the development of instruments of investigation which could be used on a wide scale under a variety of conditions.

*The current period of unprecedented interest in reading investigations.*—There are at least three characteristics of the current period which should be emphasized. The first is the tremendous increase in the number of studies published. At least sixty-nine praiseworthy studies were published in 1923. This number is almost equal to the total number reported between 1880 and 1916. This increase was due to the fact that scientists, school administrators, and teachers recognized the urgent need of studying reading problems. The interest has become so widespread that there

are very few progressive school systems and research centers which are not making each year scientific studies of one or more reading problems.

A second characteristic of this period is the wide variety of problems which are commanding attention. In harmony with expectation, studies relating to the derivation, standardization, validity, and use of tests have been very numerous. In addition, keen interest has been shown in such problems as are suggested by the following: methods of learning to read; relative merits of different methods of teaching beginning reading; the need of phonetics; the content of school readers; children's interests in reading; appropriate reading materials for the various grades; the physical makeup of books; the hygiene of reading; provision for individual differences; diagnostic and remedial work; prognosis; relation between reading achievement and intelligence; relation between reading achievement and class marks; effect of practice on specific phases of reading, such as speed and comprehension; the advantages of classification into ability groups; the objectives of reading instruction; and the uses of reading in school and in adult life. While these studies have been in progress, a series of very important investigations have been carried on in reading laboratories. For example, C. T. Gray (124) made extensive studies of the differences between good and poor readers. Buswell (51) studied the significance of the eye-voice span in reading. He also distinguished fundamental habits in both oral and silent reading and determined the periods at which they develop most rapidly. Judd and Buswell (203) made extensive studies of types of silent reading and pointed out the effect on reading habits of changes in the purpose and content of what is read. In fact, during the last eight years practically every phase of reading has been examined critically and subjected to one or more forms of scientific study.

A third characteristic of the current period is the large number of studies which have been made in classrooms by teachers and school officers. This is one of the most significant and hopeful tendencies of the times. It is due in part to the development of instruments of investigation which may be used effectively in studying practical issues. It is due primarily, however, to a clear recognition of the fact that there are numerous classroom problems which await solution and to a desire and willingness on the part of school officers and teachers to make use of scientific methods in the study of these problems.

*The problem of the future.*—The lesson to be drawn from the history of scientific studies of reading is perfectly clear. As investigation proceeds, there must be active co-operation between scientists, school officers, and teachers. The scientist must continue his laboratory studies, discover

fundamental differences in reading processes and habits, outline the principles which determine effective methods of teaching, and develop methods of investigation which can be used in the classroom. Administrators must provide agencies for dealing effectively with the mental processes and habits discovered in the laboratory, for applying the instruments of investigation which are available, for checking the results of teaching, and for discovering additional problems for study and investigation. Teachers must be zealous students of reading problems, must apply the results of scientific studies in improving and refining their technique of teaching, and must make use of scientific methods in the daily study of classroom problems. Only through continuous and wholehearted co-operation on the part of all the agencies interested in reading problems can we hope to attain an adequate solution of both the theoretical and the practical issues that are involved.

### CHAPTER III

#### SIGNIFICANT FACTS CONCERNING READING IN MODERN LIFE

*Problems for consideration.*—The purpose of this chapter is to summarize the results of investigations that contribute information concerning reading in modern life. The specific problems to be considered relate to the importance of intelligent reading, the rapid increase in the amount of reading, wide variations in the reading proclivities of adults in different sections of the country, possible causes of these variations, and the persistence of illiteracy.

*Importance of intelligent reading.*—In a series of investigations which included conferences with more than nine hundred adults, Gray (140), Parsons (290), and others found "that intelligent reading is a most significant means of familiarizing adults with current events, with significant social issues, with community and national problems, and with American institutions, ideals, and aspirations" (140: 349-50). It was also found to be an indispensable means of attaining vocational efficiency, of extending experience, of developing a broad outlook on life, and of securing pleasure and profit during leisure hours.

Some of the most frequently mentioned specific purposes of silent reading follow: to keep informed concerning current events; to secure specific information of value in making plans; to learn more about events or problems of special interest; to secure the opinions of others concerning civic, social, or industrial problems; to keep in touch with business or professional developments; to secure suggestions concerning efficient methods of doing work; to determine the important items in correspondence, messages, and instructions; to follow directions; to advance in one's field of work; to broaden one's range of information; to keep the mind stimulated with important things to think about; to develop a broad outlook on life; to secure pleasure during leisure hours; to satisfy curiosity.

Practically all the reading of adults is done silently. Nevertheless, several important purposes or occasions of oral reading were mentioned. The three which were mentioned most frequently were to inform or entertain others in private or public, to increase one's understanding and appreciation of materials read, and to entertain children or interest them in reading.

The materials read included practically every field of interest and activity. Searching investigations are needed concerning the value of much of the material that is read. However, evidence of the social need of intelligent reading was so clear and convincing that there can be no question concerning its importance as a subject of instruction.

*Rapid increase in the amount of reading.*—Judd (202) summarized facts which show that from 1850 to 1880 the percentage of increase in the number of issues of newspapers and periodicals which were published in the United States paralleled somewhat closely the percentage of increase in the population. From 1880 to 1910, however, the number of issues of newspapers and periodicals increased more than 500 per cent. During the same period the increase in population was less than 100 per cent. Interesting facts concerning the situation at a later date have been summarized by Reeder as follows:

According to Ayer's *American Newspaper Annual and Directory* for 1922, there were circulated in the United States each day last year 31,810,672 copies of daily newspapers, an average of more than one for each family. Besides these daily newspapers, there were distributed millions of copies of weekly newspapers, magazines, and books. The twenty largest magazines of the country had a combined circulation of 21,430,615, while the several thousand smaller magazines had a combined circulation almost as large [312: 236].

The percentage of increase in the amount of library reading during recent years has been at least as great as the percentage of increase in the number of issues of newspapers and periodicals. Parsons (290) studied the facts for Chicago and found that in 1880 the population of that city was 503,298 and the public-library circulation, 306,751. In 1920 the population was 2,701,705, and the library circulation was 7,651,928. As compared with 1880, the population had increased at least five times and the library circulation more than twenty-five times. Such facts indicate that the United States is rapidly becoming a nation of readers and that the responsibility of the school to teach pupils to read intelligently grows larger each year.

*Wide variations in amount of reading.*—Unfortunately, the reading proclivities described do not exist to the same degree in the various states and sections of the country. By studying the circulation in each state of the ten magazines having the largest average number of paid subscriptions, Reeder determined the percentage that the circulation for each state is of the population of that state. Table II (312: 239) shows the ranks of nine groups of states and reveals wide differences in the reading proclivities in different sections of the country. In discussing these differ-



ences, Reeder pointed out the fact that there are high correlations between the ranks of the states in amount of reading and their ranks on the basis of such other items as intelligence, the efficiency of their school systems, their productivity "as determined by agricultural and manufactured goods produced," and the extent to which they furnish national leaders. No definite conclusion was reached, however, concerning the causes of the sectional differences in amount of reading.

TABLE II

THE VARIOUS GROUPS OF STATES RANKED ON THE BASIS OF AMOUNT READ

Group	Percentage of Population Reading the Ten Magazines
1. Pacific: California, Oregon, and Washington.....	25.29
2. New England: Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont.....	17.20
3. Mountain: Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, and Wyoming.....	16.65
4. East North Central: Illinois, Indiana, Michigan, Ohio, and Wisconsin.....	15.29
5. West North Central: Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, and South Dakota.....	14.43
6. Middle Atlantic: New Jersey, New York, and Pennsylvania....	14.04
7. West South Central: Arkansas, Louisiana, Oklahoma, and Texas	8.37
8. South Atlantic: Delaware, District of Columbia, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, and West Virginia.....	8.24
9. East South Central: Alabama, Kentucky, Mississippi, and Tennessee.....	5.26

Keator (208) challenged the validity of Reeder's list of the ten most popular magazines because they do not correspond with the figures in the *American Newspaper Annual and Directory* for 1922. He also "ventures the guess that the relative magazine reading rank of the states is due to the interaction of the travel and distance upon the relative literacy of the population of each state." In a subsequent study Reeder (313) compared the circulation of the ten most widely read magazines and of thirteen "high-brow" magazines. The correlation between the results for the two groups of magazines was .93, which indicates that the states which read popular magazines most widely are also the states which read the so-called "better" magazines most frequently.

*Possible causes of differences in reading proclivities.*—Bagley (11) determined the correlation (Pearson formula) between magazine circulations as given by Reeder and the Burgess indexes of school efficiency for twenty-six states in which “at least 55 per cent of the total population was native to the state according to the 1910 census.” The correlation coefficients for 1910 and 1920 were .84 and .82, respectively. Additional findings follow:

With literacy [white adults, 1920 census], the correlation of magazine circulation for the twenty-six states is much lower (.76). Magazine reading seems to go well with the kind of intelligence measured by Army Alpha; here the correlation is .89. The states that read magazines seem also to be the states that produce leaders, the correlation with birth-states of *Who's Who* notables being .85. In every way, however, good schools seem to have the best claim to whatever honor there may be in causing people to buy the ten magazines listed in Mr. Reeder's table. And this, I think, is no slight degree of honor [11: 532].

Parsons (290) made a detailed study, through personal conferences, of the reading habits of 314 adults distributed among eight occupational

TABLE III\*  
COMPARISON OF AMOUNTS READ IN CITIES, TOWNS, AND COUNTRY

	City	Town	Country
Average number of newspapers read by 837 adults. . . . .	2.29	2.03	.57
Average number of magazines read by 837 adults. . . . .	2.66	1.11	.20
Average number of books read in six months by 314 adults	9.38	1.17	.23

\* Rearranged from author's data.

groups in the following proportions: agricultural service, 25 per cent; trades and labor, 25 per cent; proprietors, 12 per cent; public and personal service, 10 per cent; clerical service, 8 per cent; commercial service, 8 per cent; managerial service, 6 per cent; professional service, 6 per cent. In addition, 523 adults were questioned less fully. An analysis of the data secured revealed three possible causes of differences in the amounts read by the adults who were questioned: (1) The amount of reading is much greater in cities than in the country, as shown in Table III (290: 52, 56, 60). (2) The amount of reading varies widely in different occupational groups. This is shown clearly by the data in Table IV (290: 68, 71), which gives the average number of books read in six months and the average amount of time given daily to the reading of books, newspapers, and magazines. (3) The amount of reading varies widely with the educational advantages which the individuals have had. The data in Table V (290: 75, 78) show clearly