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CONSPICUOUSNESS IMAGE GENERATOR USING WAVELET TREATMENT

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Lighting has to be designed with sufficient attention given to various perceptual characteristics of humans. Some characteristics for determining visual performance include night time visibility and disability glare. There are other characteristics that create an atmosphere, for example, brightness, conspicuousness, sparkle, and gorgeousness.

Recently, studies on the creation of images that express perceptual characteristics of humans have been announced. For example, a tool for imaging a two-dimensional distribution of human-perceived brightness (brightness image) has been announced and is being applied to evaluate lighting design.

Some studies have reported the association between an illuminant's color rendering property and conspicuousness; however, there seems to be no study about generating a 2-D distribution of human-perceived conspicuousness (conspicuousness image) from a luminance distribution.

In this paper, we focused on conspicuousness because the spotlighting technique is often required for lighting design. And the aim of this study is to create a conspicuousness image generation system from the transformation of a luminance distribution image by using a two-dimensional wavelet.

Images are generated as follows. First, we take several pictures of a physical object, and combine them into a luminance distribution image by photographic photometry. (photographic photometry is a technique for measuring luminance by compositing photographs taken under varied exposure conditions). Next, the image is converted into a conspicuousness image with discrete wavelet decomposition and composition.

We tested the perceptual characteristics of conspicuousness by a subjective assessment. These characteristics were needed for building the image generation system. The subjects, eight females, and twelve males, aged from their twenties to forties, were healthy and had normal vision (mean ± SD visual acuity, 1.1 ± 0.34, including corrected VA). The assessment was conducted in a darkroom environment and consisted of 170 stimuli that were projected onto a translucent screen with a projector (ELP-73, EPSON, RGB liquid crystal shutter projection system, contrast ratio of 500:1, 1500ANSI lumen). The experimental stimuli were a combination of variously sized circular targets and 90 degree square-shaped backgrounds. All targets were located at the center of each background. The ratio of target to background varied from 30 to 0.1.

Because conspicuousness is typically sensed by comparing one thing with others, the subjects had difficulty determinating the conspicuity of singular stimuli. Consequently, the following two-step evaluation method was adopted.

First, All subjects estimated the target by the method of magnitude estimation (ex-1), and then, estimated subsets of them solely by a pre-defined conspicuousness scale of 1 to 13 (ex-2).

The luminance distribution of the 170 stimuli were taken by photographic photometry. These luminance images were decomposited to each level of the detailed parts by discrete

wavelet transform. The coefficient β_k was derived as the value at the center of the detailed part of level(-k) (where k varied from 1 to 9).

A multiple linear regression was conducted. The explained variables were obtained from the experimental values of subjective evaluations, and the explanatory variables were β_1 to β_9 as described above.

The multiple regression coefficient α_k was derived as a factor on a pixel-by-pixel basis for each level of the detailed image. A conspicuousness image system was built by using α_k.

In conclusion, we can apply the technology for creating images of perceived conspicuousness for various purposes in diverse industries. For example, for lighting designer projects calling for eye-grabbing emphasis with spotlighting, this technology can support proper renovating or adjusting of the light after the fact. Furthermore, an inexperienced designer can learn the know-how for coordinating lights through his or her experience in using this imaging technique. Mannequins in store windows, Signboards located on top of buildings, illuminated landmarks, etc., will be candidates for this estimation.