



Optical Tone

dynamic color composition

Description

To explore and to know the real world we live, how we perceive it is to be the basic start point. The principle should be true in the world of color in visual expression, here in terms of our perception and recognition of dynamic characteristics of the light. The impressionist Claude Monet often painted the same motif under several natural conditions, and fixed the dynamic effect of light on the renowned 33 canvasses of "Cathedrale de Rouen". The artist explored in essence how human being perceives change of natural scene in time and its color dynamism beyond simple problems of expression. But few people know that painting and coloring under the sky for the impressionists' exploration of natural light has made partly possible by the advanced technology at that time of pressing zinc metal to manufacture paint tubes. The advance of technology should be unvaryingly one of the motivation for re-examine the color in expression and communication on products or media in natural or artificial light environment.

Following the impressionists' approach, I have started an experiment on interaction of color with recent LED technology to control dynamic light from the view point of color composition method. Today the light source such as RGB monitors or full-color LED devices controlled by the additive mixture color method is being common in daily life. But the RGB (Red, Green and Blue) light emission is hard to adjust in accordance with the human color perception in a straight way. To solve this problem, I have developed an original algorithm based on color theory and color engineering technique to control RGB output device along with human psychological measurements of lightness, hue and chroma. Then I manufactured a tumbler shape product and implemented full color LED device, whose color should be changed by the position in accordance with the human psychological color measurements using the algorithm. And I designed a color composition to be painted on the wall for the following experiment. On this situation, we can interactively examine the problem of human perception and recognition of dynamic characteristics of the light that can not be experienced in daily life. The interaction between the swinging device as dynamic light-source color and the wall as object color allows us to perceive the pure color world freeing from our control mechanism of color constancy.

The experiment will lead further explorations for improvement of light environment in digital age and researches on understanding of human color perception, which will open a new history of visual expression and communication on electronic media.





HSB(RGB) hue color circle



Optical Tone Algorithm hue color circle



Itten's 12-hue color circle

Optical Tone Algorithm

In the Optical Tone, the original software controls dynamic color of LED and is applied to select the colors of the graphic pattern painted on the wall. As computer works on digitized data from input device and the color output should be numerically calculated. Human beings perceive color as stimuli in lightness, hue and chroma. On the other hand, the color stimuli from output device such as computer monitor or full-color LED are light which consist of red, green and blue by additive mixture color method. To control colors visually for human beings by computers, we must be sensitive to this discrepancy and find a new way to manipulate colors by numbers.

Let's look into the three types of hue color circle (see above). The lowest one is called the Johannes Itten's 12-hue color circle in which yellow, red and blue are selected as primary colors and arranged to maintain the complementary characteristics diagonally. The uppermost one is called the HSB hue color circle in which red, green and blue are the primary colors and extended while maintaining numerical differences of the hue between colors as constant. The middle one is obtained from the Optical Tone Algorithm which maintains the complementary characteristics for diagonal colors and their lightness in a circle as constant. We choose a color model suitable for each design or art work but be aware that on HSB model the hue difference is numerically constant but visually not constant, and the lightness is not also. Johannes Itten's model is visually proportional but numerical continuity is broken, and hard to manipulate by computers. The Optical Tone color model is designed in visually proportional still computational.

Because the Optical Tone is aimed to construct a relation between the light-source color and environmental object color by computer, I chose lightness primarily as most important psychological stimuli to control colors, then arranged hue to maintain the complementary characteristics. The obtained algorithm made possible visually comfortable interaction with colors in real space.

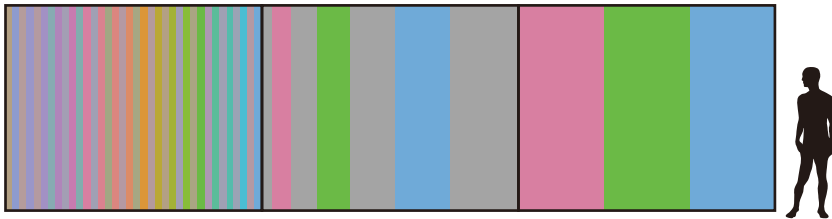


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Wall graphic pattern

The Optical Tone wall graphic pattern is a composition of colors selected by the original software (see 'Optical Tone Algorithm'). The pattern consists of vertical stripes to be visually effective with light-sources which swing horizontally. To disturb human perception of the foreground and background in the color pattern, I made the stripes in a complicated color combination with the size of same width and tall enough to cover participant's perspective. To maximize the visual effect of reflection of dynamic light-source, I adjusted the lightness of each stripes as constant. I controlled the chroma of them regulatively to invite the sense of visual resistiveness or of depth in dimension. I utilized the width of 3 sided wall to produce the dynamic range of hue on stripes large enough to show their color interaction with more than one light-source objects effectively.



Light-source object

The light-source object of the Optical Tone has a shape of tumbler. The top part is designed as a same shape and same size as bottom and the two globes are connected by a rod, which draws visual attention to the top part and gives an impression a globe emitting color light is floating and flying in the dark. The weight in the bottom is carefully adjusted to balance and to provide a comfortable response when people touch the top to swing at a moderate period. In the bottom, a three-axes acceleration sensor is embedded and detects the swinging motion to control the LED of its color output. The original software (see 'Optical Tone Algorithm') transfers the rotative motion to hue and the swing motion to brightness in accordance with the Optical Tone color model. With the system, people controls the position of the light-source and its color simultaneously by simply operation of touch.

