Evaluation of samples with different chromaticity

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Abstract: The aim was to perform a study focused on the visual assessment of four-color center samples on an LCD monitor with textile structure simulation. At the same time, the prediction performance of the selected color appearance models was compared [1].

Keywords: *color difference, CIELAB, CIECAM02, CIECAM16, STRESS index.*

Introduction: Various color appearance models were selected for subsequent analysis of the prediction performance. There are differences between the CIELAB and CIECAM02, CAM02-UCS and similarly CIECAM16 and CAM16-UCS models and the possibilities where the models can be used differ. In CAM models, the adaptive luminance, the degree of adaptation, and the luminance level adaptation factor, as well as the effect of background and surroundings, is included in the calculation. Within CIELAB these parameters are constant. Both, CIELAB and CAMs models contains chromatic adaptation. In case of CIELAB the approximate Von Kries, in the CAM models it is the CAT02 and CAT16 [2,3]. In addition, luminance adaptation is included in the CAM models compared to CIELAB. For CIECAM02 the chromatic adaptation is followed by the luminance adaptation, whereas for CIECAM16, chromatic and luminance adaptations are performed in the same step. UCS versions of both CAMs are more perceptually uniform than mentioned models [3].

Materials: In the visual experiment, set of samples containing 4 color centers (orange, green, violet and turquoise) were prepared. The sample set was supplemented with a simulated plain weave in order to be as visually close as possible to the real textile sample. Each color center consisted of 55 color pairs with known difference.

Methods*:* A calibrated EIZO COLOR GRAPHIX CG21 LCD monitor coupled with a Matrox Parhelia 128 MB graphics card was used for visual assessment. Visual assessments were performed in software Envision Pro, ver. 1.1 (Datacolor International). In the center place of the test field was the color pair to be compared with the standard placed on the left. At the bottom of the screen was a grey scale corresponding to ISO 105-A02:1993. Observers who participated in the visual assessment were asked to determine the step of grey scale that corresponded closely to the color pair being assessed.

Results:
The results of the visual assessment were used to determine the predictive performance [1] of the selected color appearance models CIECAM02, CAM02-UCS, CIECAM16, and CAM16-UCS and the CIELAB color difference formula. The results of predictive performance are expressed using the STRESS index. The results show that the highest predictive performance is achieved by the CAM02-UCS and CAM16-UCS models for all color centers, while the lowest predictive performance is achieved by the CIELAB.

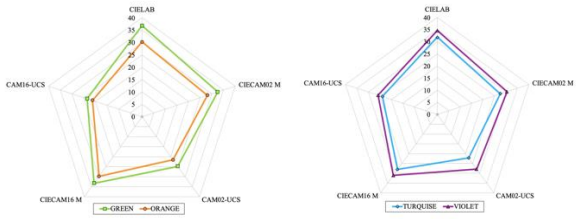

Figure 2 Prediction performance for color centers (left – green, orange; right – turquoise, violet)

The highest prediction performance was obtained for the orange and turquoise center. The evaluation of the predictive performance of the selected models and the CIELAB formula for the violet center shows the smallest difference in the evaluation with respect to the STRESS index compared to the other color centers. The statistical treatment tested whether there was a statistically significant difference between the formulas and the models. The squared ratio of the STRESS index for tested models and formula was used for testing. The resulting ratio value was compared with the value from the F-distribution with n-1 degrees of freedom and 95% confidence interval. The results showed that there was no significant difference between the CIELAB formula and the CIECAM02 and CAM02-UCS models, whereas the CIELAB formula and the CIECAM16 and CAM16-UCS models were significantly different. No statistically significant difference was found between CIECAM02 and CAM02-UCS models. Statistically significant difference was also found between CIECAM16 and CAM16-UCS models.

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