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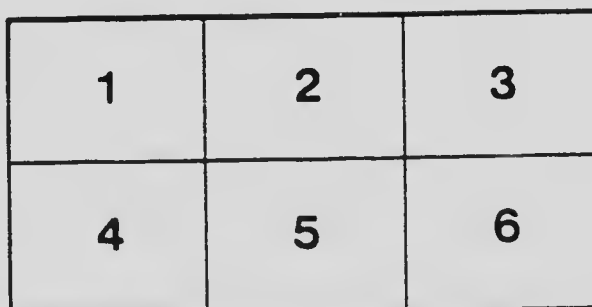
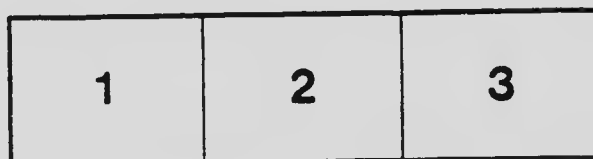
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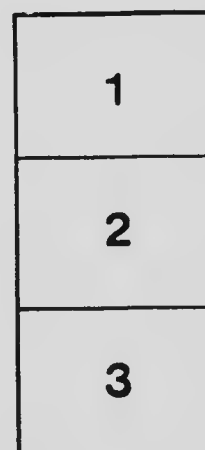
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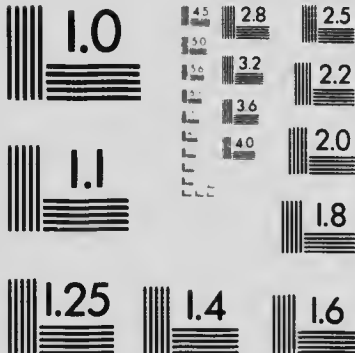
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The Psychology and Pedagogy of Handwriting

By D. E. HAMILTON, M.A.

Instructor in the University Schools, Faculty of Education, University of Toronto



THE UNIVERSITY OF TORONTO PRESS
1920



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To the Registrar,
University of Toronto.

We beg to report that the thesis of Mr. Douglas Ewart Hamilton on "The Psychology and Pedagogy of Handwriting", together with his discussions of the questions set on the History of Education, the Science of Education, Educational Psychology, and Educational Administration, qualify him for the degree of Doctor of Pedagogy.

(Signed)

H. T. J. COLEMAN,
W. E. MACPIERSON,
W. PAKENHAM,
PETER SANDIFORD.

November 20th, 1919.

To the Senate of the University of Toronto.

I hereby certify that the thesis above mentioned has been accepted for the degree of Doctor of Pedagogy, and that Mr. Hamilton has complied with all the regulations in accordance with the Statute in that behalf.

(Signed) JAMES BREBNER, *Registrar*.

University of Toronto,
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CHAPTER I.

INTRODUCTORY.

WRITING is a mode of expression. It is a mode of expression with which nature does not freely endow us at birth; on the contrary, its development demanded a tremendous expenditure of energy by the race and its acquisition makes fairly large demands upon the individual. It must be learned; and it is the business of educational psychology to discover how it can be most easily and economically learned by the child. Many of the best psychologists of recent times have brought their intelligence and industry to bear upon this problem, and the results which they have obtained are of sufficient importance to justify the compilation of their data and an attempt to apply their findings in a practical way to the problems which beset the teacher of writing.

The earlier investigators of handwriting confined themselves closely to the act of writing, devoting their attention to an analysis of the movements used. Because of their labors it is now possible to state in a fairly authoritative fashion just what is the best type of movement and how it may be most easily acquired.

Until some device for the accurate measurement of quality in writing was devised, it was almost impossible to investigate the product of the writing act with any degree of accuracy. Thorndike made this possible by his Graphometer. A new era of investigation opened then, and following his lead Ayres, Freeman, and others have constructed more or less efficient scales for the measurement of handwriting. While not as much work as could be desired has been done with these scales in the way of school surveys, comparison of methods, and the solving of various problems in writing, still sufficient has been accomplished to justify the publication of a book which attempts to bring together the main facts in a way which makes an intelligent and comprehensive view of writing and its problems possible.

The methods of teaching change very slowly and follow with hesitating step the paths blazed out by the pioneers of educational investigation. Innovations are apt to be looked upon with distaste by the average teacher, who, for the most part, is bound by the ties which tradition casts about him. Who of us does not use methods, which he knows to be faulty, just because they have been impressed upon him by his own teachers? Who among us has the courage and initiative to adopt radical changes in practice when such a change necessitates the shaking off of old habits and traditions?

The teaching of writing offers some examples of just such dislike to change. For instance, the old tradition that writing must be a thing of beauty, an artistic production, is a legacy from the ancient days of copying and illuminating by hand. A monk of the mediæval age would spend a month upon a single letter and consider it well spent. That was well enough for him; his work was intended to remain as a permanent possession of future generations. To-day the engraver and printer can do the month's work of the monk in a mere fraction of that time and have made any attempts to use handwriting as a medium of artistic expression futile and foolish. Writing of to-day is for merely temporary and utilitarian purposes, yet too often our schools labour upon it as though the attainment of beautiful handwriting was one of the most desirable ends of education. It is not education at all in any real sense of the word, but only a preparation for education, a tool to be used in worth-while work.

It will be seen from the foregoing remarks that the writer does not subscribe to the view that writing is not well enough taught in our schools, and that more time and attention should be paid to the subject. As a matter of fact, he believes that too much attention is paid to it as a school subject. Paradoxical as it may seem, he also believes that the remedy for the undoubted fact that our schools do not produce writers who are satisfactory to the men who later employ them lies in less teaching rather than more. Less teaching and better teaching at the beginning is the proper answer. To many this will doubtless seem to be radical and faddistic; but a care-

ful consideration of the facts presented later will surely convince any impartial observer.

If any reader finds the repetition of the idea that writing is a means to an end and not an end in itself wearisome, let him remember that the fundamental fallacy underlying the present methods of instruction in writing is just the refusal to accept that view and to work it out to its logical conclusion. He is warned that it will be stressed wherever emphasis upon it seems necessary; a clear understanding of the problems of writing is impossible unless this idea is kept continually in mind.

The position of writing as a school subject has been a fruitful source of debate. On the one hand, we find a few radicals who claim that writing should be acquired incidentally along with other school work. On the other, many careful thinkers believe that writing is a far too complex and specialized habit to be acquired in such a haphazard fashion. This question can be answered fully only when a good deal more work has been done in comparing the results of the one system with the other; it must be admitted, however, that the evidence at our disposal favours the radical view. It is perhaps true that the difficulty of acquiring a reasonably good hand has been over-estimated as a natural result of the analysis of the movements used in handwriting, and as a legacy from the days when reading, writing and arithmetic formed the total curriculum of elementary schools. In any case, it is certain that writing will remain as a special subject upon the curriculum of our elementary schools, and therefore the discussion of method, which would be useless if the radicals had their way, is still of value.

If the home environment of every school-child were such that it would just naturally come to want to write, the position of those who favour no instruction at all in writing would be immeasurably strengthened. Unfortunately, this is not the case, and the duty of arousing interest and training to skill in writing devolves upon the school. This alone seems a sufficiently good reason for the retention of writing as a subject in the primary grades of the public schools.

Large school systems under central control invariably tend to too great uniformity in the teaching of all subjects. In Ontario, for instance, a single standard of writing is used everywhere, and a single style in all schools. Such procedure assumes that there is only one best style which must be suited to all individuals; an assumption of which it is not difficult to dispose. One of the great faults in the teaching of writing is this same striving after uniformity, and to it must be attributed a good deal of the failure to develop good handwriting even at a large time-cost. Doubtless this opinion will be regarded with suspicion by many; the facts which support it are quite sufficient to justify it.

We now stand upon the threshold of a new era in education. For men of past ages scientific education was an impossibility; the tools which are requisite to determine values in education were not available. Nowadays every year sees other weapons added to the armory of the educational investigator; problems which either passed unnoticed or defied attack are now yielding to the unremitting assaults of investigation and experimentation. The movement is yet in its infancy, but sufficient has been accomplished to warrant a prophecy that the education of the future will be placed upon a solid foundation of facts rather than opinions, of reasonable understanding rather than prejudice. If the present study helps in some small measure to bring that era closer in the humblest of school-subjects the labour it has cost will not have been in vain.

CHAPTER II.

THE DEVELOPMENT OF WRITING IN THE RACE.

THE more or less successful efforts made in the last few decades to explain and interpret the phenomena of individual growth both psychologically and physiologically in the light of racial development demand at least an attempt to do the same in connection with the problem of writing. If we believe, with Judd¹, that such an attempt will give us no direct help in formulating a theory of correct pedagogical practice, we may at least expect that an historical sketch of the development of writing in the race will raise some questions and throw a certain amount of light upon their proper solution. Certainly, we must avoid too close an application of genetic psychology to the individual. To neglect the many differences between the problems facing the race in developing writing and those facing the individual in applying the finished product of that development would be to defeat our own ends. Our findings, therefore, must be made always with this difference held clearly in view. Care must be taken to see that there really is a clear analogy between the position of the race and that of the individual at the point discussed before we may claim that what is true of the race will be true of the individual. Even then our conclusions will be only suggestive, and will be accepted only if confirmed by evidence derived from other methods of inquiry which allow a more definite and scientific treatment.

The first effort of man to represent ideas through markings naturally took the form of direct representation of natural objects. The caveman of the Palæolithic age depicted upon the tusks of mammoths and the bones of animals the fauna which formed the most important element in their environment. The surprising feature of these efforts is their

¹Judd, C. H. "Genetic Psychology for Teachers," p. 198.

accuracy and high artistic merit. They can scarcely be classed as writing, for we should consider them as artistic products rather than efforts to find a medium of communication through markings.

It is but a short step however to apply the power of picture-making to such uses that it may properly be called writing. So the Chinese used a symbol to represent the sun, or the Indian drew the picture of a canoe to represent an actual canoe. Such ideograms, to use a convenient term, represented actual concrete things.

An important extension in the range of expression allowed by ideograms is obtained as soon as they become symbolic, and instead of representing concrete objects, suggest abstract ideas. For instance, among the North American Indians, Schoolcraft tells us, a picture of a pipe symbolized peace, a vine, friendship, a bird with extended wings, haste. Even to-day we still retain a few such ideograms in common use. The Roman numeral I is originally the picture of one finger, V represents the hand with its five fingers. Another ideogram, which we all see every day, is the barber's pole with its red and white spiral markings, which reminds us of the time when the barber practised the gentle art of blood-letting.

The next important step in the development of ideograms is their use in combination to express ideas. For instance, the old Chinese ideogram to represent wife was formed by combining two representing woman and broom, to give the idea of love, those representing a woman and a son. So, in early Cuneiform writing, the combination of the signs for house and darkness gave a sign for prison, the idea of tear was represented by the combined ideograms for eye and water. Working in this way, the Chinese have elaborated signs for 40,000 words. It is obvious that so cumbrous a system is a terrible strain upon the memory. So true is this that it takes a Chinaman twenty-five years to learn to read and write, and even then his knowledge is by no means exhaustive. It is plain, too, that such a system of writing can never be used freely by the great mass of the people, and consequently comes to be a possession of only the ruling or hieratic classes in the population.

The great step in the development of a fairly workable graphic system comes when conventionalized ideograms are taken to represent sounds instead of things. Three kinds of phonograms may be distinguished:

- (a) Verbal signs, representing entire words.
- (b) Syllabic signs, representing the syllables of which words are composed.
- (c) Alphabetic signs, representing the elementary sound into which syllables may be resolved.

The use of verbal signs in combination give us the familiar rebus. This originated in the application of ideograms to proper names, in which case the idea behind the ideogram was neglected and the sound of the spoken word representing that idea became predominant. For instance, the Aztecs represented their King's name, Itzcoatl, by the combined pictures of a snake and a knife. So Smithfield might be represented by the pictures of a blacksmith and a field.

A natural transition, though a momentous one, occurs when the conventionalized ideogram is used to represent the first syllable of the word instead of the whole word. A simplification at once is obtained. Thus the Japanese adopted the Chinese characters, but by choosing certain ones to represent all possible syllabic combinations in their tongue, they were able to represent all Japanese words by using fewer than fifty symbols. This syllabary marked the highest point attained by Japanese genius, and the fact that so gifted a race was unable to develop a true alphabet is a significant indication of the extreme difficulty experienced by man in analyzing words into their simplest elements.

The Egyptian hieroglyphs are the source of all alphabets in use to-day in the world. The Egyptians themselves in very early times were able to develop their hieroglyphs into syllabic and alphabetic symbols, but continued to use the three systems of ideograms and syllabic and alphabetic phonograms side by side. They proved unable to clear away the dead husks clinging about the living germ which they had created, probably because the art of writing was confined to the priesthood, and in that class tradition was very strong. Moreover, simple writing was not a desirable thing in their eyes, since

they enjoyed greater power, because of the very fact that they alone were able to interpret the writings of past ages.

The great task of abstracting the simple alphabet from the mass of ideograms and syllabic signs in which it was embedded was accomplished by the Semites during their tenure of power in Egypt. By about 2,000 B.C. they had succeeded in adapting the Egyptian signs to their own language. The alphabet spread from them over the whole Mediterranean basin, changed a little by the Greeks, and again by the Romans. All alphabets in use in the world to-day have come, as Taylor has shown, in direct line of descent through the Semites from the ancient Egyptian hieroglyphs.

We may now summarize the development of the art of writing from the psychological standpoint. It makes a beginning with the pictures of concrete objects, a device natural to man in an age and environment when thought was confined to the external and concrete, and did not yet embrace the more difficult ideas of relationships. As the mental process grew wider in its scope, so the ideograms took on a symbolic meaning. Up to this point it is obvious that ideograms are entirely independent of language. A Kaffir chieftain or an English settler might interpret an Indian ideogram just as well as the Indian himself. But as soon as the tendency to conventionalize and simplify ideograms appears, and they become fixed in a definite form which perhaps retains only a faint resemblance to the original picture, a system of writing arises which is no longer self-explanatory. Very few of the savage races of to-day or the ancient nations of the past reached even this point in the invention of writing.

As soon as the graphic symbols are connected with sounds rather than meanings, it is evident that the interpretation of the writing depends at once upon the spoken language, and the path to a simple and plain representation of phonetic values, and, consequently, of the whole spoken language, lies wide open. Yet of all the races in the world not more than five or six have been able to pass from the ideographic to the phonographic stage. Only two or three have been able to carry the process to its logical end and evolve a simple alphabet. The Persians succeeded in developing an alphabet out of the

cuneiform Proto-Medic syllabary, which in turn goes back to Assyrian phonograms, and they in their turn to Acadian pictography. It is believed that the Mayas of Yucatan were successful in developing an alphabet from ideograms. The important alphabet is the Semitic one originating in Egyptian hieroglyphs.

We may note, first of all, that the whole process is analytic. The symbol stands first for an idea, then for a whole word, then for the first syllable of that word, lastly for the single initial sound. It seems as though the great difficulty was the recognition of a single element such as the sound of any consonant, say "t," which by itself is quite unpronounceable; "ta" "te" "ti" were, in the syllabary stage, unresolvable elements, and the abstraction of the like element "t" from the syllables in which it occurred proved a task of almost incredible difficulty. To quote Isaac Taylor:

"To invent and bring to perfection the score or so of handy symbols for the expression of spoken sounds which we call our alphabet, has proved to be the most arduous enterprise on which the human intellect has ever been engaged. Its achievement tasked the genius of the three most gifted races of the ancient world."

One other point remains to be discussed. At what point in the development of the race does writing arise? The oldest writing we possess is that on a tablet erected by King Sent in memory of Shera, his grandson. This tablet is referred to a period somewhere between 4000 and 4700 B.C. But the writing used on this tablet is already alphabetic, and consequently implies a long period of development preceding it. Taking this into consideration, Taylor argues that writing first originated in the Nile Valley at least 7,000 years ago. Chinese tradition refers the beginning of writing to about 2500 B.C. Professor Sayce places the origin of the Accadian cuneiforms at circ. 3000 B.C. All other writings, of which records remain, are modern compared to the vast antiquity of these.

But when we consider that man has existed as man for at least 250,000 years, and perhaps twice as long upon the earth, we see that writing comes late in the development of the race.

The same point is made even more clearly if we consider

the relative time of the development of writing and of the other arts. The taming of animals, the cultivation of cereals, the art of home-building, the working of metals, the weaving of cloth, the ceramic art, the organization of society and law in some settled form precede the development of writing. It is true that a very definite and rather low limit is set to the development of civilization until some better method of handing down from generation to generation the fruits of human effort than oral tradition is devised or acquired. It is none the less true that the basic arts of human life antedate by innumerable centuries that of writing, essential as we moderns conceive it to be.

We may now ask certain questions which our historical sketch suggests:

(1) Since the evolving of a simple system of phonetic symbols has been shown to be a tremendously difficult process, should we not expect tremendous difficulties to face us in the teaching of that system? The answer is self-evident, of course. The situation is entirely different. The child in learning to write to-day has only to reap the benefits of the labour that evolution has cost. It would be as foolish to say that to drive an automobile and to invent one are tasks of equal difficulty.

(2) Since writing has been evolved through analysis, should not our teaching of writing follow the same road, and be analytic rather than synthetic in its method, on the principle that race development and individual development are parallel? We have shown the enormous difficulties conquered in analyzing the sounds of words and evolving a suitable set of symbols for them. We should now add a word regarding the amazing rapidity with which the use of these symbols has spread over the world. Eight hundred years ago the knight was proud of his inability to read or write. To-day the most ignorant and poverty-stricken labourer has cause for shame if he cannot do both. This rapid change is due to using synthetically the results of past analysis. The inference is clear. Our method in teaching writing should be mainly synthetic, beginning with the simplest letters and gradually working them into larger and larger units. In this way full advantage

is taken of the labours of preceding generations who evolved for us the few simple forms by which we can represent our language visually. The analysis needed consists mainly in the analysis of the forms of letters, so that the child can see them clearly and note the difference between them. Without such help a reasonably close reproduction of their forms is difficult for the beginner.

(3) What light does the history of writing throw upon the problem of the proper age at which the learning of writing may be most profitably begun? We have seen that writing was a late achievement of the race, belonging to a period in racial development which those who see a close parallelism between race and individual would certainly place much later than the period corresponding to adolescence in the individual. Too close an application here will not be just, but we have an indication at least that writing should be begun later than is usually the case in our schools just now.

(4) In the childhood of the race we find a strong impulse to depict scenes realistically, either as a medium of communication or for the joy in artistic production. Should the course of instruction in writing be preceded by one in drawing? Here we have a hint which we shall find substantiated from other sources.

CHAPTER III.

THE FUNDAMENTAL BASES FOR THE DEVELOPMENT OF HAND-WRITING IN THE INDIVIDUAL.

FEW psychological developments of recent times have growth of interest in child-study. Following the lead been of greater moment to the educationist than the of Stanley Hall, many observers have been engaged in the attempt to arrive at a reasonable understanding of the mental and physical life of children. Their endeavours have resulted in the accumulation of a mass of valuable knowledge—an accumulation which, though still far from exhaustive, forms a rich store from which the educationist may draw, which already has caused many revolutionary changes in our methods of education and bids fair to bring many others. The child has been studied as an individual with inalienable rights to development in the way which is most proper and natural for him rather than from the view point of the adult who sees in the child only a twig to be bent to his desire. On the whole, the result has been beneficial for education, and if occasionally such study has brought a certain over-emphasis of child-rights, and has resulted in a tendency which may be seen in many of our schools to-day to make all school-work "play," "pleasure" and "interest," and to forget that "discipline," "effort" and "work" are equally or even more important, it is but a natural reaction from the earlier days of tyranny in child-training. It is the purpose of the present chapter to summarize the results of child study in so far as they have a vital bearing upon the acquisition of handwriting.

Our whole intellectual, emotional and motor life is based upon the fundamental and primary instincts with which nature endows us at birth. The course of our development is conditioned by our environment and nurture. To this law writing is no exception; to obtain a clear understanding of the fundamental basis upon which the learning of handwriting depends must be the first problem to be attacked.

Baldwin¹ made a careful study of his own child in an endeavour to trace the course of her mental development accurately. He found that she became very fond of drawing as soon as imitation began to function well, or from the nineteenth month to the middle of the twenty-seventh. During this period the drawing seemed to imitate movements in an extremely vague and general way; no evidence appeared which proved a connection between the drawings and a mental picture in consciousness. This is commonly the case with children at this age; every one has seen the two-year-old scribbling in imitation of the fast movements of some adult writing. No attention is paid to the results at all; the fast movements, regardless of the form of the product, seem to be perfectly satisfying. The movements made when scribbling become increasingly complex; from simple curves the child passes to more involved ones; from movements in one direction it proceeds to movements in opposite directions, and gradually more intricate and complex figures grow out of the simple lines with which it begins. Such scribbling, though apparently aimless, really is of considerable importance. Through it the child acquires new motor adjustments, new nerve co-ordinations, and new muscular power, which combine to form the ground-work of motor ability upon which the learning of writing must be based. From the vast number of movements learned by such spontaneous scribbling those which are of service in writing or drawing must be selected and recombined into new series at a later stage of development.

In the twenty-seventh month Baldwin found that his child began to show signs of realizing a connection between the movements of her hand and some image in her own consciousness. She began to make movements consciously directed towards reproducing that image. Consequently, the attention was shifted from the movement to its product; an effort was made to imitate the image, which was usually a visual one. In such an effort many useless movements were made; from these the ones which gave the desired result were selected for repe-

¹Baldwin, James M. "Mental Development in the Child and in the Race."

tition and the useless ones eliminated. The child so learned to direct movement to a desired end by imitation and by selecting serviceable movements from the mass of those at its disposal. Such a method of learning is usually called the "trial and error" method, or the "trial and success" method, depending upon whether the emphasis is laid upon the movements eliminated or upon those selected. It is also called "learning by selection of successful variations."

It is evident that such a development involves at least three different groups of sensations. First of all must come a group of visual sensations from which the percept is obtained, as the child can recognize and probably even name the object or letter which it is attempting to imitate. Secondly, as the child moves hand and arm in its attempt to imitate the object or letter, it receives sensations from the skin, muscles and joints. In addition to these two series of sensations there will also be a visual series arising from seeing other people execute the movement which the child is attempting.

The first group of sensations acts as a stimulus to imitation. By it the whole process is initiated. This stimulus in the very young child is almost certainly always visual. With increasing age, auditory sensations or images or articulatory sensations or images may come to function in the same way, as, for instance, when a child writes the word "elephant" in a dictation lesson, the stimulus being the sound of the spoken word. If he is writing in free composition, the visual, auditory or articulatory image, or all three in combination, will then function as the stimulus to the movement.

The second group of sensations is also of prime importance in the development of voluntary movement, and especially in the development of the writing habit. The stream of sensations sent in by the sensory nerve-cells of the skin, joints, and muscles will gradually settle into a definite succession as the movements are repeated. In other words, a sort of report is being continually sent in during the progress of the movement, and each sensation forming part of that report tends to act as a cue to initiate the movement which habitually follows. It is largely because of this fact that writing can become so automatic that we are unconscious of the act entirely; the kin-

aesthetic sensations take control and carry the movement on without making any demands upon the writer's attention.

The third series of sensations is of the utmost importance in the early stages of learning. We have seen that the earliest and most instinctive form of imitation reproduces movements rather than forms. We may infer from this that movement is easier for the child to imitate than the results of movement. The teacher should take advantage of this fact by allowing the child to see and imitate the proper movements in writing as used by herself rather than the results of movements as shown in copy.

The development of the handwriting movement : Therefore, be considered as merely a part of the larger problem of the development of voluntary movement in general. The power of voluntary movement is acquired by the child only by selecting from a vast number of spontaneous and random movements those few which resulted in pleasure and repeating them. A child acquires such power in its essentials by the end of the fifth or sixth month of its life. By exercising this power it continues to develop mechanisms by which it can attain its ends. At first the movements are simple, then increasing development brings increasing complexity of movement and a finer co-ordination of the nerves and muscles involved. The growth of the power of making accurate voluntary movements continues until maturity. Dr. Gilbert¹, for instance, found by testing about fifty children of each sex and each age from six to seventeen, that there was a steady increase in the number of taps which could be made in five seconds corresponding to the increase in age. He concluded that the motor ability of the arm and hand does not reach maturity until adolescence. A child of six years possesses about two-thirds of the motor ability which he will possess at sixteen.

That no one should expect the same speed in writing from the six-year-old as from the adolescent pupil is the obvious conclusion. Speed should show a steady increase from early childhood until maturity, and, as a matter of fact, it does show such an increase. Although other factors, such as the mental attitude, the control which directs the writing act, and the

¹Gilbert, J. A. Studies from Yale Psych. Lab., Vol. 1.

type of movement used, also affect the speed of writing, the increase in general motor ability is really the fundamental reason for increased age bringing increased speed.

One of the major aims of child-study is the determination of the order in which instincts develop and abilities appear, in order that the training of the child may be adapted at different times to the instincts then predominant, and may be well within the power of abilities then active. One of the first questions requiring consideration in connection with handwriting is the determination of the approximate age at which children should begin to learn to write. One of the most important factors will be the physiological fitness of the child to execute the writing movements. It must be admitted that the evidence available is far from conclusive; it is given here for what it is worth. The truth seems to be that individual variations are so great that it is impossible to determine the exact age at which the teaching or writing should be begun, and that general and rather vague conclusions are the best that can be reached in the light of our present knowledge.

Bryan¹ tested the ability to tap with fingers, wrist, elbow and shoulder with children aged five to sixteen. He found (1) that elbow and shoulder movements make a smaller gain than do finger and wrist movements; (2) that a large percentage of the ability of fingers and wrist is acquired after nine or ten years of age, 28% in the boys and 17.5% in the girls. Since the fingers and wrist must play a large part in the movements used in writing, it may be argued that writing should not be begun until after they acquire at least a large part of their motor ability, that is, until after nine or ten years of age.

Writing involves not only the motor ability of the hand and arm, but also steadiness of the whole body. Precision of movement by the fingers and arm is dependent upon the steadiness of the central organism as well as upon the arm and fingers themselves.

Hancock² tested 168 boys and girls of Worcester, aged five to seven years for ability to stand still. The test required the child to stand as still as possible with feet close together, hands

¹Bryan, William L. "Development of Voluntary Motor Ability."

²Hancock. "Preliminary Studies of Motor Ability."

at side, and attention fastened upon some distant object for one minute. The swayings of the child were automatically registered by an ataxagraph attached to a cap worn on the head. The test showed that in these two years girls gained in steadiness 33% of the power of control at five years of age, boys about 16%.

Besides this central unsteadiness, there is also a peripheral unsteadiness which is plainly shown in the twitchings and jerkings of the small muscles, *e.g.*, the facial muscles, in children. This peripheral unsteadiness is due to the diffusion of nervous impulses which are spread out over the whole system instead of being confined to definite channels. This unsteadiness becomes less with increasing age and power of voluntary control.

Curtis tested the ability of children of various ages to sit perfectly still. He found that thirty seconds is the average time for children under five years of age, and one and one-half minutes the maximum for children between five and ten. He attributed this to the fact that the higher centres of voluntary control are not much developed until rather late in child life.

From these facts it has been argued that the child is not physiologically fitted to write until at least nine or ten years of age. Writing requires such close attention and finely co-ordinated movements involving practically the whole organism that it seems reasonable to postpone its learning until the child has acquired considerable control over itself through work involving larger movements and coarser co-ordinations. Such preliminary training could be better given by instruction in drawing and manual training, which may be made much less complex than writing can possibly be. This substantiates to a certain extent the conclusions reached in the sketch of the racial development of writing that the teaching of writing should not be begun at so early an age as is the general practice to-day, and that it should be preceded by instruction in drawing.

There is another side to this question, depending upon the need which the child feels for writing. Writing is a method of expression, and, therefore, to a certain extent, should be a

natural outgrowth of the expressive instinct of the child. Writing should not be taught until the child feels the need of another mode of expression than that of oral language. The age at which the recognition of this need appears seems to vary tremendously. Children well endowed by nature and in a good environment will arrive at this point much sooner than stupid children in an environment which tends to dull rather than to whet their curiosity. From my own observation, however, I should place it on the average at a much younger age than nine or ten, certainly as early as seven, and perhaps even sooner.

A further argument for beginning writing earlier than nine or ten is derived from the view that writing is a tool for thought; the sooner the child is equipped with that tool the better. This argument assumes that the child who begins to learn to write at six will be a better and more efficient writer at ten years of age than the child who does not learn until nine. Unfortunately, I can find no evidence to prove or disprove this assumption, but it does seem likely to be true, simply on the ground that the increase in power gained by the second child through practice in other voluntary movements would never be equal to the increase gained by the first through practice in actual writing, since writing is such a complex and special habit.

It seems that middle ground is the only safe position to take. Begin writing at six or seven, but do not demand precision in execution. The writing should be large, and the practice should be mainly upon the blackboard, so that large comprehensive arm movements are the only possible ones the child can use. That writing taught in this way makes too great demands upon the child's motor ability seems incredible to one who has seen a primary grade of six and seven-year-olds enjoying such a lesson. The ordinary development of the child in the years preceding school, aided perhaps by a year of manual training in kindergarten work, gives him quite enough motor ability for the kind of work described. The difficulties which arise from immature fingers, central and peripheral unsteadiness, and the great precision needed for writing on paper largely vanish when writing is taught by

blackboard practice. After a year or two of such work it is not difficult to obtain a gradually increasing precision and fineness of writing with pencil or pen and paper.

We may conclude that the evidence we possess does not so much demonstrate the necessity for postponing the learning of writing until nine or ten, as it does the necessity of adapting the work to the capabilities of the child. If the child begins at six or seven, and is taught by a teacher who realizes the importance of letting the child imitate movement, and of encouraging large and free arm movements, and who does not demand fineness of execution, the child will have no great difficulty in mastering the art of writing. He will be using a well-established writing habit at the age of nine or ten, and this early acquisition of the power to write is desirable because it opens the way for other and more valuable instruction. That this is true can be seen in any of our schools where writing is well taught in the primary grades.

Writing is an acquired habit, based upon the power of voluntary movement and upon the instincts of imitation and expression; it is not instinctive in the sense that oral language is instinctive, for it has been remarked that children without opportunities for learning a language instinctively develop a crude one of their own. Writing must be learned; we must, therefore, consider the various methods of learning to find out which is best suited to the learning of writing.

There are three methods of learning (1) imitation, (2) trial and success (3) understanding. Both children and adults use all three methods, but children mainly the first two, adults mainly the third. The first two are used together, as we saw in the case of Baldwin's child. The third cannot be used until the mind is sufficiently developed to work with ideas. It can never be successfully used in the acquisition of skill in motor activities.

The trial and success method means that a desired end is achieved by one of numerous attempts which is then selected for repetition. If, for instance, a child attempts to get his rattle which is lying beside him, he may make four or five trials before he is successful in reaching it. With this experience as a basis, he will soon be able to reduce the number of

unsuccessful attempts, and eventually will be successful in every attempt. He has learned to reach the rattle by the method of trial and success.

Kirkpatrick¹ divides imitation into five classes (1) reflex imitation, (2) spontaneous imitation, (3) dramatic imitation, (4) voluntary imitation, (5) idealistic imitation.

Reflex imitation is operative mainly in the first six months of the child's life. It is shown when a child laughs, yawns or cries when he sees the act done by another. It remains through life in a lesser degree. Yawning and laughing are infectious in a group of people of any age.

Spontaneous imitation reproduces acts simply because the impulse to reproduce an act perceived is too strong to be denied. Anything in the child's environment may act as a stimulus to such imitation. Its value lies in the fact that through it a large amount of material is accumulated in the way of knowledge and power of varied movement. It is dominant for the first three or four years of life.

Dramatic imitation implies a more extended use of imagination. The imitation becomes so real to the child that he often forgets actualities altogether; he does not imitate a street car conductor, but for the time being really is one in his own mind. Play consists largely of dramatic imitation.

Voluntary imitation reproduces an act to gain some end rather than for the mere pleasure of reproduction. It must be both analytic and synthetic, as attention is necessarily directed both to the parts of the process to be imitated, and also to the synthesis of those parts into the whole. It is upon voluntary imitation that the learning of handwriting must be based.

The first point to be noted in voluntary imitation is that a child can imitate a movement much more easily than he can perform that movement from a description of how it is done or from seeing nothing but its results. We have pointed out before that this has an important bearing upon the proper method of teaching of writing, but it is of sufficient importance to bear repetition. A teacher must continually show the class the movement to be used. To state to the class how the

¹Kirkpatrick, E. A. *Fundamentals of Child Study*

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movement should be made is useless and a waste of time. So, too, in attempting to correct bad form or movement, the best method is to show the actual movement which produces better form or which is less laborious and more rapid.

We may also note the fact that consciousness will not enter very largely into the process of imitation so far as the movement is concerned. The reason for this lies in the fact noted before that the child has gained all or nearly all of the elements of the movements needed before every attempting to write. To attempt to teach just what movements are needed to attain a certain end is bad pedagogy, for, by thus fixing attention upon the movement the teacher hinders rather than helps its correct reproduction. Further, since writing is eventually to be used automatically and unconsciously, consciousness should enter into the learning of it as little as possible. Let the child see the movements actually made by the teacher; the reproduction of those movements will then look after itself.

It has also been stated that the process of voluntary imitation must be both analytic and synthetic. Of these two phases of the process, undoubtedly the analysis presents greater difficulties to the child. It is a well known fact that a child can see only the most striking characteristics of any object, and an attempt to reproduce that object is bound to result only in a line or two which vaguely represent the form as the child sees it. This gives us an important hint on method in teaching writing. The form must be carefully analyzed for the child into its elements. By drawing attention to the rather minute differences between "a" and "o," for example, the teacher can smooth the path for successful imitation. Without such previous help, the difference will probably never be perceived in the first place, and certainly never reproduced in the second.

It will not do, however, to begin with too large subjects for analysis. The child's mind is not sufficiently developed to retain the points of difference if too many forms are introduced at once. When one sees the difficulty with which "a" and "o" or "u" and "v" are distinguished, it is impossible to agree with those who wish to use large units such as phrases

or sentences right at the beginning of instruction in writing. Experience shows that a single letter is quite enough.

If the analysis has been carefully done, the synthesis does not offer so much difficulty. Once a child sees the form clearly, it is just a matter of time and practice until he acquires the power to combine the elements of that form in a satisfactory reproduction.

Idealistic imitation will become effective only in the later stages of writing. A child who, after learning to write, makes up his mind that he will become as good a writer as his teacher, and with this ideal in view proceeds to improve his work, may be said to be learning through idealistic imitation.

Learning by understanding does not, or rather should not, enter into the teaching of handwriting at all. Any attempt to make writing a reasonable act, or to explain it on logical grounds, is as foolish as to try to teach bicycle riding by a correspondence course in physics. All the laws of mechanics will never teach any one to ride a bicycle; a few hours of actual practice will. Writing, like all manual acts of skill, is not a matter for reason to deal with at all. It is naturally and properly learned through imitation, and in no other way. The teacher who attempts to teach it as something to be understood and learned by reason will do nothing but hopelessly confuse both the class and herself.

The development of writing implies something more than the acquisition of skill. It is too closely connected with the development of language to be dismissed without an attempt to elucidate the problem from the linguistic standpoint.

Oral language is acquired of necessity through imitation which is spontaneous at the beginning and then becomes voluntary as the attempts to pronounce words become directed consciously towards the acquisition of the correct pronunciation, and as the words become used for securing a desired end rather than for the mere pleasure of producing the sound. Spontaneous imitation of sound begins towards the end of the first year of life. At this early period the child may make every sound in the language. In this way he secures a complete or almost complete ability to make any sound he hears.

This power is of service to him later on when he begins to attach meaning to sound.

The important thing so far as writing is concerned is that by the time the child commences to learn to write it possesses a fairly extensive vocabulary and auditory and articulatory word images which have meaning for him. This gives the necessary link by which the highly conventional symbols which are used to represent sounds may be attached to the content of the child's mind.

Consequently these auditory and articulatory images act as cues for writing. One writes while both hearing and speaking the words to be written, and invariably in advance of the actual writing. This anticipatory writing is a tremendous aid to fluency and speed. Visual imagery seems to play a smaller part than either auditory or articulatory, at least in adults, although it is practically impossible to determine in just what proportions the three kinds of imagery function as cues for writing.

The child makes much slower progress in learning visual language even with specific instruction than in learning oral language without any formal instruction and at an earlier age. Visual language is entirely conventional, and is not a natural and instructive form of expression. Further, the need for it in daily life and intercourse is not so pressing, for it cannot be made as necessary to the gratification of the wishes of the child.

It is probable that visual language might be learned faster if care were taken in the school room to associate it continually with oral language. When writing the letter "a," for instance, or the word "at" the repetition of the sound with each repetition of the form would help to fix firmly the association between the conventional symbol and the sound and meaning, and thus help the auditory and articulatory images to function more quickly and efficiently as cues for writing. In the same way a child should be allowed to speak all the words in every sentence he writes, at least in the initial stages of learning.

The beauty of the written product should not be analyzed or emphasized until writing has been well learned. The race,

in all arts, first learned how to do a thing, then to admire beauty and grace in the execution or in the product. This is the natural order for the individual also. The aptitude of the child for imitation must be depended upon at first to produce adequate writing, and it is only later, if at all, that it is worth while to attempt to analyze the factors which make writing beautiful, and to lead the child to a conscious attempt to produce beautiful writing.

It is extremely doubtful whether such an attempt is ever justified. Writing in modern times has a purely utilitarian purpose, so that aesthetic factors count for very little indeed. It is a tool for work, and the less the tool is the subject of conscious thought, the better for the workman. In fact, for the skilled workman the tool becomes just a part of himself, and is used with no consciousness of it at all, the attention being focused upon the result to be achieved and not the means of achieving it. This should be the case with writing, and consequently an effort should be made to have the child learn it with as little consciousness as possible entering into the actual act of writing. Learning by imitation gives this result, while an analysis of the writing would inevitably lead to the fixing of attention upon it. This would prove to be a continual impediment to the proper use of writing as a means of expressing thought.

This short outline of the relationship of the writing act to the mental and physical development of the child is necessarily sketchy and imperfect. It has merely attempted to bring together the main facts in a very general way, and to clear the path for the more detailed discussions in the following chapters.

CHAPTER IV.

THE HANDWRITING MOVEMENT AND RELATED QUESTIONS.

Sec. I—The Analysis of the Handwriting Movement.

WHEN an adult writes a word, it seems to him a simple, almost instinctive act. Yet it involves the activity of some five hundred muscles, and implies a co-ordination of muscular action which is by no means easy to achieve. It is the aim of the present chapter to analyze this muscular action as fully as can be done in the light of our present knowledge. Careful observation will give us at once an insight into the more obvious of these movements.

In grasping the pencil or pen the thumb is opposed to the index and middle fingers, while the third and little finger support the hand as it rests upon the writing surface. This mode of grasping is not instinctive and must be learnt. The child in instinctive grasping shows a tendency to encircle the object with the four fingers, not opposing the thumb in any way. It follows that even the method of holding the pencil is somewhat difficult for very young children to acquire.

In the actual work of writing the thumb and fingers have different functions. If we wish a curve to the right, the thumb applies extra pressure to produce it. If we wish a curve to the left, the middle finger gives the necessary guidance. The index finger helps to make the down strokes, the thumb the up strokes. The third and little fingers meanwhile support the hand and must adjust themselves to the work of the other fingers and the thumb.

We have seen that the ordinary method of holding pen or pencil is a matter of some difficulty for young children. This is still more true of the finger movements in writing. The thumb, index finger, middle finger, and two supporting fingers have to make different movements either simultaneously or in very quick succession. Experiment has shown that young children do not easily move one finger to the exclusion of the

rest, as for instance must be done in piano playing. The tendency is to tap with all at once. Even an adult has difficulty in separating one finger or a group of fingers from the others. The nerve cells controlling the fingers form an associated group which naturally acts as a whole innervating all the fingers at once to the same action. On the other hand the nerve cells controlling the thumb comprise a separate group and consequently association paths must be formed between these two groups before co-ordination of action in thumb and fingers becomes easy.

The foregoing assume that the fingers take an active part in the formation of letters. This is true in the vast majority of cases, as Judd¹ has shown by his tracer apparatus, which registered the amount of arm movement simultaneously with the actual writing. From his tracer records it is plain that,

(1) The amount of finger movement varies greatly with various writers, but only a very few who have had special training in excluding finger movement are able to do so entirely.

(2) The arm movement is used by every one (a) to carry the hand across the paper, (b) to a variable but fairly large extent in the formation of the up and down strokes (c) to a much smaller extent to form the curved lines. When the arm movement is excessive, a tendency appears in the writing towards an elimination of curves. It is plain, therefore, that the fingers usually do the fine formative work in making the letters, while the arm carries the hand across the paper and assists the fingers to some extent, usually rather slight, in forming the letters.

(3) The pauses between groups of letters are used for longer forward arm movements which bring the hand into position for easy writing.

It is obvious that the arm may carry the hand across the paper in either of two ways. The forearm may rotate on the muscle pad below the elbow, with the elbow as centre of rotation, or may be lifted and shifted along the paper in pauses between words. Both methods fulfill the purpose of bringing the hand into an easy writing position again. It is

¹Judd, C. H. *Gentic Psychology for Teachers*. P. 170.

plain, however, that the rotary movement is the more economical of the two, as it may be carried on without interrupting the work of writing. Furthermore, it is less fatiguing as less effort is required to swing the forearm around with the muscle pad forming a point of support than to shift it bodily, just as it requires less force to rotate a wheel on its axle than to drag it locked over the ground or to carry it off the ground entirely. The height of the desk or table has an important bearing upon this movement. If the desk is fairly high, the elbow is forced to a position well away from the body, so that it is possible to shift the forearm without lifting it entirely away from the desk. On the other hand, if the desk is low the elbow comes more closely to the side of the body and there is at once a tendency to shift the whole forearm by using the shoulder muscles. It appears, therefore, that to insure an economical forearm movement the desk should be so high that when the pupil is sitting erect or very slightly bent forward, his forearm should rest upon it with the elbow well out from the side of the body. To take this position at too low a desk can be done only by bending the body too far forward, and so a low desk necessitates either an uneconomical forearm movement or an unhygienic posture.

It is possible for rotation of the hand with the wrist as centre to occur as well as rotation of the forearm about the elbow. It is plain that either the rotation of the hand on the wrist or of the forearm on the elbow will produce an arc of a circle, the latter the flatter one as the forearm which forms the radius of its circle is longer than the hand which is the radius of the former. If we now write two lines, using the same rotation as above, and taking care to exclude as far as possible all movement except those of the forearm and hand respectively, the lines of writing will curve upwards in a similar fashion.

It appears at once that some further adjustment is necessary to keep our writing in a straight line across the page. This is done by humping the hand in the middle of the line, thus flattening out the curve. As the hand traverses the line it is easy to observe the pencil or pen becoming more vertical as it approaches the centre of the line, and assuming a greater

slant at either end. The arc may also be flattened by drawing back the whole arm in the centre of the page. My own observation leads to the conclusion that both adjustments are used by nearly everybody, the first if the paper is narrow and the adjustment needed consequently small, the second if the paper is wide and the arc to be adjusted correspondingly large. It is obvious, too, that since the arc obtained by rotation of the hand is so deep, such rotation should be excluded entirely from writing or confined within very narrow limits. Further, we may take the best position of the forearm to be at right angles to the lower edge of the paper and along its centre line, as this brings the centre of the arc to be adjusted in the centre of the line of writing. This is plainly the best position, as the line along which the writing is to go will then form the chord of the arc and the least adjustment will be necessary.

At the beginning of a line of writing, if the forearm is in the position described, the fingers point to the left hand corner of the paper, in the centre, at right angles to the line of writing, at the end, to the right hand corner. It is plain, then, that if the fingers move always in a line parallel to the axis of the forearm the letters will pass from an excessive left to right slant through a vertical position to an excessive right to left slant. But the slant of writing in adults does not vary in this manner. The reason is that the fingers instead of moving in a direction parallel to the axis of the forearm move always toward the body of the writer. There is, however, a tendency to overslant at the right hand side of the page. Professor Judd¹ has pointed out that this is often corrected by turning the hand toward the left, so as to lie more upon the palm as the hand moves to the right. This movement is called pronation, and forms a more vertical stroke, which counteracts the tendency to overslant at the end of a line.

So far we have dealt only with the movements and position of the right arm. The left arm also has its task of holding the paper firm and shifting it higher up on the desk to keep the line of writing at approximately the same distance from the edge of the desk. This is necessary to enable the right forearm to rest continually on the desk. Any position

¹Judd, Chas. H. *Genetic Psychology for Teachers*. P. 178.

of the left arm which is comfortable and fulfils the two requirements noted is permissible. No fine adjustments are necessary here, and we may leave the work of the left arm without further discussion.

It may now be profitable to take a single letter and examine the work of the fingers in forming it. The initial stroke of capital J is made with the pressure of the middle finger directed to the left and upwards until the extreme left point of the upper loop is reached. The thumb then takes charge and by an unward pressure towards the right completes the curve to the highest point of the letter. The index finger now takes the leading role and gives the long, vertical stroke to the beginning of the curve of the lower loop. The middle finger again comes into play and forms the leftward curve of the lower loop. It surrenders in turn to the thumb, which completes the letter by forming the last upward curve to the right. The practised writer does all this in something under 1.5 of a second.

We shall now take a line of writing and attempt a rough analysis in the light of the foregoing:

John and George were friends of mine

In this line we see by actual count that the thumb exerts pressure 61 times, the index finger 36 times, the middle finger 39 times. Moreover, this pressure is often complex, as in the down stroke of *n* both the index and middle fingers take part. Besides this, there is the continual sweep of the arm across the page, the adjustment of the fingers or arm to keep the writing in a straight line, and the further adjustments of fingers or hand to produce a uniform slant. All these adjustments are made in less than 10 seconds.

A moment's consideration makes it plain that fast legible writing can only be produced when all the movements which we have just discussed are thoroughly co-ordinated. The ability to write rapidly and well depends wholly upon the ability to execute these movements rapidly either simultaneously or in succession. It is the difficulty of making even the simplest of these movements accurately at even a low rate of speed and the absolute lack of co-ordination in them which the child

shows in his first attempts to write which form the core of the problem of the pedagogy of writing.

We may now summarize briefly the results yielded by our analysis of the writing movement.

(1) The holding of the pen by the thumb in opposition to the first two fingers is difficult for the young child, as it is not an instinctive mode of grasping.

(2) The writing movement is a complex of movements in which the thumb, fingers, hand, wrist, arm, all take part.

(3) The thumb exerts pressure to form curves to the right, the middle finger to the left, the index finger the down strokes, while the third and little finger furnish a base. This differentiation of action of the fingers and co-ordination of the thumb with them presents fairly large difficulties in learning.

(4) The hand by rotation about the wrist allows a little forward movement. This rotation should be excluded entirely or made a minimum because the depth of the arc produced is so great that it is impossible to adjust it to the straight line of writing without a serious cramping of the hand or an interruption in the writing caused by shifting the whole arm.

(5) The forearm resting on its muscle pad and rotating about the elbow carries the hand across the paper with the minimum of effort.

(6) The forearm should be placed in the centre of the paper as the least adjustment is then necessary for the arc caused by its rotation.

(7) Pronation is used to correct overslant at the end of a line.

(8) The fingers by moving always towards the body of the writer also aid in keeping a uniform slant.

(9) The proper co-ordination of all these movements is absolutely essential for rapid and legible writing.

Sec. II.—Discussion of the various writing movements.

We shall now attempt to discuss the relative merit of the different combinations of movements commonly used in writing in order to determine the best in economy of effort and in efficiency.

Freeman¹ classifies the usual forms of writing movements as follows:

- (1) Freearm movement.
- (2) Arm movement with rest.
- (3) Finger movement.
- (4) Wrist movement.
- (5) Combined arm and finger movement.

These terms are used not in the sense that the movement indicated by the name is used exclusively, but that it predominates in the total complexity of the movement to such an extent that it may fairly be used to describe it.

The freearm movement is especially suitable for the beginner in writing. The child is incapable of making very precise and accurate movements, simply because the co-ordination of movements required for precision and accuracy is impossible until the nerve tracts controlling the movements become associated in well-defined paths. This can only be accomplished by long practice. It follows that the beginner in writing should make his letters very large, because the same amount of deviation from the correct form in a large letter is less noticeable than in a small one. This is one reason why blackboard writing usually has a better appearance than the same person's writing upon paper. If the child uses only the fingers his writing must be very small, because the range of movement possible for his fingers is very slight. The diffusion of nervous energy which characterizes childhood affects small muscles more than large ones. Children may be seen in a schoolroom exhibiting fair control of the large muscles of the trunk, while twitchings of the face, contractions of the mouth, or restless hands and feet give clear evidence of diffusion in the nerves controlling the smaller muscles of the extremities. It follows that the fingers will be less easily controlled than the large muscles of the shoulders, and, consequently, better results will be obtained from children using the whole arm movement from the shoulder.

Another consideration will bear out our contention. Dr. Bryan¹ tested 789 children, ranging in age from 5 to 16, to

¹Freeman, Frank N. *The Teaching of Handwriting*. P. 91.

¹Bryan, Wm. L. *Development of Voluntary Motor Ability*.

determine the degree of rapidity with which they were able to tap an electric key. Four series of tests were made, the arm being clamped in such a way that in the first the fingers only could be used, in the second the wrist, in the third the elbow, and in the fourth the shoulder. As many taps as possible were made in each way in five seconds. The following tables give his results as far as they are of value here:

	Per cent. of 16 yr. ability possessed at 6 yrs. of age.		Per cent. of 16 yr. ability required between 6 and 16.	
	Boys.	Girls.	Boys.	Girls.
Fingers	57	63	43	37
Wrist	64	65	36	35
Elbow	72	75	28	25
Shoulder	69	71	31	29

From this table it is apparent that the shoulder and elbow have a noticeably greater percentage of their sixteen-year-old efficiency at six than the wrist or the fingers. We may easily infer that the shoulder in the six-year-old child is relatively more efficient and better organized than the fingers, and, therefore, it is logical to take advantage of this and allow the beginner to use shoulder muscles rather than finger muscles in the writing movements. This is accomplished by the freearm movement.

There are, however, certain objections which will prevent us from admitting the freearm movement as the most satisfactory in later writing. Judd's tracer records show that the fingers play a great part in the forming of letters with the vast majority of people. This, while not conclusive evidence that the finger movements are necessary or best, at least suggests that it is natural for people to use them unless rigidly trained to exclude them. Further, it is obvious that the freearm movement is the most fatiguing as it requires the expenditure of sufficient energy to move the whole arm without any support save the hand. This is especially true when rapidity is required, as the violent arm movement shakes the whole body. Free arm writing cannot go above a rather low speed limit without causing fatigue and discomfort from these causes. We have shown that the freearm movement favours large, free writing. When smaller and more accurate writing is

desired the freearm movement must give place to arm movement with rest, since it is much easier to make an accurate movement when the arm and hand are supported.

The extreme type of finger movement is obviously defective and will demand only a brief discussion. It puts an excessive strain upon the fingers, forcing them to do the work more easily done by the arm, and, consequently, is a very fatiguing method of writing. The writing is apt to be unduly small and cramped.

The wrist movement is difficult and little used. It is made by lowering and raising the hand turned far over to the left, by the alternate flexion and extension of the wrist. This movement produces a less cramped writing than the excessive finger movement, but the turning of the hand over to its left side prevents an easy, uninterrupted movement across the line of writing.

The difference between the arm movement with rest and the combined arm and finger movement is obvious. The former attempts to exclude finger movements entirely. The arm does the complete work of writing, not only carrying the hand across the page, but also forming the letters in detail. Again, we may refer to Judd's tracer records to show that finger movements are entirely excluded in only a few cases. Certainly their exclusion requires an amount of training far in excess of that usually given in school. It seems natural that the fingers, with their magnificent equipment of delicate nerves and their superior flexibility, should take a share in the finer work of letter forming, while the arm, by rotating at the elbow, carries the hand across the page, and by its up and down movement upon the muscle pad forms the groundwork of the letters.

Woodworth¹ concluded from an experiment conducted with adult subjects that in uniformity of slant, accuracy and speed, the forearm movement is easily the best of all movements used in writing.

Freeman² states that the chief advantages of the arm movement with rest are two. First, cramping is avoided be-

¹Woodworth. Accuracy of Voluntary Movement.

²Freeman. The Teaching of Handwriting. P. 93.

cause the movement is made with the fingers relatively relaxed. Second, the rolling movement of the arm upon the muscle pad of the forearm produces a firmness and evenness of line, and the fact that the movement is produced from a centre at a considerable distance from the pen-point results in regularity of slant.

Sec. III.—Questions related to the movement used.

(1) Position of paper.

(2) Slant.

In our analysis of the writing movement it was clearly shown that the best position for the forearm is at right angles to the paper and lying along its central vertical line. It also appeared that the elbow should be kept well away from the body to insure an easy rotation of the arm to carry the hand across the paper and to counteract any tendency to shift the arm by lifting it from the shoulder. We may add the obvious fact that the body of the writer should face the desk squarely, as this position ensures a good view of the writing without any twisting or bending of the neck or trunk. The centre of the line of writing should lie directly in the centre of the visual field when the eyes are at rest. This avoids the inevitable strain which comes from continually turning the eyes or head excessively in order to follow the writing. These considerations determine at once the position of the paper.

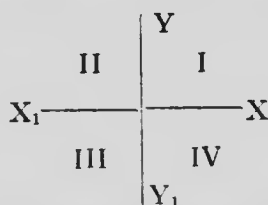
If the pen is held by the thumb in opposition to the first two fingers while the hand rests upon the little finger and its left side, observation shows that the line of movement produced by a contraction of the index finger is at right angles to the edge of the desk. To slant the stroke further to the left requires an inconvenient extension of the hand and fingers.

The extension of the middle line of the body fixes the line in which the centre of the line of writing should fall. The elbow held well away from the side, with the forearm bent at almost right angles to the upper arm and extending to the extended middle line of the body fixes the centre of the line of writing. The position of the paper is then definitely fixed by the fact that its lower edge should be at right angles to the

forearm. The left arm shifts the paper upwards to keep the centre of the line of writing opposite the middle line of the body, while to incline it further to the right necessitates too great a contraction.

This principle, taken in conjunction with the foregoing, at once determines the slant of the writing. The average person using the writing position described above, will make his letters at a slope of approximately thirty degrees from the vertical.

The results of McAllister's¹ experiments bear out the results reached here. He found that most of the movements used in writing followed the direction of the radii in quadrants I. and III. in the accompanying diagram. If quadrant I.



is taken as a standard, movements in quadrant II. require an average of 30% more time, in quadrant III., 10% less time, in quadrant IV. 25% more time. It is plain that rapid writing must lie in quadrants I. and III. Fur-

ther, his experiments showed that rapidity of writing varies directly as the increase in the degree of deviation from the Y Y₁ axis. When the deviation reaches more than thirty degrees, legibility decreases rapidly.

These considerations at once dispose of backhand writing. It requires too much effort, is too slow and tends to be illegible. The first criticism applies as well to vertical writing. Its champions, however, claim that it has greater legibility than slanting writing, permits the writer to assume a more hygienic posture and lessens eye-strain. The claim of vertical writing to legibility is at once admitted, but McAllister has shown that a slant of thirty degrees from the vertical still allows perfect legibility. In fact, legibility, as far as the actual writing is concerned, depends upon three factors.

- (1) The clear formation of individual letters.
- (2) The clear division of letter from letter by the connecting stroke.

¹McAllister, C. H. Researches on Movements used in Writing.

(3) The definite division of word from word by correct spacing.

A moment's consideration shows that as far as (1) and (3) are concerned slant and vertical writings are on an equal footing. The second factor, when vertical writing is done carefully, does help to make it more legible than slant writing, as the connecting strokes by their slope serve to divide the vertical letters clearly, whereas in sloping writing the differentiation in direction between letters and connecting strokes is not so marked. But it is a well known fact that all up and down strokes tend to take the same direction in writing. Consequently we often see vertical writing which is very illegible because of this tendency. We may conclude that vertical writing is less natural, easy, and rapid than sloping writing, and has only a very slight and rather doubtful superiority in legibility.

Sec. IV.—The Influence of Slant upon Eye-movements and Posture.

It is obvious that the eye has a leading part to play in guiding the pen in writing. This is particularly true in the case of the learner in whom writing has not yet become automatic. But even in the case of the most practised writers, the eye is of enormous aid in guiding, overseeing, and correcting the occasional errors into which the automatic muscle-sense is apt to fall.

The movement of the hand across the sheet is followed closely by the eye. Obviously, this is a very slow rate of movement compared with the rate at which the eyes move in reading. A simple experiment shows that it takes about six seconds to read what can be written in one minute. It may be said, then, that the eyes move approximately ten times faster in reading than in writing.

This slow rate of movement is an important consideration in dealing with an argument advanced by the champions of vertical writing. They believe that the head will always be brought into such a position that the line joining the two eyes is parallel to the line of writing. If the paper is tilted to one side, as we have shown above, the head will be twisted

to enable the eyes to sight along the line of writing by moving in a horizontal and not an oblique direction. This belief is based upon the Wundt-Lamansky law that the eyes move most freely in a vertical or horizontal direction, and with greater difficulty in an oblique direction. Therefore, the conclusion is drawn that if the paper is not parallel to the edge of the desk, and the writing vertical, either the eyes are strained by moving obliquely, or the head is twisted to ease the eyes. It is doubtful whether this argument can be allowed. In the first place, the eye-movement is so slow that the Wundt-Lamansky law probably does not apply. In the second, measurements made by other investigators have shown that the eyes are not brought into such a position that the line joining them is parallel with the line of writing, but that the line joining them is kept at right angles to the long downward strokes of the letters. Now, as already has been noted, the main strokes of the letters tend to be perpendicular to the edge of the desk when the writer faces it directly. Consequently, the eyes in sighting along them, move in a horizontal direction even when the paper is tilted and the writing slanted in consequence.

To focus the eyes upon any object within eighteen inches of them puts considerable strain upon them, and the closer the object the greater is the strain. If the object upon which they are focussed is equidistant from them both, the strain is reduced to a minimum. If, however, the object is closer to one eye than the other, a shorter focus is necessary for the nearer eye. In distant vision, the difference is negligible, but in reading or writing such a difference materially increases the nervous strain, as the nerve centres controlling the two eyes are so intimately connected that a difference in the degree of focus can be obtained only with considerable effort. It follows that the centre of the paper should be placed in line with the middle line of the body. Inevitably, the right edge of the paper will be further from the left eye than from the right, and vice versa, but the difference is the smallest possible, and may be corrected by just a slight turn of the head from one side to the other. This obviates any danger of a permanent curvature resulting from twisting the head to either side only,

as is the case if the paper is placed habitually to the right or left of the middle line of the body.

It is plain that the essentials of good posture as far as the eyes are concerned will be these:

(1) The writer must face the desk squarely.

(2) The centre of the paper must be placed opposite the middle line of the body.

(3) The head must be held a reasonable distance from the paper.

The object of the first two of these requirements is the same: to keep the eyes as nearly equidistant as possible from the point of focus. The third prevents the increased eye-strain so conducive to myopia which is inevitable if too short focussing becomes habitual. Plainly, these three requirements of eye hygiene are just as easily practised when writing with the paper tilted as in the square front position. We may conclude that there is no inherent hygienic benefit in vertical writing. Investigations have shown that in some cases at least the percentage of vertical writers who have spinal curvature is slightly lower than among slant writers. This slight difference is easily explained by the fact that vertical writing was introduced mainly with a view to teaching a more hygienic posture. It is very natural for teachers who favour it to emphasize correct posture, and so to obtain good results. But such correct posture is just as open to the slant writer; all that is needed is the emphasis.

CHAPTER V.

THE WRITING HABIT.

WHEN a child begins to learn to write, its attention must be concentrated upon the mere shape, size, and direction of the stroke to be made, and upon the movement by which the end desired is achieved. An adult is apt to overlook this important point, for, in his case, writing has become wholly automatic. The control of the movement by the eyes and muscle-sense has become so habitual, the association paths between the sound of letters and words and the muscular movements which produce their symbols have become so well worn that he writes almost as unconsciously as he puts on and buttons his vest.

It is the function of habit to remove from the conscious sphere all the petty but constantly recurring details of life. This relegation of such minor actions to the control of the lower centres leaves the higher brain centres free to work upon more important matters. In nothing is the beauty of such an arrangement more clearly shown than in writing. The mere mechanics of the necessary action are relegated to and controlled by the lower centres in the practised writer, and so his conscious thought can be directed wholly and solely towards the idea to be expressed. If a writer does not reach the point at which the process of writing becomes wholly automatic, his training has been faulty or his practice insufficient. It is a matter of great importance in the teaching of writing—in fact, it is the whole aim—to enable the child to write automatically as quickly and economically as possible. Any inquiry into the psychology of writing with a view to sound pedagogy must therefore consider this question, "How may the writing habit be taught so as to become so automatic that the higher centres may be left free to think of the idea expressed?"

The child must first learn how to make the various letters and how to associate these with sounds. If the letters chosen

by the teacher are within the range of the child's spoken vocabulary, he has the sound-image already in his possession. The first step in learning to write is really the first step in learning to read, and not until the child associates the written letter with its spoken sound should he attempt to produce it at all. To attempt to teach the child meaningless, unassociated strokes and letters is worse than useless.

Freeman¹ believes that the proper method of procedure is to choose some simple word, which has meaning for the child, write it on the board for him, have him attempt to copy the word through imitating the action, and finally lead him to the criticism of his product and to the practice which will produce improvement. A few elementary movement drills may be practised for the purpose of gaining control and freedom of action, and the appropriate letters may be made in connection with these drills. This method may be effective if writing is not begun until the child is eight or nine years of age, for by that time the child has perhaps acquired the ability to imitate a word of two or three letters, especially if reading has already been taught for a year or two. If writing is taught at an earlier age, nothing but hopeless confusion could result from following such procedure except in the case of especially brilliant pupils. Children of five or six years of age pick out only the most characteristic or interesting points in what they see. It is an impossibility for them to concentrate their attention to the extent necessary for even rough analyses. They cannot carry in the memory the form of even one letter without a great deal of repeated effort. To ask them to imitate a whole word without first breaking it up into its elements for them is to set an appalling task. In this point, it seems to me, Freeman has thought too much of the end to be achieved and too little of the extremely small ability of the average child of six, or even eight. He would overtax their ability and remove the most effective incentive to good practice—success.

If writing is begun, as is the usual practice in Ontario schools, at the age of six or seven, it is impossible to teach children more than a single letter at a time, and the letter will require endless repetitions before the child will be able

¹Freeman. *The Teaching of Handwriting*. P. 87.

to reproduce it with any degree of accuracy. Experience shows that the limitations of a child's mind are so narrow that any attempt to teach at this age even such a simple word as "at" without first mastering thoroughly the two component letters ends in rendering the child helpless and hopeless by a task beyond his strength. Further, granting that the child has learned the word "at" as a unit, it is extremely doubtful if he will again recognize either the "a" or "t" when he meets it again in other words, and probably would be unable to assign a sound-value to either symbol. If writing is begun so early, the only possible method is the synthetic, beginning with the simplest strokes and working them into larger and larger combinations as proficiency increases. These considerations enforce the tentative conclusion reached in the historical sketch of writing, that the synthetic method of teaching writing is the best and most economical.

It is not necessary, however, or advisable to teach the whole alphabet in this fashion before combining letters into words and so beginning the practice of writing in word-units rather than letter-units. The five vowels must first be taught, as they represent those sounds which may be most readily made separate from any other. The consonants may then be mastered, the child working the vowels and consonants into syllable-units, preferably syllables which form complete words, *e.g.*, "it," "at," "me," "him" and the like. In this way the symbols acquire not only a sound value for the child, but also convey an idea at the earliest possible moment. Meaningful combinations should be sought as much as possible, and practice should be directed towards the production of these rather than towards the production of meaningless syllables.

The emphasis at this early stage of learning to write must be laid, however, upon the correct form of the letters and their component parts. If the forms are incorrectly learned and practised, they will inevitably become automatic in these undesirable shapes, and to change at a later stage to better forms will be a matter of extreme difficulty. It follows, therefore, that correctness in form is more important at first than either rapidity or meaning. This furnishes another argument in favour of the synthetic method, as it permits a sufficiently

long delay over the elements of letters to guarantee a reasonably correct adaptation of them.

The great danger in using the synthetic method in this fashion lies in the fact that too often the method of writing by letter-units is never enlarged to word-units or even larger ones. In adult life, the child will never need to write letter by letter, but rather phrase by phrase, and unless care is taken to work towards larger and larger units the small unit becomes habitual, and inevitably results in slow writing, which demands so much attention for itself that the mind is hampered in its thought. Such a writer is in a position analogous to that of the reader who never succeeds in getting the meaning of the passage without slowly and laboriously spelling it out word by word. Such a reader is apt to miss the full meaning of the passage as a whole by his attention to individual letters and words. So the writer who must think of each letter separately has no chance to centre his attention upon the full expression of his thought, nor has his thought an opportunity to be fully elaborated. To obviate this danger the teacher must see that practice is not directed wholly towards letter-forms, but rather toward the writing of word-units and phrase-units as soon as the child can handle them reasonably well. The writing-lesson is not only a lesson in the forms of letters and their production, but also a language lesson, and after the initial stages have been passed, mainly a language lesson. Writing is merely a tool of thought, never an end in itself, and only that teacher who keeps clearly in view this fact, and is always consciously working towards this end, can be a successful teacher of writing. No matter how beautiful, even and regular the writing may be, the teaching has been faulty unless it is used by the pupils as a natural means of expression and not regarded as an end in itself. Ease and speed are much more valuable than beauty, the expression of mediocre but genuine thought even in poor writing much more desirable than poems beautifully but unintelligently copied.

It is none the less true that in the first stages of learning to write the meaning of the word imitated will be pretty well lost from consciousness during the process of imitation. The attention must of necessity be mainly directed towards the forms

of the letters and the movement necessary for their production. The child looks at the copy to be imitated, then follows his own stroke carefully with his eyes, keeping the form of the letter he is imitating in the forefront of his attention. The very fact that he is conversant with the meaning of the word, but not with its form, facilitates this. The real point in having him write words which are significant to him lies in the fact that when he has finished he has a product which inevitably is associated with a meaningful sound-image in his mind, and therefore, by that association, becomes fast woven into the warp of his mental life. A meaningless form will not be remembered; there is nothing in the previous experience of the child to which he can attach it.

At this stage the control of the writing lies in the eyes. Obviously the child cannot know the feel of writing a word until he has had considerable practice in forming it. The first step towards perfect automatism is taken when the muscle-sense becomes so educated that it will of itself govern the movements which produce the desired result.

At the same time, the child's capacity increases upon the mental side. At first, he can keep in mind the visual image of only a stroke at a time. With practice, several strokes or letters can be imaged clearly together and the child grows less dependent upon the copy.

The increase in the accuracy of the control of the muscle-sense and the less dependence upon visual control result in greater freedom in the use of the eyes for other purposes. The eyes, freed from overseeing each tiny bit of each letter, can attend to the general appearance of the writing, *e.g.*, slant, uniformity of size, spacing and the like.

As the muscle-sense increases in effectiveness, rhythm begins to appear in the writing. This means that the child begins to make strokes at equal intervals of time. This results in an increase in uniformity; but at the same time individual letters may suffer, as they are hurried in order not to break the rhythm of the movement. The appearance of rhythm in writing marks an important advance towards ease and rapidity.

The final stage in the development of the writing habit may be termed the automatic stage. The practised writer writes without thought of either form or movement, and is conscious of neither the act nor its results. The control exercised by eye and muscle-sense, which was at first painfully conscious, continually obtruding itself into the thought of the writer, has passed wholly under the guidance of the spinal nerve centres. This reduction of a conscious process to an automatic action is the end at which the teaching of writing must aim. Many people never manage to pass the conscious visual control stage, and are hampered through life by the inability to write otherwise than laboriously and haltingly. Further, thinking while writing is for them almost an impossibility. Others reach the conscious muscle-sense control stage, and enjoy a little more freedom of thought and speed in transcribing it. But both types of writers are handicapped; the very consciousness of the writing act is an impediment to thought. Writing should be the perfect tool of thought; this can only be the case when writing becomes absolutely an unconscious and automatic act. No system of teaching writing which aims at less than this can be justified.

We may thus distinguish three stages in the development of the writing habit according to the main control of the movement, whether visual, muscle-sense, or entirely automatic. The following table exhibits the variations in attention, pressure, and rhythm as the habit develops from visual control through muscle-sense control to complete automatism:

<i>Control</i>	<i>Attention</i>	<i>Pressure</i>	<i>Rhythm</i>
(1) Visual	forms of strokes and letters	even throughout	none
(2) Muscle-sense	mainly to meaning	unevenly distributed	appears
(3) Automatic	entirely to meaning	" "	marked

It is understood, of course, that even when we speak of writing being entirely automatic that the eyes still have work to do. Even with the practised writer the eyes play an important part in

- (1) Keeping alignment.
- (2) Keeping uniformity in size of letter.
- (3) Keeping uniformity in spacing.

The writer depends entirely upon muscle-sense and tactile sensations for the formation of the letters. Furthermore, since, when writing, we always look at the result, rather than the movement, there can be no association between the visual sensations and the control of the correct co-ordination of the movements involved in the writing. It is plain that the control of this co-ordination is vested in the muscle-sense and not in the eye. In the automatic stage the writer exercises these controls without the least consciousness of doing so.

The writing habit, as all other habits, can be acquired only by dint of hard work and constant practice. There is no royal road to learning, and the old saying applies to learning to write even more than to many things the child must learn, for the complexity of the process is so great that perhaps nothing in the child's school experience will offer greater difficulties. Intelligent practice is the answer to all of them, and perhaps no topic needs more thorough discussion than this, if one may judge by the unintelligent and often positively harmful methods of practice too often employed in schools to-day.

The child begins, and must begin his learning to write by the trial and error method. He sees the teacher produce a certain result from a certain movement. His own imitation of that movement is bound to be different in many points. He will make many unnecessary movements, for the intense nervous energy with which he tackles the new problem will spread itself over his whole system, resulting in strained muscles, twitching face, tongue probably protruding from the corner of the mouth, pencil or crayon gripped with unnecessary vigor and the like. This diffusion of the nervous impulse over the entire body is inevitable, since the tracts over which it should flow to produce the proper movements, and nothing more, have not yet become closely associated. Each trial will partially eliminate some of the unnecessary movements, the nerve impulse gradually is confined to the proper tracts,

until at last it will innervate only the muscles needed for the movements each to the proper degree.

In this practice the teacher must exercise constant supervision to aid in the elimination of these useless movements as speedily as possible. In this connection, the main point to remember is that the attention should always be directed towards the proper movement, not the useless one. The very fact that the attention is thus centred causes a diversion of the nerve impulse to the proper channels, and a corresponding inhibition of the improper movement. So the tyro when learning to drive a car or to ride a bicycle must always attend to where he wants to go. To look at the ditch beside the road is to invite a spill. The teacher's instruction, therefore, should always be, "Do this," and never, "Don't do that," and this, while true in all the stages, is particularly important in the early practice when the very suggestion of the wrong way is enough to fasten the child's attention upon it with disastrous results. Instruction should be positive, not negative. It must show the right course, and ignore the wrong.

Practice periods must at first be very short. If practice is carried on until the movements become irregular, it is then positively injurious. W. Smythe Johnson¹, from the results of an experiment in which he had adults draw circles free-hand after carefully looking at a copy, concluded that irregularities will appear as early as the third circle drawn from memory, and these irregularities tend to become habitual in all the following circles, despite the fact that the subjects were adults and carefully instructed to keep the first circle constantly in mind while drawing the copies. Obviously, practice may tend to establish wrong adjustments as well as right ones. Practice thus producing habitual wrong adjustments is an actual impediment to progress. In teaching writing, long practice periods must be avoided, as otherwise the latter part of the practice will tend to establish habits of poor adjustments and nullify the benefit derived from the initial portion of the practice period.

Only successful practice counts. Practice for practice sake is a false and wholly injurious mode of procedure. It will in-

¹Johnson, W. Smythe. "Researches in Practice and Habit."

evitably degenerate into careless scrawls, in which the pupils' interest is entirely lost. Many a school copy-book shows the futility of such practice. Many a time the best effort will be directly under the copy, and each succeeding attempt will be poorer and poorer instead of better and better. The last copy will be the worst. Surely no argument is needed to condemn such an utterly futile waste of time and energy as such practice. As soon as practice shows an increasingly inferior product, it has lasted too long, and becomes wholly harmful instead of beneficial.

Only intense effort counts in practice. To permit a child to practice in a lazy, haphazard fashion, is equivalent to permitting him to do nothing at all. Bryan and Harter², in their studies in learning telegraphy, and Prof. Book in a similar inquiry, both conclude that only intense concentration while practising produces improvement. They show clearly that at certain definite stages in the learning process, at which a special habit or group of habits is being perfected, the learner is apt to fall below his maximum efficiency because the intensity of effort is then relaxed. When interest is again aroused and consequently the effort to learn is intensified, further and rapid progress is made. For the young child, intense effort is possible for only short periods. This fact furnishes a further reason for having short practice periods at frequent intervals.

The periods of rest following practice play an important part in the perfecting of muscular adjustments. Johnson conducted an experiment, in which seven persons tapped the corners of an equilateral triangle. The practice was continued over a period of from six to eleven days. He found that the greatest gain in rapidity and regularity of movement was made in the early part of the practice before fatigue began. A short interval of rest, followed by a renewal of the practice, resulted in fresh effort and further improvement. This experiment shows clearly that short periods of practice and rest alternating are more beneficial than single long practice periods. The rest periods play their part by giving time for the muscular adjustments to take place. As James remarks

²Bryan and Harter. "Studies on the Telegraphic Language."

paradoxically, "We learn to skate in summer and to swim in the winter."

We may conclude, then, that practice periods must be short enough to avoid fatigue, must be frequently repeated, must be filled with work done at high pressure, and must be followed by periods of rest in which the necessary muscle adjustments become perfected. These are the essential requirements for profitable and interesting practice.

Periods in the learning process must be expected when no appreciable progress will be seen. These periods have their function; during them the habits just learned are becoming automatic and are forming a sure foundation upon which may be built successfully other groups of associated habits. The old maxim, "Make haste slowly," must never be forgotten by the teacher of writing. Prof Book¹, in connection with the learning of typewriting, concludes: "To try to crowd ahead before the elementary habits are sufficiently mastered to make safe the taking of a forward step or to fail to perfect the elemental associations which must be combined to form the higher and more direct method of writing, is fatal to progress or interest." His conclusion is equally applicable to handwriting. So, too, in the famous practice curves obtained by Bryan and Harter in their study of telegraphy, the plateaus, which mark periods of apparent lack of progress or even retrogression, indicate also the time when successful co-ordinations are being automatized. When these adjustments and co-ordinations become sufficiently automatic, the learner is again in a position to advance, and will progress with great rapidity for some time, until the new co-ordinations learned become sufficiently numerous and difficult to require another period of automatization. Very plainly, these periods are of the utmost value and importance, and on no account should they be curtailed, as the result must be an increasing inability to progress, a confusion of mind and a consequent loss of interest and effort in learning.

The type of material for successful practice remains for discussion. The easy method for the teacher is to use copy-books, but this must prove ineffective for the pupil. The fact

¹Book, Frederick. Psychology of Skill.

that movement is more easily imitated than the results of movement disposes of them so far as the beginner is concerned; for the learner who is becoming more or less proficient they are equally useless. It has been shown that visual control necessitates slow writing. If a copy book is used, naturally the pupil aims to approximate the copy as closely as possible. Such an aim must involve visual control to such an extent that free rapid writing becomes an impossibility. Further, practice for the more proficient writer should allow him to express his own thought, to use writing as a means, not an end. The copy-book system makes this impossible. The learner should have practice in thinking and writing at the same time—and the thinking may be *anything except the writing*. How is that possible, when, if using a copy-book, the thought of the writer must be centred upon the copy to be followed and the success or failure of his own imitation? The only excuse for using copy-books in class-room is that they furnish a standard of form to which reference may be made from time to time when needed, just as a dictionary may be kept as a standard of reference. Surely, however, a child receives more benefit from a viva-voce explanation of the meaning of a word from the teacher, and a drill upon its uses, than it possibly could from a dictionary. In the same way, a good teacher can do infinitely more for a child by showing how to make a correct form than any number of references to a copy-book will do. Good teaching, not the standards of form engraved in copy-books, must be relied upon to produce good writing in our schools.

The best form of practice is that in which the child expresses its own thoughts in writing while thinking. In no other way can it ever reach the point where the writing act becomes purely automatic and a help, not a hindrance, to thought. Of course, some attention must be paid to form; in the initial stages, form must be continually stressed. As soon as the initial difficulties are mastered, the child must be gradually practised in thinking while writing, for in so doing the emphasis is laid upon the thought, and the muscle and tactile sensations have to take charge of the act of writing. Many a child is told continually to think about his writing, when, as

a matter of fact, he should be told to write his thought and to try to forget that he is writing at all. The child who becomes a good mathematician does not think about the fact that $2+2=4$; he knows it, and uses it *without thought* when required. So the good writer will write without thought of his writing. The material for practice must be original composition, as it offers the only work by which the child can be trained to write his thoughts with the least consciousness of the act of writing, and consequently the greatest ease and rapidity.

CHAPTER VI.

THE PHYSIOLOGY AND HYGIENE OF WRITING.

IT has already been pointed out that the writing act involves not only adjustments of the fingers, hand, wrist, arm and shoulder, but also of the central organism. These adjustments must be considered by the teacher of writing both with a view to facilitating the best and easiest movement, and also with regard to their effect upon the health of the child. The hygiene of the eyes must be consulted. Further, the question of fatigue, important in all pedagogical discussions, must be considered in reference to the writing act.

The following method of holding pen or pencil has been widely adopted in recent years, and its use has given good results. The pen should be held between the thumb and second finger. The tip of the thumb should be at least one inch from the pen point. The second finger curves across the under side of the penholder so that the holder rests against the first joint. The tip of the index finger rests upon the upper surface of the penholder somewhat nearer the point than the tip of the thumb. The thumb and index finger are slightly curved, the second finger is curved to a greater extent. The third and fourth fingers act as a point of support for the active fingers.

In this way it is possible to control accurately the movement of the pen, as the index finger presses downwards, the thumb to the right, the second finger upwards and to the left. The slight curvature of the thumb and fingers permit sufficient flexibility to ensure accurate letter formation.

Two faults may occur in the use of this position. If the fingers are not sufficiently curved, their flexibility is lost, and it is impossible for them to carry out adequately their task of letter formation. On the other hand, they may be too much curved. Too great a curvature necessitates a very tight grip upon the pen and the result is a cramped which pre-

vents fast writing and is very fatiguing. In extreme cases writer's cramp eventually results. It is due to a too violent contraction of the muscles which flex the fingers, and in advanced cases is almost incurable. Not many school children will ever write enough to contract writer's cramp, but the consequences of a cramped position for any child are sufficiently unpleasant and harmful to warrant every effort to prevent them.

Many people adopt other methods of pen-holding as alternative positions to use when fatigued. Perhaps the most common alternative method is to grip the pen between the first and second fingers, with the thumb resting against the left lower surface of the pen-holder. This position does not permit such fine adjustments of the fingers, and throws a greater burden upon the arm. It does not necessitate so much muscular effort by the fingers to hold the pen in place. This accounts for the fact that this position is decidedly restful after one has written a good deal in the other way.

Such shifts of position should be practised only by the proficient writer. When the writing habit is being formed no alternative movements or positions should be tolerated, for they can result in nothing except the disorganization of the movement or position, and must prove a great hindrance to progress towards automatization.

The position of the wrist is determined by two requirements. The first is that the hand must be placed in such a position that it can readily slide over the paper upon the fingers which support it. Consequently, the usual working rule of teachers calls for a level wrist, as that keeps the side of the hand free of the paper and facilitates easy sliding by the little finger as the arm carries out its task of forming the ground-work of the letters and carrying the hand across the sheet. A level wrist, however, causes considerable muscular strain, and is more fatiguing than a slight inclination to the right, which is just as effective. Too great an inclination is apt to permit the hand to rest on its side in such a way that finger and arm movements alternate instead of occurring simultaneously. The second requirement is based upon the necessity of pronation to maintain uniformity in slant. Since

pronation implies a gradual levelling of the wrist as the hand crosses the paper, it is obvious that a level wrist at all times is not an adequate prescription. A slight and varying inclination to the right is better, as it allows pronation and is less fatiguing.

It was argued in the discussion of the writing movement that the arm movement with rest was the best and the least fatiguing of writing movements. The forearm should rest wholly or almost wholly upon the desk or table, so that it can move up or down and rotate easily upon the muscle-pad below the elbow. If the elbow projects more than an inch or two over the edge of the desk, the advantages of this movement are lost, for then the arm must swing from the shoulder. This was shown to be a fatiguing movement and should be excluded.

The left arm should be placed in such a way that neither shoulder is elevated or depressed more than the other. This implies that much the same position should be adopted by the left arm as by the right; the left forearm should rest its full length upon the desk. In this way curvature of the spine, due to unequal elevation of the shoulders, is prevented.

Turning now to the body, we shall outline briefly the requirements of good posture both from the standpoint of easy and fluent writing and that of hygiene.

The function of the body in the writing act is to furnish a solid support for the arm. The position of the body which best enables it to carry out this function will be found to be the most hygienic also.

The child must sit well back in his seat so that his body is securely placed. Sitting on the edge of the seat causes an unsteadiness which hinders the arm in its task. The feet placed flat on the floor add to the steadiness of the body by giving additional support. The body should be held erect or almost erect. Unless the seat projects a few inches under the desk, there will be a tendency to lean forward, as the child is too far from his work. The modern school desk complies with this requirement.

Even under the best conditions, most children show a tendency to a forward bending of the body with the back rounded. This causes the lungs and stomach to be compressed, prevents

deep breathing, interferes with digestion and the circulation of the blood. If the bending is so extreme that the centre of gravity of the body falls forward of the pelvis, the body must be held in position by muscular action instead of resting without effort upon the pelvic base. The muscular and nervous energy so used is wasted entirely.

If the paper upon which the child is working is placed either to the right or left of the middle line of the body, the trunk is apt to be twisted to correspond. Such twisting in one direction, if habitual, causes curvature of the spine. The paper should be placed directly in front of the pupil, and he must be required to face the desk squarely. This position was given as requisite for a good writing movement; it is also the best on hygienic grounds.

If the desk-top is flat and the head held erect, the eyes must turn downwards through a large angle to see the writing. This causes a considerable strain upon them, and the child meets the difficulty by bending forward so that he looks at the paper perpendicularly rather than obliquely. In avoiding one difficulty he meets another, for the bending of the head, if excessive, interferes with the proper circulation of the blood in the head. The difficulty is solved by desks with inclined tops tilted forward at an angle of fifteen to eighteen degrees. These permit a sufficiently erect position of the head without causing eye-strain.

It remains true, of course, that the child who can maintain the ideal posture for any length of time has not yet been born, nor ever will be. The danger lies in too great an habitual divergence from that ideal in one direction. If, for instance, the child places his paper to the left of the middle line of his body as frequently as he does to the right, the two deviations will balance each other and no great harm will result. But if he habitually places the paper to the right, an habitual twisting of the head and trunk in that direction will inevitably result disastrously.

As a matter of fact, the teacher must avoid demanding any one unvarying posture just as much as she must combat habitual bad posture. The younger the child, the less he should be required to hold any one position for any length of

time, and to permit changes of position, providing they are not habitual in one direction, is absolutely necessary in order to avoid restlessness and fatigue.

The hygiene of the eyes may now be considered. The most usual fault consists in holding the eyes too close to the paper. Constant focussing upon any near object causes considerable nervous and muscular strain in the eyes, and the closer the object the greater the strain. An effort must be made to keep the eyes as far from the paper as conditions will permit. Freeman¹ gives the following distances as the minimum for the grades designated: primary, ten inches, intermediate, twelve inches; grammar, fourteen inches. For the adult it is from sixteen to twenty inches. These standards imply that the writer is in an erect position.

Too small writing invites too near vision. It should be large enough to be easily seen at the standard distance. In the primary grades this requirement will be met without special effort because of the naturally large writing of young children, in the older grades it becomes of greater importance.

In this connection the quality of the mark made by pen or pencil is of importance. A hard pencil makes so light a mark that the difficulty of seeing it necessitates too close a position of the eyes. Only soft pencils making a heavy black line should be used. If the writing is done with pen and ink, a good dark ink is essential for the same reason.

Glazed paper which reflects the light is hard upon the eyes. School paper should have surface enough to take ink well and be rough enough to show pencil marks clearly. Most of our school foolscap has far too smooth and glazed a surface to be satisfactory. A pencil mark upon it can scarcely be seen, and while it takes ink well enough it reflects so much light that the eyes suffer severely through its use.

The eyes suffer if the paper is placed far to either side of the middle line of the body. The strain due to near vision is tremendously increased if the centre of focus is not equidistant from both eyes. If the paper is placed directly in front of the writer a slight turn of the head to left or right will bring the

¹Freeman, F. N. The Teaching of Handwriting. P. 43.

centre of focus to a position equidistant from both eyes. In this way the eye-strain is minimized.

The schoolroom should be lighted either from above or the left. If the lighting is from the right, the shadow thrown by the hand interferes with the work of the eyes, and if the paper is at all glazed the writing on the right half of the sheet becomes almost invisible in strong light. Diffused daylight is the most restful light for work requiring the constant use of the eyes in near vision. This requirement is now generally recognized by school architects when planning their lighting arrangements.

The practised writer does not find writing especially fatiguing, but for the beginner, even when working under the best conditions, writing does cause fatigue very quickly. The writing act is so complex, the precision of movement, slight as it seems to the adult, is so great when compared with the ability of the child, the strain of attention is so exhausting, that every precaution should be taken to prevent the writing lesson from becoming a source of too great fatigue.

For young children the writing lesson should come early in the day before the child is already fatigued with other lessons. The primary grades should not be required to write at high speed or to make very precise movements. Blackboard practice is preferable for them mainly because it permits precise movements and larger sized writing than are possible with pen or pencil. The practice period should be short and frequent rather than long and at great intervals.

The points made in this outline of the science of writing are so self-evident that no further explanation is necessary. For the most part they are just matters of common sense and practically all teachers of to-day make a point of seeing that all the conditions which have been mentioned as favorable to health and efficiency are the rule and not the exception in their classes.

CHAPTER VII.

GROUP AND INDIVIDUAL DIFFERENCES IN HANDWRITING.

1. — *Pressure.*

The distribution of pressure in writing has been investigated by a number of experimenters. Meumann¹ distinguished three types of writing by differences of pressure.

- (1) Children's.
- (2) Masculine.
- (3) Feminine.

Children's writing exhibits an even distribution of pressure throughout the word. This doubtless is due to the fact that children tend to write by letter units rather than by word units. In children of six and seven years of age, not only each single letter, but even each single stroke is written with equal pressure. Frequently, the child writes more slowly than the adult and produces each stroke at approximately the same rate of speed. The absence of variation in pressure and the uniform speed in writing the letters combine to give children's writing a tendency to uniformity and lack of individual character.

The masculine type exhibits greater pressure than the feminine, but less speed. The pressure is rhythmically distributed over the word so that the maximum pressure lies at a definite point in each word. By some individuals this point of maximum pressure is placed at the beginning, by others at the end of the word. It is characteristic of the masculine type that the pressure increases with the speed. This type is also marked by a greater variability and originality.

The feminine type writes more quickly than the masculine and with less pressure. The uniform total impulses which led to a single point of maximum pressure in each word in the masculine type are replaced in the feminine type by broken

¹Meumann, *Vorlesungen zur Einführung in die experimentelle Pädagogik und ihre psychologische Grundlagen*. P. 301.

impulses. Consequently several maxima are found in each word, and there is a tendency to stop in the middle of the word. In this type the pressure decreases with increased speed.

The general conclusion is that adults write a whole word or a considerable part of it with a single effort of the will, whereas children use as many will impulses as there are strokes or letters. Each will impulse, generally speaking, carries women further than children, while men outdistance both in the amount written per will impulse. This fact is of the utmost importance in considering the mental factors in writing. The fact that each will impulse carries men as a rule so much further than women in their writing, allows greater freedom of connected thought for the writer of the masculine type. The child cannot think and write at the same time; his mind is wholly occupied by the task of forming the letters. The pressure distribution is the visible sign of these invisible mental conditions.

Sec. II.—Sex Differences in Writing.

Binet¹ conducted an experiment to discover how accurately sex could be determined from handwriting. He submitted one hundred and eighty addressed envelopes (eighty-nine written by women and ninety-one by men) to ten people without any expert knowledge of writing, and to two professional graphologists. Obviously, if no sex difference in handwriting had been discoverable he would have obtained 50% of correct and 50% of incorrect judgments. He found that the non-expert judges determined sex correctly in the following percentages of cases: 65.9, 66.4, 67, 68, 69.3, 72.9, 73, 73, 73. The highest percentage correctly judged was 78.8 by one of the professional graphologists. The average of correct judgments for all judges was 69.7.

Downey² submitted two hundred addressed envelopes (one hundred written by men and one hundred by women) to a number of people who were without expert knowledge of

¹Binet: *Les Révélations de l'écriture d'après un contrôle scientifique.*

²Downey: *Judgments of sex in Handwriting.*

graphology. The percentage of correct judgments follows: 60, 60, 61.5, 64, 66, 66.5, 68, 68.5, 70, 70.5, 71.4, 71.5, 77.5. The average of correct judgments for all judges was 66.1.

Sandiford¹ submitted two hundred and sixty-seven samples of handwriting to ten judges, five men and five women. The percentages of correct judgments for the men were 59.2, 61.4, 62.5, 64.7, 65.4; average for all 62.9. The women judged more correctly, their percentages being 64.8, 72.6, 73.6, 73.7, 73.7; average for all 71.7. The average of correct judgments for the judges was 67.2. This experiment is particularly interesting, as the script used was written by students in the Faculty of Education, University of Toronto, who were all trained by the Ontario Schools in which a uniform system of writing is used everywhere. The results clearly show that individual differences in writing will make their appearance at adolescence no matter how strict or uniform has been the previous instruction in writing.

The above experiments show clearly:

- (1) That adult writing does show distinct sex differences.
- (2) Absolute certainty in determining sex is impossible, but approximately 65% to 70% of cases will be judged correctly by the average person.

All the experiments described above were based upon intuitive and naive judgments. An analysis of the most typical masculine and feminine scripts, *i.e.*, those most often judged correctly and also those most frequently judged incorrectly enable one to arrive at the qualities of the writing which appeal to that intuitive judgment. Originality characterizes the man's hand, conventionality the woman's. Masculine writing is therefore more variable than feminine. The typical man's hand is more bold or more careless or more experienced and shows greater individuality. A study of the cases showing inversion of judgment, *i.e.*, where a woman's handwriting is judged to be masculine, or vice versa, indicates that the sex traits are greatly influenced by (1) the amount of writing done, (2) age, (3) professional requirements.

At the first glance, it would seem that the writing of children would not show sex differences nearly so plainly as that

¹Sandiford. Sex Differences in Handwriting.

of adults, since the unequal distribution of pressure and the variations in speed which contribute so much to produce differences in the latter are lacking in the former. Gesell², from an examination of 1,260 samples of writing from grades I.-IX. of the public schools of Worcester, Mass., concludes that sex differences in writing do not become apparent until about the age of ten. An investigation by the present writer shows, however, that sex differences are plainly evident in the writing of children of eight years of age, *i.e.*, after one or at most two years' instruction in the subject.

Seven groups of samples of children's writing were prepared, each group containing fifty samples of each sex. The writings were taken at random from thousands of samples submitted by the public schools of Ontario. Group 1 contained samples of the writing of boys and girls aged from seven years ten months to eight years two months, Group 2 from eight years ten months to nine years two months, and so on, each group thus centering definitely upon a certain age with a maximum variation of four months in the ages of any one group. The seven groups thus formed a definite series of writings of children aged eight to fourteen.

The groups so prepared were given to ten judges who were asked to divide them according to sex. The results are given in the following table which shows the percentage of correct judgments of each judge in each group for boys, girls, and total. The average of correct judgments in all groups for each judge is shown and also the average in each group for all judges.

TABLE SHOWING PERCENTAGE OF CORRECT JUDGMENTS ON SEX
IN THE HANDWRITING OF CHILDREN AGED 8 TO 14.

Judge	8			9			10			11			12			13			14		
	B	G	T	B	G	T	B	G	T	B	G	T	B	G	T	B	G	T	B	G	T
P. F.	52	64	58	60	68	64	52	60	56	42	62	52	56	52	54	68	50	59	64	64	64
M. S. F.	36	50	43	46	52	49	48	56	52	46	56	51	60	62	61	60	58	59	58	54	56
A. H. H.	37	31	34	42	38	40	60	40	50	50	44	47	52	66	59	56	64	60	66	66	66
D. H. S.	22	64	43	32	82	57	30	80	55	34	71	54	57	56	44	80	62	48	64	56	56
A. N. S.	66	58	62	68	76	72	70	64	67	64	40	52	66	75	68	88	78	58	80	69	69
H. B. K.	58	48	53	52	50	51	44	56	50	44	52	48	64	66	36	60	48	62	50	56	56
M. L.	69	61	65	62	74	68	62	72	67	78	46	62	66	60	52	66	59	72	58	65	65
W. J. D.	91	73	82	94	82	88	82	72	77	90	94	92	92	92	98	98	98	98	74	76	75
D. E. H.	78	64	71	82	58	70	68	72	70	74	54	64	72	78	70	60	76	68	72	66	69
S. N. H.	69	75	72	72	76	74	56	88	72	88	60	74	78	64	71	76	60	68	84	56	70

²Gesell. Accuracy in Handwriting as related to School Intelligence and Sex.

Average for all Judges.				Average for all ages.			
				B	G	T	
8.	57.8	58.8	58.8	P. F.	55.3	60.0	53.1
9.	51.0	65.6	63.3	M. S. F.	50.6	55.4	53.0
10.	57.2	66.0	61.6	A. H. H.	51.9	49.9	50.9
11.	61.0	58.2	59.5	D. H. S.	35.4	74.0	54.7
12.	53.5	69.2	66.4	A. N. S.	67.1	68.6	67.9
13.	51.8	70.0	65.9	H. B. K.	51.4	54.8	53.0
14.	55.8	63.4	64.6	M. L.	53.8	63.6	63.7
				W. J. D.	88.1	84.4	86.3
				D. E. H.	72.3	65.4	58.9
				S. N. H.	74.7	68.4	71.6

It is noticeable at once that one judge W. J. D. was able to judge correctly a surprisingly large percentage of the samples submitted. He alone of all the judges was able to give a definite set of characteristics by which sex may be recognized in children's writing. The writer, after obtaining from him his list of sex characteristics, examined one thousand samples of children's writing of all ages to test them. The following peculiarities were found to be present in from eighty to eighty-five per cent. of the cases examined.

(1) Boys' writing tends to irregularity in the following points:

- (a) Careless alignment.
- (b) Careless slant, showing a tendency to change to vertical or even back-hand towards the end of a word. This is especially noticeable in the loops of letters which come above the line *e.g.* h and k.
- (c) Jerky strokes.
- (d) Variation in the size of letters.

(2) Girls' writing shows the opposites of these characteristics.

- (a) Careful alignment.
- (b) Careful slant, very seldom showing a tendency to change slant to the left and seldom showing leftward jerks.
- (c) Smooth strokes.
- (d) Letters of uniform size.

(3) Boys' writing looks fast and careless even when good, girls' appears painstaking even when poor.

(4) Boys' writing shows more originality, a greater tendency to diverge from the conventional hand taught.

(5) Boys' writing is much more impulsive than girls'. This is shown by the much greater number of small errors made and corrected later by boys.

As a further test of the accuracy of these characteristics, several of the judges whose score in the first test had been low, were asked to go over the samples a second time, and to judge sex by the list of peculiarities given above. The following table gives the results:

TABLE SHOWING PERCENTAGE OF CORRECT JUDGMENTS OF THREE JUDGES ON THE BASIS OF SEX CHARACTERISTICS OUTLINED ABOVE.

	8			9			10			11			12			13			14				
M. S. F.	B	G	T	B	G	T	B	G	T	B	G	T	B	G	T	B	G	T	B	G	T		
A. H. H.	48	58	53	57	61	59	60	66	63	61	59	60	66	70	68	67	69	68	70	72	71		
D. H. S.	46	50	48	51	49	50	69	61	65	58	60	59	61	63	62	58	70	64	75	67	71		
	53	65	59	60	80	70	64	70	67	58	70	64	62	78	70	58	74	66	62	66	64		
Average for all ages.																							
	B			G			T																
M. S. F.	61.3			65			63.1									Increase for			M. S. F.	10.1%			
A. H. H.	59.7			60			59.1									" "			A. H. H.	9.0%			
D. H. S.	59.6			71.9			65.7									" "			D. H. S.	11.7%			
										Average Increase for all judges												10.27%	

From this we may conclude:—

- (1) Sex characteristics are apparent in the writing of children from the end of the first year of instruction, but are difficult to discover unless the judge has had a great deal of experience with such writing.
- (2) Sex characteristics become more plainly marked with increasing age, an increase on the average of 6.3% being shown in the total number of correct judgments in age 14 over age 8.
- (3) As all the writing examined was written by pupils who have been trained under one system, it is apparent that no training, however uniform and severe, can eliminate sex characteristics in writing.

Sec. III.—Natural and Artificial Handwriting.

It is a matter of common experience that most individuals have a peculiar style of writing which may be recognized at once even from a written address. The imitation of another's handwriting is most difficult; the forger must be a real artist in his work if he is to be successful. In some few cases, the handwriting lacks individual characteristics but shows plainly

the style of copy which it imitates. Starch¹ has demonstrated by his experiments that women show a greater imitative tendency than men. This bears out Downey's findings referred to in the previous section. Such imitation of copy when carried to an abnormally high degree eliminates individual characteristics.

Accordingly Preyer has distinguished between natural writing in which the letters and connections are formed in a manner peculiar to the individual, and artificial writing, in which the copy is so closely imitated that individual peculiarities do not appear. He classed children's writing as artificial. This is not altogether true. While the child's writing naturally depends upon the copy to a greater extent than does that of the adult, still it is possible to recognize individual peculiarities in the writing of even very young children. Ufer is nearer the truth when he remarks that the writing of children begins with the artificial type and gradually approximates to the natural. He has classified the individual peculiarities of children's writing as follows:

- (1) Unnecessary additions.
- (2) Angles in place of curves, and vice versa.
- (3) Differences in slope.
- (4) Connection of letters one with another.
- (5) Spacing of characters.
- (6) Distance between words.
- (7) Absolute size of single letters.
- (8) Relative sizes of letters and parts of letters.
- (9) Observance of lines.
- (10) Form and position of auxiliary signs, *e.g.*, the dot on the *i*.

Rusk remarks that Ufer neglects to consider hand pressure and speed, which also show individual differences.

Sec. IV.—Uniformity as an aim in the Teaching of Writing.

It must be quite clear from the preceding sections of this chapter that any attempt to teach a single, uniform style of writing must end in failure. It has been shown that sex characteristics and individual peculiarities appear very early,

¹Daniel Starch. Unconscious Imitation in Handwriting.

no matter how severe an effort is made to eliminate them. Naturally, these peculiarities are enhanced and developed as soon as the writer shakes off the bonds with which a narrow and strict system of teaching ties him. We all know, from our own experience, that we develop a style of our own as soon as we are not compelled to follow a definite copy, and that style surely will be the one which is easiest and most natural for the individual concerned, in which the qualities which constitute a satisfying style, speed, beauty and legibility are combined in a proportion which seems adequate to the writer. The question is, then, whether the teaching of writing should not take into account the undoubted fact that each individual should have and will have a style peculiar to him, and instead of aiming to produce a uniform style of writing in all pupils, rather aim to improve the individual style of each pupil, permitting very wide divergencies.

A strong argument for such a method has already been given. People do develop an entirely different hand in many cases after their schooling is finished. Why not permit this to occur earlier, for the very fact that despite all the practice in school, the style of writing will almost at once change after leaving it, shows that the school type was not satisfying to the writer, and, therefore, its practice was largely wasted time. An even stronger argument in favour of the recognition of individuality in writing is the fact that almost every school child develops two styles of writing. The one used in writing exercises, essays and the like, is formal, conventional, and approximates very closely to the copy used in the writing classes. The other, used for the child's private purposes, for notes and work done for itself, very often will differ so widely from the formal style that no one could recognize the two as being the product of the same writer. This private style, so to speak, invariably forms the basis of the style of writing used in adult life.

This being true, it is at once obvious why our schools produce so many poor writers and yet spend so much time in teaching the subject. The writing classes recognize and deal only with the formal and unnatural writing which the child will never use in actual life. Consequently, a tremendous pro-

portion of the time and effort spent in formal writing classes is absolutely and entirely wasted. The whole system is directed towards an impossible end; the possibilities inherent in the natural style of the child receive little or no attention. But it is only by developing this natural style to its best that we can produce a good, easy, satisfactory hand which can be used in every business life. In the teaching of writing, as in any other subject, the best results can be attained only by painstaking study of the aptitudes and peculiarities of the individual writer. To try to make all children write an identical hand is as foolish as to expect them all to have identical ability, identical tastes, and identical physical qualities in identical proportions.

The instrument most widely used in the teaching of writing to secure uniformity of product is the copy book. The discussion of the use and the abuse of copy in writing classes is, therefore, germane to the present topic. The use of copy-books is based upon the idea that, as writing is learned largely through imitation, the more perfect the copy to be imitated the more perfect will be the imitation. This notion, however, as Freeman¹ has pointed out, neglects several important considerations. The copy is not produced by the writing movement at all, and, therefore, does not suggest it, but rather the slow drawing movement of which the perfect copy is the product. Further, it is much easier for the child to imitate a movement which it sees than to imitate the product of that movement, for the latter imitation implies an excessive power of imagination. The child who is set a copy and told to imitate it has both these difficulties to contend with, and the additional discouragement of realizing that his best efforts cannot even approximate the copy set. It is, in fact, an impossible task for the child, and, consequently, can end only in discouragement, a relaxation of effort, and little or no progress in mastering the art of writing.

Improvement in writing must come from an analysis of the child's own product, not from gazing upon and trying to imitate an impossible ideal. Further, if the improvement is to be worth while and permanent it must be based upon the

¹Freeman, F. N. "Current Methods in Teaching Handwriting."

child's own individual style, as otherwise the change for the better will be seen only in the formal product of the classroom. This formal writing should go by the board since it is useless and wasteful, and every effort should be directed towards enhancing the beauty and legibility and increasing the speed of that style of writing which comes most easily and naturally to the child. In this process copy-books can take no part. Even at the very beginning, the child should see and imitate the teacher's movement in making a letter rather than the letter itself.

All this does not mean that there are no limitations to the differences which legitimately occur in writing. The limits within which they may occur may be roughly defined in a negative way as follows:

(1) No variation should be admitted which lessens speed without a counterbalancing increase in beauty or legibility.

(2) No variation should be allowed which renders writing illegible.

(3) Variations unpleasant to the eye should be eliminated.

If the writing is fast, legible, and not displeasing to the eye, the requirements of good writing are fulfilled, and any minor peculiarities are of little account. Within these limits individual differences are inevitable and desirable, and it is only by taking their existence into account and using them as a basis for individual teaching that a permanent improvement in the child's every-day style is possible.

CHAPTER VIII.

THE MEASUREMENT OF HANDWRITING.

THE attempts made in the last few years to measure school subjects have brought a truly scientific and curately and equitably the quality of work done in efficient system of education appreciably nearer. Too often the teacher uses an arbitrary standard which may or may not be fairly efficient. This is particularly true in valuing work done in such subjects as English composition, where there is so much room for individual taste and opinion to play a part. In no school subject has there been such a wide diversity of opinion and marking as in writing. In actual tests, teachers working in the same city and using the same methods of instruction, have given values ranging from 24% to 73% to the same specimen of writing. Nothing could more strikingly illustrate the crying need for some definite scale by which writing can be fairly equitably valued.

To Dr. E. L. Thorndike, of Columbia University, belongs the credit of being the first educationist to attack this problem. The full report on his work is given in his article on handwriting in *Teachers' College Record*, March, 1910.

The scale was constructed by having forty or more competent judges rank 1,000 samples of children's writing in order of merit. The samples were selected with a view to obtaining as wide a range in quality as possible. In ranking these samples, the judges found it impossible to distinguish 1,000 grades of quality, since many specimens were indistinguishable in merit. About twenty grades only could be distinguished. It was also discovered that substantially the same average results were obtained by grading the samples into ten or eleven groups a number of times as by grading into twenty. The judges, therefore, ranked the samples into ten groups attempting to make the differences between the groups all equal. The average position of each sample could then easily be worked out, and in this way typical samples could

be selected as the scale points. The differences in quality between any one of these selected samples and the one marking the next point above or below in the scale would therefore be approximately 1-10 of the difference between the best and the worst of the writing of 1,000 children in grades five to eight.

Zero merit in handwriting was arbitrarily defined as that of handwriting, recognizable as such, but yet not legible at all and possessed of no beauty.

A specimen with these qualifications was made and used as zero point in the scale. The places between the worst specimens graded by the judges and this zero point were filled by finding out experimentally how many specimens of writing could be inserted between them, to show clearly discernible differences in quality. In this way it was found that four grades of writing were possible between the worst specimen submitted and the zero point. Consequently the worst specimen was marked quality 5 upon the scale.

The finished scale showed a series of graded specimens ranging in quality from zero to eighteen, zero being absolutely illegible and eighteen a perfect copper-plate sample.

The scale representing the combined judgments of forty or more competent judges, scientifically handled, has a high degree of accuracy. In its construction, general merit, without emphasis upon single qualities such as beauty, legibility or individuality, formed the basis of judgment.

Any specimen of writing is measured by comparing it with the scale and determining to what quality it most closely approximates. The best method is the ascending-descending procedure. That is, if a group of samples of writing is to be graded, each sample should be valued by beginning at the bottom of the scale and working up to the point where the sample is judged equal. After the whole group is rated in this way, each sample should be graded by working downwards from the top of the scale until the point of equivalence is reached. The average of the two judgments will give a more accurate rating than a single comparison with the scale.

The objection has been made that the Thorndike scale measures only form and not general merit. It is true that the form of writing will be the main factor in grading it, but form

and general merit are so closely correlated that this criticism has little meaning.

A second scale for writing was prepared by L. P. Ayres¹. The Ayres scale was constructed upon a different principle than the Thorndike. Samples of children's writing numbering 1,578, in which the words were thrown out of their natural context, were read by ten different persons. The time needed for the reading of each sample was accurately noted, and an average reading time computed for all the judges. The time required was considered a measure of legibility, that sample which required the least time for reading being obviously the most legible and vice versa. From the entire group specimens were selected which had required eight different reading times of equal increment from fastest to slowest. These samples, therefore, represent eight equally distant degrees of legibility. For each of the eight degrees of legibility, three specimens were chosen, one slant, one medium, and one vertical. To these scale points percentile values were given, ranging from 20 to 90. Any specimen of writing may be measured by a comparison with the scale in the same manner as with the Thorndike scale.

The Ayres scale was constructed upon the basis of legibility only. It was intended also to be a scale for the measurement of legibility only. Yet the very method of its use obliges its user to depend mainly upon form or appearance for his grading. This is also true of the Thorndike scale, which measures the appearance rather than the general merit of the writing, although general merit formed the basis upon which it was constructed. The criticism, however, carries more weight in the case of the Ayres scale, as in all probability, legibility and form are less closely correlated than form and general merit.

The Ayres scale is also inferior to the Thorndike scale because the range of qualities is not sufficiently great. The lowest quality in the scale is better than the average writing of first grade or even second grade pupils.

¹Ayres, L. P. A scale for Measuring the Quality of Handwriting of School Children.

Pintner¹, considering that the best test of a scale is the ease and accuracy with which it can be used by the majority of intelligent observers, experimented to find out whether the Ayres or Thorndike scale would show the least amount of deviation in the ratings of the same samples by a number of individuals. Twenty-four samples of handwriting were graded on both scales by thirty-three observers. The results showed that the samples were given almost the identical rank on both scales. This was interpreted to mean that the observers' standards of goodness and badness of writing had been practically identical in their work with both scales, and also that the steps on both scales correspond very closely with each other. The amount of deviation in the judgments of the thirty-three observers was calculated after reducing the ratings on both scales to a common basis in order to make them comparable. It was found that with the great majority of the twenty-four samples, the Thorndike scale gave the more uniform results, as the deviation among different individuals was less than on the Ayres scale. Further, this greater uniformity was distributed pretty evenly over all the observers. Pintner, therefore, considers the Thorndike scale to be the more reliable one. He attributes this greater reliability to the fact that it has taken into account all those factors that go to influence our judgment of hand-writing, and does not depend upon legibility alone.

These results are the more striking because the observers in this experiment preferred the Ayres scale to the Thorndike. This was due probably to the convenient form of the scale and to the percentage system used in marking the steps. Pintner believes that the Thorndike scale could be made more convenient for the user by placing the samples vertically instead of horizontally, and by marking off the different steps more clearly from each other. The percentage system of marking steps, as the most familiar one to the average teacher, would perhaps be an improvement.

Freeman¹, proposed an analytical scale, consisting of five charts to measure (1) Uniformity of slant, (2) Uniformity of

¹Pintner, Rudolf. A Comparison of the Ayres and Thorndike Hand-writing Scales.

¹Freeman, Frank N. The Teaching of Handwriting, Chap. V.

alignment, (3) Quality of line or stroke, (4) Letter formation, (5) Spacing. Each chart represents three degrees of excellence, numbered 1, 3, 5, in ascending order of merit. The specimens for these charts were selected by grading a large number of specimens of the writing of children from grades three to eight into as many ranks as could be distinguished, according to each of the five categories which are represented on the scale. In some cases four, in others five ranks could be distinguished. This formed a tentative scale by which twenty-three advanced students graded 100 specimens into ten ranks according to each category. Ten specimens were then selected to give ten approximately equal steps for each category on the basis of the average judgments of all the graders. The scale so obtained was remodeled by basing the order of the specimens as far as possible upon objective measurements of the characteristic or by employing some means to exaggerate the characteristic to make judgment easier. Letter formation is picked out as being the most important factor in legibility, and receives the values 2, 6, and 10 instead of 1, 3, 5.

A specimen is graded by comparing it with the five charts in turn, and assigning a value for each characteristic measured. A total value may be assigned by adding the individual measures. In this way equal weight is given to each characteristic measured, with the exception of letter formation, which Freeman considers the fundamental basis of legibility, and, therefore, is given double value.

The scale aims to assist the teacher to pick out the strong and weak points of each pupil's writing, and in this way be better fitted to aid the pupil by discriminating carefully one kind of fault from another. For instance, if a specimen grades low in uniformity of slant and alignment, and high in letter formation and spacing, clearly the writer fails in the characteristics which depend on the writing movement, but is successful in the characteristics which depend upon the recognition of the form of the written words. The teacher must in this case direct instruction towards securing a smooth, well co-ordinated movement.

The scale is open to criticism in that three qualities are not sufficient for accurate grading. I have seen many specimens of school children's writing which will grade much lower than quality one as given in the scale for any characteristic, and many which will grade much higher than quality five. Further, the difference between any two steps is far too great.

It is doubtful that the form of letters should receive twice the value of other characteristics. Attention to spacing, especially the spacing of words, increases the legibility of writing more than attention to the form or regularity of letters. Sandiford¹ improved the handwriting of a class in one month by 30% (measured by the Thorndike scale) by insisting on a space equal to the width of the letter "m" being left between each of the words. He concluded that spacing and regularity are more important factors in legibility than form.

The latest contribution to the subject has been made by Lister and Myers¹. They believe that their work incorporates the merits of the writing scales described above, and supplies some of their defects. Their scale is primarily intended, like Freeman's, to aid the teacher to analyze the pupil's product and to grade it not only on the basis of general merit, but also on the basis of merit in three qualities—form, movement, spacing. Form includes accuracy in letter formation, uniformity in size and in slant; sharp, smooth, clear-cut lines and the absence of indications showing pen-lifting, in a word, are taken to show good movement. Too wide, too close, or irregular spacings were counted as undesirable. On this basis, 21 teachers and expert penmen, and 4 psychologists ranked 300 specimens selected by chance from 3,550 samples provided by nine schools in New York City. Each judge ranked the three hundred specimens into eight piles three times, once for form, once for movement, and once for spacing. The average rank for each specimen was then determined, and the best and the worst selected as the top and bottom of the scale. The proper rank that the six intervening samples should have was then determined exactly, and specimens selected whose average

¹Sandiford, Peter. *The Mental and Physical Life of School Children*. Page 329.

¹Lister, C. C., and Myers, G. C. *An Analytic Scale of Handwriting*.

rank coincided with these positions, or approximated most closely. Three scales thus were formed, each containing eight samples in order of merit with approximately equal differences between them. No attempt was made to set a zero point. Arbitrary values of 20, 30, 40, 50, 60, 70, 80, 90 were assigned to the eight scale points.

This analytical scale is an advance over Freeman's. It is more accurately and scientifically constructed. It also gives eight qualities instead of only three, permitting a closer grading. It should prove helpful to the teaching profession, when made available for their use. It remains true, none the less, that a scale for merit will prove the most useful one. As Thorndike² himself says: ". . . such specialized scales are highly desirable. . . . But it seems sure that the scale of most importance and usefulness is that for general merit. General merit is that for which school grades are oftenest given, in respect to which school systems or classes are oftenest compared, and with which other features of a pupil's achievements are oftenest related. Moreover, only after a scale for general merit has been made can one measure the extent to which legibility, beauty, etc., respectively determine general merit."

It has been urged that measurements made by such scales are liable to be erroneous to such a degree that the value of the scale is much impaired. This is undoubtedly true; but no two men can ever apply a scale in any measurement with the identical results. If, for instance, two men measured the table at which I sit, it is likely that their measurements would differ by at least $\frac{1}{16}$ ". Further, this difficulty can be largely overcome by practice.

Gray¹ had three students of education practise grading writing with the Ayres scale for twenty weeks. The difference between the highest and lowest value given any sample was at first high, averaging in the first week 20.4 for all samples graded. By the 15th week this variability was reduced to 3.6, and by the 20th, to 3.2. From his experiment he concludes:

²Thorndike, E. L. *Handwriting*. Page 43.

¹Gray, C. Truman. "The Training of Judgment in the Use of Ayres' Scale for Handwriting."

(1) Accuracy in grading handwriting by a scale may be produced by careful training in the use of the scale. A period of such training offers an avenue of approach to the ability to grade expertly in a subject, an ability previously assumed to accompany an expert knowledge of the subject. This implies that grading may be considered a field more or less by itself. To illustrate: In the subject of writing such a field would have its chief interest in the expert application of standardized units for measuring writing rather than in the psychology or pedagogy of the subject.

(2) The experiment suggests a field in which Normal Schools and Departments of Education may well afford to give training.

(3) It is certainly within the range of possibility for any medium-sized system of schools to have within its teaching force a few teachers who have been carefully trained in the measurement of handwriting or other subjects. One objection made by teachers to grading by means of scales is that no two persons get the same results. One must admit that this objection has some merit, but grading by teachers trained until their range of valuation has reached a minimum would certainly beget the respect of all concerned, and would give an excellent basis for the establishment of forms and comparison of schools, grades and teachers. Such work would also establish many of the favourable and unfavourable points concerning a system of schools upon such a basis that there would be no denying them.

Starch¹ had two sets of judges, consisting of ten business men and ten teachers, grade fifteen specimens of writing in three different ways (a) by the Thorndike scale, (b) by the Ayres scale, (c) by the usual percentile method used in the school. The average mean variations for the fifteen samples, reduced to the terms of the percentile method, are shown in the following table:

Judges.	T. Scale.	A. Scale.	% Scale.
Business Men	6.32	6.04	10.04
Teachers	5.66	5.49	10.30

¹Starch, Daniel. *The Measurement of Handwriting.*

These results show that measurements made with either scale are approximately twice as accurate as those made without a scale at all. It should also be noted that the judges were not practised in the use of the scales. Familiarity with their use reduces the error to nearly one-half. Starch, therefore, concludes that after some practice in the use of the scale the measurements with either scale are from three to four times as accurate as the valuations made by the usual percentile marking system.

The experiments described here are sufficient to answer any criticism of writing scales based upon the fact that no two people will obtain the same results by its use. That is true; but it is also true that they will obtain much closer results by using a scale than by the ordinary methods of judging writings. This is the real test of the value of the scale as a useful tool for the educationist.

The uses to which either the Thorndike or Ayres scale may be put are manifold. From the teacher's standpoint, they give a fairly reliable method of obtaining uniformity in the marking of writing. They provide a standard by which our judgments of to-day may be compared with our judgments of a month hence, with the certainty that the basis of our judgment has not altered in the meantime. More important still, they may be used as a very real help in the work of teaching. The pupil, instead of using a perfect copy impossible of attainment, is given the quite possible task of raising his product one step at a time upon the scale. Each step conquered is a very real and visible improvement which provides a powerful incentive to fresh effort.

The scales also provide a means of comparing different classes of the same grade, different grades, different schools, or different school systems with respect to the quality of the work done in teaching writing in them. The inspector or superintendent can arrive at a fair valuation of the worth of different teachers or different methods of instruction; something that hitherto has been impossible except in the roughest and most unscientific manner. The use of the scale in school surveys will answer some of the most pressing questions in school administration, *e.g.*, how long lesson periods should be

given in writing, how many per week, in what grade should formal writing lessons be discontinued, what method gives the best results, etc. The facts obtained by a wide use of the scale in this fashion should lift these questions beyond the controversial stage and settle them once for all upon a scientific basis. This work still remains to be done; and nothing offers a fairer opportunity for the scientific educator to demonstrate his worth.

It has been noted that both the Thorndike and Ayres scales, although constructed upon different principles, both measure the form or appearance of the writing rather than its legibility. But an analysis of handwriting shows that its chief elements are three in number, *viz.*: (1) Legibility, (2) Form, (3) Ease of production or speed. The first two are those factors which affect the reader, the last is concerned with the writer. Writing has no meaning unless it is to be read; we must therefore adjudge that element to be most important which most facilitates reading. If this is true, legibility is the most important single element in writing, and we should have some method of measuring this factor alone. This is not done by either the Thorndike or Ayres scale—unless it is assumed that the correlation between appearance and legibility is 100%—a position which is impossible to maintain.

At first glance, the obvious way of measuring legibility alone would be to measure the time required to read a specimen as quickly as possible, and then to compute the time required per letter. This, however, would not be accurate when a series of specimens containing the same material is to be measured, as increasing familiarity with the material would cause faster reading despite an actual decrease in legibility.

Starch¹ has given us a simple, quick and accurate method of measuring legibility alone. The apparatus consists of a stop watch and a circular piece of cardboard, 20 cm. in diameter, into which three round openings, 2.5 cm. in diameter are punched. These holes are arranged in a straight row, 1.5 cm. apart, the middle hole being placed in the centre of the card. A card of this size was chosen because it would cover nearly all the writing of a given sample except what appeared

¹Starch, Daniel. The Measurement of Handwriting.

through the apertures. The holes are just large enough to expose several letters, but not to show entire words or groups of words.

The card is placed in any position on the sample to be measured, the number of letters exposed and the time to read them recorded. This is done a second and third time, the card being shifted for each repetition. The average reading time per letter is then computed, and the speed of this gives a reliable measure of the legibility of the writing.

To meet the possible objection that the legibility of letters thrown out of their context is not closely enough correlated with the legibility of words in sensible context to ensure an accurate measurement of the latter by the former, Starch computed the time per letter required to read ten samples of handwriting in context, and the time per letter required by the letter exposure method. Three determinations were made by both methods at intervals of about two weeks. In this way he found that the co-efficient of correlation between the two series of measurements was .90. That is, the legibility of letters is practically identical in relative order with the legibility of words in their context. The same test was made with the samples in the Ayres scale. This test showed an even higher co-efficient of correlation between the two series, .97. These tests demonstrate conclusively that the letter exposure method is a highly accurate means of measuring the legibility of a given sample of writing.

One difficulty, however, does arise. The method of measuring legibility just described is based upon the time taken by an observer to read exposed letters. As long as the same observer does the measuring, there is no difficulty in making a direct comparison of results. But men have different speeds of reading; therefore the results of two observers, while giving a correct measurement of legibility, are not directly comparable, inasmuch as they are based upon two different reading speeds. This difficulty is not insuperable; the results of two or more observers can be reduced to a common basis by measuring the time required to read the same sample of writing. If, for instance, the measurements of Starch are taken as a standard it is possible for all other observers to put their

results on a common basis with his by measuring the samples given in the Thorndike scale and comparing them with the following times of Starch:

Quality.	Sample.	Reading time in seconds.
18	125	.20
17	141	.255
16	32	.20
	84	.26
15	49	.21
	89	.17
	47	.24
	90	.23
14	54	.23
	19	.23
13	55	.22
	24	.27
	26	.24
	4	.27
12	30	.22
	7	.24
	52	.21
11	23	.24
	45	.31
	106	.27
10	17	.28
9	31	.25
	21	.23
	28	.27
8	14	.38
	48	.29
7	126	.46
6	12	.51
5	6	.56
4	121	.80

Ease of production may easily be measured by the speed of production. Writing produced by laborious, inefficient movements cannot be produced rapidly. If it is desired to

measure the ease of production of a given group of writers, the best method is to have them write for a definite number of minutes, and then figure out the number of letters produced per minute. In a test of this nature certain precautions must be taken: (1) The material chosen for the test must be so thoroughly familiar to all the writers that no one is handicapped by a lack of knowledge of the material. In such a test Starch chose "Mary had a little lamb" as suitable material, for it could be written from memory without a copy or dictation to interfere with the natural speed. (2) A short time limit must be set, to avoid errors or slow speed caused by fatigue. Two to three minutes is sufficient to obtain sufficient material for a fair measurement. (3) In testing children, care should be taken to avoid giving them the idea that either quality or speed in writing is to be tested, as such an idea will greatly alter the results of the test. In fact, it is best to let the class look upon it as a test of memory rather than writing, as in that case the ordinary writing of the child both in quality and in speed will be used.

We may now summarize the foregoing discussion of the various methods of measuring efficiency in handwriting. The best tool for measuring general merit is the Thorndike Scale, for legibility, the letter exposure method of Starch, for ease of production the computation of the number of letters written per minute. These three methods will measure adequately the three chief elements in writing. Freeman's or Lister and Myers' analytical scale is useful to the teacher when detecting and correcting the weak points in a pupil's writing.

Starch made a survey of handwriting in the schools of Madison, using the three methods of measurement outlined in the preceding paragraphs. A specimen from each pupil in the ten schools of the system was obtained, a total of 2,190. These were procured at the end of the school year in order to make it possible to establish definite standards of attainment in handwriting for each grade. To each teacher the following typewritten instructions were given:

WRITING TEST.

Give name, date and grade at the top of the paper.

Each pupil is to write "Mary had a little lamb" repeatedly for two minutes.

To get an accurate record of the time the teacher should see that each pupil is ready with pen and ruled paper. At the signal from the teacher all should begin. They should write as well as they can and without interruption at natural speed for two minutes, when the teacher will give the signal to stop.

The speed, legibility and form of each sample was then measured. The speed is indicated in terms of so many letters per minute, the legibility in terms of reading time per letter, the form in the terms of the Thorndike scale. The combined results are given in the following tables. The different schools are indicated by letters at the left, the grades are numbered across the top. The blank spaces are due to erroneous performance of the test in those particular grades.

TABLE I.

Speed of writing in letters per minute.

Schools.	Grades							
	1	2	3	4	5	6	7	8
A	12.9	31.5	32.9	35.3	39.4	51.8	55.3	84.6
B	22.1	30.8	31.7	30.6	43.7	49.7	72.9	90.7
C	18.4	21.6	25.5	44.3	44.2	59.6	86.9	86.7
D	19.4	40.8		36.2	63.9	57.9	82.2	87.3
E	16.0	38.0	40.7	47.7	56.0	83.0	81.7	89.6
F	14.7	41.7	39.4	40.3	49.8	52.4	80.3	87.6
G	21.6				56.0	50.2		
H	15.1	25.4	33.8	41.7	42.3	90.2	88.9	79.6
I	25.4	33.5	34.9	31.1	55.8	64.4		
J	27.5	34.4	33.6	54.3	55.4	57.2	76.7	72.0
Average	19.3	33.1	34.0	40.2	50.6	61.6	79.4	84.8

TABLE II.

Form of Appearance of Writing. Thorndike Scale.

Schools.	Grades							
	1	2	3	4	5	6	7	8
A	6.9	7.2	7.8	8.4	9.1	9.2	9.3	9.3
B	6.4	7.6	8.1	8.5	8.7	9.5	9.4	10.1
C	6.3	7.8	7.9	8.2	9.1	9.6	9.8	9.9
D	5.4	7.1		8.8	9.3	10.8	10.5	11.6
E	6.1	7.3	6.3	8.6	9.9	10.0	10.1	11.2
F	5.6	7.1	7.9	8.9	9.4	10.2	10.0	9.8
G	5.6				8.6	10.7		
H	5.9	8.6	7.7	9.1	9.7	8.9	10.9	10.2
I	5.7	7.0	8.4	8.2	9.1	9.6		
J	6.5	7.3	8.1	8.8	10.0	9.9	10.2	11.0
Average	6.0	7.4	7.8	8.6	9.2	9.8	10.2	10.4

TABLE III.

Legibility of Writing. Time per Letter (seconds).

Schools.	Grades							
	1	2	3	4	5	6	7	8
A .....	.52	.34	.28	.27	.29			.295
B .....	.45	.40	.30	.29				.28
C .....	.38	.32	.28	.29				.28
D .....	.56	.35		.29				.28
E .....	.53	.34	.37	.28				.28
F .....	.50	.35	.33	.30				.28
G .....	.60							
H .....	.56	.33	.326	.28				.29
I .....	.59	.37	.31	.30				
J .....	.45	.35	.29	.275	.27			.27
Average .....	.514	.35	.31	.286				.282

Legibility of grades 5, 6 and 7 was not measured as there is no improvement after the fourth grade.

These tables exhibit several interesting facts. There is relatively little improvement in speed in the first three years, then it increases very rapidly up to the seventh grade, with very small gain in the eighth. Form improves steadily with its period of greatest improvement in the first two years, and showing but a slight gain in the last year. Legibility improves tremendously in the first two years, and then more gradually, reaching a maximum in the fourth year, after which there is no improvement.

The tables show how accurate a comparison may be drawn between the work of the same grades in different schools. For instance, grade 1 in school I. and J. are superior in speed; in school A. strikingly inferior. Yet the specimens from I. and J. for that grade rank almost as high in form as those from A.; in legibility I. ranks lower, but J. considerably higher than A. The weakness of the class is at once made clear and when recognized can be remedied.

Further, class averages can be used to set average standards of attainment for the various grades. Very evidently such definite standards are needed, not only in writing but in every school subject. With such standards and with adequate means of measuring efficiency any qualified person could go into a school room and measure the ability of individuals or of the class as a whole in any subject. Such measurements would prove whether the class was up to the average standard or not, and if deficient, to what extent and in what respects.

Obviously an arbitrary standard will not do. It might be placed either too low or too high. An empirical standard derived from the average performances of a large number of individuals at their best is the only safe guide for what should be demanded from a class. The averages as given in the tables above are tentatively valid standards for speed, legibility, and form in handwriting. A universal standard, of course, would require the combining of the averages of many school systems. It is likely, however, that such combined averages would not differ greatly from those given above. The following table puts these in convenient form:

TABLE IV.

Tentative Standards for all Grades in Speed, Form and Legibility.

Grade.	Speed Let- ters per min.)	Form (Thorn- dike scale).	Legibility (Seconds per letter) *
1	19.3	6.0	.514
2	33.1	7.4	.35
3	34.0	7.8	.31
4	40.2	8.6	.286
5	50.6	8.2	
6	61.6	9.8	
7	79.4	10.2	
8	84.8	10.4	.282

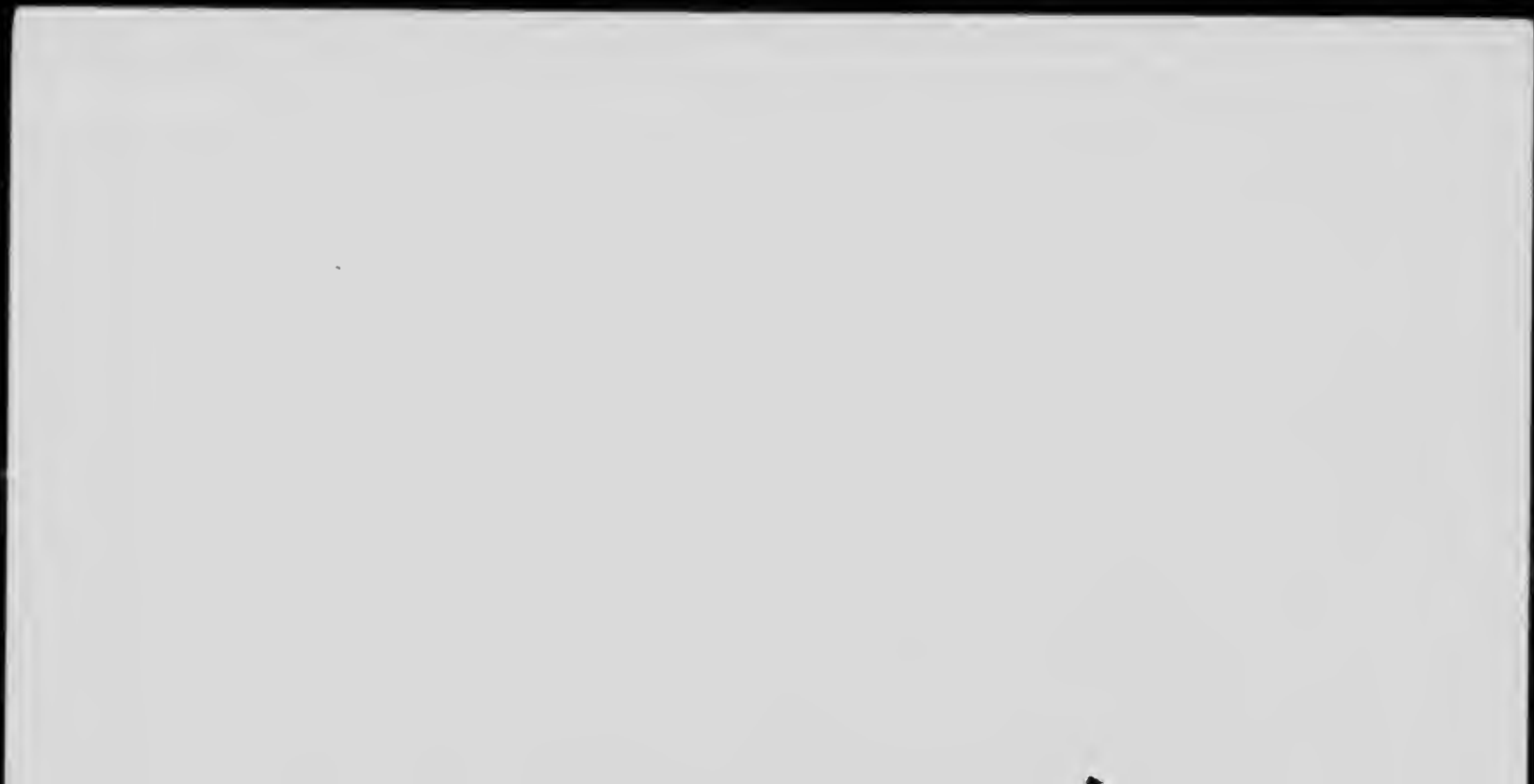
Using these standards obtained from his survey of the Madison Schools, Starch has given us a standard graph chart upon which may be plotted graphs representing the degree of efficiency in the three elements of handwriting of a given pupil, grade or school.

The advantages of precise measurements shown upon a standard chart of attainment are many. It enables the teacher to pick out weaknesses in either individuals or the entire class, and so direct her instruction towards remedying the defect. It gives a definite goal at which to aim. It makes it possible to measure progress from time to time in a precise fashion. It makes better supervision possible by giving the principal a tool for estimating justly the efficiency of the various grades and teachers in his school. Most important of all, it enables a scientific investigation of methods and conditions of teaching writing.

*Any observer may reduce this standard for legibility to his own terms by a comparison of his speed of reading with that of Starch. See p. 84.

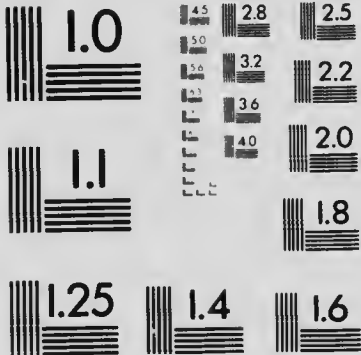






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CHAPTER IX.

SOME RELATIONSHIPS IN WRITING.

Sec. I—Legibility, Form and Speed.

WE are now in a position to discuss in greater detail the relations existing between the three chief elements in writing, viz.: Legibility, form and speed. If these three elements were highly correlated the discussion of their relationship and relative importance would not be so necessary, as by improving any one factor we could be certain of improving the others along with it. Unfortunately, this is not the case. Starch¹ has worked out the correlations between these factors, computing the co-efficient on the basis of the third and seventh grades in three schools, a total of 144 pupils. His results are shown in the following table:

Speed and Form .....	.10
Speed and Legibility .....	.12
Form and Legibility .....	.34

From this it appears that there is practically no correlation between speed and legibility and speed and form. In other words, increased speed tends to decrease quality and legibility. Form and legibility correlate to a higher degree, but less than might have been expected.

Since these three factors are to a great extent independent of one another, it is necessary to decide to which one the highest value must be given. Are form and legibility to be developed at the expense of speed, or speed at the expense of the other two? How can a proper balance be struck, so that no one element will suffer unduly?

Writing is a mode of expression, a way of conveying thought. Unless it is legible, it is useless for its purpose. Legibility, therefore, is the most important single element in writing for either the producer or the recipient. Writing is not writing at all unless it can be read. Further, it must be

¹Starch, Daniel. *Measurement of Handwriting.*

read fairly easily; a writer has no business to put his reader to great trouble in making out his meaning, and if illegibility in any degree results from undue haste upon the part of the writer, he is then saving his own time at the cost of another's, which is neither just nor satisfactory.

From the writer's standpoint, ease of production or in other words speed in writing is almost or quite as important as legibility. The writing is valuable only for the meaning it contains, and provided the meaning is plain, the shorter the time in which it can be produced the better for the writer. Rapidity means efficiency, economy of time, and, therefore, is of the utmost importance to the writer.

Writing is not an end in itself. Beauty and aesthetic qualities, in a word, form, must therefore be ranked as lowest in value of the three elements. Of course, of two samples of writing, each of equal legibility and produced at the same rate of speed, that one that appeals most to our sense of beauty will be judged the better. If, however, the additional beauty has been procured at the cost of rapidity, we can no longer safely say that the writing is better, for one element, and that one the least important, has been enhanced at the expense of another. If any one objects to such a low estimate of the aesthetic qualities in writing, we must reply that writing is a tool for work, and must be judged as a tool, *i.e.*, for its efficiency rather than its appearance. If a cord of wood must be cut, any sane man prefers a sharp saw, no matter how poor its appearance may be, to a beautiful but dull one. In the same way we must give more weight to the strictly utilitarian qualities of writing than to its aesthetic appeal.

We may conclude that the order of the three elements in writing when ranked in the order of descending value, will be:

- (1) Legibility.
- (2) Speed.
- (3) Form.

Legibility itself is not a simple quality, but a complex depending upon various factors. A simple analysis shows that the main factors in legibility are the following:

(1) The clear formation of letters, so that they are readily recognizable.

(2) The clear division of letter from letter by the connecting stroke.

(3) The definite division of word from word by correct spacing.

(4) The proper spacing of lines, so that the loops of letters on the lower line do not meet the tails of letters upon the upper line in confusing manner.

One of the most important faults in writing is that of poor spacing. Fortunately, it is also one of the easiest to remedy. As a practical guide, the proper space between words is about the width of the letter "m," whatever that may be for the individual writer. Less space than this is confusing, a much greater space makes reading difficult, as the work of the eyes is increased and the continuity is lost when too large spaces are left.

Form is a factor in legibility only up to a certain point. Starch¹ measured the legibility of the samples in the Thorndike scale. The samples from Quality 4 to Quality 9 show a steady increase in legibility, but from Quality 9 to Quality 18 legibility is practically the same. For practical purposes, one can say that improvement in form or general merit as measured by the first five steps in the Thorndike scale denotes a closely corresponding increase in legibility, but beyond that, there is no such corresponding increase.

From the utilitarian viewpoint, Quality 9 upon the Thorndike scale is just as effective as Quality 17. To spend much time and effort in the attempt to have classes produce writing of quality much above 9 seems, therefore, to be largely a waste of time and energy. As Thorndike¹ points out, if, writing of such high quality is required, the typewriter is a much more efficient and economical tool than the pen. The amount of time required to bring classes to a very high standard in quality in the last two years of the elementary schools would be quite sufficient to teach correct typing at an equal rate of speed.

¹See page 84 for table showing results.

¹Thorndike, E. L. *The Teaching of Handwriting*.

This argument is reinforced by the data obtained by Thorndike in forming his scale for adult women's handwriting. He discovered that children in the last two grammar grades write considerably better than adult women teachers customarily do. Apparently, very few teachers find it worth while to maintain a high standard in their writing, although they have a greater need and incentive to do so than most people. As noted previously, as soon as people leave school, they promptly forget the formal writing of their school days and develop a hand which, though perhaps poorer in quality, seems adequate for their purpose. This being the case, there appears to be no real reason at all for attempting to reach a very high standard in handwriting. Even those who demand a pleasing hand as well as legibility, should be satisfied with writing of Quality 12 or 13. To go further than this is to demand a temporary increase in beauty, of no practical value and at a time cost to the child which should render it prohibitive.

In his survey of the schools of Madison, Starch has shown that legibility increases tremendously through the first four years of schooling, but after that remains practically stationary. During the same period form improves correspondingly, but continues to improve after no increase in legibility is noticeable. This is due to the fact noted before, that all writings of Quality 9 or better are approximately the same in legibility. Since the maximum of legibility is reached at the end of the fourth year of teaching, it is only reasonable to discontinue formal lessons in writing at that time. The average writing of school children at the end of the fourth year is adequate for its purpose—it can be read as easily as the best penmanship of the last year. To continue instruction in writing beyond that period simply implies a fundamentally wrong view of the place of writing as a school subject. It is a tool, not an end in itself; as soon as the tool is ready for use there is no useful purpose served by attempting to refine it further. Let it be treated as a means to an end, but not as an end in itself.

These arguments must be conditioned by a further factor. It has been shown that adequate efficiency from the reader's

standpoint is reached by the average pupil in the fourth year of the elementary school. But is the same true from the writer's standpoint? In other words, is ease of production sufficiently advanced to warrant discontinuing instruction in writing?

By reference to table 1 page 81, it will be seen that speed increases but little in the first three years. From grades 4 to 7 a tremendous increase—almost 100%—is made. The eighth grade shows little gain over the seventh. This appears to show that to discontinue the teaching of writing as early as advocated in the preceding paragraph would be wrong from the writer's standpoint, as his great gain in speed or ease of production is made after the fourth grade is passed. This argument assumes that the increase in speed is due to instruction in writing; an assumption which not only cannot be proved, but can be disproved without much trouble.

An analysis of the factors upon which speed depends shows that they are three, viz.:

- (1) The possession of a good writing movement.

- (2) The co-ordination of the various elements in that movement into an automatic act in which the muscle sense and tactual sensations control the movement without consciousness entering into the act at all.

- (3) The maturity of the writer.

A good writing movement can be taught in four years or less. As a matter of fact, the type of movement will have become habitual long before the expiration of the fourth year of school life, and will be modified only by the increasing maturity of the child. There is, therefore, no reason why the formal teaching of writing should continue beyond this period so far as acquisition of good movement is concerned.

In the discussion of the writing habit, it was clearly shown that the greatest help to the acquisition of an automatic writing habit is the continual use of writing in original composition, as such practice forces the mind to deal with the thought to be expressed, and so gives the muscle-sense a chance to take control of the movement. If this be true, the acquisition of speed will follow more quickly from the everyday work of the school in all subjects than from formal writing-lessons,

which tend to hinder the automatization process by the very fact that in them attention is centred on the writing. That this is true, and not merely a theoretical conclusion is shown by the following table, which shows the results of a test conducted by Dr. C. W. Stone and reported by E. L. Thorndike¹:

School System		A	B	C	D	E	F	G
Letters per minute	Gr.8	61	67	66	51	48	47	37
in careful writing	Gr.7	46	48	62	46	43	48	26
Letters per minute	Gr.8	79	75	80	60	63	63	56
in natural writing	Gr.7	68	63	75	61	56	64	36
Quality (Thorndike Scale)								
in careful writing	Gr.8	11.4	11.8	11.7	12.0	12.3	14.5	14.1
	Gr.7	11.4	11.7	11.4	11.7	13.0	14.0	13.1
Quality (Thorndike Scale)								
in natural writing	Gr.8	10.3	11.2	11.0	11.7	11.6	13.7	14.0
	Gr.7	10.3	11.1	10.6	11.3	12.7	13.0	13.0

The table shows the median results for speed and quality for eighth and seventh grade pupils in seven school systems. Of these schools system A and B teach no fixed system, and devote no time to penmanship as such. C devotes 50 to 60 minutes weekly. D spends 75 to 100 minutes in these grades on penmanship, E 60 to 90 in grade 7 and 60 in grade 8. F, 75 minutes in grade 7 and 30 in grade 8, G 60 to 90 minutes in each grade.

It is at once apparent that A and B have developed fast writing of fair quality at no time-cost whatever. C at a small time-cost shows practically the same results as A and B. The other systems have developed form at the expense of speed, particularly G. The average quality of A, B and C is quite adequate, being well above quality 9 on the Thorndike scale.

We may conclude that speed and quality will both improve with advancing age simply because of the greater maturity of the child. Formal instruction in writing will improve quality, but only through a ruinous loss of speed and at a cost of school time entirely out of proportion of the value of the results achieved. Further, the improvement in quality usually is only temporary, as adults do not maintain the standard reached through school instruction.

¹Thorndike, E. L. Handwriting. P. 71.

All the data at our disposal point to the conclusion that writing is overtaught in our schools. As Thorndike¹ has pointed out, handwriting as treated in schools seems to be a case of "learning for learning's sake." The fact that it is only a means to an end, and not an end in itself, has not yet been sufficiently well grasped by our teachers. The one or two hours a week spent now in formal writing lessons in the four upper grades of our schools could be used far more profitably in other work. Further, too often formal writing lessons are actually injurious, condemning a pupil to a slow and inefficient rate of writing which will be a handicap to him through life, unless he develops a style and speed in later life which will prove more adequate for his purpose. At the best, it is a sheer waste of time when time is most valuable.

Sec. II.—The Relation Between Ability in Handwriting and General Intellectual Ability.

It is a common experience of teachers to see pupils who are very deficient in general ability produce rather better than the average writing. On the other hand, very often the brightest pupils are among the poorest writers. One would expect to find a very low degree of correlation between hand-writing and general ability. That this is true, the following investigations make abundantly clear.

Gesell¹ examined 1,260 specimens of writing submitted by grades I.-IX. of the public schools of Worcester, Mass. Each of 105 teachers submitted four groups of three samples each representing:

- (1) The three best writers in the class.
- (2) The three worst writers in the class.
- (3) The three pupils of highest school standing.
- (4) The three pupils of lowest school standing.

He concluded from his investigation that there is a high positive correlation between accuracy of handwriting and intellectual ability. Thorndike, however, claims that Gesell's figures really show a correlation of only about .3. He also

¹Thorndike, E. L. *Handwriting*. Page 78.

¹Gesell, A. L. *Accuracy in Handwriting as Related to School Intelligence and Sex*.

believes that this correlation is due more to the desire of the better pupils to excel in all respects than to any fundamental connection between intellectual ability and accuracy in handwriting.

Kavanagh² investigated the relations existing between intellectual abilities in the various subjects of the New York Civil Service Examinations. The investigation dealt with the papers of 1,100 boys. He found a lower correlation between handwriting and other abilities than between any other pair of subjects.

Starch¹ computed the correlation between handwriting and scholarship in the cases of 144 pupils in the schools of Madison. He found the co-efficient of correlation to be .31, a result which is almost identical with Thorndike's interpretation of Gesell's figures.

Thorndike² measured the correlation between scholarship and quality of handwriting of adult women students in Teachers College. He found that the correlation between scholarship grade and quality of handwriting was zero. For 21 individuals taken at random from the best third of the writers, the median grade in scholarship was C+. For 22 from the worst third, the median grade was better than B—.

We may conclude that there is a slight positive correlation between ability in handwriting and general scholarship in the pupils of the elementary schools, but that is due to instruction and to the general desire of the better pupils to excel in all branches of study; and that this is entirely lost in adult life.

Sec. III.—The Relation Between Handwriting and Other School Subjects.

With writing we may class reading, spelling and composition in a single group of closely related school subjects. They all deal with language, and the aim of all is to develop a reasonable skill in the use of the mother tongue.

²Kavanagh, Francis Edge. "Co-efficient of Correlation of Abilities in Mental Traits Measured in the Civil Service Exams. of the City of New York."

¹Starch, Daniel. *Measurement of Handwriting*.

²Thorndike, E. L. *Handwriting*. Page 79.

In reading, the reader obtains a meaning from a group of artificial symbols. The psychological process may be roughly divided as follows:

(1) An impression upon the retina of the eye followed by the percept of the word or words seen.

(2) The percept causes (1) the auditory image of the word, (2) the visual image of the word, (3) the articulatory image of the word, either singly or in combination. Visual imagery appears to be the least common.

(3) The image results in the actual articulation of the word, either silently or audibly.

(4) The meaning follows this articulation.

In spontaneous writing, the process is reversed. We begin with the meaning, pass through the silent articulation of the word to its imagery, and that stimulates the proper motor centres and the writing follows. It is evident that the two processes have common ground in the two middle sections, though the direction is reversed.

We may say, then, that writing and reading have common material in the words used. The process, however, which brings home the meaning of words when read, and that which produces written words when meant, are so entirely different that it is doubtful whether any clear case can be made out for believing that a close relationship between the two can be established. Still, it is true, that writing uses the results of reading, and in so far as that is true, is one reason for a child learning to read before it learns to write.

Our outline of the mental process preceding spontaneous writing brings in another factor. Spelling is of importance only in written language, and, therefore, we must carefully consider spelling in its relationship to writing.

As a matter of fact, from one point of view, spelling is writing and writing is spelling. There is no clear line of demarcation between the two at all. In any case, spelling forms an inseparable part of the act of writing.

If the writing habit is to be perfectly automatic, there must be no doubt of the spelling of a word when one is writing. That is, the spelling must be as automatic as the writing movement itself. The automatization of both writing and

spelling must go on hand in hand to result in a proper habit of writing.

If it is to be true, it follows that learning to spell lists of words out of context and orally is almost an entire waste of time. The oral spelling is almost useless, for spelling is a matter of writing, not speaking. Only in so far as the oral repetitions give articulatory, visual or auditory images of the word which in their turn may help to stimulate a correct spelling in writing is it useful at all. It seems natural that the motor images of hand-movements, as they result from the act of writing, and not of speaking should prove more efficacious in producing correctly spelled words. That this is true is shown by the following table, which presents the results of an experiment carried out by Lay. Nonsense words were learned by various groups of scholars in different ways. The table shows the number of mistakes per scholar when tested.

Hearing without vocalizing	3.04	per scholar
Hearing with speaking in an undertone.....	2.69	" "
Hearing with speaking aloud	2.25	" "
Seeing without vocalizing	1.22	" "
Seeing with speaking in an undertone.....	1.02	" "
Seeing with speaking aloud	0.95	" "
Spelling aloud	1.02	" "
Transcription	0.54	" "

This shows fairly clearly how much more effectively spelling is learnt by actually writing words than by any combination of visual and oral work.

Language is just a tool of thought—that and nothing more. It is not enough to have pupils able to spell words correctly, they must be able to use them correctly in the expression of their thought. This can best be done by original composition.

Original composition demands from the child a concentration upon the thought to be expressed and not upon the form of its expression. This, as noted before, favours the complete automatization of the writing habit by throwing the burden of the task upon the lower nerve centres which then must and do look after the act of writing. The same holds good in spelling. Original composition forces the child to leave the spelling of words to the control of the lower centres, while his

consciousness is busy with the thought. In this way, composition favours the development of good, efficient habits in both spelling and writing.

The teacher who believes that the work of teaching a child to spell a word is ended when it can name and write the letters composing it, has not grasped the proper idea. As a matter of fact, the work of learning to spell has only just begun. The child must learn, through practice, to use the word properly in different contexts, and to write it so automatically that consciousness does not enter into the process at all.

We may conclude that writing, spelling, and composition are so closely connected with each other that it is foolish to try to separate them. Every writing lesson after the first few years should be a spelling and composition lesson as well. Only in this way can progress be best made towards the end in view—complete automatization of the writing and spelling habits, so that they become efficient tools at the command of thought.

CHAPTER X.

THREE SCALES FOR THE MEASUREMENT OF QUALITY OF CHILDREN'S HANDWRITING IN THE SCHOOLS OF ONTARIO.

IT is evident from the discussion of the various scales described in Chapter VIII. that none of them are exactly suitable for extensive work in measuring the results obtained in the teaching of handwriting in a single large homogeneous school system. The Thorndike scale is based upon the handwriting of children of the four upper grades of the public school; it can scarcely be satisfactory as a scale for the four junior grades or for the high schools. Further, it was not based upon any single system; in fact, both the Thorndike and Ayres scales give several samples of the same quality but of different styles of writing in an attempt to make the scales applicable to all styles of writing.

The writer believes that a satisfactory scale must be based upon the actual product of the system in which it is intended for use; that the application of the Thorndike or Ayres scale to the product of Ontario Schools would be less satisfactory than the use of a scale derived from the actual product of our schools.

Such a scale might be continuous, including all qualities of writing from the worst of the primary grades to the best of high school pupils, or it might be built in sections, so to speak, one for the four junior public school grades, one for the four senior public school grades, and one for the high schools.

The accurate ranking of the immature, ill-formed writing of young children with the writing of older pupils is a matter of some difficulty. However poor the writing of the older pupil may be, it shows a certain maturity, e.g., in size of letters, indications of rapidity, etc., which render it difficult to rank in comparison with more immature writing. For this reason it was considered advisable to construct three scales based on the product of the four junior public school grades,

the four senior public school grades, and the high schools respectively, rather than one scale, including them all. Further, it seemed probable that the number of qualities requisite for such a scale would be large, perhaps twenty, and the scale resulting would be cumbrous. The upper range would be almost useless to the teacher of the primary grades; the extreme lower end equally so to the high school teacher. For practical purposes the three scales have a distinct advantage over the one.

Three scales have therefore been constructed; Scale I based upon the writing of children of grades Junior I. to Senior II.; Scale II. upon the writing of children of grades Junior III. to Senior IV.; Scale III. upon the writing of high school pupils.

Thousands of samples of handwriting were contributed by all sections of Ontario. These samples were divided into three groups, (1) junior public school (2) senior public school (3) high school. From each group 1,000 samples were selected in an effort to secure as wide a range of quality as possible. Each group of 1,000 contained approximately 500 samples of girls' writing and 500 of boys'. To make the groups as representative as possible, each group contained approximately 500 samples from urban schools and 500 from rural or village schools.

The Thorndike method of making the scale was adopted. Each group was ranked into ten grades, with equal distances between each grade. This grading was done by thirty-two judges for each group. Each judge used his own idea of merit as a basis for his ranking.

After six rankings had been made, the groups were reduced from 1,000 samples to 600 by taking out those samples which were obviously alike in quality with others. In this elimination only samples which had fallen within ranks 4, 5, and 6 were removed. This reduction lightened the labour of the task materially, and left just as wide a range in quality as before.

After the 32 rankings had been made, those samples were selected whose medians fell exactly upon the scale points 1, 2, 3, — 10. This initial selection yielded from 4 to 7 samples of each quality desired, ranging from one to ten. In this way

the number of samples for scale 1 was reduced from 600 to 53, for scale 2 from 600 to 54, for scale 3 from 600 to 54.

The groups so chosen were again graded by 32 judges into ten ranks. It was believed that the small groups would permit still more accurate grading and a more precise evaluation of each sample. This second ranking formed the basis of the final choice of ten samples from each group to serve as the ten scale points of the completed scales.

When each group had been graded for the second time by 32 judges, the median average of each sample was computed. Each sample selected for the final scale was tested by two requirements (1) its median must fall upon the exact position it would occupy in the scale (2) it must be judged better than the next sample below it by not more or less than 75% of the judges.

It was found to be impossible to obtain ten samples from each group which exactly satisfied both requirements. The best selection which could be made was compelled to admit a maximum variation of .1 in the median average from the ideal, and a variation of 3% from the ideal number of judges.

The following tables show (1) the distribution of the samples chosen for the scales over the ten ranks (2) the median average of each sample (3) the size of the step between successive qualities (4) the number of judges ranking each sample as better than the preceding one.

SCALE I.

JUNIOR PUBLIC SCHOOL GROUP.

Table Showing Distribution of Samples Over Ten Ranks.

No. of Sample.									
Quality	377	951	471	631	51	104	182	653	204 657
1	25	6							
2	7	20	6						
3		6	22	7	2				
4			3	20	5	1			
5			1	3	19	6	2		
6				2	5	21	5		
7					1	3	17	5	1
8						1	8	23	4 2
9								4	22 6
10									5 23

Sample	Median	Size of Step between qualities	
377	1.0	1 to 2	1.0
951	2.0	2 " 3	.954
471	2.954	3 " 4	.996
631	3.95	4 " 5	1.024
51	4.974	5 " 6	.955
104	5.929	6 " 7	1.101
182	7.03	7 " 8	.948
653	7.978	8 " 9	1.022
204	9.0	9 " 10	1.0
657	10.0		

Table Showing Scale Tested by Method of Just Noticeable Differences.

Sample 951 judged better than sample 377 by 75% of judges									
"	471	"	"	"	"	951	"	75%	" "
"	631	"	"	"	"	471	"	75%	" "
"	51	"	"	"	"	631	"	75%	" "
"	104	"	"	"	"	51	"	75%	" "
"	182	"	"	"	"	104	"	78%	" "
"	653	"	"	"	"	182	"	75%	" "
"	204	"	"	"	"	653	"	78%	" "
"	657	"	"	"	"	204	"	72%	" "

SCALE II.

SENIOR PUBLIC SCHOOL GROUP.

Table Showing Distribution of Samples Over Ten Ranks.

Quality	No. of Sample.									
	561	405	351	79	174	31	113	175	51	104
1	24	7								
2	8	20	4							
3		5	25	6	2					
4			3	21	3	1				
5				5	24	7	3			
6					3	17	4			
7						6	19	6	1	
8						1	5	20	7	
9							1	6	18	7
10									6	25

Samples	Median	Size of step between qualities	
561	1.0	1 to 2	.95
405	1.95	2 " 3	1.03
351	2.98	3 " 4	.9862
79	3.9762	4 " 5	.9818
174	4.958	5 " 6	1.012
31	5.97	6 " 7	1.004
113	6.974	7 " 8	1.026
175	8.0	8 " 9	.944
51	8.944	9 " 10	1.056
104	10.0		

Table Showing Scale Tested by Method of Just Noticeable Differences.

Sample 405 judged better than sample 561 by 78% of judges									
"	351	"	"	"	"	405	"	78%	"
"	79	"	"	"	"	351	"	75%	"
"	174	"	"	"	"	79	"	78%	"
"	31	"	"	"	"	174	"	72%	"
"	113	"	"	"	"	31	"	75%	"
"	175	"	"	"	"	113	"	75%	"
"	51	"	"	"	"	175	"	72%	"
"	104	"	"	"	"	51	"	78%	"

SCALE III.

HIGH SCHOOL GROUP.

Table Showing Distribution of Samples Over Ten Ranks.

No. of Sample.									
Quality	266	41	65	147	152	870	936	699	207 673
1	23	6	1						
2	9	18	7	2	1				
3		8	16	5	3				
4			6	21	5	3			
5			2	3	19	8	2		
6					3	17	6	2	
7				1	1	3	20	7	1
8							3	16	7 2
9						1	1	5	18 7
10								2	6 23

Samples	Median	Size of step between qualities	
266	1.0	1 to 2	1.055
41	2.055	2 " 3	.945
65	3.0	3 " 4	.929
147	3.929	4 " 5	.939
152	4.868	5 " 6	.985
870	5.853	6 " 7	1.047
936	6.9	7 " 8	1.037
699	7.937	8 " 9	1.007
207	8.944	9 " 10	1.056
673	10.0		

Table Showing Scale Tested by Method of Just Noticeable Differences.

Sample 41 judged better than sample 266 by 72% of judges									
"	65	"	"	"	"	41	"	78%	" "
"	147	"	"	"	"	65	"	75%	" "
"	152	"	"	"	"	147	"	72%	" "
"	870	"	"	"	"	152	"	72%	" "
"	936	"	"	"	"	870	"	75%	" "
"	699	"	"	"	"	936	"	78%	" "
"	207	"	"	"	"	699	"	75%	" "
"	673	"	"	"	"	207	"	75%	" "

It will be noticed that the medians of the samples ranking lowest and highest for each scale are given as exactly 1 and 10. In this way allowance is made for the fact that the lowest sample in each series would have been rated below quality 1 a certain number of times if that had been possible. Similarly the best sample would have been rated above 10 by some judges. That is, quality 1 means 1 or worse than 1 quality 10 means 10 or better than 10. For instance, sample 377 in Scale 1 was rated 7 times in 2, 25 times in 1. It is likely that at least 7 of the 25 judges rating it as 1 meant "worse than 1" by that rating. Similarly probably 9 of the judges rating sample 657 as 10 meant "better than 10" by that rating. This fact accounts for the median shown in the tables for the worst and best samples in each scale.

The scales, therefore represent a series of 10 qualities of writing ascending from worst to best by approximately equal steps. It is based upon the ratings of 64 judges, 6 of whom ranked 1,000 samples, 26 ranked 600 samples and 32 ranked 54 samples for each scale. Each scale gives the average judgment of 64 competent judges of writing.

The tables showing the scales tested by the method of just noticeable differences confirm the opinion that the scale points are fairly accurately determined. The differences, however, were not tabulated from the results of a direct comparison of each sample with the one below it in the scale, but from the rankings of the 32 judges in grading 54 samples. That is to say, sample 631 was not judged better than sample 471 by 24 judges and equal or worse by 8 in a direct comparison of those two samples only, but 24 judges put sample 631 in a higher group than sample 471 and 8 put it in the same group or a lower one. Even so, since only 4 or 5 samples were graded into any one group, and the groups were carefully compared to prevent overlapping, the tables are of value as a confirmation of the accuracy of the scales.

The writer believes that the fixing of the qualities with reference to a zero point is of only theoretical value. For practical purposes, the essential points of a good scale are (1) that the scale contains a range of quality extensive enough to include all but the most exceptional writing of our schools

(2) that the qualities are accurately determined and proceed by equal steps. If these two conditions are fulfilled, it matters little whether the lowest quality be called one or five, and the highest ten or fourteen. The numbering of the qualities of one to ten seems the simplest and most practical way to denote them, and was therefore adopted for the scales presented here.

It is hoped that the scales will prove of real service to the schools of Ontario. They offer a constant standard of relative qualities to which both teachers and pupils may constantly turn. The teacher will find in them a means of more accurate valuation of her pupils' product, whether they are used to compare one pupil with another or to compare the present work of an individual with his past performances. The pupil should use the scale on his own account to judge his own improvement. To see a steady improvement in the quality of his work as shown by a higher ranking on the scale should prove a great incentive to successful practice.

SUGGESTIONS FOR USING THE SCALE.

1. When measuring a group of samples, rate the entire group by comparing each sample with quality 1 first, then ascend the scale until the point of equivalence is reached. Note the value assigned to each sample. Repeat the rating, taking the samples in the same order as before, by comparing each with Quality 10 first, and then descending the scale until the point of equivalence is reached. The average of the two ratings will be a more accurate valuation than either one by itself.
2. Possibly a sample may be worse than Quality 1 or better than Quality 10. To such samples the values 1- or 10+ may be assigned respectively.
3. The scale, if hung in the class-room so that the class may have free access to it, may be used to demonstrate objectively to each pupil exactly what progress has been made.

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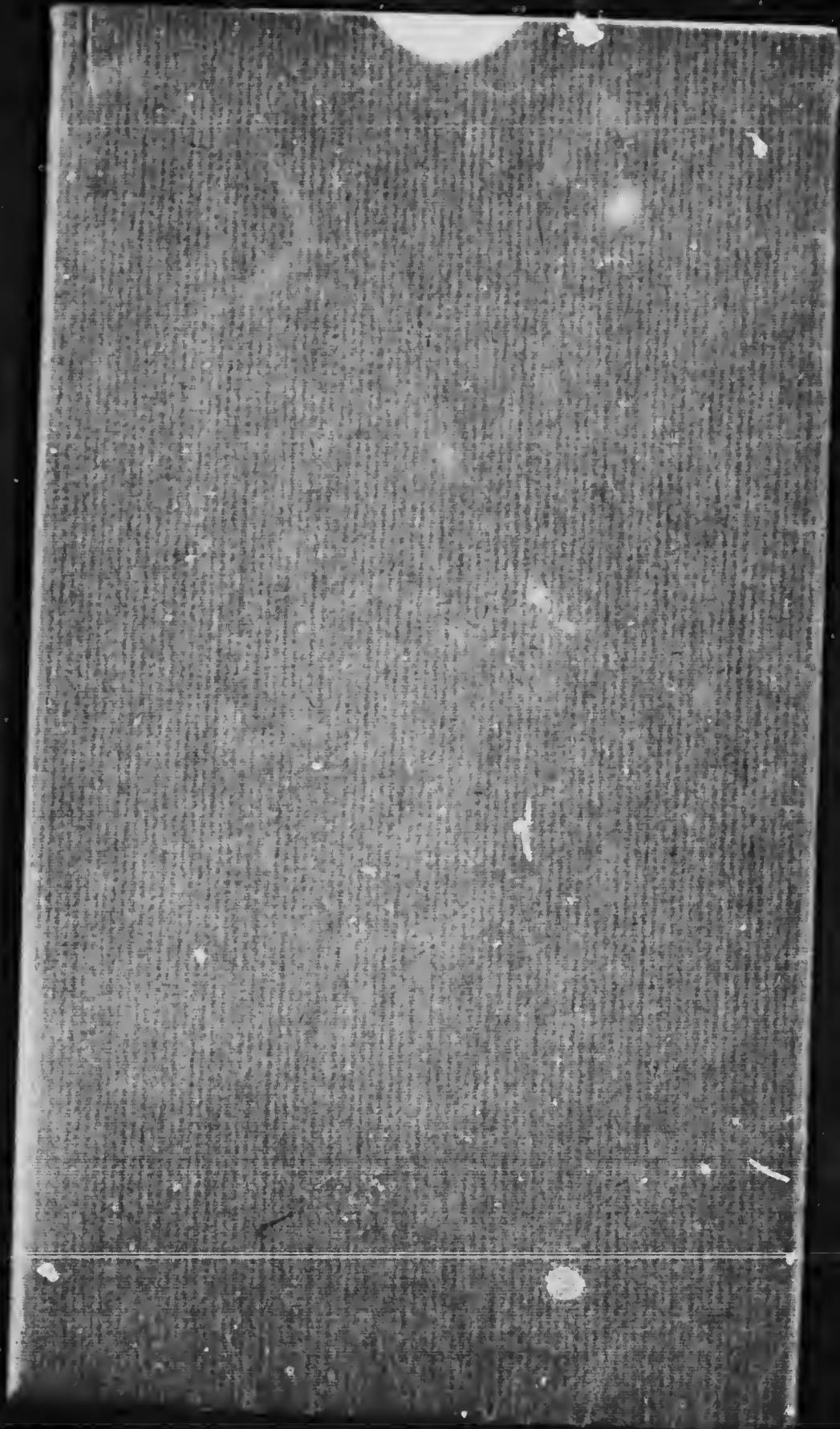
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Senior Public S

Sample 1
Quality 1

When Britain first, at
Arose from out the
This was the charter of
And guardian angels
Rule, Britannia, rule
Britons never will be

Sample 5
Quality 9

The Maple
Oh, tenderly deepen
And merrily sway
Breathe delicately the
And the pines re
The cloms toss high til
Pale catkins the y
But the tree I love
Is the maple of s

Sample 17
Quality 8

O Canada! My Ca
My heart is all u
Thy hills and val
Thy fields and fo
I love thy flag tha
Floats over thy fest
So will we by the
Preserve it free fro

Sample 11
Quality 7

Public School Scale

Sample 104

Quality 10

at Heaven's command,
the azure main,
of the land,
singing this strain.
rule the waves!
be slaves!

Sample 51

Quality 9

ple.
in the woodland glooms,
ay the beeches;
the willow blooms,
rehearse new speeches;
till they reach the sky,
the yellow birch launches,
all the greenwood above
of sunny branches.

Sample 175

Quality 8

Canada!
all with thee,
valleys glorious,
forests free.
that far and wide
fertile plains,
the help of God
from stains.

Sample 113

Quality 7

High So

Sam
Qua

The time I spent
on this island is still
thought to me to
it lightly over.
I have read of
away, either the
pockets full of

Sample
Qualit

The spirit of courage in
to-day as bright and
mantle of her banner,
in proportion to her
Great Britain. She has
blood of her youth as
treasure. She has suf

Sample
Quali

Sir, in all these
ations of our nation
life, history will a
singular dignity and
great Ruler whom

Sampl
Qualit

In Flanders fields,
Between the cross
That mark our path
The larks, still bravely
Scarce heard amid

h School Scale

Sample 673

Quality 10

spent upon the
all so horrible a
that I must pass
er. In all the books
of people cast
they had their
of tools, or a

Sample 207

Quality 9

in Canada is still
and far-flung as the
ter snows. She has suffered
her numbers as deeply as
he has lavished the best
as freely as her accumulations
supplied incredible

Sample 699

Quality 8

ese multiform manifest
rational and imperial
ll assign a part of
y and authority to the
m we have lost. In

Sample 936

Quality 7

lds, the poppies grow
osses, row on row,
r place; and in the sky
bravely singing, fly,
mid the guns below.

Junior Public

Sample
Quality

Who has seen
Neither your
But when the t
their he

Sample
Quality

When spring has burn
The ragged robe of win
And deftly turned
To moving melody thier
The pale green pasture
Is goldened over with cl

Sample
Quality

Who has seen
Neither you nor
But when the
their

Sample
Quality

Who has seen

Public School Scale

Sample 657
Quality 10

seen the wind?

your nor I;

he trees bow down

r heads,

Sample 204
Quality 9

burned
winter, stitch by stitch,

the wayside ditch,
are field behind the bars.
dandelion stars.

Sample 653
Quality 8

on the wind?

nor I;

he trees bow down

r heads,

Sample 182
Quality 7

on the wind?

I love thy flag that
Floats o'er thy fern
So well we by the
Preserve it free from

Sample 1
Quality

The ragged daisy starring
The buttercup abrim with
The thistle and burr-fl
prickly shields,
All common weeds the
With shrivelled pods in
Like-hers of earth and

Sample 3
Quality

Dear common folk
growst beside
Fringing the dune
harmless good
First pledge the

Sample 12
Quality

O Canada! My
My heart is a
Thy hills and v
Thy fields and
I love thy that

Sample 75
Quality 4

the great event of
noon-meal, or dinner
hall. A little before
and all his house
stray guests who

That far and wide
lestial plains,
the help of God
from stains.

Sample 113

Quality 7

ing all the fields,
th pallid gold,
-flowers hedged with

the draggled pastures hold,
s and leaves are kin to me,
and her maturity.

Sample 31

Quality 6

flower, that
side the way,
dusty road with
gold,
the blithesome.

Sample 175

Quality 5

My Canada!
s all with thee,
d valleys glorious,
and forests free.
hat far and wide

Sample 79

Quality 4

of the day — was
lunner in the great
before three, the chief
ousehold, with any
might have dropped.

San
Qu
England has lost
sons; but the loss is not
is it confined to the
acknowledges England
even to the proud race

S
O
- group of closely allied
are known in the
Lentour or German
languages of the group
more closely connected
the rest, are Dutch
or Old Norse, Swedish

San
Qu
The English language
closely allied language
by the general name
Germanic tongues. In
the group, some of
connected with English
Dutch, German, Danish

San
Qu
All of us have
distance. Business
proud with the end
often write hundreds
in all civilized
ment has taken
out of the hands of

Sample 870

Quality 6

lost the most illustrious of her
is not England's alone, nor
the great Empire which
land's suzerainty, nor
race which can claim kinship

Sample 152

Quality 5

allied languages which
the general name of
manic tongues. The other
the group, some of which are
connected with English than
Dutch, German, Icelandic
Swedish, and Gothic; to

Sample 147

Quality 4

language is one of a group of
languages which are known
name of the Teutonic or
. The other languages of
e of which are more closely
English than the rest, are
Danish, Icelandic or

Sample 65

Quality 3

have friends at a
ness men have to corres-
ends of the earth, and
hundreds of letters a day. Hence
ized countries the govern-
then in the delivery of letters
of private people and

their -

Sample
Quality

Who has seen -

Neither you -

But when the
their heads,

Sample 10
Quality

If men cared less
And less for battle
If wit in human
Seemed better than

Sample
Quality

I affydowndily
because in his
bled a flower, a
by what was b

Sample 6
Quality

Do you know people
that beautiful land be
Let me tell you about the
in fare-off days. two th
that country was wild,

Sample
Quality

I have task in

ir heads,

Sample 182
Quality 7

n the wind ?

ou nor I;

u trees bow down
is,

Sample 104
Quality 6

ss for wealth and fame
attle - fields and glory
man hearts, a name.
than in song and story

Sample 51
Quality 5

lly was so called
o nature he resem
, and loved to on
s beautiful and

Sample 631
Quality 4

ople who lived in England
beyond the sea ?
that land and its people
+ thousand years ago
ild, and its people little

Sample 471
Quality 3

thy fields and
I love thy that

Sample 7

Quality 4

the great event of
noon - meat, or dinner
hall. A little before
and all his house
stray guests who

Sample 3

Quality

Faintly as tolls the bell
Our voices keep tune and
Soon as the wood one shore -
We'll sing at St. Ann's our
Row, brothers, row the ship
The Rapids are near and

Sample

Quality

Beside the ungathered
His sickle in his hand
His breast was bare, but
Was buried in the sand
Again, in the mist of
He saw his Native Land

Sample

Quality

Latin was the language
Of course, they spoke
years before they began
In writing they used
and no punctuation.
not leave spaces between

and forests free.
that far and wide

Sample 79

Quality 4

of the day — was
dinner in the great
before three, the chief
household, with any
might have dropped.

Sample 351

Quality 3

the evening chime
one and our oars keep time.
shore look divine,
is our parting hymn.
the stream runs fast,
and the daylight's past.

Sample 405

Quality 2

ered rice he lay,
rond;
his matted hair
he sand.
ist and shadow of sleep,
Land.

Sample 561

Quality 1

age of the Ancient Romans.
ke it for many
begun to write it.
not no small letters
in. I frequently they did
between words or sentences.

by the general name
Germanic tongues. In
the group, some of
connected with Eng
Dutch, German, Da

Sam
Qu

All of us have
distance. Business
pond with the end
often write hundred
in all civilized
ment has taken
out of the hands of

Sam
Qu

all things else being equal
the ability to present
convincingly will possess
prestige and wield a
on the public life of
who does not possess it
do. If it is true that

Sam
Qua

The first campaign
east was for by the
defensive purpose
control, not of the
Indian office and
very small expeditions

name of the Teutonic or
The other languages of
of which are more closely
English than the rest, are
Danish, Icelandic or

Sample 65

Quality 3

have friends at a
men have to corres-
ends of the earth, and
hundreds of letters a day. Hence,
in civilized countries the govern-
ment the delivery of letters
of private people and

Sample 41

Quality 2

equal, the man who has
put his ideas and arguments
possess immensely greater
influence than the man
of his time, than the man
this power can hope to
at the battles of the empire

Sample 266

Quality 1

mission undertaken in the
the affair was purely for
poses. It was under the
the war office, but the
re and consisted of a
editionary force. It easily

Sample 6
Quality

Do you know people
that beautiful land be
Let me tell you about the
in fare-off days. two the
that country was wild,

Sample
Quality

If a task is o
Never leave it to
Be the labour o
Do it well, or

Sample
Quality

If a task is
Never leave i
done;
Be the labour
small;
Do it well,

Sample
Quality

On a small
mountains ther
a tortoise he
do with the
ther to feed

Sample 631

Quality 4

people who lived in England,
beyond the sea?
that land and its people
a thousand years ago
old, and its people old

Sample 471

Quality 3

once begun
till its done;
or great or small,
or not at all,

Sample 951

Quality 2

is once begun,
it till its

or great or

, or not at all

Sample 377

Quality 1

like up in the
her once lived
had made him
e these who came
ed.

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