

Table 6. Chroma Property Respondent Effect Detection Abstract

Resource of variance	SS	df	MS	F	P
Chroma low/medium/high	31.262	2	15.631	14.559	.000***
hue (R, Y, G, B, P)	4.160	4	1.040	.969	.426
Chroma(low/medium/high)*	6.427	8	.803	.748	.649

P<0.05*, P<0.01**, P<0.001***

5. Conclusions

Watercolor effect was proposed by Pinna in 1987. He pointed out that the contour of dark and light hue matching will produce watercolor illusion. The color features of watercolor illusion are as follows: (1) effect can still be seen but will be weakened if two lines are of the same color; (2) the effect when the purple and orange lines are juxtaposed is the most apparent; (3) all colors can produce a coloration effect; (4) color spread does not have a scope; and (5) watercolor illusion also occurs in colored and black background[1,2,7,12,13,15,16,17,18]. We cannot conclude that the above results are obtained from measuring or summarizing three properties, which is possibly because the darkness/lightness is not properly defined from the aspects of hue, value, and chroma. We found from this experiment that value, in contrast to hue and chroma, has the strongest influence. This study proposes that light value implies expansion and dilation [4,6,7,8,9,19]. Each stimulus has a light-valued outer contour to match with the light, medium, and dark inner contour. Because of the diffusivity of light value, value is the top factor in watercolor effect. Hence, we surmise that the matching of purple and orange, and dark and light proposed by Pinna has confused hue with value.

This study has discussed the influence of color matching (between complementary and contrast colors and between low and medium chroma) on watercolor effect, which is similar to the result of watercolor effect triggered by purple and orange, blue and yellow, and red and green as proposed by Pinna, Belstaff, and Spillmann[16].

This study has manipulated hue, value, and chroma as independent single variables. Future studies can manipulate two factors: hue and value, value and chroma, and hue and chroma to examine the differences in results from matching two properties or one property, and conduct a complete research on watercolor effect.

Footnote

¹Munsell Conversion Software is developed by WallkillColor and can convert Munsell's color code to C, M, Y, K, such as 5R/8/6, equivalent to C=0, M=27, Y=30, K=0.

References

- [1] Broerse, J., & O'shea, R.P. (1995). Local and global factors in spatially-contingent coloured aftereffects. *Vision Research*. 35, 207-226.
- [2] Broerse, J., Vladusich, T., & O'shea, R.P. (1999). Colour at edges and colour spreading in

- McCollough effects. *Vision Research*. 39, 1305-1320.
- [3] Da Zhihao (1993) *Design Color Scheme*. Taipei: Mainland Publishing House.
- [4] Edwards B. (2004) . *A Course in Mastering the Art of Mixing Colors*. Putnam Pub Group.
- [5] Hishami Naoki (2002) *Art and Design Color Composition*. Taipei: Longxi International Book.
- [6] Kuehni, Rolf G. (2004) . *Color: An Introduction to Practice and Principles*. Hoboken : John Wiley & Sons Inc.
- [7] Lin Kunfan (2008) *Color Theory*. Taipei: Quanhua.
- [8] Lin Shuyao (1981) *Color Recognition Theory*. Taipei: Sanmin Publishing House.
- [9] Ou Xiuming (1994) *Applied Color Science*. Taipei: Lion.
- [10] Ou Xiuming, Lai Laiyang (1990) *Applied Color Science*. Taipei: Lion.
- [11] Pinna, B. (2008) . Watercolor illusion. *Scholarpedia*, 3 (1) ,5352.
- [12] Pinna, B.& Grossberg, S (2005) . The watercolor illusion and neon color spreading A unified analysis of new cases and neural mechanisms. *JOSA A*, 22, 2207-2221.
- [13] Pinna, B. (2005) . The role of Gestalt principle of similarity in the watercolor illusion. *Spatial vision*, 21, 1-8.
- [14] Pinna, B. (2006) . The Discoloration Illusion. *Visual Neuroscience*, 23, 583-590.
- [15] Pinna, B., & Reeves, A (2006) . Lighting, Backlighting and Watercolor illusions and the Laws of Figurality. *Spatial vision*, 19,341-373.
- [16] Pinna, B., Brelstaff, G., & Spillmann, L. (2001) . Surface color from boundaries : A new 'watercolor' illusion. *Vision Research*. 41, 2669-2676.
- [17] Pinna, B., Brelstaff, G., and Spillmann, L. (2001) Surface color from boundaries: a new 'watercolor' illusion. *Vision Research*, 41, 2669-2676.
- [18] Pinna, B., Werner J.S., & Spillmann, L. (2003) . The watercolor effect : A new principle of grouping and figure-ground organization. *Vision Research*, 43, 43-52.
- [19] Shevell, Steven K (2003) . *The science of color*. Amsterdam, Boston : Elsevier.
- [20] Yamanaga Goto (2003) *Basics of Color Science*. Taipei: Liuhe Publishing House.
- [21] Zhu Jieying (1996) *Color Design Scheme (Revision)*. Taipei: Applied Arts Technology.
- [22] Zhu Jieying (2005) *Color Science-Color Scheme & Matching*. Taipei: Yanuo Culture.