

# Scaling of comfort for a colored scene and development of a colour comfort meter

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## Introduction

Comfort or discomfort feeling when we see a colored scene is one of the most important aspects of coloring objects or environments. However, the properties of this colour comfort feeling has not been fully understood yet and the method of scaling of it in terms of colours has not been developed yet. Sagawa reported that two colorimetric measures are useful to evaluate the color comfort: One is the averaged saturation over a colored image and the other one is the number of fundamental colors contained in the image (Sagawa, 1999; Sagawa, 2000). Being based on these basic properties of the color comfort, scaling of the color comfort was developed and a comfort meter based on the scale was developed.

## Scaling of the colour comfort

It was found in previous studies that two major factors affect the extent of the feeling of the color comfort, (1) the average saturation and (2) number of fundamental colours. The former factor was further divided into 4 components of opponent colors, such as red, green, yellow and blue. The psychological experiment was carried out to investigate how these components affect the subjective evaluation of the color comfort for natural colored scenes, and the relative weighting factors for the four components were determined. Including an additional factor of number of colours, the final form of the formula to express the colour comfort in the arbitrary 100 point scale is as follows;

$$C \text{ (100 point scale)} = w_n N + w_r R + w_y Y + w_g G + w_b B + \text{const} \quad (1)$$

Where N means number of fundamental colours contained in an image and R, Y, G, B are averaged components of opponent colours over the image, all being able to be derived from the distribution of colorimetric values over the scene.

A set of 36 colored images were presented on a large (50 inch) display and subjects who watched them were asked to evaluate the scenes in terms of the color comfort, and from those data weighting factors for the 5 components in the equation (1) were obtained by using the multi-regression method.

## Development of a color comfort meter

Being based on the developed formula for the color comfort a measuring system was developed to objectively obtain the comfort value. The system consists of digital camera and a computer system to analyze and calculate the comfort scale for a captured scene.

Figure 1 shows the outlook of the comfort meter developed. The meter can capture a colored image through a digital camera and calculate chromaticity value of each pixel of the image in terms of the CIE colorimetry. The meter then analyze the number of fundamental colors contained in the image by using the concept of categorical colour

perception, as well as four opponent colour components i.e. red, yellow, green, blue. Finally, the system calculates the comfort value for the scene.

### **Conclusion**

Comfort feeling of for natural colored scene was scaled by using 5 variables i.e. 4 variables related to color opponency and the number of fundamental colours in the image. A measuring system was developed to obtain the comfort value objectively.



*Figure 1. A color comfort meter*

### **References**

- K. Sagawa: Visual Comfort to Colored Images Evaluated by Saturation Distribution. *Color Research and Application* 24 (1999), 313-321.
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