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THE HYGIENE AND PSYCHOLOGY OF SPELLING.

By WM. H. BURNHAM.

The current discussions (28-31) in regard to spelling reform bid fair, at least, to call attention to the importance of the economics of the subject and also to the complex psychology of the processes involved. If the possible saving of time from simplification in the orthography of a few hundred words is worthy of the serious consideration of scholars, literary men, and the highest government officials, it is not unimportant to consider the whole subject, and especially the methods of instruction in spelling, from the point of view of economy and hygiene.

Perhaps it may be found that the dropping or change of a few letters in case of the three hundred words now under consideration is after all a matter of minor importance either one way or the other, but that the really important reforms should be made by simplifying instruction and by regard for psychological and hygienic principles.

It seems at first that the most that can be said of the hygiene of spelling is ancient history. Modern pedagogy gives oral spelling a place of minor importance; and in spite of the idiosyncrasies of English orthography, to learn to spell in connection with writing is not an extremely serious task. It deserves special attention, however, because of the time devoted to it. Dr. Rice (36) in his investigations in the schools of twenty-one cities in this country found from 6 or 10 minutes to 50 minutes devoted each day to spelling. Mr. McKay (26) collected statistics in the town of Pictou, Nova Scotia, in regard to the amount of time spent in learning spelling both at home and in school. The gross results were as follows:

Pupils from 5 to 7 yrs. were spending 74% of the time on spelling.

"	"	7	"	9	"	"	"	47%	"	"	"
"	"	9	"	11	"	"	"	37%	"	"	"
"	"	11	"	13	"	"	"	25%	"	"	"

"That is, forty-nine per cent. of the whole time of study at home, and in school, for the first six years was absorbed in spelling lessons, or over forty per cent. of the first eight years of school time. But making allowance for other work done incidentally in connection with the spelling, such as the study of definitions, etc., and incidental reading, expression and elocution in the higher classes, more than twenty-five per

cent. of the first eight years of school work was absorbed entirely in overcoming the difficulties of our orthography." (26, p. 10.)

Lay (21) estimates that for the eight school years of the People's schools in Germany on an average one hour every week is sacrificed to orthography. As much time is devoted to it as to instruction in history, natural science, and geography together. The reason that so much time is devoted to spelling in German schools is not far to seek. In Germany the instruction must give practice in eight different alphabets; namely, the German large and small script letters, the Roman large and small script letters, the German large and small printed letters, and the Roman large and small printed letters. The German orthography has developed in such an inconsistent manner that there are always innumerable exceptions to the rules, and in methods of instruction; finally, there is a confusion of opinion such as is found in no other subject. The English child, to be sure, is not required to learn so many alphabets; but English orthography is, in spite of that, usually deemed more difficult than the German.

Historical. The invention of the art of printing first brought spelling into the world as a school subject and exalted reading to the first place among the three R's. Before that the schools taught writing and reading, after that, reading and writing.

The history of the subject is not without significance; for the rôle that spelling has played in connection with the teaching of reading is an illustration of the extreme to which the scholastic tendency may go when attention centres upon the scholastic work instead of the children; and the whole story of spelling as a school subject records an interesting chapter in the conflict between scholasticism and the true pedagogy based upon psychology and hygiene. Not to go very far back we may begin with the spelling method of teaching reading. It came into universal use in the 18th century. How this could happen, and how such a method could so long keep a foothold on the earth, is a very strange thing in the history of pedagogy. It seems, says Campe (9) as if our forefathers used all their ingenuity to make the simple and easy art of reading very complicated and as difficult as possible. The development and persistence of this method is an astonishing example of fetish-worship in pedagogy. Not only did the children learn to read by spelling, but spelling was kept up after they had acquired some facility in reading. Even the most difficult and outlandish words were used. At public examinations the more difficult the words that the children could spell, the greater the skill of the teacher and the ability of the pupils were supposed to be. Proper names from the Old Testa-

ment, American Indian geographical names and the like were highly esteemed. *Constantinopolitanische Dudelsackpfeifenmacher-gesell* was a favorite.

A reading book published in 1766 (9, p. 30) contains the following words for spelling: Allerliebenswertigster. Regimentsquartiermeister. Wiederherstellungszeichen. Allerverlangenswertigster. Weysenhausveranstaltungen. Almosenamtsverpflegungsgelder. Obervormundschaftscassenbestand. Parückenmacherzunftgebräuche. Kathismuswiederholungsstunde. Religionsangelegenheiten.

Hempel (9, p. 30) in his reading and spelling-book for the first instruction, (Leipzig, 1804) begins the spelling with the word Viceoberappellationsgerichts-president. One of the old New England primers could boast words of nine syllables. Here is one of fourteen. A primer published in Darmstadt in 1805 (9, p. 30) had such words as Johannisbeerstrauch, Räucherpulferschachtel, Hollunderbluththee. As if in English we should use the following: philoprogenitiveness, incomprehensibleness, disproportionableness, transsubstantionableness, suticonstitutionalist, honorifibilitudinity, velocipedestrianistical. In many books the most unheard-of and idiotic combinations of sounds were used. Campe¹ in his primer furnishes a good illustration: tlantlaquakapatli, tschintschanz, thundertentrunk, tschitschatschots, are among the words given.

Ludwig Hörstel (9, p. 31) seemed to think that nonsense syllables were valuable for arousing the intellect and cultivating the understanding. His primer contains among others the following combinations: Xacha, Xoko, Kara, Kari, Kuri, Pikpar, Marmar, Kakakar, Kirkur, Tatat, Tattatattat Tumtutum, Tam, Tititittit, Tititittitit, Pupuput, Papapab, Pappap, Ticktack, Tickticktickticktack, Tack-tackticktackticktack, Tackak, Katkatkaat, Zaza, zazezaza, Zuzu, zazezizu, Zauzau, zauzeziazu, Zipzip, zappaz, zipzipzapzap, Kazkaz, Kazkazkizkaz, Kozkozkuizkiz, Pizpizpizpiz.

C. H. Wolke² deemed the following suitable for children between the ages of 6 and 12: Behiblobra, Kiklekrunkna, Chichleuchlauchra, Oblobribla, Pfiipflapfropfa, Schlischmoschnus-schwa, Spisplospruspla, Ksikseksuksa.

Even in recent times such combinations have been used, but many voices have been raised against such nonsense.

A multitude of witnesses testify to the results of this method. Many complained especially of the loss of time from it. Buno (9, p. 33), for example, in 1650, declared that many who showed ability in other things, after several years and much pains and vexation, scarcely were able to tell the names of the letters and

¹ Neues Abeze-und Lesebuch. 3 Aufl. Braunschweig, 1830. S. 216. Cited by Fechner (9).

² Erstes Lesebuch für sechs-bis zwelfjarige Kinder und für ire sibel-erenden und erzihenden Freunde. Berlin und Leipzig, 1820. Cited by Fechner (9), pp. 40-41.

to put them together properly. Ventzky (9, p. 33), in 1722, wrote as follows in his *Erleichtertes Lesebuchlein*: "Spelling seems to be a frightful judgment of divine wrath, which the righteous God has allowed to come upon us and oppress us for a long time on account of our school sins, and we fervently pray God for Christ's sake that he will have mercy upon us and take away this judgment from us and open the eyes of those who cannot see until he does, in order that a permanent foundation may the sooner be laid, and that which has long lain waste may the sooner be rebuilt."

Peuschel (9, p. 33), in 1746, said that generally in the public schools two or three years were passed with indescribable pains in getting spelling and reading into the heads of the children.

Samuel Heinicke (9, p. 34), the founder of the first institution for deaf mutes in Leipzig in 1778, attacked the spelling method in a way that, as Fechner says, was very shocking to tender nerves. In a number of essays and books he expresses his disgust. In his *Metaphysik für Schulmeister und Plusmacher*, published in 1785, he wrote in substance as follows:

"Spelling is not only altogether unnecessary and useless, but also indescribably injurious, and, moreover, the greatest folly, comparable to no other since the fall of man." And he adds: "All that the scholar carries away from his spelling is a suppressed reason, empty perception of words, a pitiful, disgusting whine, a contracted eye, a spoiled ear, and a parrot-like mode of thought; but, for his comfort, there are millions of men like him. One can give no idea of this cruel drudgery on paper. One must himself see the spellers in the spelling factories, victims of nonsense, standing like condemned criminals before the judgment seat, trembling and shaking till their eyes and ears fail, and the sweat of anxiety, their only relief, breaks out. A land with 20,000,000 inhabitants loses 10,000,000 dollars a year by the inane, slow spelling method and empty word-cram; for the constant results of this perverted method of instruction are ignorance and stupidity, from which will come crimes, contempt of religion and of morals, misery and want." "The spelling method," he exclaims, "is a greater evil than the burning of witches and heretics, a greater crime than the rack and all inhumanities taken together. For it is opposed to all natural and revealed law; it creates stupidity, crimes, diseases, and even death. It is child torment and child murder." In another place he speaks in similar Carlylean fashion, and exhausts the whole Teutonic vocabulary of scorn; and, finally, he declares that no man, as long as the world has stood, ever learned to read by the spelling method. The schoolmasters of the time were naturally very much aroused by this attack, and they attempted to defend the method. A bitter contest arose;

both parties claimed the victory. But the old method was continued in use.

Many other writers pointed out the sterilizing, deadening influence that it had upon the minds of the children. Graser (19, p. 63) characterized it as "the crudest *Mechanismus*, a real tyranny of the mind, a torment of childhood, and an outrageous libel upon human education." In a book published in 1845 (9, p. 32), he vigorously condemns what he calls mechanical, senseless lip-bawling,—referring to the use of nonsense words. It gives an adult vertigo to read two or three pages of it, and how must it be with a child who practices articulating this nonsense the whole week long? Battig (9, p. 35) in 1860, declared that children were worse off than parrots and crows, because in teaching the latter whole syllables and words were used. The children did learn to read by this old method. How did it happen? Partly, perhaps, as Zeller (9, p. 36) thought, it was the result of a process of abstraction, by which the simple sounds of the oft-repeated letters were impressed upon the mind; more, perhaps, as Hecker (9, p. 36) said in 1750, the final learning to read was the result, not of the ceaseless repetition of the letters, but of the pronunciation of the words and syllables that followed the naming of the letters.

There have been plenty of defenders of this method; but the evidence for favorable results is rather meagre. Junker (9, p. 38) in 1787, said that children of the common people usually wrote more correctly than children of the higher classes, who did not attend the public schools. This was the result of the spelling method. Others maintained that reading was learned more thoroughly by this method. One strong argument seems to have been that the spelling method was easier for the teacher.

The irony of this child torment is emphasized when we consider that the older writers of distinction, as Fitch (11) and others have pointed out, were largely free from any Pharisaic pedantry in regard to spelling. The liberal orthography of the early times is well known. Queen Elizabeth was confessedly a well educated woman, but it is said that she spelled the word "sovereign" in seven different ways. Passing to Germany and to later times, Frederick the Great, Blücher, and others are examples of this freedom.

Gradually the old methods were given up, and in recent years serious effort has been made to put the whole subject on a sound psychological basis. Much of the old devotion to the subject, however, still survives. The amount of time and money expended at the present time upon the subject of spelling is suggested by the vast quantity of spelling books published. The old spelling book, as everybody knows, had a place next to the Bible, not only in the importance attributed

to it, but in the number of copies used. Up to 1885 it is said that 65,000,000 copies of Noah Webster's spelling-book had been sold. While this classic has lost ground in the face of modern competition, the total number of spelling-books of different kinds sold to-day is enormous.

Spelling holds a place of great importance in the popular consciousness and in the opinion of educators; and every little while some one notes with alarm that the rising generation cannot spell, and more attention to the subject is demanded. Nevertheless, complaints from high quarters continue. Dean Briggs, of Harvard, for example, says: "We have boys who cannot spell, men who cannot spell, teachers who cannot spell, college professors who cannot spell and who have a mean opinion of spelling." The results of all the time and effort devoted to this subject are apparently unsatisfactory; and to the question, what should be done, there are various answers, and great confusion of opinion and method prevail.

Lay (21) describes in detail the various methods of teaching orthography, and the conflict of opinion, from the time of Comenius down, and especially the views of modern writers. A brief account of this history will be sufficient.

In the nineteenth century Pestalozzi and others began to study the psychology of the subject. In 1804 Olivier (32) published his *Lesebuch*, in which he demanded that speech exercises for the purpose of clear articulation and distinguishing sounds should precede the instruction in reading. With him the ear and speech were the important instruments. Most of the writers since Olivier follow one or the other of two leading psychological tendencies; the one emphasizing the ear, the other the eye. Diesterweg (6) may be taken as the leader of the former tendency; Bormann (1), of the latter.

Diesterweg maintained that while the spelling of words in a foreign tongue may be learned by the eye alone, in the living mother-tongue the chief tool is the ear, that the different branches of instruction in language, hearing, speaking, reading and writing are interrelated and form a connected whole. No part should be isolated, and in all the aim should be a perfect understanding of the speech. While in spelling the chief emphasis should be placed on the ear in the lower grades, nevertheless in the later grades the eye should take the lead.

Bormann represents the other important movement, emphasizing the eye. According to him there is no simpler or more secure method than that of accurate copying; for every man retains better the impressions received by the eye than those received by the ear. Just as one who hears only correct speech learns to speak correctly, so one who sees always only correct writing learns by this means to write correctly. Hence the

pupil should be guarded from the representation of any false orthography and guided only by correct word forms. Every word in written speech has its own peculiar physiognomy. The task of orthography is to help the children to imprint the physiognomy of the words upon the mind, a process which naturally occurs predominantly by means of the eye. Hence correct copying should be practiced and the teacher should incidentally, in connection with the reading, call attention to the spelling of words, to differences in spelling and the like. Writing like speaking should be learned mechanically by imitation. Strong evidence of this predominant rôle of the eye and the actual hinderance that hearing may prove to be, is found by Bormann in the alleged fact that all those who are deaf and dumb write orthographically. With them the memory of the word forms is not confused by the auditory memory of sound relations.

Others represent a combination or mediation of these two schools. Kellner (21, p. 49) seems to have had much influence, and he distinguished between the spelling of those words which are written as they are pronounced, where one can truly speak of *orthography*, and those words which are not written as they are pronounced, where we really have *heterography*. For the former class of words the ear is the supreme judge, and the rule is "write as you speak." For the latter class of words, that vary in form from their pronunciation, the eye should be chiefly active, and the rule is "write according to the writing custom." In regard to another class of words the judgment of the pupil should be exercised and attention given to the derivations and the like. Kehr (20) attempted to unite the demands of Bormann and Diesterweg placing the emphasis, however, upon the principles of the former. Dittes (21, p. 54) advocated spelling exercises in connection with the reading exercises, at first simple copying and dictation and the writing down of selections from memory.

The one psychological contribution which seems to have had special influence upon orthography was Stricker's *Studies of Speech Images* (41). Basing his views on Stricker's doctrine Wawrzyk (42) maintained that along with sight and hearing the muscle sense of the hands and of the speech organs should be considered, since these play an important rôle in the comprehension, retention and reproduction of words. Accordingly, Wawrzyk was the first to emphasize the motor element in spelling, and he rejected ordinary oral spelling altogether.

As Lay (21, p. 60) points out, confusion and conflict of opinion have prevailed from the time of Pestalozzi. Olivier, Grassmann, Harnisch, Diesterweg, Rudolf emphasize the sound and the ear; Bormann and Kehr, on the other hand, the

physiognomy of the word and the eye; Wandes, Heyse, Mohr, finally, the rule and the understanding. Diesterweg especially emphasized the pronunciation. Bormann considered this a disadvantage rather than an advantage in spelling, and Wawrzyk is the only one who points out the significance of movements of the hands and the speech organs. Bormann and Kehr recognize in copying the most advantageous movements for learning a given orthography. On the other hand, Naumann combats the method of copying most strongly. Heyse *et al.* give a system of rules. Harnisch and others make light of rules. Diesterweg *et al.* have many dictation exercises. Bormann and Kehr are hostile to this. All, especially Diesterweg and Kehr, use oral spelling; only Wawrzyk altogether rejects this.

Thus it appears that no writer upon method has succeeded in establishing his opinions and principles sufficiently to win universal recognition. No one has conquered the opinion that he opposed. The reason for all this confusion is easy to see. There are no psychological principles. In recent years the attempt has been made to establish such psychological foundation for orthography.

The Psychology of Spelling. Spelling is primarily a sensori-motor habit acquired like any other habit of this kind by repeated motor reaction to certain sensory stimuli. The habit is a complex one. As Lay points out, the writing movement image of a word is composed of motor images of the separate syllables and letters. The movement images for the separate letters are learned in the first writing instruction. The combination of the writing movement images of the separate letters to the writing movement images of syllables and words is the germ of the whole instruction in orthography, but this is an extremely complicated process. Dozens of muscles must be co-ordinated with definite strength in a definite sequence and with definite accuracy and rapidity. This very complex process goes on unconsciously, of course. The process is similar to that in learning any other motor accomplishment.

In the case of one who has already acquired the habit the psychological process, to describe it briefly, is somewhat as follows: Suppose it is the case of spelling a given name, for example, Worcester. First of all, by memory one recalls the given word. One gives consent to it as a word-to-be-written and forthwith the act of writing the word occurs more or less automatically.

This memory of the word-to-be-written is made up of auditory images of the different sounds composing the words, or of the motor images of the speech movements involved in pronouncing the word, or of the visual images of the different let-

ters, or of the motor images of the hand movements involved in writing the letters, or it may be made up of any two or of all these classes of images.

The modality of the images in any concrete case is determined by two things. First, by the general tendency of the individual's mind, some being ear-minded or having a special tendency to think in auditory images; others being eye-minded or having a special tendency to think in visual images, and still others motor minded, or having a special preference for motor images, or finally, others of a mixed type. Second, the modality of the images is determined by the method by which one learned to spell the given word, being auditory perhaps if one learned by dictation, or visual if one learned by reading, or speech motor if one learned by oral spelling, or hand motor if one learned by copying. In any case the translation into motor terms must occur when one spells the word orally or in writing.

Of course the practical pedagogical problem is to determine by what method one can learn to spell most easily and with the least danger of interference of association, or error. On account of the different mental types the solution of this problem must be largely an individual one. The error of most writers upon spelling in the past has been that each has generalized, perhaps from his own experience, and insisted upon one method as best for all individuals, the result being the conflict of opinion already noted, the teacher who was eye-minded being likely to emphasize the importance of visual images, the one who was ear-minded, the ear and dictation, the motor-minded, pronunciation and copying. But while the solution must be an individual one, it is profitable to inquire what methods in general are likely to be best; and if, as is probable, a method combining all the different images should appear desirable, it is profitable to inquire to what extent the images of these different kinds have a share in the act of spelling under ordinary conditions. Experiments to determine all this were made first by Lay (21).

Experimental Studies. Lay's immediate problem was to determine the value of orthographic exercises, and wherever possible to determine the share which perceptions of hearing, sight, speech movement, and writing movement have in spelling.

Accordingly he tried experiments with dictation, reading, oral spelling, copying. After various considerations and preliminary experiments and modifications he adopted, finally, the following method. Nonsense syllables were used for material. For example, the following:

1. Hearing: Libug, Bollis, Gohlin, Seufil.
2. Hearing with low speaking: Labog, Bulles, Gihlan, Saifol.

3. Hearing with speaking loud: Lubag, Billas, Gahlen, Seiful.
4. Seeing: Ribog, Mellis, Kahlun, Teufar.
5. Seeing with low speaking: Rabig, Meilos, Lihlon, Taitur.
6. Seeing with loud speaking: Rubag, Millus, Kuhlin, Teifor.
7. Oral spelling: Labeg, Bellas, Guhlin, Teufir.
8. Copying: Lobig, Billos, Gehlan, Teifur.

The series of experiments contained eight individual tests. In each test the same number of similar words were used. The series of words in each experiment were several times pronounced by the experimenter, or read by the pupils, or spelled, or copied. The number of repetitions was the same for each series. Then the word series was written from memory on a special sheet, and this given up for correction. In the case of hearing, the words were spelled orally by the experimenter; in seeing, they were written on the blackboard; in the spelling and copying also, the words were placed on the board. Hearing and seeing without speech movement was investigated in the following manner: The pupils, when words were spelled to them, or read, repressed the speech movements in such a way that the jaws firmly closed and the vocal organs remained quiet, a result obtained after some practice. In seeing or hearing with speech movement, they repeated the letters in a whisper or aloud.

The number of repetitions was too great if only very few errors were made; too small if too many errors were made. The fitting number had to be determined first by investigation.

The twenty-four series of experiments with pupils of the people's school included about a hundred class experiments, each experiment embracing about thirty pupils on an average, so that these class experiments equalled 3,000 individual experiments. The results were sufficient to demonstrate that the motor presentations which occur by the activity of the vocal organs and the hands have a predominant share in orthography, and that the ear has far less influence than the eye.

All experiments of the same kind,—hearing, seeing, spelling, copying, resulted without exception in the same way. Of the many experiments only a few gave a contradictory result, and in every case it could be definitely shown that the normal conditions of the experiments had been disturbed by some more or less accidental occurrence.

These experiments were made with children from the first to the sixth school year. With older pupils, who had read and written for ten years, different results perhaps might be expected. Still, from a physiological standpoint, the activity is

essentially the same. The same nerve processes are involved, and there should be the same general result. To test this Lay tried the same experiments with classes in the teachers' seminary. 49 class experiments were made. In all 1,800 individual experiments. Although, as might be expected, the number of errors was less, the same general results appeared.

A striking difference between the average results of the experiments for members of the seminary and pupils of the school occurred only in case of oral spelling and copying. The members of the seminary gave greater attention to the oral spelling than to the copying. The latter was done hastily and in shorter time than the spelling. In the case of the pupils the opposite was the case.

Taking the results of both investigations together, the experiments with the pupils and with the members of the seminary, the number of errors for each individual with the different methods was as shown in the following table:

Method tested.	% of errors per pupil.
Hearing, without speech movement, dictation,	3.04
Hearing, speaking low,	2.69
Hearing, with loud speaking,	2.25
Seeing, without speech movement (reading),	1.22
Seeing, speaking low,	1.02
Seeing, speaking loud,	0.95
Spelling (loud),	1.02
Copying (low speaking),	0.54

"If," says Lay (21, p. 96), "we note the increasing number of errors, then the exercises in orthography are to be arranged in the following order, according to their value: Copying, spelling orally, reading aloud, dictation. According to our experiments with pupils in the People's Schools, seeing excels hearing by twice or three times, and copying is twice as valuable as spelling, two or three times as valuable as reading, and six times as valuable as dictation."

From these results, Lay (21, p. 115) argues that the speech apparatus has a much more important part in orthography than the ear; that speaking the letters is better than hearing them. Again, the experiments with hearing without speech movements gave 3.04% of error. The experiments of seeing without speech movements gave only 1.22% of error. Therefore it appears that the visual image is from two to three times better than the sound images; that sight has a greater share in orthography than hearing. Again, the experiments with seeing and speaking low gave 1.02% of error; the experiments in copying 0.54% of error. In these experiments, copying was seeing and speaking low with the addition of writing. The difference between these two numbers, there-

fore, is due to the motor images in writing. It appears that they decreased the error, as compared with visual images alone, by one-half. The writing movement images thus have a greater share in orthography than the visual images; writing is better than seeing.

Experiments were made, also, to determine the memory for the spelling after intervals of different length. These experiments were based in part upon the investigations of Ebbinghaus, and of Mueller and Schumann, and it appeared that those exercises which gave the best immediate result also gave the best memory for spelling; and Lay makes the general inference that, from the point of view of permanent result, copying, and, in a less degree, reading, and reading with speaking, far surpass oral spelling and dictation.

Further experiments were made to determine the value of printed as compared with script spelling books. These experiments were made in different years, with pupils of different ages, with words of varying difficulty, and in different order, and yet similar results were found in all cases. And they indicated that for practice in orthography script spelling books surpass printed books, that they are about twice as valuable as material for sense perception.

The late Herman Schiller (39), director of the pedagogical seminary at Giessen also attempted to solve the same spelling problem; and at his suggestion Herr Haggemüller made similar tests with pupils in the third school year of the Vorschule of the gymnasium using German words; and Herr Fuchs with pupils in the lowest class of the Gymnasium (Sexta) using Latin words of unfamiliar meaning. Dr. Schiller's problem was to determine the relative value of the different images in correct spelling. Schiller's results also indicated that sight is a better aid than hearing in spelling, and that in case of both sight and hearing the errors are decreased when these senses are reinforced by speech or writing movements. In general Lay's results are corroborated by Schiller's investigation. The following is the order of value of the methods as fixed by Schiller's tests.

1. Copying with speaking softly.
2. Copying with speaking aloud.
3. Seeing with writing movement.
4. Oral spelling.
5. Seeing with speaking aloud.
6. Seeing with speaking softly.
7. Seeing alone.
8. Hearing with writing movement.
9. Hearing with speaking aloud.
10. Hearing with speaking softly.
11. Hearing alone.

Two Germans, Mally and Ameseder (27), have made a careful technical study and criticism of the results obtained by Lay and Schiller. To quote directly the words of these authors: "If it has been shown that the pupils by the mere hearing of the words have learned least in the way of spelling, that is easily to be understood, but no surprising discovery at all. So much the less, since the words pronounced to the pupils were completely new, and the experimenter established a form of writing for them which varied from the phonetic, although not considerably, still in many cases without the subjects having any experience of this form of writing."

The authors point out further that a universal objection to Lay's experiments in this: what the subjects in the whole experiment had to do was the correct writing down from memory of senseless words which had just been learned. Whoever, therefore, had retained the words themselves well in memory, had undoubtedly accomplished the most difficult and greatest part of the task, and it was hardly so very difficult to arrange the correct, that is the prescribed, writing for the correctly noted word. For the real orthographic errors there remained accordingly little opportunity. And among other criticisms they make the point that the errors in Lay's tests were not comparable to those in orthography. Among other things these writers raise the question in regard to the different results obtained by the different methods of learning tested by Lay.

It is probable that Lay's results must be discounted on account of the sources of error suggested by these writers, and perhaps he attaches too great significance to the differing number of errors by the different variations of method adopted. But in spite of these strictures the main result, namely, the indication of the importance of the motor images in spelling remains, and until further investigations have been made it is advisable, in order to avoid interference of association and error, to depend especially upon the eye and the motor images in learning orthography.

Mr. Smedley (40), director of the department of child study of the Chicago public schools, gives an account of a study of the different kinds of memory among Chicago school children with special reference to spelling. His results are very interesting.

The investigation included tests of immediate sense memory, that is, memory span tests, using digits; tests of auditory memory by reproduction of a series of digits read to the pupils; tests of visual memory consisting of reproduction of a series of digits showed on a card for $\frac{2}{3}$ of a second; tests of audio-visual memory, in which the children reproduced a series exposed to view on a card and at the same time re-

peated aloud by the experimenter; tests of audio-visual-articulatory memory, in which the pupils reproduced a series exposed on a card and read in concert by the pupils; tests of audio-visual-hand-motor memory, where the children wrote the digits on paper while the series was dictated and also exposed on a card, the pupils turning the paper face downward at the close of the dictation and reproducing the series from memory on test paper.

It was found that the different memories cannot be tested as isolated memories. In testing the visual memory, for example, it was noted that many children, in spite of admonitions to the contrary, moved their lips and throat. In the auditory tests, too, short lip movements were noted in some pupils.

As regards the relation of memory to spelling ability, it was found that "while usually the better spellers are possessed of better memory power than are the poor spellers, yet there are bad spellers with a high development of memory. Superior memory may make the acquisition of spelling easy, yet it by no means removes the necessity for some intelligent application on the part of the pupil. While most good spellers tend toward the visual type, still there are both good and bad spellers of each type."

Both these investigators make certain pedagogical suggestions. As a result of his experiments and general study and observation, Lay (21) draws several important, practical inferences, as follows: cultivation of a correct pronunciation is of great importance for learning orthography. As much as possible the sense of a word, pronunciation, reading and writing must be united, and the motor presentation in writing is the determining factor in orthography. Again, the instruction in orthography should give to the pupil the habit of imprinting the orthography of each new word that he meets in his reading upon the mind. Since in the usual spelling lesson much time is wasted, exercises in this should be omitted and, Lay thinks, forbidden, by law, as formerly the spelling method in first instruction in reading was forbidden. Dictation may be used in orthography only as a method of examination, and only sparingly and with discretion even here. The so-called copying method, the writing down of sentences, or the like, from memory, is useful since it is most closely related to the orthographic practice in common life. The knowledge of the derivation of words is advantageous in orthography as a means of fixing the attention on the word forms, although it has no direct value in the acquisition of orthographic skill. The rules also, are not directly of value but are important as a means of fixing the attention and arousing the critical sense for orthographic forms. The choice and division of the material of instruction in orthog-

raphy should not follow an orthographic system. It should rather, in its general scope and in details, be related most intimately to the words or word sounds employed in the material of instruction in the regular subjects. In other words, instead of having material for the spelling selected according to a special system it should be selected from the words contained in the regular reading lessons, etc. This last point is of great importance, and much time would be saved if this rule were generally followed.

Dr. Smedley (40) takes the genetic point of view and thinks there is a place for oral spelling with young children. On the basis of his investigation he makes the following suggestions:

"The fact that children have the ear memory stronger during the early years suggests at once that the teaching of spelling to the young will be effective if the ear is appealed to; that there is probably a place for oral spelling; that there should be some pronunciation of syllables with the spelling; that the words presented to the child at first should be, as far as possible, phonetic in their spelling leaving the 'more cruel and unusual' forms of English orthography to be learned in later years when the eye memory has become stronger.

"The investigation shows that there is no 'memory period,' no period in early school life when the memory is stronger than it is at any later portion of the child's life, a period especially adapted for learning to spell. While there are no memory stages, there are undoubtedly periods of interest that are especially favorable for the child's learning to spell; times when, through the influence of companions or teachers, the child is aroused from indifference or from a feeling that spelling is a small part of life to a recognition that it is important."

Dr. Smedley (40) concludes that:

"The aim in teaching spelling should be to render words of the most frequent use automatic, to have them so well known that in writing they will flow from the point of the pen, requiring but little thought as to their formation. The spelling of words is rendered automatic through practice in writing them. Though the first grasp of the word may well be made through other combinations of sense memories, yet the final retention of the spelling of most words should be through the audio-visual-hand-motor memory."

One investigator in this country has found results that seem to be in conflict with the inference made by Lay. A few years ago Mr. B. C. Gregory (14), then Supervising Principal of Schools in Trenton, N. J., made an interesting study of the errors made in dictation exercises. He experimented with two classes. The children were of an average age of 11 years in one class and 13 in the other. The misspelled words were

marked by the teachers, and the returns from the two classes were studied altogether. In all there were 80 papers. The result very briefly indicated clearly this law, according to Mr. Gregory: "That sound is the dominating element in children's spelling," and he infers from this also that oral spelling should have a large place.

Mr. Gregory's investigation, however, suggestive as it is, as he himself suggests is only "semi-scientific;" conditions were not controlled. The criticism may fairly be made that at best his results demonstrate not the law which he formulates but rather that sound is the dominating element in children's *mis-spelling*; further, that he does not sufficiently consider that his results may have been largely due to the methods of teaching that had been employed in the case of these children; and, finally, in general that he devotes more attention to the question of treatment of errors in spelling than to the problem of avoiding errors. In this, as in all other forms of motor training, the fundamental rule should be to avoid error rather than to correct it.

The contribution of these experimental studies is not specially remarkable. The chief results would probably have been anticipated by most psychologists. But the investigation is very instructive in the light of the history of methods in spelling. It is noteworthy that, with the exception of a few, notably Comenius, who in his simple, common-sense way had a remarkable faculty for getting on the right side and anticipating the future, most writers have neglected the rôle of motor images in orthography.

As Lay (21) points out, the best writers upon method, Diesterweg, Bormann, Kellmer, Kehr, could arrive at no solid foundation in orthography for the reason that the facts and psychological experiments which physiological psychology affords us to-day were unknown to them. From this it appears that thorough psychological studies are necessary for the school man; that innate skill, many years of practice, and higher scientific training, alone, are not enough.

The main result of these investigations is perhaps to show the importance of the visual and motor images in learning orthography. The problems are by no means all solved, yet these experimental studies point the direction in which *terra firma* lies, and it seems probable that by further experimentation a consensus in regard to certain fundamentals may be attained where hitherto there has been an apparently hopeless conflict of opinion.

So much for Lay and the rest and their heroic experiments. Returning to the general subject, three things are obviously essential in the hygiene of spelling: First, economy; second,

avoidance of confusion and interference of association; third, regard for the effect of instruction on the type of mind developed.

1. *Economy.* As everybody knows, a vast deal of time is wasted in the schools in the learning of spelling. As Superintendent Johnson (18) has said:

"It would not be an impossible task to determine by statistics, approximately, the few hundred, or even thousand words most often written in English. There are defined in the Century Dictionary about two hundred thousand words, but the vast majority of these are seldom, if ever, heard in conversation, and not much oftener seen in print. According to Max Müller, 'A well-educated person, who has been at a Public School in England and at an English University, who reads his Bible and his Shakespeare and all the books in Mudie's Library—that is, nineteen-twentieths of all the books published in England, seldom uses more than three or four thousand words in conversation.' Shakespeare's works contain fifteen thousand different words, Milton used eight thousand, the King James' version of the Old Testament has less than six thousand, and Robinson Crusoe three thousand."

The number of words in the vocabulary of the scholar is probably from 25,000 to 75,000, but, according to Max Müller, he probably uses ordinarily not more than one-fifth or one-third of this number. Prof. Kirkpatrick has estimated the number of words whose meaning is known to him at sight at about 70,000. Prof. Holden has estimated his own vocabulary at somewhat over 33,000 words. Miss Shinn estimated her actual speaking vocabulary at 40,000, and that of her brother, a business man, at 25,000 words. Recent investigations seem to indicate that the vocabulary of primitive peoples and children is considerably greater than has generally been supposed. Dr. Chamberlain (3, p. 162) gives the words in certain Indian Dictionaries as follows: Navaho Indians, 10,000; Dakota, 20,000; Blackfoot, 25,000; Micmac, 30,000; Yahgan, 40,000. But, while as indicated by the studies of Dr. Chamberlain (4) and Mr. Bell, the number of words in a five-year old child's vocabulary, specially if the child comes from an educated family, is probably often greater than the philologists have supposed, and perhaps approximates that of the adult, the vocabulary in daily use, relatively to the total number of words in English, is very small. Prof. Kirkpatrick would put the number of words with which a child of twelve is acquainted at about 7,000 to 10,000. Mr. Johnson, however, estimated that the words used by a class of children below the High School in composition will seldom exceed 6,000. It should be noted, however, that the difficulties of orthography are exhausted in a comparatively small number of common words.

To quote this investigator again :

"The difficulties of English orthography are very largely exhausted in the common words, if not, indeed, in the monosyllables of the language. And the more common the word misspelled, the more doubtful is the literacy of the writer. We attach much more discredit to the misspelling of *does*, *which*, *having* and *getting* than to the misspelling of a word not frequently written. It is wrong to assign to children who miss the commonest words, words they will scarcely use in their composition after they have learned to spell them. But a child who understands and has mastered the difficulties of spelling in a vocabulary of three or four thousand of the most common words is a very accurate speller for the words he will ordinarily use in writing; for other words it is very proper that he should consult his dictionary.

Whatever the number of words that should ultimately be learned, it is probable that in most schools altogether too much time is spent in learning them. Dr. Rice (36), on the basis of the study of papers prepared by some 33,000 pupils in nineteen cities in different parts of this country, seems to have demonstrated that beyond a certain maximum each day the time spent in spelling is practically wasted. In the schools of the nineteen cities where his studies were made the time devoted to spelling varied from six or nine to fifty minutes. He found the spelling of children in the schools giving ten minutes to the instruction each day was as good, on the whole, as that of children in the schools giving fifty minutes per day to the subject.

Dr. Rice maintains that generally with fifteen minutes instruction each day children will learn just as much about spelling as if they have more, and hence anything above this limit is time thrown away. The Committee of Fifteen recommend only fifteen minutes for each day for three or four grades; and yet there are not lacking popular writers who are ready to maintain that five times this amount of time should be devoted to the subject. Mrs. Plunkett, writing in the Springfield Republican, illustrates the prevalent ideas, and advocates beginning near the cradle.¹

"When," she asks, "should these spelling lessons begin? Not later than when a child is five years old. At that age a half-hour lesson in spelling words of three or four letters, and reading short sentences containing the same words, repeated after an interval, will give the child in the 200 days of the school year command of all the words to 'baker' in lesson twenty-six of Webster, and in definitions he should be taught the different meanings of words that sound alike, and also different meanings of words that are spelled the same."

Dr. Cornman (5) has made an extensive investigation of the ability of school children in Philadelphia schools in the subject of spelling, and studied his results with such care that his work

¹ Boston Evening Transcript, July 29, 1901.

deserves special attention. His tests included (1) lists of spontaneously selected words; (2) lists of specially selected words written in vertical columns from the dictation of the teacher; (3) series of short sentences containing selected words written from the dictation of the teacher; (4) spelling papers of the regular term examination set by the superintendent of schools; (5) compositions and other written exercises of the regular schoolroom work.

In two schools, the Northwest and Agnew schools, where there was incidental but no special instruction in spelling, the results at examination after five months were about the same as in the other schools with special instruction.

The averages of the marks of the term examinations of these schools, in comparison with those of other schools, are shown in the following table (5, p. 59):

Northwest and Agnew.		Other Schools.
Grammar grades,	77.3	73.9
Primary grades,	66.2	66.5
All grades,	72.3	68.0

The results seemed to warrant the continuance of the experiment, and consequently during the school years ending June, 1899, and June, 1900, the same conditions were continued and at intervals tests were given. The result of these tests did not show any marked differences between the pupils who had special instruction and those that did not, that is, with the standard of measurement of proficiency employed by Dr. Cornman (composition tests, four column tests, regular term examinations), the pupils spelled about as well one year as another in spite of the omission of the daily instruction in spelling.

As a result, then, of this three years' experiment,—“the conclusion, therefore,” as Dr. Cornman argues, “is forced upon us that an influence, the suspension of whose operation for three years is not plainly manifested in such a series of tests as those described above, is of so little importance as to be practically negligible (5, p. 65).”

The general result of Dr. Cornman's investigation is in harmony with the results found by Dr. Rice; and it appeared that the improvement in accuracy of spelling was a function of age, grade, and general mental development rather than of the quantity of special training in spelling itself.

Whatever deduction may be made for possible sources of error, and it is probable that they would not greatly modify the results, it is clear that special instruction in spelling has no such result as instruction in other subjects. In few if any other subjects would it be possible to omit all instruction for three years and yet show so little difference between the work

of the pupils who had special instruction and those that did not.

The incidental teaching referred to, however, did not mean that spelling was totally neglected. Words likely to be misspelled were placed conspicuously before the pupils when they were engaged in an exercise in which the words were likely to occur. Pupils were taught to consult the dictionary, mistakes in written work were corrected; thus an effort was made to prevent mistakes and to detect and correct them. Cornman's investigation indicates that the average teacher is able to employ such methods without loss of effectiveness; and, on the other hand, the teacher who is unable to do such work well cannot make up for deficiency by any amount of specific drill. To quote the words of Dr. Cornman: "The spelling result is a function of the general pedagogical health of the class, and under normal conditions is a quite constant quantity altogether independent of the method of teaching. In other words, given a class making fair progress in its general work, and its spelling result, as measured by a composition test, may be *predicted* with scientific accuracy, no matter what the daily procedure in regard to the teaching of spelling may have been" (21).

Among his conclusions are the following:

"That the pupils neither gained nor lost appreciably in spelling proficiency;" that "the percentage of correctness of spelling for pupils of any school grade is a fairly constant quantity for that grade;" that "the amount of time devoted to the specific spelling drill bears no discoverable relation to the result;" that "the degree of general mental development, as measured by the school grade of the pupil, is the most important factor contributing to the accuracy of his spelling;" that "the spelling result varies with the variations in the general progress of a class;" that "it is therefore advisable, in view of the economy of time, to rely upon the incidental teaching of spelling to produce a sufficiently high average result."

These results of investigation have been corroborated by the observation of practical teachers (37) who often have benefited overworked pupils by devoting less time to formal drill and by giving more attention to incidental instruction. The English child's burden in orthography seems to be in large part imposed by scholastic convention and tradition rather than due to the inherent difficulties of the subject.

2. *Interference of Association.* It is important in teaching spelling to avoid interference of association. Every error means confusion and interference; and the choice of words, the methods of instruction and length of period should be devised with constant regard to the avoidance of this evil. The English language seems peculiarly liable to cause confusion of association.

English orthography is largely a matter of arbitrary association. The learning of a series of associations involved in acquiring the correct spelling of a given word may be a source of confusion in regard to the spelling of another word apparently similar. These difficulties of English orthography have been frequently pointed out. Mr. McKay (26), superintendent of education for Nova Scotia, has put this graphically as follows:

"Were our language phonetic in its written form, our children could be taught to read within two or three weeks at the longest, anything about which they could talk intelligently. The most unpleasant and monotonous work of their early years at school now, would then vanish. Every sound having its sign and every sign representing its sound, the task is simply mastering some 40 signs."

Professor Sayce of Oxford (26), also states the difficulties forcibly: "English spelling," he says, "has become a mere series of arbitrary combinations, an embodiment of the wild guesses and etymologies of a pre-scientific age, and the haphazard caprice of ignorant printers. It is good for little else but to disguise our languages, to hinder education and to suggest false analogies." Gladstone is reported to have said that he would go mad if he were a foreigner and had to learn English. And Mr. MacKay quotes Max Müller to the effect, "that a child who believes what he is taught in learning to spell the English language, will hereafter believe anything." In a single word, the spelling of English is a matter of convention, and the conventional associations must be learned by heart by every one who would spell correctly.

These writers, however, go to an extreme and have neglected an important aspect of the psychology of spelling. Against Mr. Gladstone's hypothetical insanity should be placed the testimony of a psychologist who has had actual experience and remarkable success in learning the English language. Apropos of the difficulties of foreigners and proposed reforms Prof. Münsterberg (31) writes:

"But can we doubt that the alteration of the sixty-two participles works diametrically against his comfort? *Kist* is now to be written like *list*, *prest* like *rest*, *discust* like *disgust*. Even the obscuring words with a double meaning have been increased: *mist* is now *mist* and *missed*; *past* is now *past* and *passed*; and yet nowhere unity; *wisht* but not *fisht*; *winkt* but not *linkt*. You could not make it worse for the foreigner; whether pleasant for the English-born, it is not for me to utter an opinion.

"The vowels do not fare better than the consonants. Of course, the English child, who hears the simple sounds of *though* and *through* in the nursery and learns much later how to write them, may be irritated by the complexity. But the foreign schoolboy who sees words of that type has not the slightest difficulty with them. To learn how they are pronounced is very easy because they stick in the imagination just through their curious configuration; no German or French word looks like them—they are taken as interesting freaks of lan-

guage, which are the more impressive on account of their very originality. Just so it was easy for us, in the geography lesson, to read the word 'Worcester.' Such grotesque abnormalities are quite handy for the foreigner. Now he is suddenly to see the word *tho* written like *who*, and once again he loses a convenient landmark in the printed sentence. But perhaps he is still more puzzled by *thru* when he is required to speak it like *shoe* and *true*. And with the edict of the Board that *clew* become *clue*, *queue* become *cue*, and *woe* become *wo*, the helps for the eye are gone. You have only to write the three words *to*, *two* and *too* simply *tu* in harmony with *thru* to make the phonetic victory complete. Is this a help to the foreigner who asks nothing but to see with ease the differences between the word?"

The complexity of the process in learning orthography is well illustrated by Lay (21) in his analysis of the act of spelling the word Sahlweide by the different methods. For example, where the teacher emphasizes the ear and the rule the following are the important facts:

The act of orthography in the practically most important cases has for its starting point the concept. Second, the external act, the carrying out of the writing movement for the given script picture is preceded by an inner act, a conflict of motives, a conviction, a consideration, a strife whether the movement for Sal or Saal or Sahl, etc., for Waide, or Weide or Weite, etc., should be carried out. Third, the striving motives are rules, speech-movement-images, sound images, derivation or analogies, Weite from Weit, Saal from Saal (room), and script images. Fourth, the goal of the contest is the motor image. Fifth, those images conquer which appear in the consciousness with the greatest clearness and vividness. Sixth, if a writing movement wins, then this immediately brings up the writing movement without any intervening act, that is, the hand, under certain circumstances also the foot or some other part of the body, moves corresponding to the motor image whether the letter is right or wrong.

In such a complex process interference is liable to occur unless care is taken. In regard to certain words many persons are the victims of chronic interference of association. Examples are the noun *advice* and the verb *advise*; "*principal*," an individual, and "*principle*," a rule of conduct, words with *ie*, *ei*, *or*, *ar*, *er*, *able*, *ible*, *tion*, *sion*, etc.

In some respects prevalent methods might be revised with advantage. The usual method of teaching the spelling of homonyms, for example, is to present them simultaneously. The result is apt to be interference of association. To avoid this they should be taught separately. The very similarities that are supposed to aid the pupil become the source of confusion. In such cases the slight difference, not the general similarity, is the important thing.

This, I take it, was very much what Jean Paul Richter (38)

meant when he said: "Resemblance, the rudder of recollection, is the dangerous rock of memory.—Thus, the correct spelling of very similar words, such as *ahnen* (to forbode), *ahnden* (to revenge); *malen* (to paint), *mahlen* (to grind),—is more difficult than that of totally different ones." Applying this principle pedagogically he says: "It is incomprehensible to me how people fancy they can teach children to read or write the letters easily by pointing out their resemblances, and laying before them at once, i, y; c, e; or, in writing, h, k, etc. The very opposite plan ought to be pursued; i should be placed next g, v next z, o next r; the contrast, like light and shadow, make both prominent. The fast-rooted dissimilarities serve at last to hold fast the resemblance that exists among them."

An error of the kind to which teachers seem especially prone prevailed to a large extent in the early part of the 19th century. It was introduced by Zerrenner in 1814 (21). He published lists of sentences containing examples of both correct and incorrect orthography, the latter to be corrected by the pupils. Baumgarten and others systematically carried out this method of teaching spelling by the correction of examples of false orthography, and even Diesterweg in his *Praktisches Uebungsbuch* gives sentences with substantives written with small letters and other errors to be corrected. Such a method puts a premium upon interference of association; but it may be suspected that it is not altogether obsolete to-day. Fitch (11, p. 201) refers to it as not uncommon in England.

It should be noted that spelling cannot be divorced from reading, and whatever tends to make the process of reading easy and to prevent interference of association is likely to be helpful likewise in orthography. Interference of association is often less likely to occur in reactions to two different groups of stimuli, *i. e.*, two different complex situations, than in case of stimuli that represent relatively simple situations. This, again, has been clearly stated by Professor Münsterberg (31, p. 103). The greater the number of stimuli the easier the apperception.

"In just this way the written image may tell us much which seems logically superfluous (since it brings out elements of the word that cannot be pronounced), and which phonetic spelling seeks to abolish. But just as well might we propose to close one eye in reading, for the reason that the nervous processes in the second open eye and in the corresponding half of the brain are a shameful waste of neuron activity. Indeed, we can read 'just as well' with one eye, and hear with one ear; and yet nature knew better; this luxury is economy. Give us as many optical hints for the discrimination of the words as possible, and the more we apparently waste, the more we save. Simplicity and uniformity are the only real waste, because they

demand from us an amount of attention which is ruinous in its cumulation; they prehaps reduce the expense for printer's ink, but they increase neurasthenia among the millions of newspaper readers."

3. *Mental Habits developed.* We should judge any method by the habits of mind that it is likely to develop,—whether habits of concentrated attention, orderly association, and healthful mental habits in general, or of desultory attention, confusion of association, and the like.

As regards the type of mind developed by the methods of instruction in orthography, we as yet know relatively little. To what degree one is made eye-minded, ear-minded, or motor-minded by methods of instruction, is still a matter to be determined. If it should appear that methods in orthography have any considerable influence in determining the type of mind, then some, like Professor Patrick, of the University of Iowa, might maintain that it would be wise to use oral spelling to a considerable extent to off-set the tendency in so many subjects to neglect the cultivation of the ear.

Miss Carman (2) in a study of bad spelling finds that those who are chronically poor spellers are also characterized by poor power of observation for printed letters, simple figures, and the like. Her first test was as follows:

The pupils were given a printed page from Appleton's Fourth Reader containing 100 misspelled words. They were asked to mark each misspelled word as quickly as possible.

The time was accurately recorded. The average was:

	Time, seconds.	Words omitted.
Good spellers,	130.1	8.9
Poor spellers,	199.6	28.1

The next test was with two cards containing each ten letters of various sizes, and irregularly placed. These were exposed to them for five seconds, after which they wrote as many of the letters as they could.

The average mistakes were, for the good spellers, 6.6; for the poor ones, 8.2.

"The last test consisted of four cards on which were forms, such as triangles, circles, squares, lines parallel and otherwise, and some figures of undefinable shape. These were also exposed for five seconds, after which they were to be drawn on paper. The average mistakes were: for the good spellers, 11; for the poor ones, 11.6."

"Ability to spell well, therefore," Miss Carman concludes, "probably implies not a *general* habit or power of observation, but a *special* ability to notice small differences in *words*.

"The vision of each of these persons was tested, and showed satisfactorily that it was no factor in the case."

Miss Carman is probably right in this inference, but a number of other factors doubtless contribute to the ability to spell well as suggested by the complexity of the mental process. Whether poor power of observation for small differences in words is the cause of the inability to spell, or whether improper training in spelling is one cause of the lack of observation for small differences, there is at least an interesting correlation here. It is probable, however, that the special training in spelling does not contribute to general power of observation.

The Chicago studies indicate deficiency in spelling is likely to be correlated with sensory defects and inferior memory power, but, nevertheless, they do not demonstrate any necessarily causal relation in this respect. As regards the comparison of good and bad spellers Dr. Smedley (40) reports:

"Each teacher in the Ogden School furnished the names of the five poorest and the five best spellers of her room. This gave an opportunity to study the characteristics of good and bad spellers. While on the whole the good spellers have decidedly better memory power than the bad spellers, yet there are individuals among the poor spellers who are superior in memory power, and individuals among the best spellers whose memory power is scarcely up to the average of their age. While this native power of sense memory plays an important rôle, it is by no means the only factor in learning to spell.

"It should be added, also, that while the number of sight and hearing defects is greater among the poor spellers, yet there are among the very best spellers pupils with marked sensory defects."

In determining the practical value of pedagogical experiments one must always keep in mind that it is not a question of establishing results on a solid psychological foundation beyond all source of error and possibility of criticism, but rather a question of whether the given results furnish a more trustworthy ground for methods of instruction than mere personal opinion or tradition. The problems of the school are practical problems which must be solved immediately in one way or another without waiting for the ultimate verification of scientific results. The recent investigations by Lay (21), Schmid,¹ Cornman (5) and others show that in elementary instruction there are many important questions which it is impossible to solve by intuition, by the pooling of opinion, or by ordinary observation, but that special experimental investigation is necessary, and this often in order to come to close quarters with the facts.

Conclusion. The chief points that seem to be established by investigation thus far may be put briefly as follows:

1. The larger part of the instruction in spelling should be given incidentally in connection with reading, writing, and other subjects.

¹See article by the writer, on Home Study, *Ped. Sem.*, June, 1905, Vol. XII, pp. 213-230.

2. Special instruction in spelling should not be begun before the age of 10 or 12.
3. Not more than fifteen minutes a day for three years should be allotted to special instruction in spelling. This is the amount of time suggested by the Committee of Fifteen and should be considered the maximum.
4. Instruction in spelling should have regard for individual differences of the reproductive imagination.
5. Many different methods may be wisely used, but for the majority of children the methods of writing, and specially of copying seem to be the most efficient, appealing to the visual and hand motor images.
6. The psychology of association and the need of avoiding interference of association should always be regarded; for example, the avoidance of error rather than the correction of error, the automatization of the orthography of simple typical forms, and the isolation of homonyms and the like are advisable.
7. Apparently the drill in spelling develops a special power of observation for small differences in words, a special habit of preperception, but does not have any particular value in general mental training or in developing a general power of observation.
8. The reforms in spelling now advocated seem to be in a large part of the cases desirable, as *honor* for *honour* and *favor* for *favour*, and the like; but in many other cases as *mist* for *missed*, *kist* for *kissed*, and the like, the changes suggested are open to serious question from the point of view of psychology and from regard to the demand of hygiene that interference of association should be avoided.
9. It is likely to be found that such simplifications in orthography, important as many of them are, would amount to relatively little compared with the great possibility of economy to be looked for from improved methods which have regard for the principles of psychology and hygiene.

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