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Review of research on tachistoscopic means of increasing visual perception

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REVIEW OF RESEARCH ON TACHISTOSCOPIC MEANS OF
INCREASING VISUAL PERCEPTION

A Thesis
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the Faculty of the School of Education
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In Partial Fulfillment
of the Requirements for the Degree
Master of Education

by
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CHAPTER I

HOW WORDS ARE RECOGNIZED

There is probably no one best way to recognize words. Differences of pupils in intelligence, in physical and mental background, and variations in the abilities and interests of teachers make it impossible to find a method adequate in all cases. Some children cannot profit by certain types of training that are highly effective with others. Therefore any method or means of recognizing words would be modified by the individual differences of the group concerned.

*There are two theories with regard to how printed words are recognized. The first theory, which is generally accepted by American psychologists, maintains that words are perceived as a whole, in the same way chairs, trees and other objects are recognized by the total impressions they make upon the retina of the observer. There are certain distinguishing features about the shape of a chair or tree that are responsible for the observer's ability to distinguish it from any other object that he may perceive. The experimental evidence in favor of this view is that words are perceived just as quickly and easily as letters

and short words more quickly than letters."¹

"It has been found that words are recognized when they are too far removed for the letters to be seen. It has also been shown that words having the most individual form are more easily recognized than such words as 'now' and 'no'. It has further been pointed out by advocates of this view that in life we perceive the whole first, then learn to analyze and distinguish the parts. This suggests that the same procedure is probably followed in observing language symbols in reading. It is believed that only certain letters or parts of a word are noticed and used as cues to recognize the whole word."²

"This theory has led to the development of the word and sentence methods of teaching reading. It makes the word and sentence the unit of perception and the meaning of the words an aid for learning to recognize and interpret the printed language symbols."³

"The matter of perceiving and recognizing the printed language symbols is a progressive process which starts on a very low level with the recognition of letters and parts of words. At a later stage in the learning, the reader can apprehend the meaning of several words during one perceptual

¹Book, William F., "The Development of Higher Orders of Perceptual Habits in Reading," Journal of Educational Research, (March, 1930), 21:3:161-172.

²Ibid., p. 161.

³Ibid., p. 162.

pause because he has learned to combine them into a phrase or sentence which he now is able to observe and interpret as a whole. At a still later stage, the most expert readers will select and observe only the key words in a sentence and the key sentences in a paragraph."¹

Book enumerates the following six points to increase recognition and reading rate.

"The ability to read rapidly and more efficiently is dependent, in the last analysis, upon the correct recognition and accurate apprehension of the language symbols observed, for there can be no real gain in speed without a corresponding gain in accuracy of comprehension. The development of perceptual habits which make such increases in reading skill possible is dependent upon a number of things that may be controlled by a teacher wholly or in part."

"1. Greater efficiency in reading rate depends in the first place upon the development of proper eye habits and eye controls. Without this, the printed language symbols could not be accurately observed or correctly interpreted. The development of the eye habits needed to observe the words correctly may be facilitated by the use of suitable materials in the different grades and by seeing that this material is printed in appropriate form so that it may be properly adjusted to the eye control that has already been

¹Ibid., p. 164.

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developed by the learners. Considerable practice on familiar material would aid the development of these necessary eye habits.

"2. There must also be a mastery of the individual words. One of the necessary prerequisites for increasing the rate of reading consists of perfecting the elemental perceptual habits involved in recognizing and interpreting the words. Greater familiarity with words, especially with their meaning, would, therefore, help a learner in handling the language symbols in a way that would enable him to increase his reading rate. Special drill on the words whose correct interpretation slows down the perceptual process, should, therefore, be given.

"3. Conditions must also be arranged so that the learners will develop the perceptual habits used by the most efficient readers. The development of these higher orders of perceptual habits is aided by using material for practice which the learner can readily interpret or understand because it is well adapted to his interests and intellectual needs. Attending more carefully to the meaning of what is read makes it easier to combine words into their normal thought units. Such a series of words soon becomes recognized and interpreted as a whole and just as easily as a single word. This makes it easier for the learner to select the more important words in a sentence and at a later stage

the key sentence in a paragraph, a procedure that is absolutely required to develop the highest order of perceptual habits.

"4. The motorization of the words, so universally used in oral reading and so generally employed to help the learner in linking the proper meaning response to the printed words in the earliest stages of learning to read, must be entirely eliminated before the highest speed in reading can be obtained. Articulation of the words, actual or incipient, prevents the use of the higher forms of recognition and interpretation employed by the best readers today. Experiments have shown that the habit of pronouncing words can be eliminated by the right kind of direction and practice. It would be better, of course, if these habits had never been formed.

"5. Greater familiarity with the fundamental language forms would also assist learners in developing their perceptual habits. Special drill on the various sentence forms and practice on the more fundamental grammatical constructions used in the sentence would, therefore, greatly assist the learners in recognizing and interpreting these language symbols more rapidly and correctly. These different sentence forms should be observed in a paragraph setting.

"6. A certain amount of practice in reading for

speed, is necessary to increase the learners' reading rate. All learners must be forced to leave behind the elemental habits and simpler ways of observing words as rapidly as more complex and economical methods of observing them can be successfully used. Such practice should, however, be taken on materials that are familiar as to context, so that getting the meaning from the selection would present less difficulty to the learner and would not be slighted. If this were done, the learners could devote their entire attention and energy to increasing their perceptual span instead of devoting some of it to the problem of extracting the meaning from unfamiliar words."¹

"To read phrases without hesitation requires quick recognition of words. Consequently a child's ability to recognize words flashed in a quick exposure device should be determined. The cardboard device known as the "tachistoscope" may be used for quick exposure of words. For this purpose select ten words that have been taught recently. If the child cannot recognize the word in a quick flash, he will be unable to read it in a book without extra eye movement."²

Research has shown that words are recognized in

¹Ibid., pp. 170-172.

²Durrell, Donald D., Improvement of Basic Reading Abilities, Yonkers-on-Hudson, World Book Company, New York, 1940, p. 29.

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several ways. In the initial stage individual letters are seen and gradually the scope expands to include syllables, words, phrases, and even short sentences. Further development may make it possible for a reader to gain the meaning from a key word or sentence. Briefly then, recognition of words is a progressive development with each step depending on the one that proceeds it.

CHAPTER II

MENTAL AND PHYSICAL CONDITIONS OF VISION

Physiological, anatomical, and psychological differences in individuals add up to many varied and peculiar combinations of factors which have a direct effect on the abilities of a person to see and to read. Differences that are, as yet, little or only vaguely understood may eventually be defined and isolated as important factors in the mental and physical side of vision. Psychologists speak of eyedness and handedness and hemispherical dominance in the brain as possible factors in the problems of vision. Further research and experimentation in these fields may enable vision to be more completely and accurately understood.

Center and Persons have the following to say about the eyes in regard to reading.

"The importance of the eyes in reading must be obvious; as it has been said, the eye is to reading what the hand is to writing. Eye movements in reading, fixations, and regressions are now well understood, and the successful teacher of reading will use mechanical equipment more and more. Eye movements must be rhythmical; fixations must be of short duration and few in number; regressions must be eliminated; the span of recognition must be increased if

the reader is to be free to read with complete comprehension--that is to think with the author. Any failure of the eyes to perform their function easily and painlessly will dissipate the determination of the reader to concentrate and will defeat instruction in reading which might otherwise be expert."¹

Cattell was one of the first to investigate the eye and its functions with regard to reading. He had this to say on the subject.

"In considering this subject we must distinguish four operations, the time taken up by each of which we might seek to determine.

"1. The time a light must work on the retina, in order that a sensation may be excited.

"2. The time a light must work on the retina, in order that the maximum intensity of the sensation may be brought about.

"3. The time required for the light to be changed into a nervous impulse.

"4. The time taken eye in the nerve and brain before the light is seen."²

¹Center, Stella S. and Persons, Gladys L., Teaching High-School Students to Read., A publication of the National Council of Teachers of English, (New York: L. Appleton-Dentury Co., 1937), p. 118.

²Cattell, James McKeen, Brain, (London: October, 1885, p. 295.

Dolch describes the seeing process in a more or less technical way.

"First of all it is clear that seeing is done with the thousands of nerve endings represented by the rods and cones crowded together on the retina. The surface we see with resembles to some extent the surface of a hair brush, but is composed of many more points much more closely crowded together, each point nevertheless distinct from every other. To see anything we must use a great many of these points, or nerve endings. For the perception of even the simplest object, hundreds of them must work together. Thus every perceptual image is a coordination of these nerve endings. Each different coordination, or pattern of these hundreds or thousands of endings, results in a different meaning. The more often a particular coordination is practiced, the more quickly the meaning follows. For instance the more often we see a person's face, the quicker we recognize that person, and the more often we see a word, the quicker we recognize it."¹

"These fundamental facts about seeing, throw a great deal of light on the reading process. In reading, printed matter, it is clear that we are using the nerve endings in

¹Dolch, Edward William, The Psychology and Teaching of Reading, (Chicago: Ginn and Company, 1931), p. 127.

a horizontal strip of the retina right across the central most sensitive part (the fovea). In both good and poor reader the line of type looked at stimulates a strip all across the retina. The impression upon the retina of one is the same as that upon the retina of the other. But good readers can read more of this strip than poor ones can. The difference is that in the case of the good reader a greater number of nerve endings are trained to work together. Therefore we say he sees more at a single fixation. Hence he requires fewer fixations per line."¹

"The conclusion, therefore, must be that skill in reading, which is essentially speed in word recognition, means the training of the retinal nerve endings to work together on the letter forms and the letter form combinations, which makes words or word parts."²

"The more familiar the group of stimuli become, the more stimuli that can be handled at one time and the wider the recognition span that can be used in reading."³

"In the light of this explanation, it is clear we must take with great caution the claims that we can produce a general increase in recognition span or train the eye to 'take in' more at every fixation. It is true that practice

¹Ibid., p. 128.
²Ibid., p. 129.
³Ibid., p. 130.

with flash cards and quick exposure devices produces greater speed in their use, but the quicker perception can be explained in various ways. In the first place, practice with flash cards and the like trains the child to a concentration of attention in that kind of situation, which is found to get better results in all flash card work. Second, quick practice develops special methods of perception which fit the case and which work in any similar situation. Third, the words or phrases practiced on certain syllables which appear in many other words or phrases in English. If these syllables are noted in the process of recognition, they will help in recognition of other words.¹

"Factors in the Reading Process.

Factors in the Reader

1. Intelligence
2. Word knowledge
 - a. Knowledge of meaning
 - b. Skill in recognition
3. Eye-muscle habit

Factors Changing with each Reading Situation

1. Interest and attention

¹Ibid., p. 130.

2. Purpose and attitude
3. Difficulty of material
 - a. Vocabulary
 - b. Style
 - c. New ideas

Result in:

1. Recognition, or perception span
2. Number of fixations
3. Duration of fixations
4. Regressive movements
5. Rhythm
6. Amount of comprehension and reaction."¹

Eames has the following to say regarding the process of reading and the factors which lead to reading difficulty.

"Reading is a psycho-physical process that begins with the word to be read and passes through various stages, among which are the transmission of light from the several parts of the word to the eyes, the formation of a real image of the word on each of the two retinas, the stimulation of the retinal end organs, the transmission of neural energy to the brain where the fusion of the image from each eye into one mental image takes place, the transmission of neural energy from the visual areas to the (left) angular gyrus and ends with the recognition of the word. It also involves coordinated innervation of the oculomotor, abducent, and

¹Ibid., p. 138

trochlea nerves, as well as the cervical sympathetic.

*This takes time. There are many factors that may increase the time consumed in the act of reading, among the more common of which are the following.

1. Externally the illumination may be so low that more time is required to gain sufficient stimulation from the retinal image to affect the rest of the visual and recognition system adequately.
2. Errors of refraction in the eyes may make it necessary for compensatory muscular, or interpretative activity, requiring additional time for adjustment and appropriate stimulation and image formation. This is especially true of hypermetropia, in which a measurable amount of excess contraction of the ciliary musculature must be made.
3. Defects and deficiencies of the ocular muscles and their innervation may introduce slowing of the process while compensating adjustment is made.
4. Defects of the visual fields and deficiencies of fusion may also introduce a lag in the transmission of the nervous impulses requisite to reading or seeing.
5. Defects or diseases of the retina, optic nerves, chiasm, and tracts, or the lack of appropriate elimination from them of waste products may

restrict or slow the process as the neutral discharge passes through these structures. This may apply equally well to the mid-brain, the occipital lobes (vision) and the area in which memory and recognition of words appear to be located. Regardless of the reader's opinion as to localization, he must admit that the process of seeing and recognizing takes time, and if it takes time to see and recognize letters and words, slowness in doing so must affect the ability to read. If a person is slow in recognizing words, he must be slow in recognizing phrases, and such slowness must reduce the speed of reading. So much time may be required for recognition of components of sentences that the thought of the sentence and its recall may be influenced adversely."¹

For many years, psychologists have recognized the fact that poor readers generally make irregular eye movements. The good reader makes few fixation pauses as his eyes move from the beginning to the end of a line of print, while the poor reader makes many more fixations per line. Some educators have assumed that the eye movement is a

¹Eames, T.H., "A Study of the Speed of Word Recognition," Journal of Educational Research, (November, 1937), pp. 181-187.

significant factor in causing poor reading. Accordingly devices and machines have been developed to cultivate rhythmic eye movements and to improve the speed of reading.

"Samuel Renshaw reports improvement in reading skill by use of tachistoscopic methods in which rapid perception of words and phrases is stressed."¹

"The work of investigators who use devices such as the Metronoscope to provide eye drills has been widely publicized. It is assumed by many readers of popular magazine articles that these devices have been proved to have validity and general usefulness. Of course the poor reader does make an unnecessarily large number of fixation pauses per line. However, when he is given an opportunity to read much interesting material, chosen in accord with his ability and adapted to meet his improved status during a remedial program, his eye movements almost invariably improve and the number of fixation pauses decreases."²

"Cattell rates comparative difficulty in material as follows. The statement being relative in view of the fact that he considers individual differences, light, color, type form, etc., as having a marked effect on any experiment.

¹Witty, Paul, Reading in Modern Education, (Boston: D.C. Heath and Company, 1949), p. 188.

²Ibid., p. 188.

"Letters are slightly more difficult to grasp than the numbers, every combination of numbers making a number that gives 'sense'. Not as many words as letters can be grasped at one time, but three times as many letters when they make words as when they have no connection. Twice as many words can be grasped when they make a sentence as when they have no connection. The sentence is taken up as a whole; if it is not grasped, scarcely any of the words are read; if it is grasped, the words appear very distinct. This is also the case when the observer constructs an imaginary sentence from the traces he has taken up."¹

Buswell came to the following conclusions in an experimental study.

"Eye-voice span means the amount the eye leads the voice in oral reading. This is as much as 7 or 8 words in a mature reader and much less in the immature reader.

"A positive correlation is shown between rapid reading and a wide span.

"The evidence here is perfectly clear that a wide eye-voice span is a characteristic of rapid readers for subjects of all grades of advancement from the second grade of the elementary school to the college.

"It has been shown that some good readers in the

¹Cattell, op. cit., pp. 311-312.

fifth grade have an eye-voice span as wide as many high school pupils. If it is possible to develop a wide eye-voice span in the first four years of school it would be an aid not only to quality of reading but also to rate."¹

"Increase in speed of silent reading is encouraged by simple narrative reading, aided by speed tests given often enough to keep the child's attention on the need for rapid reading. However, rapid reading is not encouraged in situations where it is out of place. Children with faulty habits, such as lip movements and whispering, are aided in overcoming their difficulty by suitable exercises."²

Sutherland's investigation at Butler University with 125 students enabled her to draw the following conclusions in regard to perceptual span and rate of reading.

"The results of this investigation indicate that perceptual span is related to rate of reading and to rate of perception. They also indicate that training directed at the improvement of perceptual span and which accomplished this end may also improve rate of reading and rate of perception. The results regarding the efficiency of training in perceptual span upon improvability in reading rate by direct instruction are inconclusive. There is a suggestion that the groups that

¹Buswell, Guy T., "An Experimental Study of the Eye-Voice Span in Reading," Supplementary Educational Monographs, (Chicago:University of Chicago; December, 1920), 17:53-62.

²Durrell, op. cit., p. 9.

had previous training in perceptual span, made faster initial progress in improvement in rate than a comparable group that had not had training in perceptual span.¹

The eye is of utmost importance in reading. Any failure of the eye will defeat any attempt to increase reading ability. It is an organ sensitive to light. Its reaction is governed by the strength and the duration of the stimuli. The coordination of nerve endings and the speed with which they react controls the transmission of the impulses to the brain.

Practice in these functions and familiarity with the stimuli leads to more accurate and rapid coordination. Defects or diseases of the eye and its coordinating parts are detrimental to efficient use of the organ for reading or any other purpose.

The physical aspect of the stimuli can have a positive or negative effect on the ability of an individual to comprehend its meaning.

All of these factors further complicate the physical and mental conditions of vision.

¹Sutherland, Jean., "Relationships Between Perceptual Span and Rate of Reading," Journal of Educational Psychology, (September, 1946), 37:373-380.

CHAPTER III

TYPES OF TACHISTOSCOPIC DEVICES

According to Webster's Unabridged Dictionary a tachistoscope is: an apparatus for giving a brief but accurately measureable exposure to visual objects, with a view to discover the time - rate and time - conditions of their apperception.

To fulfill all requirements of the definition a tachistoscope would, of necessity, have to be a complex device with mechanical means of measuring an allotted span of time. A more modern conception of tachistoscope is any device that will allow a very rapid view of the desired words or phrases.

Perhaps the simplest device of this kind is the flash card. The major difficulty with this device is that the rate of showing is not constant, hence the results cannot be so accurately measured.

The cardboard tachistoscope developed by Durrell is an economical device that employs a shutter instead of a blank card. A little practice by the teacher should enable a fairly constant speed to be developed.

The Flashmeter is a more elaborate device equipped with a photographic shutter with which it is possible to set an exact rate. As in a camera an expensive shutter makes it possible to adjust the speed to include very rapid exposures.

An added advantage of this device is that it can be employed with much larger groups of pupils than is possible with either preceding devices.

The most elaborate device and the most written about is the Metronoscope. It is described by Taylor as follows.

"The Metronoscope is a triple shutter tachistoscope. A Universal Dumore Motor with a gear reduction of 50 to 1 moves both the roll of reading material and the shutters, but the mechanism is so arranged that the roll and the shutters may be operated separately.

"The shutters operate on a system of cams. Any shutter can be shut and locked independently. When all shutters are unlocked they open and close intermittently, in a left-to-right sequence. A control switch enables the operator to make the following adjustments:

- a. One left-to-right operation of the shutters while a line of print is exposed.
- b. Three left-to-right operations of the shutters while a line of print is exposed.
- c. Continuous operation of the shutters while the roll remains stationary.
- d. Continuous unwinding of the roll in an unspaced movement, and
- e. Continuous rewinding of the roll in an unspaced movement.

"The roll is spaced automatically by means of an electric contact roller unit and a series of small holes near the right hand margin of the paper roll. If the control switch is set at space one on the dial (a) when the roll is inserted, (b) after the roll has been reversed, or (c) after it has been wound continuously, the roll slips into place automatically, so that the printed line is exposed in the proper position in the windows.

"The exposure time, or speed of the presentation, depends on the speed of the instrument, which is regulated by setting the speed dial at the appropriate point. The number of words to be presented in a line depends on the grade level and nature of the reading material. In the story rolls the number closely approximates the number of words per line in a textbook of the same grade level.

"The reading rolls are inserted in the case in much the same way that music rolls are inserted in a player piano. They vary in length. Many are long enough to carry several short stories or selections. When all the material on the roll has been presented, the spacing mechanism stops automatically. To re-wind the roll, the control switch is set at 'Re-Wind'.

"From the discussion it is seen that the Metron-O-Scope is versatile and lends itself to all sorts of teaching and drill in the classroom. Any type of printed material

or pictures may be presented on the rolls. The shutter combinations enable the teacher to present this material in a great variety of ways, not only for teaching, drilling, and testing, but for corrective reading of all types in cases of reading disability. The instrument permits adequate control of the total reading situation, and yet requires very little attention on the part of the operator unless the procedure is to be varied during the presentation of a roll."¹

Whether we agree or not with total use of tachistoscopic device, we must be aware of the immense improvement made in the devices themselves.

The tachistoscope was first mentioned by A. W. Volkman in 1859. An early type was described by Pillsbury as follows.

"The early tachistoscope was provided with two double convex lenses. This was enclosed in a wooden case, with the necessary doors for adjusting the lamp and inserting slides, and an opening in front through which the cylindrical lens holder projected and which it fitted tightly. Immediately before the lens tube was placed in the shutter, a Bouch and Lomb pneumatic photographic shutter, an oil lamp was used for light source."²

Another device which is not truly a tachistoscopic

¹Taylor, Earl A., Controlled Reading, (Chicago: The University of Chicago Press, 1937), p. 155.

²Pillsbury, Walter B., "A Study in Apperception," American Journal of Psychology, (1897), 8:315-393.

device but which is used in conjunction with them may be worthy of mention here. Center and Persons describe the ophthalmograph which helps indicate troubles that may be corrected by tachistoscopic means.

"The ophthalmograph is a camera which photographs the movement of the eyes while the student reads. The principle of this camera is based upon the fact that rays of light projected upon the corneas of the eyes will be reflected. These beams can be used to activate a sensitized plate, the photographic film, and to make images upon the film. Rays of light are projected from two sources to the eyes. These corneal reflexes are then focused by means of two telescopic lenses into a camera in which a 35 mm. film is moving actuated by a synchronous motor at the rate of half an inch per second."

"The student is told to read a standardized factual selection. When he has finished reading, he is asked a series of questions on the material read. The exposed film is cut from the unused part in a light proof case and developed. The photograph will show graphic parallel records of the movements of the reader's eyes."¹

All tachistoscopic devices have two things in common; the means of presenting stimuli rapidly, and the means of

¹Center, S.S., and Persons, G.L., Teaching High School Students to Read, (A Publication of the National Council of Teachers of English; New York: D. Appleton-Century Company, 1937), p. 119.

controlling the duration of such stimuli more or less accurately. The finer the control in each case the more complicated the machine is. In many cases the type of machine used has to be governed by the mercenary factor of what funds are available for investing in mechanical aids.

CHAPTER IV

THE CASE FOR THE USE OF TACHISTOSCOPIC DEVICES

In this chapter and the following one the writer has selected representative views from various experimental reports as to the effectiveness of tachistoscopic devices. As noted before, it is impossible to say with certainty that any one machine or method of using a machine is the one best means of increasing visual perception. In all cases the experimenters are able to see good and bad features in the use of mechanical devices. However, in the opinion of some (Chapter IV) the good outweighs the bad, while in others (Chapter V) the reverse is true.

The writer will make no attempt to classify the following nine recommendations for the use of tachistoscopic devices other than to record them in the chronological order of their writing.

I. "Real objects, pictures, and nonsense drawings were shown to three observers for moderate times (10-60 sec.). Exact reproduction by drawing, sometimes supplemented by written description was then required. Stress was laid upon introspection of the observing and reproducing consciousness. Each observer devoted to the work about forty hours, distributed through ten weeks.

"Ability to reproduce increased with practice, al-

though the increase was rapid at first and slow later. The greatest gain of final over initial ability was 44%; the least 6%.

"The chief reasons for the practice improvement were:

1. Confidence and 'doing one's best' replaced discouragement and 'giving up'.
2. Familiarity with the material lessened the difficulty.
3. The observer learned where and how to distribute attention effectively.
4. More efficient methods of work were adapted, tricks of counting, naming, grouping, etc., were discovered and used.
5. Regular and definite procedure replaced haphazard unorganized procedure.

"In no case did practice increase the ability or even tendency to visualize. The best reproducer of visual impressions was the poorest visualizer, and relied almost wholly upon verbal cues for recall.

"Our results show that the ability gained is very specific."¹

¹Foster, W.S., "The Effect of Practice upon Visualizing and upon the Reproduction of Visual Impressions," The Journal of Educational Psychology, 1911, 2:11-22.

II. "Twenty-nine second grade public school pupils, of both sexes, were given daily for 17 weeks a ten minute exercise in the rapid observation and reproduction of various visual materials - letters, digits, words, geometrical figures, etc.,

"The chief results are (1) the improvement from drill is rapid at first, then slow, save that (2) the group of children classified as 'poor' made a slower and more prolonged improvement by which they ultimately came to surpass the group classified as 'medium'; (3) the effect of the drill seems to be clearly persistent even after 41 weeks of no practice. (4) University students, tested without special practice are superior to second grade pupils, with 3 months' practice, though the best group of pupils surpasses the poor group of students. (5) Boys surpass girls and men surpass women in visual apprehension. (6) There is a direct, though small, correlation with age. (7) Individual differences are marked. (8) There is a distinct correlation between ability in visual apprehension and school standing. (9) In the term following this drill work there was a striking general rise in the school grades of the pupils, seemingly due to the formal drill exercise. (10) A special test by the Aussage method (Binet's card-of-objects) showed that the practiced children were super-

ior in recall and description to their unpracticed schoolmates when tested some fifty weeks after the termination of the special drill."¹

III. "The data obtained in the experimental work with the Metron-O-Scope indicate that controlled reading develops the accurate mechanical adjustments of the eyes which are essential to rapid reading. By eliminating the periods of confusion which result from uncoordinated eye activities, inequalities in duration of fixations, lack of lateral control, excessive number of fixations and regressions, probably due to narrow span of recognition and irregularities of binocular fixation, it aids the child in concentrating on the interpretation of the material under consideration.

"The tendency is not only to reduce the reaction time but to broaden the recognition span. It is true that the span of recognition is dependent, to a large extent, on the physiological structure of the eyes, and the majority of subjects cannot, therefore, be taught to read a line of print with just three fixations. On the other hand, experiments show that the breaking of the line into three exposures tends to broaden the span

¹Dallenbeck, K. M., "The Effect of Practice Upon Visual Apprehension in School Children," Journal of Educational Psychology, 1914; 5:321-334, 387-404.

of recognition, which in turn tends to reduce the number of necessary fixations and regression."¹

IV. "Initial and final measurements of reading comprehension and reading speed (The Iowa Advanced Silent Reading Test, Forms A and B, together with a test devised for the purpose of the experiment) were given to 22 experimental and 20 control subjects of college grade. Between the initial and final tests, the experimental subjects were given periodic practice in identifying forms, in reading sense and nonsense materials, and in responding to true-false statements. The practice materials were exposed for critical time intervals.

"On the final tests the experimental subjects made a residual gain over the controls of 4% in reading comprehension, and a residual gain of 24% in reading speed. Twelve days intervened between initial and final tests."²

V. "The Metron-O-Scope is recommended for initial instruction and corrective work. The following advantages have been claimed for this device, either by the manufacturers or by those who have used it.

¹Taylor, Earl A., Controlled Reading, (Chicago: The University of Chicago Press, 1937), p. 156.

²Weber, C. O., "The Use of Tachistoscopic Exercises in the Improvement of Reading Speed," Psychological Bulletin, (October, 1937), 34:533-534.

1. Each line of print is exposed in such a way that the pupil may learn to control the eye fixations in a rhythmical left to right direction along the line.
2. Regressions are prevented because the sections of the line already exposed are blocked off by closed shutters.
3. An accurate return sweep may be conditioned by the manner of exposure.
4. Maximum concentration and more rapid reactions to printed material are encouraged because of the recommendation that the speed of presentation always be slightly faster than the average reading rate of the group or individual being trained.
5. Vocalization and lip movement tend to be eliminated because these become almost impossible at the higher rate of speed.
6. The machine is considered to have high value as a motivating device for all children and especially for older boys and men who need remedial treatment."¹

¹Cason, Eloise, Mechanical Methods for Increasing the Speed of Reading, (New York: Teachers' College, Columbia University, 1943), p. 9.

VI. "It is true that the novelty of the instrument serves as a motivating factor in the students performance at first, and also that they permit much greater control of the teaching situation than do non-mechanical devices. The instructor know exactly what the students are reading and how fast they are reading it, for he completely controls the nature of the material and the rate at which it is shown."¹

VII. "Fifty-six men of the Battelle Memorial Institute, a metallurgical research laboratory in Columbus, were given two training periods per week for 15 weeks. The men were chemists, physicists, engineers, etc. About two-thirds held doctorates or engineering degrees. The training sessions comprised about 25 exposures each and were given on Tuesdays and Thursdays at 5:15 to 6:00 P.M. Such time of day was certainly not the best time for such work, since complaints of fatigue at the start of the sessions were frequent. It was impossible to arrange any other time so the work went on. Had it been possible to double the amount of this training, we are confident the results would have been much better. This experiment ran from November 30, 1944 to March 2, 1945.

¹Triggs, Frances, Orolind, Remedial Reading, (Minneapolis: The University of Minnesota Press, 1943), p. 84.

*Thirty-one citizens of Arlington, a residential suburb, met two evenings per week for the same sort of training. This group comprised lawyers, physicians, teachers, business men, housewives, and a few high school students. The main training materials used were numbers of 5 to 9 digits at exposures of from 0.1 to 0.01 seconds, with some English words, Magyar words and geometric forms. Two forms of the Robinson-Hall standardized silent reading test for college students were given at the start, at the middle, and at the end of the 30 training sessions. Tables 4 and 5 give the reading speeds in words per minute and comprehension percentiles for college freshmen.

TABLE 4

*Increases in Speed and Comprehension in
Silent Reading from Tachistoscopic Training
(Battelle Memorial Institute: N-56)

	Mean at beginning	Mean at middle	Mean at end	Gain
	Nov.30,'44	Jan.15,'45	Mar.2,'45	
Speed words per minute	262	294	313	51
Percentile	44	61	71	27
Comprehension Percentile	52	67	85	33"

TABLE 5

"Increases in Speed and Comprehension in
 Silent Reading from Tachistoscopic Training
 (Arlington Group: N-37)

	Mean at beginning	Mean at middle	Mean at end	Gain
	Nov.30,'44	Jan.15,'45	Mar.2,'45	
Speed words per minute	246	278	288	42
Percentile	34	52	60	26
Comprehension Percentile	44	62	77	33"

"The Battelle group gained 33 percentile ranks in comprehension, the average moving from the 52nd to the 85th percentile. Speed moved up from the 44th to the 71st percentile. Practically the same results were obtained in the Arlington group. The top quintile of each group added about 100 words per minute to speed and changed comprehension from mediocrity or slightly better to the top tenth of the standard for college freshmen. Standards for upper classmen and graduates are not available for this tests.

"In view of the fact that this small amount of training gave the subjects only a low level of skill with 8 or 9 digit numbers at 0.02 second exposures, it is fair to assume that far greater effects on reading would

be shown if the pure visual form training had been doubled or tripled.

"As a further check on the influence of tachistoscopic visual form training an experiment was set up in the city of Gary, Indiana, in which 100 six year old children were given three training sessions per week from early September, 1944, to June, 1945. One hundred additional children of like age and grade were studied as controls. The three experimental groups were selected from three schools, representing different socio-economic levels.

"There is every reason to believe that this work will have far reaching significance for primary education, particularly for its effects upon reading, spelling, and skill with numbers. Preliminary results are confirmatory of this assumption. The Gary experiment represents the first attempt to give this type of training to whole classes of unselected first grade children and to observe its effects upon scholastic achievement, not only immediately, but from the follow-up as the children progress to higher grades. No detrimental visual effects have been observed to date (May 1945) consequent to such training. On the contrary, far-point tachistoscopic training may prove to be an important means of helping to combat the high increase, in the past two decades, in the incidence of adventitious

myopia.

"From still another type of experiment we are able to show that tachistoscopic visual form training produces other important benefits to other visual functions, for example, with tachistoscopic training, there is a significant and large increase in the form-field of the two eyes. The form field is defined as the solid angle within and beyond the anatomical macula in which an observer is able to see shapes.

"Early in the war, the loss of lives and slowly replaceable and costly equipment from inability to identify aircraft, ships, tanks, etc., as friend or enemy, became a first order concern for us and our allies. In January, 1942, a proposal was submitted to the Bureau of Aeronautics of the Navy Department for the development and use of group training by tachistoscopic methods.

"Prior to this time many systems of recognitions training had been tried. Practically without exception they were based on analytical methods conducive to piece-meal or disjunctive seeing. Pictures, silhouettes, and models were shown and it was expected that pilots, bombardiers, gunners, etc., would memorize them.

"The so-called W E F T system (wings, engine, fuselage, tail) is an example. Too frequently when the plan

or side view of a plane or ship was fairly well mastered, the same craft seen forward or aft was unrecognized.

"The situation in the Navy was summarized (1942) by the commanding officer of one of our largest training air bases. He said summarily that he had tried every known method of recognition training, with no success, and further that he doubted that any method could be effective. In contrast (1945) a recognition officer from a carrier with a year and a half of active duty reports, 'We have never fired a shot at any of our own stuff and never missed a shot at the Jap.'

"For the attainment of the maximum skill in the visual perception of forms, wholes must be seen rather than a succession of discrete and disjointed parts. Brief exposure is one item in forcing the perceiver to see shapes coherently, unitarily. Skill in aggregating the sub-units within the total lattice comes with the active effort of making seeing a species of handling response. The motor or effector thus come to transform the sensory impression patterns into a more stably structured field. Visual form perception becomes freed from such limiting factors as position, size, brightness, characteristic of the performance of the untrained. The trained perceiver actually utilizes a different set of functions from the untrained. The change is a

transformation analogous to (or possibly identical with) the change of the tension movements characteristic of low orders of manipulatory skills to the fluent, accurate and effortless ballister movements of the virtuoso. Tachistoscopic training is thus certainly not a mere memory process, dependent as some psychologists have asserted principally on the frequency of impression. Sheer repetition alone is incapable of producing the reorganization of the art of perceiving shapes which leads to high order of skill. The results in Table 6 are typical of the Navy training program.

TABLE 6

"Group Tachistoscopic Training -
Navy Preflight Cadets

Percent of planes* and ships correctly identified.	N - 323	N - 272
	Cumulative percent Cadets (Session 15)	Cumulative percent Cadets (Session 50)
100	2.5	12.5
90	30.3	74.7
80	66.6	94.6
70	88.9	99.3
62.5	----	100.0
60	96.6	
50	98.8	
22.5	100.0	

*Forty slides were shown at 1/25 second on Session 15; 40 at 1/75 second on Session 50. The pretest averages of the two battalions before training showed no significant differences. Many of the views of planes used in the tests were not seen previously in the training sessions.

"Ninety-five percent of the 272 cadets correctly identified 80 per cent or more of the planes at 1/75 second exposures. One fourth of all the cadets correctly identified 90 per cent or better. Only 1 percent failed to get approximately three out of four correct identifications.

"Untrained American and British pilots given a similar test on operation aircraft succeeded at 1/25 second exposures, in one correct out of three.

"Suppose the views of planes and ships were shown for three seconds. Would not all of these men now make much higher scores of correct identification? The answer is in the negative. The trained perceiver sees more accurately in short than in long exposures. For the untrained increasing the exposure time not only does not help but frequently hinders accurate perception. Sculptors, painters and architects know that the longer the look, the less you see. Tests of a number of officer groups at 1/50 and 1 second exposures gave practically

unanimous reports that the shapes were easier to see and more certain at the shorter exposure time.

"In tachistoscopic training the kind of result secured will depend, like the acquisition of any skill, on the proper use of the method, and on the realization that sufficient time and training must be given to extend skillful performance to or beyond the shoulder of the curve of improvement. When this is done there is little or no forgetting.

"There is ample evidence of the present and future importance of increasing functional visual proficiency in seeing forms, sizes, positions, distances, etc., by tachistoscopic methods.

Summary

"1. Sol Finkelstein, in many respects the greatest of the lightning calculators, increased by training his own super-performances, reducing exposure times by a third to a half in some instances.

"2. University students were trained to equal and in specific instances to exceed Finkelstein's world records.

"3. The trained perceiver differs from the intrained mainly in that he uses a different set of functions. As skill approaches virtuosity sensory features recede and the process becomes essentially motor.

"4. In tachistoscopic work the exposure time/length of material relation is a function of grouping and field organization in perception. Concepts such as the 'span or attention' or 'span of visual apprehension' must be specified in terms of the developmental level of the skill of the perceiver.

"5. The limits of improvement from training by tachistoscopic methods are undetermined. The control of motivation and the active restructuring of the visual field by the perceiver seem to set the limits of improvement through training.

"6. Tachistoscopic training with digit patterns produces marked increase in reading comprehension and speed, measured by standardized tests. It enlarges form fields, in the vertical as well as the horizontal meridians, and assists in the reduction of myopia.

"7. Used in Naval Aviation, the method has made a useful contribution to the more accurate and speedy identification of air planes and ships."¹

VIII. "The same technique used during the war to teach aviation personnel to spot and recognize aircraft at the first glance is now being used to train Air Force Officers to speed up their reading.

¹Renshaw, Samuel, "The Visual Perception and Reproduction of Forms by Tachistoscopic Methods," Journal of Psychology, (1945), 20:219-232.

"The officers, including generals, are taking turns going to classes in a Reading Improvement Laboratory under the direction of Major B.E. Prater. After six weeks spent in the laboratory the officers find that they can read on the average from 50% to 60% faster than before they entered. They can go through their mountains of 'paper work' much faster.

"First step, when an officer goes to the laboratory is to photograph his eyes while reading. This is done with a scientific instrument called the ophthalmograph. The film record made by this instrument shows the number of stops made by the eyes in reading a line of type, and the number of times the eyes backtrack to re-read a difficult word or phrase. It shows up irregularities in rhythm of eye movements.

"Basic to the new technique of reading is a scheme for increasing the span of what the eye takes in at a single glance and the shortening of the time required for that glance. For this the tachistoscope is used. This machine flashes slides onto a projection screen. At first, the machine is set so that each slide is seen for 1/25 of a second, the length of the shutter click when you are taking a snapshot with your box camera. Later the time is cut to 1/100 of a second. At the beginning of practice the slides contain numbers of five

digits. The reader is soon able to recognize any of these numbers in 1/25 or even 1/100 second. But the idea is to train the eye to cover a greater span in the same brief instant. So he next tries six digit numbers and gradually works up to seven, eight and even possibly nine digit numbers.

"This technique was worked out by Dr. Samuel Renshaw at Ohio State University to train men in flash aircraft recognition.

"While the reader is lengthening his eye span, he is at the same time breaking up any faulty reading habits of pronouncing, either aloud or silently, the individual digits, it just can't be done at that speed. You have to learn to recognize by sight alone.

"This is what the fast reader must do with the printed page. He must take in a phrase as a whole and not pay attention to individual letters or syllables.

"Officers in the Reading Improvement Laboratory spend 30 minutes a day with the tachistoscope. Work is individual; each has his own tachistoscope and works at his own speed, improving at his own rate. For the next 30 minutes they move to another room to practice with the reading rate controller. This is a machine developed by Dr. Guy T. Buswell at the University of Chicago. It is equipped with a metal screen that slides down the

page of a book at a regular rate, covering up what the individual has already read.

"Next step is to carry over the habits learned on machines to the day-by-day reading for work or pleasure. This the officer does by reading one page on the reading rate controller and then turning off the machine and reading the next page in the normal way."¹

IX. "The most helpful procedure for increasing speed of word recognition is to use flash-cards or tachistoscopic exposure. One should start with one syllable words, printed one on a card. The card can be exposed in a single tachistoscope or by covering the card with a blank one which is withdrawn and quickly replaced. The time of exposure should be less than half a second, so as to prevent more than one look at the word. At first words should be short and of different shapes, such as pill, here, pony, and cart. As skill in quick recognition is gradually acquired, words of the same general configuration may be used in groups, such as hall, bill, kill, and tell. Longer and longer words can then be introduced, until the reader has developed to the point where he can recognize immediately words like 'opposite' and 'superiority'. Similar short exposure practice

¹Davis, Walter E., "Improving Reading Speed," Science News Letter, (Science Service Inc., Washington, D.C., July 16, '49), 56:33-48.

should also be given in the reading of short phrases such as 'to me', 'in the house', and from the store'.¹

"According to Dolch, 50 percent of the running words found in school reading material are repetitions of only 220 different words. He has published the list which consists entirely of prepositions, conjunctions, adjectives, adverbs and verbs. He reports that three or four weeks of practice on recognizing these basic words at sight produced remarkable improvement in reading especially in speech and fluency. Improvement in comprehension also took place because the pupils no longer needed to waste energy on these common words and were able to concentrate better on getting the meaning. This list of basic sight words is very useful to remedial teachers.

"When flashed exposures are used as a method for improving speed of word recognition, there is a possibility that the skill acquired in reading the cards may not carry over to the reading of the same words in connected material. This danger can be avoided by giving the pupil, after each flash card drill, connected reading to do which includes the words that have been practiced in isolation. When this is done, there should be no diff-

¹Harris, Albert J., How to Increase Reading Ability, (New York: Longmans, Green and Company, 1950), pp. 329-330.

iculty in getting the desired transfer of training from the isolated drill to ordinary reading."¹

The concensus of opinion seems to be that mechanical devices serve a useful purpose in training visual senses to cooperate with utmost efficiency by eliminating wasteful movement and time consuming hesitations. It is thought that seeing accurately and quickly is a habit and, as such, can be cultivated to a finer degree in most cases.

Renshaw differs from the majority opinion in that he sees the ultimate perfection in visual perception as a point at which the sensory features recede and the processes become essentially mechanical.

¹Ibid, p. 330.

CHAPTER V

THE CASE AGAINST THE USE OF
TACHISTOSCOPIC DEVICES

The following seven writers put forth various arguments against the use of tachistoscopic devices. These writings have been arranged in the chronological order of their publication.

I. "One conclusion to be drawn from the variety of experimental results is that we are capable of seeing 'at a glance' much more than is ordinarily supposed; hence we could probably learn to read much faster than we do. Beyond this conclusion it is difficult to generalize from several different opinions."¹

II. "The following possible disadvantages of the Metron-O-Scope have been mentioned by those who have used it:

1. The reader probably makes more than one eye fixation each time a shutter is dropped to expose the reading material. Although the material is exposed rhythmically, there may not be a corresponding rhythm of the eye movements of the reader.

¹Payne, Cassie S., The Derivation of Tentative Norms for Short Exposures in Reading, (Cambridge: Harvard University Press, 1930), p. 8.

- "2. As only one-third of a line is exposed at a time, and the rest is blocked off, it makes it difficult, if not impossible, to use cues from peripheral vision which may be of importance in a typical reading situation.
- "3. The material is usually presented at a uniform rate of speed throughout the selection, whereas studies have shown that good readers tend to vary the rate and number of fixations in accordance with the character of the material presented. This uniformity might be helpful to certain individuals but detrimental to others.
- "4. The relation of comprehension to speed probably needs further study when using this instrument, Directing attention to speed might interfere to some extent with habits of comprehension.
- "5. The grouping or phrasing which the individual might naturally use may not correspond to the grouping of the words as they are presented by the machine. This factor might be very important as an individual rereads a selection at increasing rates of speed.
- "6. Adjusting the speed for a group of pupils is an especially difficult problem as speed of reading and ability to comprehend differ greatly in a

typical class. The fact that the rate of reading is 'set' by the machine, raises the possibility that the speed used may be inappropriate for a number of individuals in the group."¹

III. "In general the writer concludes that the two methods used in beginning teaching made no statistically significant difference in the number of words learned.

"There is a general trend favoring the basic method in delayed recall in class A, and in both forms of recall in class B.

"While other studies have shown that quick perception is an effective method of systematic review this study shows that quick perception is of no value in initial teaching."²

IV. "Devices for Rapid Recognition of Words.

Accurate, rapid perception of words and phrases is an asset in reading. Many children look half-heartedly at words and do not master a recognition vocabulary to the point where they can quickly identify familiar words. The remedy, however, is not necessarily practice with tachistoscope or flashmeter. A more vigorous, vital,

¹Cason, Eloise, Mechanical Methods for Increasing the Speed of Reading, (New York: Teacher's College, Columbia University, 1943), pp. 9-11.

²Prario, V.S., "An Evaluation of a Quick Perception Method in Teaching a Reading Vocabulary to Grade One," Unpublished Master's Thesis, Boston University, 1945.

instructional program with provision for wide reading of familiar vocabulary in many situations would seem to be the more natural way to promote accurate perception.

"It may be that as a motivating device for discouraged, disinterested readers the flashmeter exercises may serve as a 'shot in the arm'. This committee, however, takes the position that complicated machines such as the flashmeter, the Metron-O-Scope, and the ophthalmograph are not necessary equipment for the classroom. It decries the indiscriminate use of gadgets and machines in the teaching of reading and advocates more natural and informal methods closely related to actual reading. It believes that available money can be more wisely used in furnishing additional supplementary books and library copies for children or in providing workshops for teachers."¹

V. "Mechanical devices which are both diagnostic and instructional include the metronoscope, the tachistoscope, and the flashmeter. The objection generally made to these instruments is that they represent an artificial reading situation and so far as has been determined, produce no better results that have been secured by the use of ordinary classroom materials. Furthermore, these

¹Beery, Althea, "Development of Reading Vocabulary and Word Recognition," Forty-Eighth Yearbook of the National Society of Education, Part II. (Chicago: University of Chicago Press, 1949), pp. 172-192.

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devices can be effectively used only by especially trained personnel.

"Therefore, the yearbook committee recommends that the mechanical devices be reserved for use in reading clinics and psychological clinics in school systems. Pupils should be adequately supplied with reading materials and other types of essential equipment before schools are justified in providing regular classrooms with mechanical devices. Even then it is doubtful whether time on the program is sufficient to allow for their use."¹

VI. "But may not the process be accelerated by judicious use of pacing devices such as the Metron-O-Scope? Several experiments suggest that little is gained by the use of such devices."²

In these experiments there was little or no important differences.

VII. "Use of Mechanical Devices

The limitations of these instruments (Metron-O-Scope, tachistoscope, and flashmeter) apply also to their use in instruction. The objection, in general, is that

¹Whipple, G., "Desirable Materials, Facilities, and Resources for Reading," Forty-Eighth Yearbook of the National Society of Education, Part II, (Chicago: University of Chicago Press, 1949), pp. 147-171.

²Witty, P., Reading in Modern Education, (Boston: D.C. Heath and Company, 1949), p. 188.

they represent an artificial situation. In some instances a pupil must acquire certain highly special techniques in order to deal with the instrument which are not called for in ordinary reading. For example, with a tachistoscope, a pupil must learn to disregard the moving parts and the noise. A more serious deficiency is that learning to recognize thought units when exposed in a tachistoscope is likely to be a very different performance from recognizing the same unit in a body of connected printed material. In such devices the phrase is neatly framed by itself and the whole task of isolating it, by oneself, in the body of a sentence, is not provided for. The sharply timed appearance and disappearance of the phrase is also a kind of aid which the ordinary printed page does not unfortunately, provide. It is conceivable that a pupil may become very expert in reading phrases from tachistoscopes and still be quite unable to read ordinary sentences and paragraphs in thought units.¹

"The metronoscope has certain advantages over the other types of tachistoscope and flash device. In the metronoscope, connected materials may be presented one phrase at a time. Indeed quite a long selection can be presented at a predetermined rate, one phrase at a time.

¹Gates, A.T., The Improvement of Reading, (New York: The Macmillan Company, 1950), p. 351.

It is argued that children rapidly learn to do ordinary reading by thought units because the skill is built up by pacing.

*Theoretically, this argument is largely false.

What the pupil can learn to do very well in responding to the metronoscope is to read phrases when they are separated by a space and automatically presented one at a time, in a carefully prearranged form. It is obvious that when the child takes up his book, the phrases do not pop into view one at a time across the line in carefully arranged order.

"One can learn to do the whole task practiced by the Metronoscope and still be far short of possessing the skill to read by thought units in ordinary reading."¹

"In some instances a very unusual device may have a special value merely because, being new, it may remove the pupil's feeling that the remedial method is the same old thing and will result in the same old failure. In general, the elaborate mechanical devices should be regarded as last resorts to be used when other methods have failed or when there is some tangible reason for selecting them at an earlier stage."²

¹Ibid., p. 352.

²Ibid., p. 354.

The major objections to the use of mechanical devices are that (1) they represent an artificial situation calling for techniques not required in ordinary reading, and (2) the gains made by use of these devices could also be obtained by more conventional methods, thereby freeing the money involved for more of the ordinary classroom materials.

CHAPTER VI

PROCEDURE IN USING TACHISTOSCOPIC DEVICES

Following are some suggestions that have been found satisfactory in the use of mechanical devices. The same indefinite factors, individual differences, are present here perhaps in a lesser degree, however, since the teachers are primarily concerned. After practice in the use of mechanical devices to present material in a classroom it is conceivable that the teacher would find modifications of these suggestions better fitted to his particular methods of presentation.

"With the trend on remedial work away from special clinics and toward the practice of having each teacher handle the retarded cases in her classroom, there has come less dependence on mechanical contrivances as agents of remediation. However, in all justice, it must be admitted that the Metronoscope, which focuses attention on meaning units at a high rate of speed, tends to interest children in the middle and upper grades, and promotes certain improvements in their comprehension and retention. The 'nuisance value' of any mechanical phrase projector is high."¹

Taylor lists the following suggestions in the use of

¹Adams, Gray and Reese, Teaching Children to Read, (New York: The Ronald Press, Company, 1949), p. 409.

the Metronoscope. The writer thinks, however, with minor changes the same rules could be utilized with any of the mechanical devices.

I. "Positive Suggestions for Children

1. Sit directly in front of the instrument, if possible, and eight to ten feet from it. Twenty feet is not too far away if your vision is normal.
2. Make yourself comfortable; keep your body relaxed and quiet.
3. Give your eyes a chance to get into correct habits of reading, with a rhythmical left-to-right movement.
4. Read the material shutter by shutter. If you get lost, omit a few shutters, and then catch up with the instrument.
5. When reading orally, say the words quickly and keep the voice low.
6. To improve your reading:
 - a. Work kinesthetically on the words which are difficult for you. Record each word on a card for your card catalogue; after looking up the meaning and pronunciation and using it in a sentence, learn these words so that you will know them when the roll is presented again.

- b. Ask questions when the meaning of the content is not clear.
- c. Help the teacher record your percentage of accuracy and the number of lines read per minute. Be ambitious to improve your record daily.

II. "Positive Suggestions for the Teacher

1. Secure a reading-graph for each subject before training begins.
2. Have available the records of latest oral and silent reading scores for each child. Spelling scores also are indicative of the type of difficulty in the individual case.
3. Select the roll according to the grade level of the individual or group with which you are working. Do not repeat a roll too often, for memory is bound to affect results in terms of percentage of accuracy.
4. Have each individual read orally. If the accuracy of reading the material from forty or more shutters is 85 percent or over, the instrument can be increased in speed.
5. In the case of poor readers:
 - a. Read orally while the child reads silently.
Set the instrument at a lower speed.

- b. Use a pointer to further aid word recognition. Stop the Metron-O-Scope frequently if necessary.
 - c. Work on many of the words kinesthetically. Put them on individual cards for drill purposes. Give phonetic help.
 - d. Concert reading of instructor and child is often helpful.
 - e. Let the child aid in the creating of content for a new roll.
6. Group reading.
- a. Let each child have an opportunity to read at least once a day.
 - b. Record the name of the child, the roll used, the date, speed of reading and percentage of accuracy.
 - c. Make a straight line for each shutter read accurately and a cross for each one containing an error or errors. Record as many of them as possible. Let the groups help you to remember, so that the individual child will know what his standing is. At least forty shutters should be read if percentage of accuracy is to be figured from the data.
 - d. Set the instrument at a suitable speed for

- each child. Have his past record before you.
- e. Be sure that each child keeps his card catalogue up to date. Check him constantly on the pronunciation and meaning of words.
 - f. When not recording, watch the position of each child and compliment those who maintain good posture.
7. New rolls: Use the same technique as when introducing a new story from a book.
- a. Read a portion aloud to the children and let them originate possible endings.
 - b. Read aloud only the most difficult words as the children read the roll silently.
 - c. Study the new words, look them up in the dictionary, and so on.
 - d. If the roll is informational, question the children about the subject matter. Use pictures to create interest. After reading the material, have the children question each other about the content. Let them list points learned from the reading. Ask them to read additional material in the library on the same subject.
8. From time to time check progress with stand-

ardized tests and eye movement photographs."¹

The rules for using mechanical devices are fundamentally the rules of good attention and attitude of the pupil to the material being presented and the usual rules of adequate preparation by the teacher, coupled with a thorough knowledge of his pupils.

¹Taylor, Earl A., Controlled Reading, (Chicago: The University of Chicago Press, 1937), pp. 158-159.

CHAPTER VII

TESTS USED FOR APPRAISAL OF
TACHISTOSCOPIC METHODS

In the following pages the writer has attempted to indicate some of the standard tests used in connection with tachistoscopic methods of teaching reading, also to give a few selected samples of informal tests.

By utilizing these tests and other informal ones to fit the occasion an instructor could cover the testing suggested by Eames as follows:

- "1. A standardized reading test.
2. Non-standardized test of phrase reading.
 - a. Picture test.
 - b. Flash card test.
 - c. Flashmeter test.
3. Test of ability to phrase in oral reading.
4. Test of recall on the Metron-O-Scope.
5. Observation of eye movements.
 - a. Crude observation of eye movements in a mirror.
 - b. Reading graphs obtained with the Ophthalm-O-Graph."¹

¹Eames, T.H., "A Study of the Speed of Word Recognition," Journal of Educational Research, (November, 1937), 31:3:181-87.

The following are some of the standard tests used:

I. For early grades:

1. Betts Ready to Read Tests - Keystone View Company, 1934.
2. Classification Tests for Beginners in Reading - Webster Publishing Company, 1933.
3. Durrell-Sullivan Reading Capacity Test - World Book Company, 1937.
4. Gates Reading Survey, The - Bureau of Publications, Teacher's College, Columbia University, 1926.
5. Metropolitan Readiness Tests - World Book Company, 1933.
6. Monroe Aptitude Tests - Houghton Mifflin Company, 1935.
7. Reading Readiness Test - Educational Test Bureau, 1932.
8. Sangren Information Test for Young Children - 1926, World Book Company.

II. For Upper Grades:

1. Cooperative English Test, The; Reading Comprehension -
2. Diagnostic Examination of Silent Reading Abilities, The - Van Wagenen and Doorak.
3. Metropolitan Achievement Tests - World Book Company, 1933.
4. Modern School Achievement Tests - Bureau of Publications, Teacher's College, Columbia University, 1931.
5. Progressive Achievement Tests - Southern California Book Depository Ltd., 1931.
6. Reading Readiness Tests - Southern California Book

Depository Ltd., 1931.

7. Stanford Achievement Test - World Book Company, 1929.

8. Unit Scales Attainment - Educational Test Bureau, 1932.

III. For Establishing Reading Level

1. Gates Silent Reading Tests - Bureau of Publications, Teacher's College, Columbia University, 1926.

2. Instructional Tests in Reading - Public School Publishing Company.

3. Iowa Silent Reading Tests - World Book Company, 1932.

4. Sangren-Moody Reading Tests - World Book Company, 1927.

The following are tests of various types taken from informal tests of Goodlight:

"I. Quick Word Perception Test. (Form A)

- | | | |
|----------|-----------|----------|
| 1. meat | 2. beef | 3. meal |
| 1. hair | 2. steep | 3. cheap |
| 1. shark | 2. store | 3. storm |
| 1. hide | 2. home | 3. hare |
| 1. pack | 2. sack | 3. sail |
| 1. stall | 2. crawl | 3. drawl |
| 1. store | 2. gaze | 3. glare |
| 1. smash | 2. snatch | 3. catch |
| 1. harm | 2. hard | 3. balm |
| 1. deep | 2. leak | 3. leap |

- | | | |
|------------|------------|------------|
| 1. woke | 2. soap | 3. soak |
| 1. strike | 2. choke | 3. stride |
| 1. drug | 2. drag | 3. brag |
| 1. found | 2. hound | 3. bound |
| 1. blew | 2. chew | 3. stew |
| 1. peach | 2. perch | 3. parch |
| 1. square | 2. quaint | 3. quail |
| 1. daisy | 2. daily | 3. dairy |
| 1. peach | 2. plum | 3. grape |
| 1. rack | 2. crock | 3. rock |
| 1. gown | 2. dress | 3. grown |
| 1. squat | 2. squash | 3. quart |
| 1. cable | 2. marble | 3. maple |
| 1. stock | 2. storm | 3. stork |
| 1. gale | 2. jade | 3. wade |
| 1. jingle | 2. juggle | 3. jungle |
| 1. salmon | 2. shark | 3. whole |
| 1. banquet | 2. bouquet | 3. blanket |
| 1. walrus | 2. walnut | 3. walker |
| 1. autoum | 2. autumn | 3. antonym |
| 1. onion | 2. tomato | 3. radish |
| 1. coffin | 2. cotton | 3. steel |
| 1. parade | 2. pocket | 3. parrot |

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|---------------|----------------|----------------------------|
| 1. motive | 2. mosque | 3. mosquito |
| 1. maintain | 2. mountain | 3. mounted |
| 1. study | 2. steady | 3. sturdy |
| 1. ancient | 2. anxious | 3. ancestor |
| 1. healthy | 2. wealthy | 3. weary |
| 1. graceful | 2. grateful | 3. hateful |
| 1. curious | 2. furious | 3. spurious |
| 1. scatter | 2. spatter | 3. scamper |
| 1. master | 2. murder | 3. further |
| 1. collect | 2. connect | 3. column |
| 1. despair | 2. repair | 3. repaid |
| 1. single | 2. sickle | 3. signal |
| 1. oppose | 2. opposite | 3. opponent |
| 1. difficult | 2. different | 3. difference |
| 1. stupendous | 2. tremendous | 3. momentous |
| 1. renovate | 2. separate | 3. delegate |
| 1. comparable | 2. comfortable | 3. commutable ¹ |

***II. Word Recognition with Meaning. (Form A)**

- () animal () to pull () tree () bird () to motion
 () bag () to eat () bird () plant () to gather
 () fish () to hit () strong wind () vegetables () to
sprinkle

¹Goodlight, G.L., "Evaluation of Exercises in Rapid Word Recognition with Meaning," Unpublished Master's Thesis, Boston University, 1950, p. 58.

- ()low cost ()to jump ()vegetable ()angry ()to kill
- ()meat ()to make wet ()dress ()insect ()to fix
- ()to look ()fruit ()animal ()beauty ()not easy
- ()go slow ()stone ()feast ()rich ()different
- ()to hurt ()flower ()season ()old ()very great
- ()to jump ()fish ()fish ()strong ()at ease
- ()to grab ()bird ()wild forest ()a very high hill ()apart¹

III. Word Classification with Rhyme Clues.

Directions: Write 'F' if the word is the name of a flower, or 'B' if it is the name of a bird. Listen first to the word that rhymes with the one to be flashed.

<u>Clue</u>	<u>Word Flashed</u>
1. carrot	parrot
2. hazy	daisy
3. park	lark
4. fork	stork
5. beagle	eagle
6. hilly	lily
7. hose	rose
8. dobbin	robin
9. pail	quail
10. fancy	pansy ²

¹Ibid., p. 60.
²Ibid., p. 64.

***IV. Word Classification with Clues.**

Directions: These words are related to the weather. Each word will be shown slowly and the meaning explained. Read each one aloud. The second time, when all the words are flashed quickly, something will be said with each word. If the statement is true write 'T' and if the statement is false write 'F'.

Clue

Word Flash

1. After a storm, we sometimes see a -----rainbow.
2. Mixed snow with rain or hail is -----sleet.
3. Another name for pouring rain is -----mist.
4. When snowflakes fall slowly, it's a -----blizzard.
5. Bouncing frozen rain is -----hail.
6. A very strong wind is a -----breeze.
7. When the rain falls, the sky is -----cloudy.
8. A soft gentle wind is a -----gale.
9. A short fall of light rain is a -----shower.
10. When the sun shines, the weather is -----fair."¹

***V. Word Classification without Clues.**

Directions: These words tell about things to eat. Write 'M' if the word is some kind of meat or write 'D' if it is a dessert.

¹Ibid., p. 69.

Word Flash

- 1. Jello
- 2. cookies
- 3. sausage
- 4. bacon
- 5. beef
- 6. pastry
- 7. pork
- 8. pie
- 9. custard
- 10. ham¹

*VI. Verbs - Antonyms and Synonyms

Directions: If the word clue means the same as the word flashed, write 'S'. If the word has a different meaning than that of the word flashed, write 'D'.

<u>Clue</u>	<u>Word Flash</u>
1. mimic	imitate
2. lend	borrow
3. appear	vanish
4. pull	haul
5. gather	collect
6. fail	succeed
7. frighten	scare

¹Ibid., p. 74.

<u>Clue</u>	<u>Word Flashed</u>
8. act	perform
9. smile	frown
10. beg	urge ¹

¹Ibid., p. 84.

CHAPTER VIII

SUMMARY AND CONCLUSIONS

Summary

1. Recognition is a progressive development with each succeeding step dependent on what goes before.

2. The eye is of paramount importance in reading. Practice in using the eyes makes for more accurate and rapid coordination. Defects or diseases of the eye and neural system are detrimental to its efficient use.

3. Tachistoscopic devices aid in increasing visual perception by demanding close attention to rapid, measureable exposures.

4. Mechanical devices tend to eliminate wasteful inefficiencies in visual perception. Possibly more intensive use of mechanical methods and lead to a situation where response is almost automatic.

5. The main objections to mechanical devices are based on the artificial situation developed and the expense of the equipment.

6. Procedures in using mechanical devices are, in general, rules of good teaching.

7. The tests used with these devices are the standard reading tests and informal tests adapted from the subject matter being used.

The writer found that much has been written on the subject of tachistoscopic methods of increasing visual perception and increasing reading speed; but that the majority of the literature referred to a relatively few original experimental works. The arguments are fairly evenly divided between favoring and repudiating the effectiveness of tachistoscopic methods and devices. Apparently much more original research is necessary to prove, conclusively, the value of tachistoscopic methods.

Most of the experiments assume that these means of training are directly associated with the standard means of increasing reading ability and perception. Renshaw, on the other hand, believes that tachistoscopic training develops a different set of functions than those normally used in basic reading training. If this is found to be the case, a new field of experimental endeavor remains to be explored with tachistoscopic methods and devices.

Conclusions

The writer draws the following conclusions from his review of previous research:

1. There is no definite proof of the effectiveness of tachistoscopic methods and devices.

2. Experimentation and research has not been exhaustive enough to draw any final conclusions.

3. There is an extensive field to be further explored before tachistoscopic methods and devices can be completely accepted or rejected.

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