Categorical Effects in Printed Color for Elderly and Young People under Different Color Temperature of Lighting

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Categorical identification of color is crucial to daily use
Categorical colors

- The categorical colors were mostly based on the theory of 11 basic color terms recommended by Berlin and Kay (Berlin et al. 1969 and Hardin 2013).

- Ishida (2002) applied the 11 basic color terms by adding 2 color terms of “yellow-green” and “blue-green used in daily life of Japanese people.
Color categories (continued)

Sagawa et al. (2003)

- 5R5/12 (red)
- 5YR5/10 (red-yellow)
- 5Y5/6 (yellow)
- 5GY5/8 (yellow-green)
- 5G5/8 (green)
- 5BG5/8 (blue-green)
- 5B5/8 (blue)
- 5PB5/10 (purple-blue)
- 5P5/10 (purple)
- 5RP5/10 (purple-red)
- 5N (grey)
Color categories (continued)

- 12 color categories were used in the present study based on the mentioned research.

1. 5R5/12 (red)
2. 5YR5/10 (red-yellow)
3. 5Y5/6 (yellow)
4. 5GY5/8 (yellow-green)
5. 5G5/8 (green)
6. 5BG5/8 (blue-green)
7. 5B5/8 (blue)
8. 5PB5/10 (purple-blue)
9. 5P5/10 (purple)
10. 5RP5/10 (purple-red)
11. 7.5RP5/14 (pink)
12. 5YR5/6 (brown)
Color application should be more concerned on elderly people

Source: Chittinandana et al. 2017
Color application should be more concerned on elderly people (continued)

- Declines in color vision with age can undesirably affect Elderly daily life caused by a yellowing of vision (Ishiharaa et al, 2001) including
Color application should be more concerned on elderly people (continued)

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Color application should be more concerned on elderly people (continued)

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Understanding of perceived color of elderly can guide young designer proper color choice for everyday product or packaging for elderly customers.
Objectives

- to find out the effects of categorical colors in printed color for elderly and young people under different color temperature of lighting.
Experimental procedure

Viewing distance and angle were 30 cm and 0/45 under 2700 and 6500 K CCT and illuminance of 700 lux (Clare et al., 2016 and Hegde et al., 2012) about 3 minutes for light adaptation.

Testing with Farnsworth-Munsell 100 hue test

15 elderly (12 F and 3 M), 60-70 yrs.
30 young people (16 F and 14 M), 25-35 yrs.
Results and discussion: Color patch arrangement into the 12 reference categories, $a^*b^*$ value of red color
Results and discussion: Color patch arrangement into the 12 reference categories, $L^*C^*_{ab}$ value of red color
Results and discussion: Color patch arrangement into the 12 reference categories, \(a^*b^*\) value of red-yellow color.
Results and discussion: Color patch arrangement into the 12 reference categories, $L^*C^*_{ab}$ value of red-yellow color
Results and discussion: Color patch arrangement into the 12 reference categories, $a^*b^*$ value of all 12 colors (6500 K)
Results and discussion: Color patch arrangement into the 12 reference categories, $a^*b^*$ value of all 12 colors (2700 K)
Results and discussion: Color patch arrangement into the 12 reference categories, $L*C_{ab}^*$ value of all 12 colors (6500 K)

Elderly-6500 K

Young-6500 K
Results and discussion: Color patch arrangement into the 12 reference categories, $L^*C^*_{ab}$ value of all 12 colors (2700 K)

Elderly-2700 K

Young-2700 K
Multivariate analysis of variance (MANOVA) result of lighting, age groups, and categorical color by Wilks’ Lambda statistic

<table>
<thead>
<tr>
<th>Items</th>
<th>Wilks’ Lamda</th>
<th>F</th>
<th>Sig.</th>
<th>b. Exact statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>.081</td>
<td>356352.833b</td>
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<tr>
<td>Categorical color</td>
<td>.071</td>
<td>11222.254</td>
<td>0.000</td>
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<tr>
<td>Group (elderly and young)</td>
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<tr>
<td>Group detail (elderly with 6500 K, young with 6500 K, elderly with 2700 K, and young with 2700 K)</td>
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<td></td>
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<tr>
<td>Light type (6500 K, 2700 K)</td>
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<tr>
<td>Categorical color*Group</td>
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<td></td>
<td></td>
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<tr>
<td>Categorical color*Group detail</td>
<td>1.000</td>
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<tr>
<td>Categorical color*light type</td>
<td>1.000</td>
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<tr>
<td>Group*Group detail</td>
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<td>Group*light type</td>
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<tr>
<td>Group detail*light type</td>
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<tr>
<td>Categorical color <em>Group</em>Group detail</td>
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<tr>
<td>Categorical color <em>Group</em>light type</td>
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<td>Group<em>Group detail</em>light type</td>
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<tr>
<td>Categorical color <em>Group</em>Group detail*light type</td>
<td>1.000</td>
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<tr>
<td>[F(36, 277988.315) = 11222.254 (Wilk’s Lambda) p-value&lt;0.001)]</td>
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</tr>
</tbody>
</table>

b. Exact statistic
Color difference comparison

\[ \Delta E_{ab} \]

\[ \Delta E_{00} \]
Conclusion

- Based on the categorical color concept, the printed color chips used for printing design were categorized by elderly and young people under CCT 6500, 2700 K and illumination 700 lux.
- It was shown that the categorical color was the most significant impact on CIELAB.
- The proper color for designing on packaging printing should be chosen with concerning on both young and elderly customers.
Acknowledgement

- This study was supported by Grant from Sukhothai Thammathirat Open University (STOU) academic research fund.
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References


