ELDERLY VISION ON LEGIBILITY OF THAI LETTERS PRESENTED ON LED PANEL

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ABSTRACT

Some of Thai letter differ from their similar letter only the length of the letter tail or the gap inside the letter. Presenting Thai letter on LED panel may cause the difficulty for elderly people to discriminate the letters, because the glare from the bright part (text itself or background) of LED panel may obscure letter details. The objective of this research is to investigate the legibility of Thai letters presented on the LED panel with the real and simulated elderly people. The stimuli were sets of Thai letters varied on their size. The letters were black and presented on white background. Subjects were asked to read the random letters. We found that result of the young and the simulated elderly are quite similar whereas the smallest legible letter size of the real elderly is larger than those of two groups.

INTRODUCTION

LED panel is now widely used to present information because the LED panel can present variable and up-to-date information. Since the LED panel is self-emitting source, no additional projected light is required even if the LED is used to present information in dark place. Figure 1 shows an example of Thai letters. Thai letters in the above line are quite similar to the below letter in the same column. The difference between these pairs is only the direction of letter head, or the existence of letter head or the gap inside the letter. When Thai letters are presented on the LED panel, there is not much difficulty for young people to read it. However, elderly people possibly suffer than young people because the elderly vision suffers from scattered light due to cataract in their eyes. The glare from the bright part of the LED panel may obscure letter's details. To help the elderly see Thai letters clearly, larger Thai letter size is possibly required. The objective of this research is then to investigate the legibility of Thai letters presented on the LED panel. Thai letters varied on their size were presented to the young and the elderly. They were asked to read the random letters under a dark or bright environment.

ส ก ค ม พ ช ร
ล ถ ด น ฟ ซ ธ

Figure 1 Example of similar letters

METHODOLOGY

Apparatus

The schematic diagram of apparatus was illustrated in Figure 2. Two rooms (subject room and test room) were separated by a wall with a square aperture. Both rooms were covered by black curtain in order to avoid undesirable light from outside. An LED panel (Toshiba LED40PU200T) was placed in the test room and connected to a PC via HDMI cable. This LED panel was used to present stimuli in this experiment. In the subject room, the inside wall was covered with white wall paper. A set of intensity-controllable fluorescent lamp was attached on the ceiling. The subject room illuminance was measured by Minolta CL-200A placed on the shelf closed to the front wall. On the front wall, there was a 5 cm × 30 cm aperture placed at the subject eye's level. The distance between the front wall and the subject's eye was fixed at 2 m. A cataract experiencing goggle is used to simulate elderly vision. The cataract experiencing goggle is made from three filters (58% transmittance filter, 14% of haze values filter and yellow filter. [1]

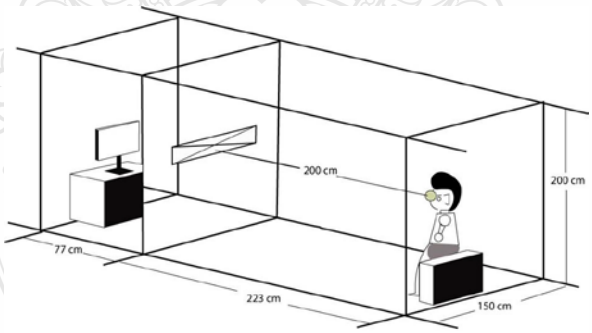

Figure 2 Schematic diagrams of the apparatus

Subjects

Ten undergraduate students (age: 22-25) and three elderly (age: 55-59) were participated in this experiment. All subjects had normal or corrected to normal visual acuity.

Experimental Conditions

The experimental conditions consisted of two levels of subject's room Illuminance (0 and 300 lux). Five letter's size is selected in this experiment. The RGB values of text and background are "0, 0, 0" and "255, 255, 255", respectively. The stimulus is a line of ten Thai letters which are randomly selected.

Experimental Procedure

The subject was asked to complete two tasks in two separated session. The first task is reading task. The experimenter set one of two illuminance level for each experimental session. One subject was asked to sit in the experimental room and look around inside the room for two minutes. After two-minute adaptation, a line of ten random Thai letters was presented. The subject was asked to read each letter. The experimenter will record %correction of each line. After finishing, a new line of ten letters with different letter's size is presented. The procedure is repeated until all letter's size is tested.

RESULT AND DISCUSSION

Figure 2 shows relationship between Thai letter size and percentage of correct responses from the young (square), the simulated elderly (circle) and the elderly (triangle). The solid line and dashed line represent the results when the subject room's illuminance is set at 0 lux and 300 lux, respectively. To compare between results of the young and the simulated elderly who are the young wearing cataract experiencing goggle, the results are quite similar. The percentages of correct response of the simulated elderly are slightly lower than those of the young. When the effect of the subject room's illuminance is considered, both groups of subject show just slightly better reading performance under dark room than under bright ambient illuminance. Our result agrees well with previous research. Waleetorncheepsawat [2] applied two-room technique, where the letter chart is illuminated independently from the light illuminated in the subject room, in his legibility test. He found that the reading performance of the simulated elderly is improved and nearly equal to the reading performance of the young. Our experimental setup then can be compared to Waleetorncheepsawat's two-room technique that presenting letter on LED panel, which is a self emitting source is similar to presenting letter chart with independent illuminance in the test room in his condition. Our result, therefore, show the same tendency as Waleetorncheepsawat's result. Both groups require the same letter size to maintain the legibility of letter on LED panel.

When the elderly participated in this experiment, the results of the elderly are quite different from both previous groups. The percentage of correct reading suddenly decreases when letter size changes from 0.20◦ to 0.18◦. At the 0.18◦ letter size, the performance of the elderly is only around 15% correct compared to around 50-65% correct of the simulated elderly's reading. To compare between dark room and bright room condition, we found that the legibility of letter is similar when letter size is smaller than 0.20◦. When the letter is larger than 0.20◦, the letters are more legible under the dark room than under the bright room.

Note that there is significant difference between the result of the elderly and the simulate elderly in our experiment. This difference is possibly due to the imperfect simulation of elderly vision by the cataract experiencing goggle. Since the cataract experiencing goggle was developed to simulate elderly vision on color, we are not sure that the goggle can perfectly simulate the elderly vision in legibility test. It is, therefore, interesting to improve the cataract experiencing goggle for use in legibility test.

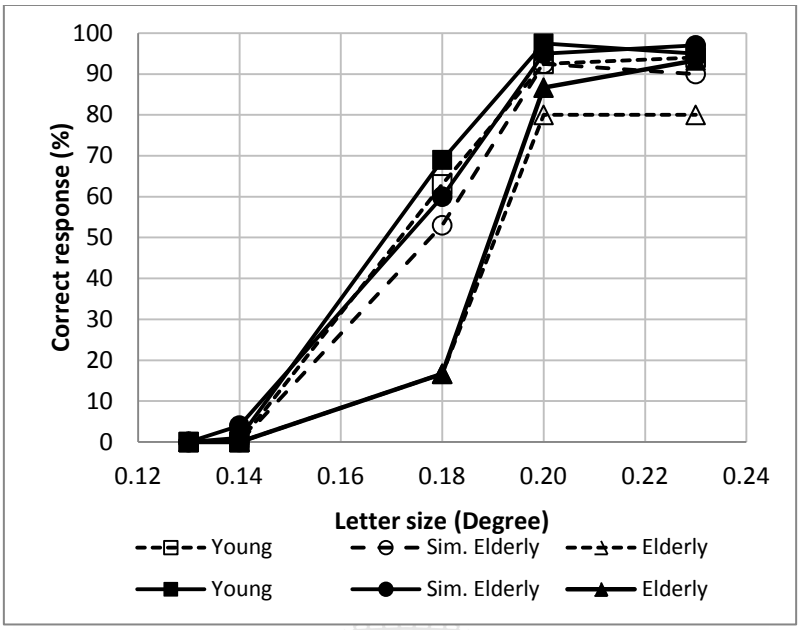

Figure 2 Average % correct response. Solid lines and dashed lines represent results under 0 and 300 lux illuminance, respectively.

CONCLUSION

Our results indicated that the minimum legible letter size for the elderly is larger than those of the young. The minimum letter size should be larger than 0.18◦. We will conduct further experiment to confirm the exact recommended letter size not only in term of legibility but also reading comfort in order to standardize the use of Thai letter on LED panel.

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