AN EXPERIMENTAL STUDY OF THE EFFECT OF A CHANGED HOME KEY POSITION ON THE USE OF THE UNIVERSAL TYPEWRITER KEYBOARD

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CHAPTER I

THE PROBLEM

Christopher Latham Sholes, who is given credit for the creation of the first practical typewriter,[1] apparently gave little thought to a scientifically arranged keyboard in which those letters occurring frequently would be most accessible. Willis L. Uhl and August Dvorak discuss this:

> The keyboard was patched together in Sholes' heartbreaking experiments to fit keys into positions without colliding or sticking at the writing point. Although such mechanical difficulties have long since disappeared from the modern typewriter, this patchwork keyboard has scarcely changed.[2]

An analysis of the typewriting of words, made by Dvorak and Uhl,[3] revealed several interesting facts. A fourth of all the usual typewriting is forced into more or less awkward stroking of the keyboard. Four per cent of ordinary typewriting is done by the same finger slowly tapping two keys in succession. Fully a sixth of the two-letter combinations reach across the barrier of what is recognized as the home row above which the typist's fingers

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[1] Alan C. Reiley, "The Fiftieth Anniversary of the Typewriter." Current History Magazine, 19:306, November, 1923.

[2] Willis L. Uhl and August Dvorak, "Cost of Teaching Typewriting can be Breatly Reduced." Nation's School, 11:39, May, 1933.

[3] Ibid., p. 41.

are supposed to hover. Furthermore, "the left hand has thrown upon it a 47 per cent overload, apart from its repeated carriage throws."[4] These facts seem to justify the contention of many that the present keyboard is not properly arranged.

Undoubtedly, the most satisfactory way of solving the difficulties would be the adoption of a keyboard, arranged according to letter frequency. This change would encounter difficulties, such as, the tendency on the part of many to be satisfied with the present keyboard, with a reluctance to accept changes involving the expenditure of any great amount of energy and effort in relearning. Aside from these considerations, there are probably others who would think the change not feasible because of the expense involved. The problem must, therefore, be approached from another angle. It is with this situation in mind that the present study has been undertaken.

Statement of the problem and purpose of the study. The present study, which is concerned with the effect of a changed home position on the use of the universal typewriter keyboard, has been undertaken with the idea of determining whether the new position on the typewriter will in some

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[4] Loc. cit.

measure mitigate the handicaps of the poorly arranged universal keyboard.

Importance of the study. In an article published in the Atlantic Monthly for August, 1921, the following statement concerning the use of the typewriter at that time appears: "Well, that is the business world, and undoubtedly the typewriter is of immense value; but do you not resent its intrusion on the world of friends and social relationship?"[5]

Today there are few, in all probability, who would subscribe to the above statement, for typewriting is becomin increasingly more important in the schools. In 1930 there were 151,058 pupils enrolled in three hundred sixty-nine junior and senior high schools in California. Of that number, over one-third or 54,475 were registered in typewriting classes.[6] From that time to 1932 there was a steady increase in the enrollment of all business subjects.[7] The figures for the period from 1932 to 1934 are not as yet available.

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[5] "On Typewriters." Atlantic Monthly, 128:272, August, 1921.

[6] Ira W. Kibby, "Report of the Bureau of Business Education." Biennial Report, State Department of Education, Sacramento, California, June, 1930, p. 90.

[7] Ira W. Kibby, "Report of the Bureau of Business Education." Biennial Report, State Department of Education, Sacramento, California, June, 1932, p. 53.

Skill in typewriting is of great value as an aid in completing university and college work and lack of it is considered, by college students, a detriment both for school studies and daily life activities. Academic majors make as wide and practical application of typewriting as do the students of business education.[8]

Typewriting was formerly considered only a tool subject for commerce, but now it is recognized as a practical subject "for all whose educational and vocational levels correspond to that of the usual high school senior or junior."[9] Many of the leading educators are recognizing the value of typewriting more than ever before and are recommending that instruction for one semester in the subject be required for every child in the high school.[10]

The majority of people today are appearing to recognize the importance of typewriting and would in all probability heartily indorse the following statement concerning the increasing need and value of skill in this subject.

In this generation the requirement of being

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[8] Jeanette Felsen, A Study of Values to be Derived from a Knowledge of Typewriting by College Students (unpublished Master's thesis, University of Southern California, Los Angeles, California, 1933), p. 142.

[9] Willis L. Uhl and August Dvorak, op. cit., p. 39.

[10] E. G. Blackstone, "Personal Typewriting." The American Shorthand Teacher, 10:104, November, 1929.

> able to write rapidly and legibly is both fundamental and universal. Economy of time is a pressing demand and rapid methods of intercommunication are a necessity. It is inconceivable that the coming generations of the age of air travel will be willing to make their written self-expressions by laboriously pushing an illegible pen at 25 words per minute when a comparatively small amount of educational training will give them from two to three times the speed with greater legibility. The time is near at hand when the typewriter will become as indispensable in the household as the telephone, vacuum cleaner, automobile, and the radio.[11]

Because of the cost of necessary desks, adjustable chairs, typewriters, typewriting materials, special rooms, the time required, and the services of specialized teachers, typewriting is one of the most costly subjects in the commercial department,[12] and it is one of the more expensive subjects in the high school program of studies.[13] It is, therefore, important that the pupils acquire a maximum degree of skill in a minimum amount of time. Earl W. Barnhart says, "Economies in school operating costs will be controlling factors in every community for years to come. The wastes of pseudo-education must be eliminated."[12] It follows from this that if less time is spent in developing skill in

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[11] Jane E. Clem, "Typewriting Below the Senior High School." Commercial Education, 15:41, March, 1930.

[12] Earl W. Barnhart, "Foreword." National Business Education Quarterly, 1:1, December, 1932.

[13] Willis L. Uhl and August Dvorak, op. cit., p. 39.

typewriting, more people can take it without an increase in school costs.

The greater the skill an individual has in typewriting the more likely he will typewrite. In a survey of college students it was found that those persons who wrote less than twenty words per minute made little or no use of their typewriting.[14] Inasmuch as many persons are able to take but one semester of instruction, the responsibility of the school and teacher lies in seeing that the pupils attain the maximum degree of skill.

Analysis of the problem. The most important questions which a satisfactory solution of the present problem would answer are as follows:

1. Is there any justification for advocating a changed home key position?

2. What attempts have been made to improve typewriting instruction?

3. Have the various methods and devices proposed before taken into consideration the poorly arranged keyboard?

4. What does the proposed system of typewriting offer that is better than other methods?

5. In the class taught by the new method, as compared with the one taught by the traditional home key position

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[14] Jeanette Felsen, op. cit., p. 142.

is there (a) a more rapid increase of the typewriting speed? (b) a higher speed in general? (c) a higher class median at designated intervals? (d) a greater degree of accuracy?

5. In the experimental and control classes is there any relation between (a) the net rate of speed and I.Q.? (b) the accuracy results and I.Q.? (c) the gross rate of speed and I.Q.? (d) the net rate and the sex? (e) the accuracy results and the sex? (f) the net words per minute and the age? (g) the accuracy results and the age?

6. Do the results of the experiment justify advocating a changed home key position in the teaching of typewriting?

Review of related investigations. As far as can be determined, no investigations dealing with the improvement of the teaching of typewriting, similar to the one undertaken in this study, have been made. Since the general recognition of the need for class instruction, "in 1916 and 1917, when huge war classes forced the adoption of more efficient methods,"[15] numerous plans for improving instruction have been advocated. Some devices have been proposed which discard the generally accepted universal keyboard and substitute one on which the letters have been placed accord-

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[15] Harold H. Smith, "The Teaching of Typewriting." The American Shorthand Teacher, 9:242, March, 1929.

ing to letter frequency. Other educators have accepted the keyboard now in use and have attempted to overcome these handicaps by means of improved methods of presentation. The studies selected for review are those which show the two types of effort that have been made to improve the teaching of typewriting.

As an example of the type of investigation working towards improvement by means of a changed keyboard, the studies, Common Errors in Typewriting[16] by August Dvorak and Gertrude C. Ford and The Improvement of Speed and Accuracy in Typewriting[17] by Hoke, have been discussed in considerable detail.

As Dvorak and Ford's study is the more recent one, it will be reviewed first. The results of their investigation have led to the development of the Dvorak-Dealey Simplified Keyboard, a replica of which may be seen in Appendix A.

The errors of one hundred sixth-three high school test papers, written in a Washington State typewriting contest, were studied. Approximately one-half of the typing errors were made in the first 100 words, and two-thirds of

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[16] August Dvorak and Gertrude C. Ford, "Common Errors in Typewriting." Balance Sheet, 15:223, January, 1934.

[17] Roy Edward Hoke, The Improvement of Speed and Accuracy in Typewriting (Baltimore: The Johns Hopkins Press, 1922) 41 pp.

Accuracy in
1922) 41 pp

the errors were made in the first 250 words of the "Ayres List."[18] The first 250 present practically no spelling difficulty to high school pupils and the first 100 words are usually spelled correctly by first and second grade pupils.

A study of the typing errors made by the pupils in the contest showed Dvorak and Dealey the necessity of seeking some basic interference underlying all pupil typewriting. They found 10,450,000 of thirty-seven million letter combinations in written English are stroked by awkward, tiring, time-consuming finger reaches and hurdles on the present keyboard. Four per cent of the time, the typist must repeat taps with the same finger; a full sixth of typing consists of hurdles or stretches across the middle row or home row; frequently the entire hand idles while the other does double duty. As a results of the above facts, they quite naturally concluded the difficulty lay in the arrangement of the letters on the keyboard.[19]

To overcome the handicaps of the universal keyboard, Dvorak and Dealey proposed a simplified keyboard in which the letters most used are on the second bank of keys. Seventy per cent of all words are written without reaching

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[18] Willis L. Uhl and August Dvorak, op. cit., p. 41.

[19] August Dvorak and William L. Dealey, "New Typewriter Keyboard is Proposed as Speedier." Management Methods, 62:218, May, 1933.

up or down. The vowels, together with the least used consonants, are concentrated on the left side of the keyboard so that no word can be typed with the right hand alone. There is a play between the opposite hands, less faltering, and all hand and finger loads are evenly balanced. The "rearrangement reduces the underlying interference by 85 per cent in the direction of more relaxed, rapid, and accurate typing, learned in less time."[20]

The simplified keyboard has been used with experimental groups in the University of Washington. The usual student achievement of one semester of training is fifty net words per minute.[20]

The earlier study of the improvement of speed and accuracy in typewriting by means of a revised keyboard was made by Hoke in 1922. He approached the problem by investigating (1) the frequency of occurrence of the letters in the alphabet, (2) the number and distribution of errors, (3) the relative abilities of the eight fingers, and (4) the loads or burdens of work for each hand.[21]

An investigation of four diverse vocabulary studies showed that the letters of the alphabet occurred according to frequency in the following order: e, t, a, o, s, i, n,

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[20] Willis L. Uhl and August Dvorak, op. cit., p. 42.

[21] Roy Edward Hoke, op. cit., p. 9.

r, h, l, d, c, u, m, y, b, p, w, f, g, v, k, j, x, q, z.[22]

As a result of a study of the number and distribution of errors, Hoke found frequency of use and accuracy, and infrequency of use and inaccuracy seemed to go hand in hand.[23]

The results of the tapping tests used to determine the relative abilities of the eight fingers showed that the eight fingers have about the same rank and relative ability for the two sexes; letters can be tapped more rapidly with the right hand; the j and k fingers are the fastest on the right hand, whereas the e and f fingers are the quickest on the other hand.[24]

On the basis of frequency of occurrence of letters, the left hand had a heavier load. As a result of this and the other findings, Hoke developed a so-called scientifically arranged keyboard. A copy of this keyboard may be found in Appendix A on page 154.

Although there are some who would improve typewriting instruction by revising the keyboard, there are others who accept the present arrangement of keys and propose improved methods of presentation as the solution to the problem.

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[22] Ibid., p. 12.

[23] Ibid., p. 23.

[24] Ibid., p. 26.