PWDAS-49

LIGHT PHENOMENA IN ARCHITECTURE APPEARANCE OF VOLUME COLOUR AND ITS RELATION TO THE EDGE

Nozomu Yoshizawa

Kanto Gakuin University, Yokohama, Japan

Phenomenological psychologist D.Katz once pointed out that there are *'colours which are seen as organized in and filling a tri-dimensional space',* and he named them 'volume colours'. A slightly cloudy liquid in a glass vessel or a fog is an example. In some architecture you can encounter such phenomena even if there is no actual fog or minute particles in space. In that cases the edge appearance of the space has deteriorated, and the depth perception has got into difficulties, then the appearance of surface colour will be transformed into volume colour and you can see the foggy appearance in the space. These phenomena could give a special charm and meaning or a unique atmosphere to architectural spaces. Good examples of this phenomenon in architecture can be observed in some Romanesque churches in Europe, or in some galleries of the type of white-cube, e.g. in the Aomori Museum of Art and Akino Fuku Museum in Japan. You can also find similar phenomena in some modern and up-to-date shops, e.g. using LED lighting in the edgeless spaces. The aim of this study is to find some practical and engineering solutions for designing that kind of light phenomena, i.e.volume colour. For that purpose, firstly, we made new method to get the quantity of edge perception in space, then secondly, we made an experiment to clarify the relation between the visual perception of the volume colour and the quantity of edge perception in the space using architectural models with LED lighting.

Researches in the 1950's by J.J.Gibson or by W.Cohen already pointed out that foggy appearance in space is related to the edge perception, but its causal connection was not made clear entirely and quantitative analysis was not done. We proceeded with this study on the assumption that the quantity of the edges in space is a necessary condition for the appearance of the volume colour in the architecture. Edge is defined as a border between two surfaces, and we also define 'the quantity of edge perception' as the strength of visual stimuli caused by edges in space. We calculated the quantity of edge perception by applying the wavelet analysis to the luminance distribution image. The approximate process is as follows: 1)Take the luminance distribution image in a visual field, 2)Two dimensional multi resolution analysis is applied to the image, and the image is divided into six sub-images at every frequency band, 3)At every sub-image edge detection is done by Canny method, 4)Weighed with contrast sensitivity function, 5)Integrated and Taking logarithm, then we can get the quantity of edge perception.

Subjective experiments were done by using 3 architectural models (800*800*800mm), each model had different roundness at the edge (=at the intersection of two walls). White LED light intensity was adjusted in 15 steps. 10 subjects evaluated the edge perception and foggy appearance of the inner-space using a 7-step bipolar scale method. By comparing the subjects' evaluation(y) and the quantity of edge perception(x) calculated by the method given above, we got the equation $y = -1.98x + 6.43$ to estimate the appearance of volume colours. Finally we verify this equation by applying to the real space, e.g. Akino Fuku Museum, Aomori Museum of Art and Oya Stone Museum in Japan, and the

result indicated that we could estimate the appearance of volume colours in architecture to some extent by using this equation based on the quantity of edge perception.

Though a continuous examination of the mechanism of foggy appearance in real space would be necessary from now on and the relation between edge and texture is still controversial, this approach has great possibilities for the prediction of the actual appearance of volume colours in architecture.

Nozomu Yoshizawa
College of Human and Environmental Studies
Faculty of Human and Environmental Design
Kanto Gakuin University, Japan
E-mail : yosizawa@kanto-gakuin.ac.jp