

The Research and Design of More Legible and Readable Key Legends for school children while operating Chinese computer keyboard

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For school children users, mostly less skilled in keying or unfamiliar with the keyboard, most key legends are important since a major proportion of the time is spent looking at the keyboard. The key legends need therefore to be as explicit and easy to understand as possible. In the initial experiment, we sampled twenty-one school children users to simulate the situation of computer keyboard operation. All subjects were requested to view the different designed key legends on the key-tops. We tried to find out the best Chinese character attributes including the style, shape, stroke width, size, and the location relationship on the computer key-tops. In the following experiments, we then adopted the well-known Chong-Je Keying words and tried the illegible Chinese keying words for the reference of related product designers.

INTRODUCTION

According to past surveys, the methods of Chinese character input are Chinese 3-code method), Chong-Je method, Triangle-code method and big-letter-keyboard method. By the survey of the Institute for information Industry, the degree of satisfactory using keyboard by 58 user-firms are still not very high. (The Institute for Information Industry of R.O.C.,1982; Hsu, et al.,1999)

The results above illustrate that there is still a room for improvement in keyboard design. Because of the limits of capital and labor and time, the thesis merely pinpoints the typography of Chinese character and carries on a series of ergonomics experiments, then gives the Chinese computer keyboard designers some suggestions on applied design criteria.

EXPERIMENT (I)

Basic Theory and Experimental Apparatus

Theory. Compare the shortest time required to distinguish the characters on keys so as to find their readabilities. Then based on the frequency of misread of each character by the candidate to find the distinguishability. (Laubli, et al.,1981 ; Gunnarsson, et al.,1983 ; Swanson, et al.,1997)

Method. Time the period required to read a character

by the candidate with the shutter control timer of camera. (Fletcher,1982 ; Treaster, et al.,2000)

Experimental Typography of Character. Based on the analysis of the present typeface, we come to a conclusion of a set of reasonable characters compose of assemblies of different sizes, line widths and typefaces. There are 6 groups: (1). Chinese extra bold extended 1 ; (2). Chinese light bold extended 1 ; (3). Chinese extra bold extended 2 ; (4). Sung light extended 1 ; (5). Chinese black extended 2 ; (6). Chinese light extended 1. Each group has 26 characters. It includes all the character roots of Chong-Je method. We want to find the most optimum style and size proportions of characters by these 6 groups of characters. Select 3 best representatives out of the 6 groups. Fix the proportions of length to width at "extended 2" which is then evolved into 5 kinds characters of different sizes so as to find to the optimum size. There are merely 10 words in this set of characters. There is no need to include all the 26 words because the sole aim of the experiment is to define the optimum size. Only 10 representatives selected are enough. (Pollard,, 1979 ; Springer,,1982 ; Murata,, 1982 ; Caivano, 1998) .

Apparatus. Camera tripod, computer desk, computer chair, eye-weariness meter, model of keyboard in acrylic board, stickers of required characters

Experimental Procedure

Place. Computer room of ID Department in the National Cheng Kung University

Number of samples. nine school children six male, three female, age 9-12 yr, rehabilitated eyesight is 1.2) selected from Tainan Municipal Shin-Li Primary School. They were consented by their parents prior to the experiment and carefully instructed by school computer teachers.

Procedure. Weariness of sighting is measured before and after the experiment to compare their difference. If the increment is large, the experiment would be performed part by part to prevent overload of the eyes then give deviated results. Candidate keeps his eyes to the camera as close as possible. When he is ready, he presses the shutter. As the shutter curtain opens, he can see the experimental character. Shutter speed begins from 1/1000 sec. Open for twice. If the character cannot be recognized, adjust the shutter speed to 1/500 sec., repeat for 2 times, and so on till the character is read. (Hsu, et al., 1999) If any misread happens, record the character misread.

Results

Total number samples were nine school children. Each was tested for three hundred and six character variables. Results of the first experiment are interpreted as below:

1. The weight listed in the table is the weight of the shortest recognition time at which over 1/2 of the total candidates can distinguish the character (e.g. weight of "xx" of 1 Chinese extra bold extended 1 is 4. In other words, five or more out of nine candidates could recognize the character during the shutter speed of 1/1000 second.)

2. The thresholds of flashes distinguishability before and after the experiment drops within 0.5%. (i.e. if the threshold is 40 before experiment, then after that the value may fall between 38 to 40) The phenomenon is inconspicuous. The test of eyes weariness proved that the experiment was carried on in a constant eyesight circumstance of the candidates.

3. By learning, the shutter speeds in the rear half of the experiment were usually faster than that of the front half. However, for each individual, the sequence of character set was different, and the characters did not follow a fixed succession. Then learning did not affect the experimental results.

4. From the results of the first experiment, it is clearly shown that: (1) The readability of Sung Style in group 4 is worse than that of Chinese bold and Chinese bold expanded. In the results obtained from the experiment, the weighted

scores of Sung Style, A, B, C, D & E are less than the others in level A, B, C, D, E. (2) The comparison between 3 Chinese extra bold extended 2 and 5 Chinese black extended and that of the 2 Chinese light bold extended 1 & 6 Chinese light black extended 1, the differences of weighted scores are 5 and 2. It is so inconspicuous that the readabilities of Chinese extra bold and Chinese black are assumed to be the same.

5. The comparison between 1 Chinese extra bold extended 1 & 3 Chinese extra bold extended, 2 and that of 2 the Chinese extra bold extended 1 between 5 the Chinese black extended 2, the differences between the weighted scores are 3. Then the readabilities of the characters in extended 1 and extended 2 are probably similar.(due to the similar readabilities of the Chinese black and Chinese extra bold extended 1 and the Chinese black and Chinese black and Chinese bold are considered to be the dependent variables).

6. The comparison between 1 the Chinese extra bold extended 1 and 2 the Chinese light bold extended 2, and that of 2 the Chinese extra bold extended 1 and 6 the light black extended 1. the differences are 8 and 6, their readabilities are quite unique to each other. It shows that the Chinese extra bold are more readable than the Chinese light bold.

7. In the case of the size, A & A are most suitable, their dimensions are: height x width =0.43cmx0.35cm

Discussion and Suggestion

Among the input methods of Chinese computer nowadays, the phonetic method is regarded as the most suitable one for the nonprofessional user. The phonetic method consists of phonetic symbol method and the Roman alphabet method. The advantage of the phonetic symbol method is that everyone finished the country education can learn it easily. The key should be reorganized, however, (Subject to this, some Taiwan ergonomic specialists have already been researched at present.) About the advantage of the Roman alphabet input method, present keyboard can be used directly. Its drawback is that the user has to learn the Chinese phonetic method first. Because the alphabet input method utilize English keyboard, there are already so plenty literature information about it that we make use of the typeface of input method in the typographic input method for the experiment.

For novice school children, the readability and distinguishability of typeface on keyboard are especially important. To improve the readability and distinguishability

of typeface on keyboard not only enhance the efficiency of keyboard operation but also eliminate eyes' weariness and the input error during operation (Nylen,1985 ; Grandjean, et al.,1984 ; Downton, et al.,1998) .

After the prolong experiment (I), some suggestions about keyboard design are listed below:

1. The typeface on keyboard should be Chinese extra bold. The readability of Sung typeface is worse than that of Chinese bold and Chinese extra bold. And so it is discarded. The Chinese extra bold is more aesthetic more compatible with the environment and more acceptable by people than the Chinese bold. And so the former is better.

2. The ratio of weight to width of the character type is 0.45:0.35. Although the dimensional ratio does not greatly affect the readability of the character type, in the economic aspect, that on the key should be approximately 1: 1, if some esthetic factors are considered, the ratio should be lengthened to 0.45:0.35.

3. Thicker character type on keyboard is more acceptable. Generally, keys are gray and character types are black. Thus the letters should be thicker to prove better readability.

4. The characters that would be easily mixed up and mistaken should be redesigned to demonstrate its own characteristics so as to eliminate error.

5. "—" is too simple to be notice. Thus its thickness is considered to be increased. On the contrary, for the complicated and clumsy characters, thickness should be reduced.

6. The closed characters are more readable. The loose and open characters may lead to be misread. Therefore they should be pinpointed in further redesign.

7. English letters on the upper left, the Chinese characters on the lower right, are the commonest locations at present. It is also proved to be reasonable.

8. Based on the research and analysis above, the rational pattern obtained is illustrated below:

(1) The Chinese extra bold.

(2) Height x width=0.43cmx0.35cm.

(3) English letters on the upper left corner, the Chinese characters on the lower right corner.

9. The Chong-Je character roots that are easily misread should be redesigned.

EXPERIMENT (11)

Based on the previous experiment, we proposed to improve the character roots which are usually misread.

Basic Theory and Method

Experimental theory. Make use of the timer of shutter in camera to investigate the distinguishabilities of the 6 characters that are easily misread in the keyboard of the Chinese computer. The shorter the time of recognition, the better are the readability and distinguishability of the character.

Experimental procedure.

1. Well prepare the experimental instruments (such as camera, tripod, testing paper strips of keyboard mockup) Confined the controllable variables in the laboratory, like indoor illumination, distance and angle between camera and keyboard (procedures similar to experiment (I)).

2. Insert the paper strips into the keyboard. Removed lens and open film case. Adjust shutter speed to 1/1000 sec. Operator took at the character on keyboard during the period of shutter speed set. One character each time. (total 13 groups of characters, each group contains 6 words)

3. Examiner continues to change the characters on keyboard to eliminate the subjectivity of candidate during reading. If the shutter speed is too fast to read the character for 2 successive trials, the speed should be lowered by 1 level (to 1/500 sec) until the character is recognized.

4. Candidates are asked about the preferred forms of characters and are recorded in detail. The misread words are especially listed.

5. Based on the experimental record, evaluate the characteristics of each group. Make use of the ranking table (the shorter the period of recognition, the higher the weighted score) List out the weighted scores of each group. Get down to practicalities of the group with highest scores and work downwards.

6. Eliminate the mis-designed characters. Select the most appropriate group of character to be the suggestions of redesigned. The record formats of tested subjects are illustrated in Table 5.

Design of testing characters.

6 Easily misread characters are redesigned to become more readable and distinguishable. 13 groups are set. The dimension of character is 0.43cmx0.35cm. They are distinguished from one another.

Results

twelve school children were examined. Each was tested with 6 Chong-Je words of 13 groups of different typefaces. The

statistical analysis shows that the distinguishability of group 2 typefaces is the highest and it is followed by group 13.

Discussion and Suggestion

1. From the results of experiment (II), group 2 typefaces have the best distinguish-abilities and readabilities. Based on the typefaces on group 2 and evaluate the 13 groups of characters.

2 The typefaces chosen for the experiment are based on the origins of characters. If the candidate is not experienced "learning" (for example: understand that "|||" stands for the meaning of "水". The recognition test would be a hard task).

3 Every candidate has different sight. The data therefore obtained differ considerably. Despite the former fact, relative comparison was used during the experiment, i.e. each individual would have an unique distinguishability of words. From experiment, i.e. each individual would have an unique distinguishability of words. From their relative distinguishabilities, the optimal typeface was obtained. The liability of the experiment was then retained.

4. Based on the results of market survey, the "typefaces" on the "Chinese phonetics stickers" utilized by the computer companies at present have not taken the distinguishabilities of words into considerations. Therefore we recommend that the typefaces should be standardized to suit the optimum. That curve surface on key should also be standardized.

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