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COLOUR PREFERENCE UNDER DIFFERENT ILLUMINANTS – NEW APPROACH OF LIGHT SOURCE COLOUR QUALITY

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The appearance of coloured objects in the environment is different under natural light and artificial light. Colour shifts of coloured surfaces produced by light sources are described with the CIE colour rendering index. The failure of this metric in case of modern light sources has been proved by many authors. Many attempts have been made to renew the current CIE CRI method or to develop new metrics. Authors would like to supplement these metrics with visual results based on colour appearance, accumulated from a new approach of light source colour preference.

Method

Three pictures of the ISO series for graphic arts testing have been selected. Reproductions of the three pictures can be seen in Figures 1-2.

Figure 1 a, ISO N2, Flowers. b, ISO N7, Threads.

These pictures have been selected because in Figure 1a some typical flower colours are shown, while in Figure 1b many shades of different colours can be observed. In Figure 2 observer could concentrate on human complexion colour. In the present experiment five light sources have been compared in a double lighting booth. A tungsten halogen lamp has been mounted in one of the compartments (randomly) as reference illuminant. In the other compartment of the double booth one of the following test lamps has been operated: CFL, three LEDs: an RGB and two different white phosphor LEDs. Luminance in the viewing plane has been standardized at 170 cd/m^2 ±5%. Table 1 summarizes the correlated colour temperature (CCT) and general colour rendering index(R_a) as well as the $R9$ index, critical for the red colours.

Figure 2. ISO N1, Woman with glass

	Halogen lamp	Compact Fluorescent Lamp	White Phosphor LED – low $R_{a,\ pLED1}$	White Phosphor LED – high $R_{a,\ pLED2}$	RGB Cluster
CCT [K]	2634	2797	3005	2977	2667
R_a	99,76	83,75	76,78	93,42	41,88
R9	99,86	7,57	9,93	56,66	-22,35

Observers were asked to sign their impression on the scale, which can be seen in Figure 3. The investigated properties were: more preferred, more vivid, more lively, more natural.

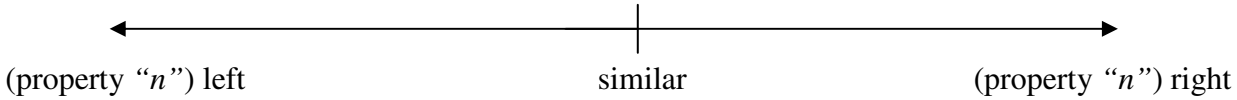

Figure 3. Judgement scale used to quantify observers impression.

Figure 4 shows, as an example the visual rating scores of a group of students and instructors of colour science[1].

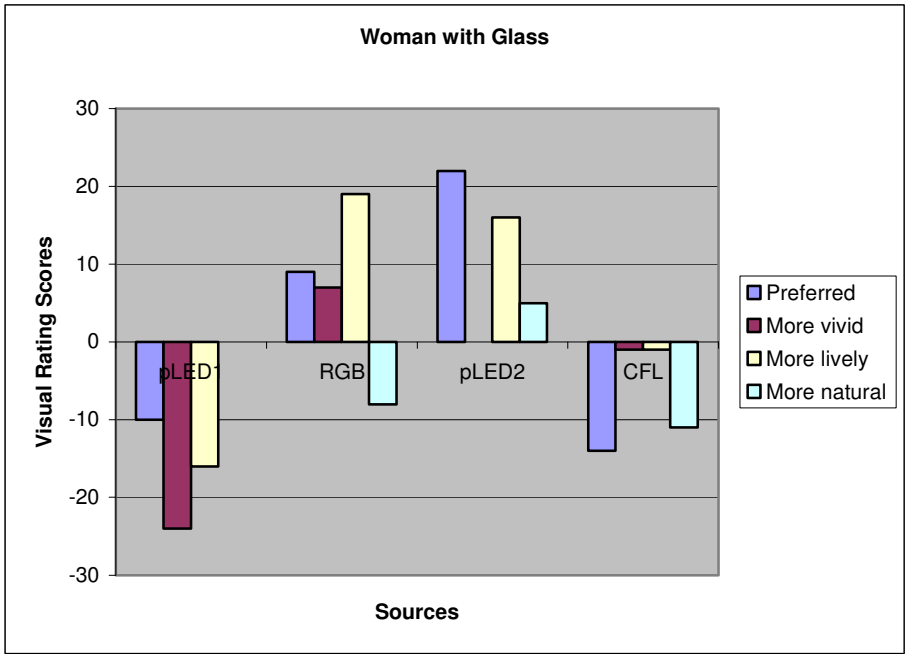

Figure 4: Absolute spectral power distribution of the five sources tested.

Detailed analysis of the visual investigations and objective correlates will be presented at the meeting.

Future work

Appearance of these 3 ISO images (pixels by pixels) will be simulated under the different illuminants. Colour shifts of remarkable surfaces (i.e. skin, colours of greenery and threads) will be calculated and visualized in the CIECAM02 colour appearance model. Distortion vectors will be correlated with visual results. The same visual experiments will be

[1] Thanks are due to the participants of the CREATE EU funded workshop in Bristol, Nov. 2009, to rate the lamps.

carried out with artists and students of fine arts to investigate the difference between artists and engineers. Based on these experimental results an improved description of colour preference and light source colour quality can be achieved.

Acknowledgments

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