Designing Usable Sequential Color Schemes for Geovisualizations

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Extended Abstract

The contribution aims to introduce the proposal of computational method of designing sequential color schemes of user-specified coloring, number of classes and their mutual color distances specified by CIEDE2000 formula (developed by Sharma et al. 2005).

Color distance (a metrics established by the International Commission on Illumination to quantify the human ability to differentiate between colors) has been empirically proven to be an important factor of overall maps readability (e.g. Brychtova and Coltekin 2015, Brychtova 2015, Brychtova and Coltekin 2014, Brychtova and Vondrakova 2014). Insufficient color distance between cartographic symbols impairs the map-users ability to distinguish and interpret the visualized spatial information.

The method of designing sequential color schemes is based on analytic geometry calculations, specifically on finding the intersection of two subspaces: CIELAB color space and a straight line, on which the color scheme lies. A straight line A_1A_0 is defined by two points A_1 and A_0, where A_1 becomes marginal shade of the color scheme and A_0 is auxiliary shade determining the direction of the color scheme within the CIELAB color space.

The principle consists in finding color shades A_2, A_3, …, A_n lying on straight line A_1A_0 at given distances defined with CIEDE2000 $\Delta E_{00}(A_1, A_2)$, $\Delta E_{00}(A_2, A_3)$,…, $\Delta E_{00}(A_{n-1}, A_n)$ (see the example on the Figure 1).

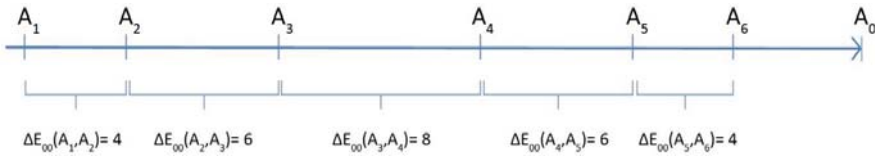

Figure 1. An example of color scheme of 6 classes and color distance between them ΔE_{00} = (4-8-10-8-4).

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The method is intended for the construction of schemes for *digital maps* only and for this reason their construction is limited by the gamut of sRGB color space.

Between sRGB and CIELAB color spaces doesn't exist any one-to-one correspondence and, at the same time, transformed to CIELAB, the set of possible sRGB colors forms a non-convex shape, therefor out-of-gamut colors can result from the computation. In these cases (when resulting color coordinates are outside the range $R,G,B \notin \langle 0;255 \rangle$) the computation is terminated and the user is notified that in this direction there are no more available color shades.

To access the presented method an on-line tool *Sequential Color Scheme Generator 1.0* was created. It is freely available at **http://eyetracking.upol.cz/color**. Users can manipulate *colors*, *number of classes* and *visual difference* between them by applying color distance steps with CIEDE2000. Each step is instructed with information bubbles.

In the future we want to implement color scheme computation in color space designed for *printing* purposes (FOGRA39) resulting in C, M, Y and K color coordinates. We also want to replace current square color picker with irregular shape of the color space to allow better perception of its dimensions.

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