Proceedings of the 2011 International Conference on Industrial Engineering and Operations Management
Kuala Lumpur, Malaysia, January 22 – 24, 2011

Study on the Visual Identifiability of Taiwan Doorplate Designs

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ABSTRACT

Doorplate design in Taiwan is not unified, and is regulated by local governments. The results of field investigations and research demonstrate that green/white and orange/white combinations, which are commonly used in Taiwan, are not the best identifiable design. In fact, according to the findings, the black/white combination has the highest identifiability, followed by blue/white, while the orange/white is the lowest. A higher value gap between the foreground color and the background color indicates a higher visual identifiability, which would reduce the probability of wrong identification. In addition, research also indicates a positive correlation between identifiability and readability. Thus, this study suggests that the color value gap of doorplates should be a priority of design, followed by color saturation, and the blue/white combination is the best doorplate design for identification.

Keywords: identifiability, color

1. Introduction

In the 21st century, besides exploring better living environments for humans, researchers also strive to utilize the advancement of technologies to serve toward the human needs. With plentiful reading materials available, researchers also aim to create better efficacy of identifiability and readability. Most past studies focus on the basic factors of color and typeface. For instance, Macdonald (1990) attempted to determine how to effectively display color in computers[4]. Garcia, & Caldera(1996) probed into the readability of color and typeface in computers[2]. Familant, & Detwiler (1995)focused on the fatigue caused by color combinations[2]. Zhao, Rau, Zhang, and Salvendy, (2009)conducted study on images and color design, with particular focus on the aged or those suffering from amblyopia. Findings of such studies on identifiability and readability provide reference for designers when designing new products[5]. Moreover, researchers would treat color, typeface, and speed as variables[1-2], as humans and animals should have the ability to identify objects in order to survive in their surrounding environment. The color and sizes of objects directly influence the precision of identifiability. Thus, when elaborating on identifiability and readability of vision, researchers tend to treat color and size as variables.

This study discusses the identifiability of doorplate design in Taiwan, as it is a common experience to search for doorplates. In addition, there is no standard doorplate design in Taiwan, and doorplates are regulated by local

governments. Thus, different doorplate designs can be seen in different counties and cities. Through field investigation, this study intends to propose improvements for doorplate design. In addition to color and size mentioned in the above researches, humans' motion perceptions and reading abilities should also be factors. Motion perception refers to humans' interpretations and judgments of objects in motion as seen in the environment, as well as the speed and direction of the motion. When individuals perceive objects in motion, the identification time of vision becomes longer and precision is decreased. Using driving or walking as examples, visual focus is distracted by motion, which reduces the precision of identifiability. Thus, the time required for identification is extended beyond the 300 ms required for stationary objects. Huang, Rau, and Liu, (2009) found that in the motions of Chinese characters, the different sizes of typeface would influence reading and examination reactions[3]. Thus, this study limits the speed to 1 sec and the view to 60° to simulate the human eye searching for doorplates while in motion, and reduces extraneous variables and visual distractions with a white background. In literature, reading ability includes two areas, namely, the ease of reading and readability[6], which cannot be exactly divided. Thus, this study focuses on readability and the computer display explored in most research, and treats participants' comprehension of typeface as sample design.

The typeface arrangements of doorplate designs in Taiwan are mostly the same, while the color combinations differ. Therefore, this study aims to probe into the effects of color combinations and sizes on doorplate identifiability. The purposes are as follows 1) to study the effects of color combinations on identifiability; 2) to study the effects of sizes on identifiability; and 3) to study whether participants of different genders show different levels of identifiability for color combinations and sizes.

2.Methods

2.1 Research method and procedures

This study adopted the experimentation method. The participants were asked to answer questions after reading the samples displayed on computer screen in order to find out the identifiability effects of different color combinations and sizes of doorplates in visual motion. The experiment involved two stages. The first stage explored the effects of five color combinations on identifiability, and the second stage probed into the precision of colors and sizes on identifiability. There were 16 participants, including 6 males and 10 females between 21-25 years old. The data were analyzed by SPSS for descriptive statistics, One-way ANOVA, and post multiple-model testing.

2.2 Sample design

The doorplate designs in Taiwan are based on combinations of foreground and background colors. White is the common background color, while the foreground color is determined by local governments. According to the field investigations, common foreground colors include green, blue, orange, and red (Table 1). Besides the above colors, this experiment also included black as a foreground color. Regarding size, three sizes were used as distance variables, namely, 100%, 125%, and 150% (Table 2). The speed of motion was set as 1 sec. The experimental location was a computer classroom, where each participant was assigned to complete the test on one computer. The participants were required to gaze face up at the screen of the computer. After the experiment, each participant received one small gift.

The first stage of the experiment studied the effects of the five color combinations on identifiability. The test contained 15 questions, and the participants were asked to answer the questions based on their personal feelings, on a perception scale of 1-7 (1=very poor identifiability and 7=very good identifiability). The second stage examined the identification precision of color and sizes, where the evaluation was based on the correct selection of names and numbers of roads. There were three kinds of designs, namely, 1) changes of names of roads: randomly select the typeface with the same number of strokes; 2) changes of numbers: select the numbers randomly; and 3) changes of names and numbers of roads for a total of 45 questions (Table 3).

The film was design using Adobe Illustrator CS10.0, and exported into the Adobe After Effect to convert into a DVD format.

Table 1 Design of color variable

Black	Red	Green	Orange	Blue
				
R0 B0 G0	R255 B0 G0	R0 B0 G255	R255 B0 G125	R0 B255 G0

Table 2 Design of size variable

100%	125%	150%
		

Table 3 Design of questionnaire options

Change the option of road name	Change the option of number	Change options of both road name and number
		

3. Results

This study probes into the effects of different color combination sizes in order to identify doorplates during visual motion. Experimental figures and analysis are shown below.

3.1 Effects of five color combinations on identifiability

This study discusses the effects of color combinations on identifiability, and conducts variable analysis and the Scheffe method on the results.

According to Table 4 and Table 5, evaluations of participants' perceptions of black, red, green, orange, and blue reveal significant differences. The identifiability of black is the highest, followed by blue, and orange is last. According to Table 6, in the Scheffe method, black is significantly different from red, green, and orange; red is significantly different from black, orange, and blue; green is significantly different from black, orange, and blue, while orange is significantly different from black, red, blue, and green; and blue is significantly different from red, green, and orange.

Table 4 Narrative statistics for color identifiability evaluation

	Mean	Sd	N
Black	6.14	0.16	3
Red	5.35	0.13	3
Green	5.35	0.20	3
Orange	4.52	0.03	3
Blue	5.81	0.06	3

Table 5 Variance analysis for color identifiability evaluation

		Sum of squares	Freedom	Mean sum of squares	F-test	Significance
Color analysis	Intergroup In group Total	4.47876 0.176 4.65476	4 10 14	1.11969 0.0176	63.61875	.000

Table 6 Scheffe multiple test for color identifiability evaluation

	(I) Color analysis	(J) Color analysis	Mean difference	Standard error	Significance
Scheffe	Black	Red	0.79	0.11	.00*
		Green	0.79	0.11	.00*
		Orange	1.62	0.11	.00*
		Blue	0.33	0.11	.12
	Red	Black	-0.79	0.11	.00*
		Green	-1.7763568394e-	0.11	1.00
		Orange	0.83	0.11	.00*
		Blue	-0.46	0.11	.03*
	Green	Black	-0.79	0.11	.00*
		Red	1.7763568394e-015	0.11	1.00
		Orange	0.83	0.11	.00*
		Blue	-0.46	0.11	.03*
	Orange	Black	-1.62	0.11	.00*
		Red	-0.83	0.11	.00*
		Green	-0.83	0.11	.00*
		Blue	-1.29	0.11	.00*
	Blue	Black	-0.33	0.11	.12
		Red	0.46	0.11	.03*
		Green	0.46	0.11	.03*
		Orange	1.29	0.11	.00*

3.2 Identification precision of color and sizes

This study probes into the identification precision of color and sizes, and conducts variable analysis and the Scheffe Method on the results.

According to the figures, sizes do not reveal significant differences in participants' perceptions($F=1.68$，$p>.0005$). In addition, color does not reveal significant differences($F=3.49$，$p>.843$), thus, the table is not shown. .

3.3 Difference of male and female participants

According to the results, in analysis of the first stage, female and male participants do not reveal significant differences($p > .05$). In analysis of the second stage, they do not show significant differences($p > .05$) , thus, the table is not shown.

4.Conclusion and suggestions

This study uses color combinations and sizes as variables to discuss the visual identifiability. The results are as follows.

1. According to analysis on color, there are significant differences among black, red, green, orange, and blue. The black/white combination has the highest level of identifiability, followed blue/white, while the lowest is orange/white. Therefore, a higher value contrast of a color combination indicates a higher visual identifiability. The results are consistent with Garcia & Caldera(1996) and Charness & Bosman (1990), that a higher contrast is more readable[2, 5]. Similar to the findings of Isamu Tsukada (1983), this study found that black/white has the highest identifiability, followed by blue /white[7]. This study infers a correlation between identifiability and readability. A higher identifiability indicates a higher readability. Therefore, when designing doorplates, value gaps between foreground and background colors should be enhanced in order to increase the readers' identifiability and readability. It is suggested to design doorplates of blue/white combinations because black/white combination may be easily influenced by light sources, such as street lights at night. In addition, old doorplate designs in Taiwan included blue /white combinations (background color is blue and foreground color is white), which is different from the current doorplate formats, thus, they were not compared in this study.
2. Most of the participants could correctly identify doorplates. Thus, it is suggested that future research can probe into both color combinations and speed.
3. Male and female participants do not reveal significant differences on identification reactions. Therefore, their identifiability of color combinations and sizes is not different.

This study is exploratory research, and had some limitations, and suggests that future studies can discuss changes of speed, and treat the speed within one second as the variable. Regarding color, future studies can include other color combinations or simulate identifiability differences between night and day. In addition, the actual sizes of the samples can be directly displayed by projection, which could better meet reality. As to the identifiability of Chinese characters, this can include strokes and difficulty of meanings in order to result in the best design.

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