COLOR PREFERENCE OF THE KOREAN ELDERLY

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ABSTRACT:

Color is believed to be a significant factor for products and environments because human beings are emotionally affected by colors although color adds almost no functional or additional value. Recently elderly persons have been studied widely because of a rapidly increasing aged population in developed countries. However, color preference should be studied in more detail. Five hundred Korean elderly persons, in this study, participated in a survey to investigate color preference of the Korean elderly. The survey was conducted by a survey agency and participants were selected in Seoul and Busan, Korea. Favorable and unfavorable colors of the elderly were analyzed based on their ages and lifestyle by employing sensibility engineering methodologies. Designers and marketing professionals can utilize the results of this study to design emotionally appealing products and environments.

1. INTRODUCTION

Consumers are emotionally affected by the appearance of products and environments. Color is actually believed to be a significant element differentiating consumer products although color adds almost no functional or additional value. Mahnke (1996) reported that people will associate colors with emotions. The color red stimulates excitement and strong emotion. Orange expresses energetic, lively and an extroverted sense. Yellow represents hope, wisdom, and expansive feeling. Blue delivers a clean and quiet emotion. Green evokes a natural, quite, and refreshing image. These feelings are evoked by either single colors or color combinations and often called color emotions (Ou et al., 2004a).

It is well known that color emotions are influenced by gender, age, and cultural background (Hupka et al., 1997; Manav, 2007; Shoyama, 2003). Geographic and cultural elements can affect color preference (Saito, 1996). The age-related decline in visual abilities has been observed (Kline and Scialfa, 1997; Sanders and McCormick, 1993) and the reduced visual ability of the elderly can cause color confusion and difficulties in daily activities (Ishihara, 2001).

Color emotion and preference have been studied for single colors (Ou et al., 2004a) and color combinations (Ou et al., 2004b). Color combinations have not been studied as extensively as single colors even though our environment consists of many colors (Camgöz et al., 2002). Camgöz et al. (2002) found that brighter and more saturated colors are preferred on bright and saturated backgrounds. Many researchers also insisted that brighter and more saturated single colors are preferred (Camgöz et al., 2002).

Recently seniors have been studied much because of the increasing elderly population and their potential purchasing power. Shoyama et al. (2003) compared clothing color preference between elderly and non-elderly Japanese and Korean women. This study indicated Japanese consumers preferred red and grayish-orange apparel whereas Korean consumers preferred cold hues and achromatic colors. Saito et al. (2006) observed that aged persons are affected more by the contrast of colors compared to the chromaticity. Color perception is, however, not much influenced by age (Wijk, 2002).

Despite increased attention and concern for the elderly, the color perception, cognition and preference of seniors have not been studied enough (Wijk, 2002). In this study, color preference of the Korean elderly will be investigated. Favorable and unfavorable color will be compared. This study is part of a larger study : Color Design Study of The Elderly and Online Application Project" researched by The Universal Design Research Center at Kyungsung University. The entire study includes analysis for the preference for single and multiple colors, product colors, apparel colors and development of a web application to utilize this research for color designers and marketing experts.

2. METHOD

The survey was designed to produce useful and practical color information that can be applied to a product plan and color development for surroundings. The survey was conducted in Seoul and Busan, Korea because elderly persons living in large cities were assumed to have more interests in color and more consumer products available to them. Total of five hundred seniors from the two most populous cities in Korea participated in the survey. Table 1 represents age, gender, and geographic information of the participants.

Table 1. Participants of the survey

Age	Gender	Seoul	Busan	Total
60~64	Male	60	40	100
	Female	60	40	100
65~69	Male	40	20	60
	Female	40	20	60
70~74	Male	30	20	50
	Female	30	20	50
75+	Male	20	20	40
	Female	20	20	40
TOTAL		300	200	500

A color list and questionnaire were developed for the survey. The color list was composed of 120 single colors and 40 color combinations (Figure 1 and 2). RGB (Red, Green, Blue) and CMYK (Cyan, Magenta, Yellow, Black) values for single colors are given in Appendix 1. The questionnaire consisted of five sections such as individual information, economic status, psychological status, lifestyle, and emotional feeling.
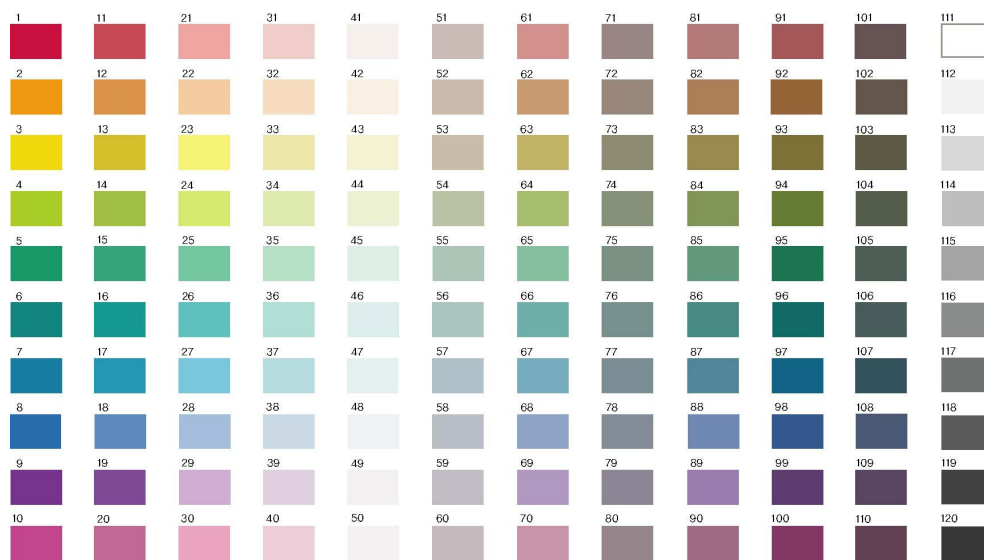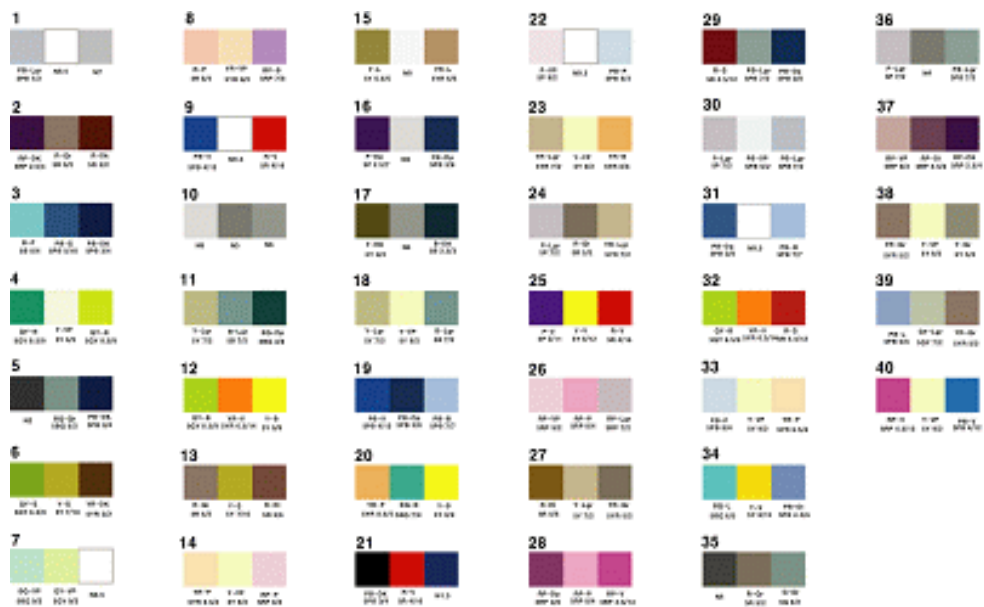

Figure 1. Single colors

Figure 2. Color combinations

Fashion and interior colors were also presented to subjects by using color image files and examined in the study although those results are not included in this article. Abbreviations were used to describe hue and tone in this study and they are given in Table 2.

Table 2. Abbreviations for hue and tone

Hue	Red	Yellow Red	Yellow	Green Yellow	Green	Blue Green	Blue	Purple Blue	Purple	Red Purple	
	R	YR	Y	GY	G	BG	B	PB	P	RP	
Tone	Vivid	Strong	Bright	Pale	Very Pale	Light Grayish	Light	Grayish	Dull	Deep	Dark
	V	S	B	P	VP	LGR	L	GR	DL	DP	DK

A professional survey agency, Focus Research Ltd. was selected among several candidate agencies by examining their experience and survey capabilities. Ten subjects participated in a pilot study to check the survey. Questions were then reduced and several questions were revised to be understood more easily. Before the actual survey, interviewers were trained. They surveyed individually at public places such as department stores, markets, and health care centers for eleven days.

3. RESULTS

The five most preferable single and combined colors were detected by employing simple frequency analysis (Table 3). Korean seniors preferred bright and pastel single colors and disfavored dark and gloomy colors. A reddish color (5R 4/16) was evaluated as favorable and as unfavorable simultaneously since many women assessed the color as favorable while many men disliked the color. Elderly men were observed to favor bluish colors and women preferred light reddish colors.

Table 4 represents favorable and unfavorable color combinations. Male seniors preferred light combinations while disliking dark combinations and strongly contrasting combinations. Elderly women favored pinkish and warm color combinations and disliked heavy and dark combinations. These colors and color combinations were not preferred by elderly men.
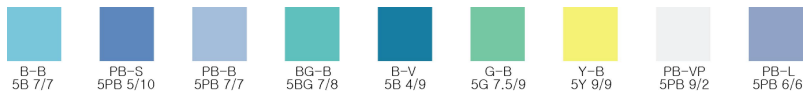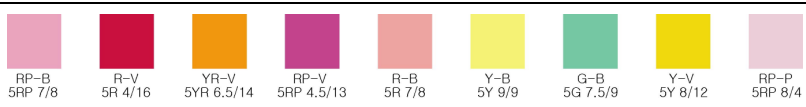
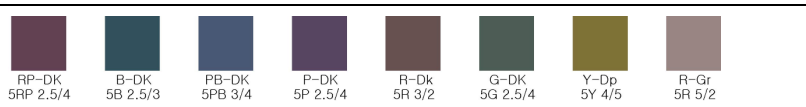Table 3. Single color preference of the elderly

Male	Favorable colors	B-B 5B 7/7	PB-S 5PB 5/10	PB-B 5PB 7/7	BG-B 5BG 7/8	B-V 5B 4/9	G-B 5G 7.5/9	Y-B 5Y 9/9	PB-VP 5PB 9/2	PB-L 5PB 6/6
	Frequency(%)	17.6	16.0	15.2	12.8	12.0	11.6	10.8	8.8	8.8
	Unfavorable colors	R-V 5R 4/16	RP-V 5RP 4.5/13	RP-DK 5RP 2.5/4	R-Dk 5R 3/2	B-DK 5B 2.5/3	RP-S 5RP 5/10	Y-V 5Y 8/12	R-S 5R 4.5/12	
	Frequency(%)	24.4	18.6	15.2	14.8	14.4	12.4	12.0	11.6	
Female	Favorable colors	RP-B 5RP 7/8	R-V 5R 4/16	YR-V 5YR 6.5/14	RP-V 5RP 4.5/13	R-B 5R 7/8	Y-B 5Y 9/9	G-B 5G 7.5/9	Y-V 5Y 8/12	RP-P 5RP 8/4
	Frequency(%)	27.6	24.8	22.8	18.8	18.0	15.6	14.8	14.4	14.0
	Unfavorable colors	RP-DK 5RP 2.5/4	B-DK 5B 2.5/3	PB-DK 5PB 3/4	P-DK 5P 2.5/4	R-Dk 5R 3/2	G-DK 5G 2.5/4	Y-Dp 5Y 4/5	R-Gr 5R 5/2	
	Frequency(%)	21.6	18.8	18.8	18.8	16.8	16.8	15.6	12.4	

Table 4. Color combination preference of the elderly
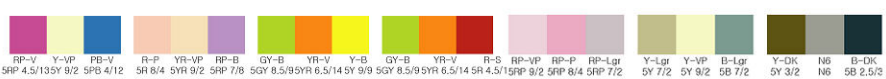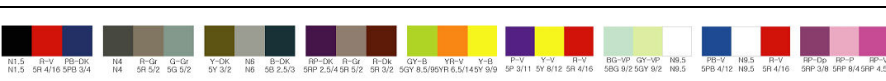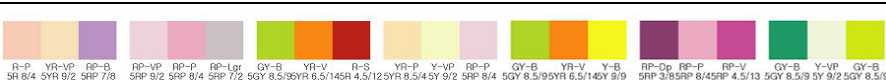
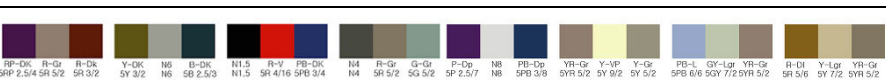|								
Male	Favorable combination	RP-V Y-VP PB-V 5RP 4.5/13 5Y 9/2 5PB 4/12	R-P YR-VP RP-B 5R 8/4 5YR 9/2 5RP 7/8	GY-B YR-V Y-B 5GY 8.5/9 5YR 6.5/14 5Y 9/9	GY-B YR-V R-S 5GY 8.5/9 5YR 6.5/14 5R 4.5/15	RP-VP RP-P RP-Lgr 5RP 9/2 5RP 8/4 5RP 7/2	Y-Lgr Y-VP B-Lgr 5Y 7/2 5Y 9/2 5B 7/2	Y-DK N6 B-DK 5Y 3/2 N6 5B 2.5/3
	Frequency(%)	18.0	17.2	17.2	17.2	16.8	16.4	16.0
	Unfavorable combination	N1.5 R-V PB-DK N1.5 5R 4/16 5PB 3/4	N4 R-Gr G-Gr N4 5R 5/2 5G 5/2	Y-DK N6 B-DK 5Y 3/2 N6 5B 2.5/3	RP-DK R-Gr R-Dk 5RP 2.5/4 5R 5/2 5R 3/2	GY-B YR-V Y-B 5GY 8.5/9 5YR 6.5/14 5Y 9/9	P-V Y-V R-V 5P 3/11 5Y 8/12 5R 4/16	BG-VP GY-VP N9.5 5BG 9/2 5GY 9/2 N9.5	PB-V N9.5 R-V 5PB 4/12 N9.5 5R 4/16	RP-Dp RP-P RP-V 5RP 3/8 5RP 8/4 5RP 4.5/1
	Frequency(%)	45.2	34.0	33.2	28.8	16.0	15.6	12.8	12.4	15.2
Female	Favorable combination	R-P YR-VP RP-B 5R 8/4 5YR 9/2 5RP 7/8	RP-V RP-P RP-Lgr 5RP 9/2 5RP 8/4 5RP 7/2	GY-B YR-V R-S 5GY 8.5/9 5YR 6.5/14 5R 4.5/12	YR-P Y-VP RP-P 5YR 8.5/4 5Y 9/2 5RP 8/4	GY-B YR-V Y-B 5GY 8.5/9 5YR 6.5/14 5Y 9/9	RP-Dp RP-P RP-V 5RP 3/8 5RP 8/4 5RP 4.5/13	GY-B Y-VP GY-B 5GY 8.5/9 5Y 9/2 5GY 8.5/9
	Frequency(%)	38.8	32.4	28.0	32.0	29.6	26.0	20.8
	Favorable combination	RP-DK R-Gr R-Dk 5RP 2.5/4 5R 5/2 5R 3/2	Y-DK N6 B-DK 5Y 3/2 N6 5B 2.5/3	N1.5 R-V PB-DK N1.5 5R 4/16 5PB 3/4	N4 R-Gr G-Gr N4 5R 5/2 5G 5/2	P-Dp N8 PB-Dp 5P 2.5/7 N8 5PB 3/8	YR-Gr Y-VP Y-Gr 5YR 5/2 5Y 9/2 5Y 5/2	PB-L GY-Lgr YR-Gr 5PB 6/6 5GY 7/2 5YR 5/2	R-Dl Y-Lgr YR-Gr 5R 5/6 5Y 7/2 5YR 5/2
	Frequency(%)	49.6	46.8	45.6	42.8	21.6	16.8	12.0	11.6

Table 5. Color preference of different age groups

<table>
<tr><td rowspan="4">60~64</td><td>Favorable color</td><td>R-V
5R 4/16</td><td>RP-B
5RP 7/8</td><td>YR-V
5YR 6.5/14</td><td>Y-B
5Y 9/9</td><td>BG-B
5BG 7/8</td><td>B-B
5B 7/7</td><td>RP-P
5RP 8/4</td><td>B-V
5B 4/9</td><td>G-B
5G 7.5/9</td><td>BG-V
5BG 4/9</td></tr>
<tr><td>Frequency(%)</td><td>16.5</td><td>16</td><td>14</td><td>14</td><td>12.5</td><td>14</td><td>12.5</td><td>12</td><td>12</td><td>12</td></tr>
<tr><td>Unfavorable color</td><td>RP-DK
5RP 2.5/4</td><td>R-Dk
5R 3/2</td><td>PB-DK
5PB 3/4</td><td>R-V
5R 4/16</td><td>B-DK
5B 2.5/3</td><td>P-DK
5P 2.5/4</td><td>Y-V
5Y 8/12</td><td>RP-V
5RP 4.5/13</td><td>R-S
5R 4.5/12</td><td></td></tr>
<tr><td>Frequency(%)</td><td>24</td><td>16.5</td><td>16</td><td>15.5</td><td>14</td><td>14</td><td>11.5</td><td>11.5</td><td>11.5</td><td></td></tr>
<tr><td rowspan="4">65~69</td><td>Favorable color</td><td>RP-B
5RP 7/8</td><td>G-B
5G 7.5/9</td><td>R-V
5R 4/16</td><td>B-B
5B 7/7</td><td>YR-V
5YR 6.5/14</td><td>BG-B
5BG 7/8</td><td>PB-B
5PB 7/7</td><td>Y-B
5Y 9/9</td><td></td><td></td></tr>
<tr><td>Frequency(%)</td><td>19.3</td><td>16</td><td>15.1</td><td>13.4</td><td>13.4</td><td>12.6</td><td>12.6</td><td>12.6</td><td></td><td></td></tr>
<tr><td>Unfavorable color</td><td>G-DK
5G 2.5/4</td><td>RP-DK
5RP 2.5/4</td><td>PB-DK
5PB 3/4</td><td>R-Dk
5R 3/2</td><td>R-V
5R 4/16</td><td>B-DK
5B 2.5/3</td><td>BG-DK
5BG 3/2</td><td>P-DK
5P 2.5/4</td><td></td><td></td></tr>
<tr><td>Frequency(%)</td><td>22.7</td><td>21</td><td>17.6</td><td>15.1</td><td>15.1</td><td>15.1</td><td>13.4</td><td>13.4</td><td></td><td></td></tr>
<tr><td rowspan="4">70~75</td><td>Favorable color</td><td>R-V
5R 4/16</td><td>RP-V
5RP 4.5/13</td><td>YR-V
5YR 6.5/14</td><td>B-V
5B 4/9</td><td>B-B
5B 7/7</td><td>RP-B
5RP 7/8</td><td>Y-B
5Y 9/9</td><td></td><td></td><td></td></tr>
<tr><td>Frequency(%)</td><td>19.8</td><td>17.8</td><td>16.8</td><td>16.8</td><td>15.8</td><td>16.8</td><td>13.9</td><td></td><td></td><td></td></tr>
<tr><td>Unfavorable color</td><td>R-V
5R 4/16</td><td>B-DK
5B 2.5/3</td><td>P-DK
5P 2.5/4</td><td>RP-DK
5RP 2.5/4</td><td>RP-V
5RP 4.5/13</td><td>PB-Dp
5PB 3/8</td><td>R-S
5R 4.5/12</td><td>RP-P
5RP 8/4</td><td></td><td></td></tr>
<tr><td>Frequency(%)</td><td>21.3</td><td>20</td><td>17.5</td><td>17.5</td><td>16.3</td><td>15</td><td>13.8</td><td>13.8</td><td></td><td></td></tr>
<tr><td rowspan="4">75+</td><td>Favorable color</td><td>RP-B
5RP 7/8</td><td>G-B
5G 7.5/9</td><td>YR-V
5YR 6.5/14</td><td>R-V
5R 4/16</td><td>B-B
5B 7/7</td><td>G-P
5G 8/4</td><td>B-P
5B 8/4</td><td>Y-B
5Y 9/9</td><td>R-B
5R 7/8</td><td></td></tr>
<tr><td>Frequency(%)</td><td>20</td><td>18.8</td><td>18.8</td><td>15</td><td>15</td><td>15</td><td>12.5</td><td>12.8</td><td>11.3</td><td></td></tr>
<tr><td>Unfavorable color</td><td>PB-DK
5PB 3/4</td><td>R-Dk
5R 3/2</td><td>G-DK
5G 2.5/4</td><td>P-DK
5P 2.5/4</td><td>B-DK
5B 2.5/3</td><td>Y-Dl
5Y 5/5</td><td>BG-DK
5BG 3/2</td><td>RP-V
5RP 4.5/13</td><td></td><td></td></tr>
<tr><td>Frequency(%)</td><td>23.8</td><td>17.8</td><td>17.8</td><td>16.8</td><td>16.8</td><td>15.8</td><td>15.8</td><td>10.9</td><td></td><td></td></tr>
</table>

Color preference for the different age groups of the participants was analyzed and is shown in Table 5. In general, seniors preferred bright and light colors and disliked pale and dark colors. Table 6 shows preference for color combinations. Those studied favored warm and light color combinations and disfavored dark and pale colors.

Table 6. Color combination preference of different age groups

60~64	Favorable combination	R-P 5R 8/4 / YR-VP 5YR 9/2 / RP-B 5RP 7/8	GY-B 5GY 8.5/9 / YR-V 5YR 6.5/14 / Y-B 5Y 9/9	P-V 5P 3/11 / Y-V 5Y 8/12 / R-V 5R 4/16	YR-P 5YR 8.5/4 / Y-VP 5Y 9/2 / RP-P 5RP 8/4	GY-B 5GY 8.5/9 / YR-V 5YR 6.5/14 / R-S 5Y 5/8	Y-Lgr 5Y 7/2 / B-Lgr 5B 7/2 / BG-Dp 5BG 3/8	P-Lgr 5P 7/2 / R-Gr 5R 5/2 / YR-Lgr 5YR 7/2	YR-Gr 5YR 5/2 / Y-VP 5Y 9/2 / Y-Gr 5Y 5/2
	Frequency(%)	27.5	25.5	22	20	19	14	13	13
	Unfavorable combination	N1.5 N1.5 / R-V 5R 4/16 / PB-DK 5PB 3/4	RP-DK 5RP 2.5/4 / R-Gr 5R 5/2 / R-Dk 5R 3/2	N4 N4 / R-Gr 5R 5/2 / G-Gr 5G 5/2	N2 N2 / BG-Gr 5BG 5/2 / PB-DK 5PB 3/4	Y-DK 5Y 3/2 / N6 N6 / B-DK 5B 2.5/3	RP-V 5RP 4.5/13 / Y-VP 5Y 9/2 / PB-V 5PB 4/12	P-Dp 5P 2.5/7 / N8 N8 / PB-Dp 5PB 3/8	P-V 5P 3/11 / Y-V 5Y 8/12 / R-V 5R 4/16
	Frequency(%)	43.5	39	38.5	35.5	29	19.5	16.5	16.5
65~69	Favorable combination	P-V 5P 3/11 / Y-V 5Y 8/12 / R-V 5R 4/16	R-P 5R 8/4 / YR-VP 5YR 9/2 / RP-B 5RP 7/8	GY-B 5GY 8.5/9 / YR-V 5YR 6.5/14 / R-S 5Y 5/12	YR-P 5YR 8.5/4 / Y-VP 5Y 9/2 / RP-P 5RP 8/4	GY-B 5GY 8.5/9 / YR-V 5YR 6.5/14 / Y-B 5Y 9/9	YR-P 5YR 8.5/4 / BG-B 5BG 7/8 / Y-B 5Y 9/9	RP-Dp 5RP 3/8 / RP-P 5RP 8/4 / RP-V 5RP 4.5/13	GY-B 5GY 8.5/9 / Y-VP 5Y 9/2 / GY-V 5GY 8.5/8
	Frequency(%)	29.4	26.1	23.5	23.5	20.2	18.5	18.5	18.5
	Unfavorable combination	N1.5 N1.5 / R-V 5R 4/16 / PB-DK 5PB 3/4	RP-DK 5RP 2.5/4 / R-Gr 5R 5/2 / R-Dk 5R 3/2	N4 N4 / R-Gr 5R 5/2 / G-Gr 5G 5/2	N2 N2 / BG-Gr 5BG 5/2 / PB-DK 5PB 3/4	P-Dp 5P 2.5/7 / N8 N8 / PB-Dp 5PB 3/8	N9 N9 / N5 N5 / N6 N6	PB-Lgr 5PB 7/2 / N9.5 N9.5 / N7 N7	
	Frequency(%)	43.7	39.5	38.7	33.6	17.6	18	14	
70~75	Favorable combination	R-P 5R 8/4 / YR-VP 5YR 9/2 / RP-B 5RP 7/8	GY-B 5GY 8.5/9 / YR-V 5YR 6.5/14 / R-S 5R 4.5/12	RP-V 5RP 4.5/13 / Y-VP 5Y 9/2 / PB-V 5PB 4/12	YR-P 5YR 8.5/4 / Y-VP 5Y 9/2 / RP-P 5RP 8/4	P-V 5P 3/11 / Y-V 5Y 8/12 / R-V 5R 4/16	PB-P 5PB 8/4 / Y-VP 5Y 9/2 / YR-P 5YR 8.5/4	PB-V 5PB 4/12 / N9.5 N9.5 / R-V 5R 4/16	
	Frequency(%)	27.7	25.7	25.7	23.8	22.8	15.8	12.9	
	Unfavorable combination	N1.5 N1.5 / R-V 5R 4/16 / PB-DK 5PB 3/4	Y-DK 5Y 3/2 / N6 N6 / B-DK 5B 2.5/3	RP-DK 5RP 2.5/4 / R-Gr 5R 5/2 / R-Dk 5R 3/2	N2 N2 / BG-Gr 5BG 5/2 / PB-DK 5PB 3/4	N4 N4 / R-Gr 5R 5/2 / G-Gr 5G 5/2	P-Dp 5P 2.5/7 / N8 N8 / PB-Dp 5PB 3/8	N9 N9 / N5 N5 / N6 N6	
	Frequency(%)	50.5	44.6	43.6	41.6	38.6	18.8	14.9	
75~	Favorable combination	R-P 5R 8/4 / YR-VP 5YR 9/2 / RP-B 5RP 7/8	GY-B 5GY 8.5/9 / YR-V 5YR 6.5/14 / R-S 5R 4.5/12	YR-P 5YR 8.5/4 / Y-VP 5Y 9/2 / RP-P 5RP 8/4	P-V 5P 3/11 / Y-V 5Y 8/12 / R-V 5R 4/16	GY-B 5GY 8.5/9 / YR-V 5YR 6.5/14 / Y-B 5Y 9/9	R-Gr 5R 5/2 / Y-S 5Y 7/10 / R-Dl 5R 5/6	P-Lgr 5P 7/2 / R-Gr 5R 5/2 / YR-Lgr 5YR 7/2	
	Frequency(%)	32.5	27.7	27.5	26.3	21.3	16.3	15	
	Unfavorable combination	Y-DK 5Y 3/2 / N6 N6 / B-DK 5B 2.5/3	RP-DK 5RP 2.5/4 / R-Gr 5R 5/2 / R-Dk 5R 3/2	N2 N2 / BG-Gr 5BG 5/2 / PB-DK 5PB 3/4	N4 N4 / R-Gr 5R 5/2 / G-Gr 5G 5/2	N1.5 N1.5 / R-V 5R 4/16 / PB-DK 5PB 3/4	P-Lgr 5P 7/2 / N4 N4 / PB-Lgr 5PB 7/2	P-Dp 5P 2.5/7 / N8 N8 / PB-Dp 5PB 3/8	PB-Lgr 5PB 7/2 / N9.5 N9.5 / N7 N7
	Frequency(%)	48.8	47.5	47.5	46.3	37.5	25	16.3	16

This study divides the subjects into four groups with nine possible characteristics. Those groups are: Weak Intent, Gloomy but Active, Conservatively Frugal, Healthily Managing. Table 7 shows the major characteristics of each group.
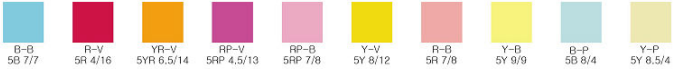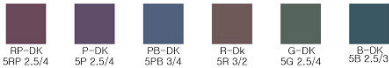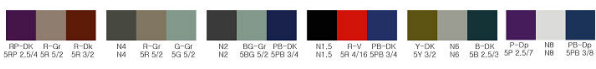
Table 7. Major characteristics of different lifestyle groups

Group	Weak intent	Gloomy but active	Conservatively frugal	Healthily managing
Life Factors	-Health conscious -Productively leisured -occasional purchasing	-fashionable -dietary conscious -vigorously leisured -shopping vigorously	-occasional purchasing -health conscious	-fashionable -productive leisured -shopping vigorously

Thirty seven questions on the survey relating to the lifestyles of the participants such as food, home, leisure, and purchase behavior were analyzed and classified by factor analysis. Based on the screen plot, nine characteristics were rotated using a Varimax rotation procedure. These characteristics are: 1)fashionable, 2)occasionally fashionable, 3)dietary conscious, 4)health conscious, 5)productively leisured, 6)vigorously leisured, 7)passively leisured, 8)shopping vigorously, 9)occasional purchasing.

Color preferences for the elderly having different lifestyles were analyzed to provide design guidance for designers and marketing professionals.
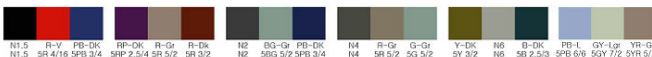
Table 8. Color Preference of weak intent seniors

Favorable colors	B-B 5B 7/7	R-V 5R 4/16	YR-V 5YR 6.5/14	RP-V 5RP 4.5/13	RP-B 5RP 7/8	Y-V 5Y 8/12	R-B 5R 7/8	Y-B 5Y 9/9	B-P 5B 8/4	Y-P 5Y 8.5/4
Frequency(%)	23.6	21.7	19.9	19.3	18.6	15.5	15.5	14.3	14.3	11.2

Unfavorable colors	RP-DK 5RP 2.5/4	P-DK 5P 2.5/4	PB-DK 5PB 3/4	R-Dk 5R 3/2	G-DK 5G 2.5/4	B-DK 5B 2.5/3
Frequency(%)	27.3	23	19.9	16.8	16.1	16.1

Favorable color combination	GY-B YR-V Y-B 5GY 8.5/95YR 6.5/145Y 9/9	GY-B YR-V R-S 5GY 8.5/95YR 6.5/145R 4.5/12	R-P YR-VP RP-B 5R 8/4 5YR 9/2 5RP 7/8	RP-V 5RP 4.5/13	Y-B 5Y 9/2	PB-V 5PB 4/12	P-V Y-V R-V 5P 3/11 5Y 8/12 5R 4/16	YR-P Y-VP 5YR 8.5/4 5Y 9/2	RP-P 5RP 8/4	RP-Dp RP-P 5RP 3/8 5RP 8/4	RP-V 5RP 4.5/13	RP-VP RP-P RP-Lgr 5RP 9/2 5RP 8/4 5RP 7/2	PB-V 5PB 4/12	N8.5 N8.5	R-V 5R 4/16
Frequency(%)	35.4	30.4	28.6		28		23	21.1		19.9		19.9	16.8		

Unfavorable color combination	RP-DK R-Gr R-Dk 5RP 2.5/4 5R 5/2 5R 3/2	N4 N4	R-Gr G-Gr 5R 5/2 5G 5/2	N2 N2	BG-Gr PB-DK 5BG 5/2 5PB 3/4	N1.5 N1.5	R-V PB-DK 5R 4/16 5PB 3/4	Y-DK 5Y 3/2	N6 N6	B-DK 5B 2.5/3	P-Dp 5P 2.5/7	N8 N8	PB-Dp 5PB 3/8
Frequency(%)	51.6		51.6		46.6		44.7	42.2		22.4			

This study, assuming weak intent people are usually introspective and don't have specific goals in their life, finds preference by these subjects to favor light colors, especially yellowish and vivid red colors (Table 8). Grayish and dark colors were not preferred.

Table 9 represents color preference of gloomy but active seniors. This group of seniors are socially active and are comparatively more educated, younger and richer than other subjects but more melancholy.

Table 9. Color Preference of gloomy but active seniors

Favorable colors	R-V 5R 4/16	G-B 5G 7.5/9	Y-B 5Y 9/9	BG-B 5BG 7/8	RP-B 5RP 7/8	RP-V 5RP 4.5/13	P-B 5P 7/8	B-B 5B 7/7	PB-B 5PB 7/7	R-S 5R 4.5/12
Frequency(%)	19	19	16.5	15.2	15.2	12.7	11.4	11.4	11.4	10
Unfavorable colors	R-V 5R 4/16	R-Dk 5R 3/2	RP-DK 5RP 2.5/4	PB-DK 5PB 3/4	R-S 5R 4.5/12	R-Gr 5R 5/2	P-DK 5P 2.5/4	PB-V 5PB 4/12		
Frequency(%)	20.3	16.5	16.5	15.2	12.7	12.7	11.4	10.1		
Favorable color combination	29.1		25.3		21.5		21.5		19		19		19		17.7
Frequency(%)	29.1	25.3	21.5	21.5	19	19	19	17.7
Unfavorable color combination	44.3	32.9	32.9	32.9	26.6	17.7
Frequency(%)	44.3	32.9	32.9	32.9	26.6	17.7

Conservatively frugal seniors have relatively lower economic conditions but they are frugal and manage their lives. They preferred pastel colors and dislike brilliant colors (Table 10).

Healthily managing elder people believe they are healthy and enjoy relatively active social life. They are more interested in news and new technology than others. Bright greenish colors were preferred and strong red colors were not preferred by healthy seniors (Table 11).

Table 10. Color Preference of conservatively frugal seniors
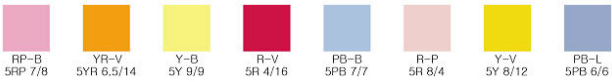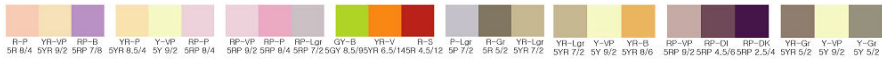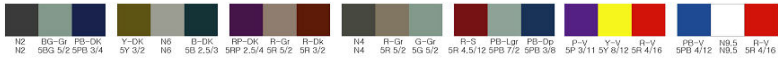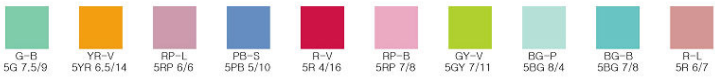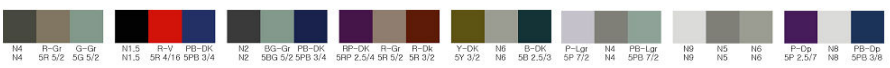
Favorable colors	RP~B 5RP 7/8	YR~V 5YR 6.5/14	Y~B 5Y 9/9	R~V 5R 4/16	PB~B 5PB 7/7	R~P 5R 8/4	Y~V 5Y 8/12	PB~L 5PB 6/6		
Frequency (%)	20	14.9	14	13.2	12.4	11.6	10.7	8.3		
Unfavorable colors	R~V 5R 4/16	RP~V 5RP 4.5/13	RP~DK 5RP 2.5/4	R~Dk 5R 3/2	B~DK 5B 2.5/3	R~S 5R 4.5/12	BG~Dk 5BG 3/2	R~Vp 5R 9/2	RP~Gr 5RP 5/2	RP~S 5RP 5/10
Frequency (%)	22.3	19.8	19	17.4	16.7	14	14	13.2	12.4	11.6

	Combination 1	Combination 2	Combination 3	Combination 4	Combination 5	Combination 6	Combination 7	Combination 8
Favorable color combination	R~P 5R 8/4, YR~VP 5YR 9/2, RP~B 5RP 7/8	YR~P 5YR 8.5/4, Y~VP 5Y 9/2, RP~P 5RP 8/4	RP~VP 5RP 9/2, RP~P 5RP 8/4, RP~Lgr 5RP 7/2	GY~B 5GY 8.5/9, YR~V 5YR 6.5/14, R~S 5R 4.5/12	P~Lgr 5P 7/2, R~Gr 5R 5/2, YR~Lgr 5YR 7/2	YR~Lgr 5YR 7/2, Y~VP 5Y 9/2, YR~B 5YR 8/6	RP~VP 5RP 9/2, RP~Dl 5RP 4.5/6, RP~DK 5RP 2.5/4	YR~Gr 5YR 5/2, Y~VP 5Y 9/2, Y~Gr 5Y 5/2
Frequency (%)	32.2	26.4	21.5	21.5	19	17.4	15.7	14.9

	Combination 1	Combination 2	Combination 3	Combination 4	Combination 5	Combination 6	Combination 7
Unfavorable color combination	N2 N2, BG~Gr 5BG 5/2, PB~DK 5PB 3/4	Y~DK 5Y 3/2, N6 N6, B~DK 5B 2.5/3	RP~DK 5RP 2.5/4, R~Gr 5R 5/2, R~Dk 5R 3/2	N4 N4, R~Gr 5R 5/2, G~Gr 5G 5/2	R~S 5R 4.5/12, PB~Lgr 5PB 7/2, PB~Dp 5PB 3/8	P~V 5P 3/11, Y~V 5Y 8/12, R~V 5R 4/16	PB~V 5PB 4/12, N9.5 N9.5, R~V 5R 4/16
Frequency (%)	38.8	37.2	34.7	34.7	20.7	19	12.4

Table 11. Color Preference of healthily managing seniors

Favorable colors	G~B 5G 7.5/9	YR~V 5YR 6.5/14	RP~L 5RP 6/6	PB~S 5PB 5/10	R~V 5R 4/16	RP~B 5RP 7/8	GY~V 5GY 7/11	BG~P 5BG 8/4	BG~B 5BG 7/8	R~L 5R 6/7
Frequency (%)	17.8	15.6	14.4	13.3	13.3	13.3	11.1	11.1	11.1	8.9
Unfavorable colors	RP~DK 5RP 2.5/4	PB~DK 5PB 3/4	P~DK 5P 2.5/4	R~S 5R 4.5/12	RP~S 5RP 5/10	Y~V 5Y 8/12	R~Dk 5R 3/2	Y~Dp 5Y 4/5		
Frequency (%)	18.7	15.6	14.4	14.4	14.4	13.3	13.3	12.2		

	Combination 1	Combination 2	Combination 3	Combination 4	Combination 5	Combination 6	Combination 7	Combination 8
Favorable color combination	R~P 5R 8/4, YR~VP 5YR 9/2, RP~B 5RP 7/8	RP~VP 5RP 9/2, RP~P 5RP 8/4, RP~Lgr 5RP 7/2	YR~P 5YR 8.5/4, Y~VP 5Y 9/2, RP~P 5RP 8/4	GY~B 5GY 8.5/9, YR~V 5YR 6.5/14, Y~B 5Y 9/9, GY~V 5GY 8.5/9	Y~VP 5Y 9/2, GY~B 5GY 8.5/9	PB~B 5PB 8/4, Y~VP 5Y 9/2, YR~P 5YR 8.5/4	P~VP 5P 9/2, N9.5 N9.5, PB~P 5PB 8/4	
Frequency (%)	26.7	24.4	23.3	20	20	17.8	16.7	

	Combination 1	Combination 2	Combination 3	Combination 4	Combination 5	Combination 6	Combination 7	Combination 8
Unfavorable color combination	N4 N4, R~Gr 5R 5/2, G~Gr 5G 5/2	N1.5 N1.5, R~V 5R 4/16, PB~DK 5PB 3/4	N2 N2, BG~Gr 5BG 5/2, PB~DK 5PB 3/4	RP~DK 5RP 2.5/4, R~Gr 5R 5/2, R~Dk 5R 3/2	Y~DK 5Y 3/2, N6 N6, B~DK 5B 2.5/3	P~Lgr 5P 7/2, N4 N4, PB~Lgr 5PB 7/2	N9 N9, N5 N5, N6 N6	P~Dp 5P 2.5/7, N8 N8, PB~Dp 5PB 3/8
Frequency (%)	42.2	38.9	35.6	31.1	30	16.7	16.7	16.7

4. CONCLUSIONS

Color preference of Korean elderly was investigated in the study and favorable and unfavorable single colors and color combinations were detected. Even though color does not increase functional values of consumer's products, it is certain that color emotion could affect consumer's purchase. The results of this study can be used as basic data to build a color preference database for the Korean elderly.

Korean elder people showed that they prefer light and pastel colors and disfavored dark and strong colors (Table 3). This information can be applied to produce products and to provide services for the Korean elderly. Different color preference was observed between elderly men and women. Reddish colors were preferred by the senior women but bluish colors were preferred by senior men.

In the color combination preference, they also favored light and warm color combinations. To design products, interiors, exteriors, etc. color combination is very important however, color combination preference has not been studied enough. Most of our surroundings are actually composed with multiple colors. We are accustomed to match colors for clothing, furniture, electronic products and living spaces, etc.

If enough data of color preference was accumulated, it would be helpful for elderly persons to select new furniture, products, apparels, vehicles, and so on. With digital color information of their current surroundings, customers could search and find well matched colors from websites, color experts, and marketing managers utilizing this data.

Color preference of different age groups was also investigated. Favored and unfavored colors and color combinations were analyzed (Table 5 and 6) because color preference may change based on age of subjects (Hupka et al., 1997; Manav, 2007; Shoyama, 2003). There was little difference in color preference of the elderly in comparison with other age groups. Most elderly favor light and bright colors.

Four groups of lifestyles of the elderly were compared in this study by employing cluster analysis with factor variables. Color is a very complicated system and color emotion can be affected by emotional and situational status of the subject. Weak intent people were analyzed to prefer yellowish and vivid red colors. Gloomy but active people comparatively favor pale colors. Reddish

colors were selected as both favorable and unfavorable colors. Conservatively frugal seniors prefer pastel colors and healthily managing seniors like light greenish colors.

Reddish colors were evaluated as favorable and unfavorable because female seniors favor the red colors while male seniors dislike red colors. Some gloomy but active and conservatively frugal people reported red color is their favored color and others answered they dislike red colors. Color emotion can be different based on the gender, cultural background, age. In addition, color emotion can be changed in short term and long term affected by many factors.

In this study, we showed color preference of Korean elderly and provided basic color information to be used to build a color preference database system. This database is actively being constructed and contains this study and other color preference studies. You can refer to our future studies to know more information related to color design for the elderly and online application.

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APPENDIX 1: RGB AND CMYK VALUES FOR 120 SINGLE COLORS

HUE / TONE	R	YR	Y	GY	G	BG	B	PB	P	RP
V	R:206 G:17 B:9 C:15.7 M:94.1 Y:94.5 K:3.9	R:248 G:127 B:17 C:3.9 M:49.4 Y:89.0 K:0.4	R:220 G:225 B:22 C:10.9 M:8.2 Y:95.3 K:0.8	R:131 G:191 B:31 C:48.6 M:4.3 Y:96.1 K:0.4	R:27 G:131 B:59 C:89.4 M:11.7 Y:88.6 K:1.96	R:26 G:123 B:90 C:89.8 M:16.8 Y:63.9 K:4.7	R:17 G:126 B:131 C:94.9 M:16.1 Y:36.1 K:3.9	R:27 G:66 B:141 C:90.9 M:59.6 Y:8.6 K:1.9	R:76 G:28 B:124 C:72.9 M:85.8 Y:8.2 K:1.9	R:177 G:20 B:92 C:21.9 M:92.5 Y:25.4 K:8.6
S	R:182 G:30 B:22 C:21.9 M:88.6 Y:83.5 K:8.2	R:188 G:109 B:19 C:20.3 M:49.1 Y:92.2 K:7.1	R:179 G:167 B:31 C:26.3 M:21.9 Y:89.8 K:4.7	R:126 G:166 B:36 C:49.4 M:13.7 Y:93.3 K:2.4	R:40 G:130 B:89 C:84.3 M:16.1 Y:65.1 K:4.3	R:33 G:142 B:109 C:87.5 M:9.4 Y:56.1 K:1.9	R:31 G:126 B:123 C:88.2 M:18.4 Y:40.4 K:5.1	R:43 G:85 B:120 C:83.5 M:44.3 Y:24.3 K:10.9	R:89 G:57 B:111 C:63.1 M:67.8 Y:22.8 K:9.4	R:173 G:37 B:81 C:23.1 M:83.1 Y:38.8 K:10.2
B	R:245 G:133 B:101 C:2.4 M:47.5 Y:47.8 K:0.4	R:235 G:177 B:90 C:6.3 M:27.8 Y:58.8 K:1.2	R:245 G:242 B:31 C:3.9 M:3.5 Y:86.6 K:0	R:170 G:211 B:38 C:33.3 M:2.4 Y:91 K:0	R:93 G:174 B:112 C:63.5 M:5.9 Y:55.7 K:0.8	R:55 G:162 B:137 C:78.6 M:5.5 Y:41.2 K:0.8	R:63 G:174 B:179 C:76.1 M:2.8 Y:18 K:0	R:113 G:152 B:171 C:54.9 M:23.4 Y:14.5 K:2.8	R:179 G:139 B:189 C:29 M:39.2 Y:3.1 K:0	R:224 G:98 B:105 C:9 M:60 Y:40 K:1.6
P	R:243 G:198 B:174 C:3.5 M:21.2 Y:23.1 K:0.4	R:245 G:224 B:170 C:31 M:11 Y:29 K:0.4	R:245 G:246 B:115 C:3.9 M:2 Y:54.5 K:0	R:182 G:216 B:58 C:28.2 M:2.8 Y:80.8 K:0.4	R:126 G:196 B:149 C:50.6 M:2.8 Y:37.7 K:0.4	R:126 G:196 B:161 C:50.6 M:3.1 Y:31.4 K:0.4	R:125 G:195 B:197 C:32.6 M:4.3 Y:12.2 K:0.4	R:172 G:209 B:207 C:16.1 M:6.3 Y:10.2 K:0.4	R:210 G:181 B:203 C:5.1 M:24.3 Y:5.9 K:0.8	R:238 G:171 B:152 C:5.1 M:31.8 Y:28.2 K:0.4
Vp	R:242 G:223 B:192 C:4.3 M:11 Y:19.6 K:0.4	R:243 G:222 B:178 C:3.9 M:11.4 Y:25.1 K:0.4	R:239 G:243 B:189 C:6.3 M:2.4 Y:24.3 K:0	R:218 G:237 B:154 C:14.5 M:1.2 Y:38.4 K:0	R:212 G:231 B:198 C:16.9 M:3.1 Y:18.8 K:0	R:189 G:225 B:197 C:25.8 M:2 Y:18.4 K:0	R:191 G:224 B:209 C:25.1 M:2.8 Y:12.6 K:0	R:221 G:222 B:220 C:12.9 M:8.2 Y:7.5 K:0.4	R:232 G:224 B:229 C:8.2 M:9 Y:3.9 K:0.4	R:241 G:222 B:200 C:4.7 M:11 Y:16.1 K:0.4
Lgr	R:197 G:165 B:137 C:18.4 M:27.1 Y:33.7 K:4.7	R:194 G:180 B:137 C:20 M:19.6 Y:36.5 K:4.7	R:187 G:186 B:132 C:23.9 M:16.4 Y:40.8 K:3.1	R:155 G:169 B:135 C:36.1 M:18.4 Y:36.5 K:4.7	R:141 G:182 B:136 C:43.9 M:11.4 Y:40.4 K:2	R:115 G:149 B:137 C:52.2 M:21.2 Y:32.2 K:6.3	R:145 G:174 B:151 C:41.6 M:15.7 Y:30.2 K:3.1	R:136 G:155 B:145 C:43.5 M:22 Y:28.2 K:5.9	R:163 G:152 B:149 C:31.4 M:27.5 Y:24.3 K:6.7	R:194 G:166 B:159 C:20.8 M:26.7 Y:23.1 K:3.5
L	R:238 G:137 B:108 C:4.7 M:45.1 Y:44.7 K:0.8	R:179 G:146 B:102 C:23.1 M:31.4 Y:48.2 K:8.2	R:156 G:145 B:70 C:32.2 M:26.7 Y:66.7 K:9.8	R:134 G:153 B:70 C:44.3 M:20.8 Y:71 K:5.9	R:82 G:154 B:101 C:67.5 M:12.9 Y:58.8 K:2.4	R:80 G:143 B:124 C:67.8 M:18 Y:43.5 K:4.7	R:58 G:136 B:143 C:76.9 M:18 Y:40.4 K:4.7	R:100 G:132 B:143 C:58.4 M:27.8 Y:23.9 K:7.1	R:159 G:136 B:158 C:34.1 M:36.1 Y:16.5 K:4.7	R:190 G:108 B:112 C:19.6 M:51.4 Y:35.7 K:6.3
Gr	R:135 G:116 B:100 C:36.9 M:36.5 Y:41.6 K:15.7	R:121 G:110 B:89 C:41.2 M:35.7 Y:46.7 K:19.2	R:107 G:103 B:78 C:46.7 M:36.1 Y:52.6 K:21.6	R:101 G:108 B:85 C:51.8 M:33.7 Y:50.6 K:18.4	R:77 G:102 B:82 C:63.9 M:32.9 Y:53.3 K:18	R:79 G:106 B:95 C:63.1 M:34.1 Y:44.7 K:17.3	R:84 G:106 B:98 C:59.6 M:32.1 Y:40.4 K:19.2	R:87 G:97 B:97 C:56.9 M:40 Y:37.7 K:21.6	R:113 G:100 B:100 C:44.7 M:41.2 Y:35.7 K:20.4	R:103 G:93 B:91 C:47.1 M:38.8 Y:38.8 K:23.9
Dl	R:119 G:74 B:57 C:34.5 M:52.6 Y:58 K:28.6	R:125 G:89 B:21 C:35.7 M:45.5 Y:90.2 K:23.9	R:106 G:99 B:19 C:46.7 M:36.5 Y:96.1 K:22	R:89 G:111 B:25 C:59.6 M:30.2 Y:96.9 K:14.1	R:63 G:99 B:65 C:70.6 M:32.2 Y:67.1 K:17.7	R:38 G:99 B:84 C:67.5 M:33.3 Y:50.9 K:18.8	R:42 G:92 B:84 C:82.8 M:32.2 Y:52.2 K:18.4	R:91 G:81 B:97 C:60.4 M:39.6 Y:34.5 K:22	R:91 G:60 B:105 C:60.4 M:65.1 Y:26.3 K:12.6	R:105 G:66 B:81 C:43.1 M:56.9 Y:36.5 K:27.8
Dp	R:113 G:15 B:18 C:35.7 M:90.6 Y:82 K:31	R:119 G:76 B:14 C:36.1 M:51 Y:95.3 K:27.1	R:116 G:106 B:20 C:43.1 M:35.3 Y:94.9 K:20	R:80 G:96 B:26 C:60.8 M:34.5 Y:93.7 K:20	R:26 G:77 B:38 C:87.5 M:34.5 Y:87.8 K:23.5	R:20 G:67 B:56 C:89.8 M:38 Y:64.7 K:30.9	R:13 G:65 B:76 C:82.8 M:32.2 Y:52.2 K:18.4	R:23 G:47 B:82 C:91 M:61.6 Y:33.3 K:24.7	R:63 G:24 B:84 C:72.9 M:85.1 Y:28.6 K:16.1	R:91 G:14 B:68 C:54.1 M:92.2 Y:32.9 K:23.9
Dk	R:85 G:21 B:9 C:40 M:82 Y:92.2 K:44.3	R:85 G:50 B:15 C:41.6 M:57.7 Y:89.4 K:43.1	R:84 G:75 B:20 C:51 M:42.8 Y:91.8 K:32.9	R:43 G:65 B:20 C:74.9 M:40.8 Y:96.5 K:33.7	R:14 G:53 B:23 C:92.2 M:40 Y:95.3 K:39.2	R:15 G:43 B:33 C:90.2 M:43.1 Y:76.5 K:45.9	R:19 G:47 B:50 C:87.8 M:40 Y:49.4 K:47.8	R:22 G:10 B:68 C:90.6 M:72.9 Y:35.7 K:30.6	R:34 G:10 B:64 C:85.5 M:93.7 Y:33.7 K:26.3	R:62 G:18 B:64 C:67.8 M:87.5 Y:34.9 K:29

Neutral

N9.5	R:255 G:255 B:255 C:0 M:0 Y:0 K:0
N9	R:217 G:216 B:213 C:14.1 M:10.2 Y:9 K:0.8
N8	R:179 G:179 B:168 C:27.1 M:18.8 Y:21.2 K:3.5
N7	R:150 G:150 B:139 C:36.1 M:25.5 Y:29 K:7.8
N6	R:120 G:121 B:112 C:44.7 M:32.2 Y:36.1 K:14.9
N5	R:96 G:96 B:89 C:51 M:37.7 Y:41.6 K:23.9
N4	R:64 G:64 B:57 C:59.2 M:45.1 Y:52.6 K:39.2
N3	R:51 G:51 B:51 C:62.4 M:48.6 Y:48.6 K:47.8
N2	R:30 G:30 B:30 C:67.5 M:53.3 Y:54.9 K:64.7
N1	R:0 G:0 B:0 C:0 M:0 Y:0 K:100