

Constrained Palette-Space Exploration- Supplementary materials

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1 OVERVIEW

This document presents additional materials for the paper *Constrained Palette-Space Exploration*. It is structured as follows: we first provide a few complementary technical details on our method, discuss parameters, and evaluate the robustness of several of its subprocesses. Then, we present additional details on the user study, such as user statistics and results statistics. Finally, we present more results obtained with our method.

2 TECHNICAL DETAILS

2.1 Parameter setting

We designed our approach to work in semi-automatic and automatic palette exploration systems. The main parameters of our approach are the input palettes themselves. We also have constants that can be tuned in several stages of our approach, see Table 1 for the numerical values used in our experiments.

Notation	Value	Equation(s)
β	500	(3)
λ	1000	(4), (11)
γ	$1e^{-5}$	(11)

Table 1. Parameter values used to generate all the illustrations and results shown in the paper and in supplementary material.

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The parameter β is defined as twice the length of the Lab space diagonal, in order to be always larger but of the same order of magnitude than the maximum contrast that can be obtained between two colors. The parameter λ defines the penalty factor we apply to out of gamut colors. Finally, we set γ to reduce the influence of the Laplacian constraint to under-constrained configurations in interpolation-based interpolation.

2.2 Interpolation-based exploration

2.2.1 Color-spaces. Color interpolation is strongly influenced by the embedding color space. In this work, we use Lab for its perceptual properties. As demonstrated in our paper, our optimized

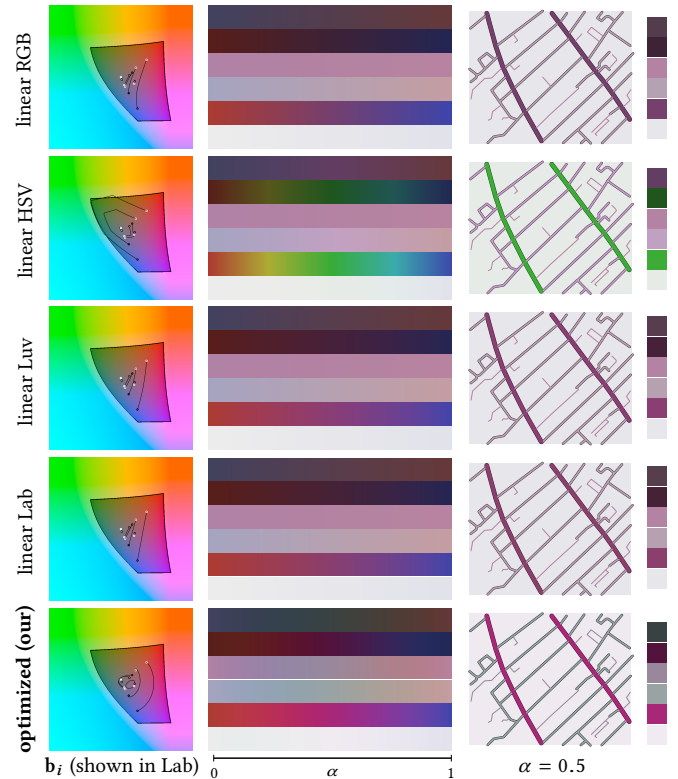


Fig. 1. Comparison of linear interpolation paths for common color spaces, against our approach, for the scene Small Map (Fig. 4 in the paper). The first row shows interpolation paths in Lab (slice for $L = 50$), the second row the interpolated colors, and the third row the palette obtained for $\alpha = 0.5$.

interpolation paths outperform linear interpolation in existing color spaces. For the sake of clarity, we show in Figure 1 a comparison between linear interpolation in several color spaces, and compare against our approach.

2.2.2 Bézier curves degree. All interpolation results in the paper are optimized using 4 degree Bézier path. Using a higher degree provides slightly smaller error, but increase computation time. Nevertheless, the results are stable, and higher degree do not produced oscillation as shown Figures 2 and 3. Figure 3 shows how the paths stay stable as degree increase, while the optimization take the increasing degree of freedom to adapt arc the nodes distribution along the path changes with the degree. The optimization take the degree of freedom to adjust speed along each path during the interpolation.

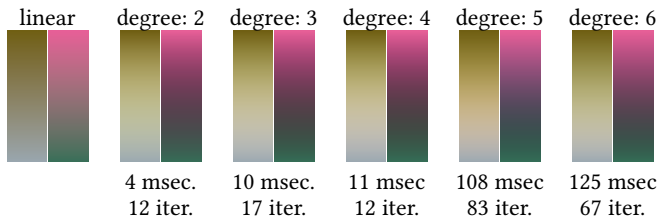


Fig. 2. Stability of the paths computation when increasing the path degree.

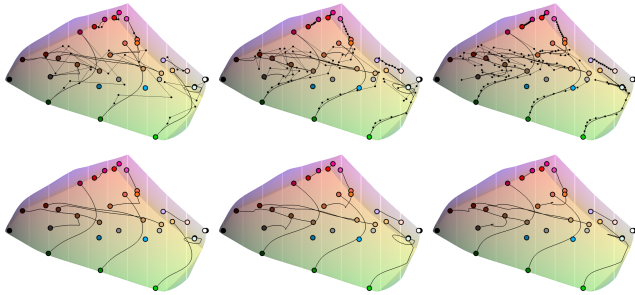


Fig. 3. The 3D path in Lab space for the interpolation of presented Figure 1 of the paper. From left to right we use degree 4, 8 and 12 Bézier curves. The first row displays the curve only, while the second row displays the curve along with their control polygon.

3 USER STUDY

Figure 4 presents the gender, age and expertise distributions of our recruited users.

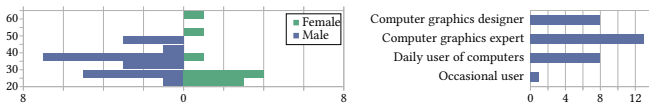


Fig. 4. User statistics. Left: ages, right: expertise.

3.1 Task 1: Augmented harmony and color-blindness

User feedback. As stated in the paper, we provided real-time feedback during the exploration to help users evaluating their design:

- two views of the palette applied on an image, with and without deuteranopia simulation (Figure 5-a,b),
- a 2d scatter plot, giving quantitative values of the color contrasts (both vision types) and harmony deviation ((Figure 5-c)). These values are computed as the sum of the residuals of the constraints modeling these relations. Users were advised to keep the deviations as-small-as-possible.

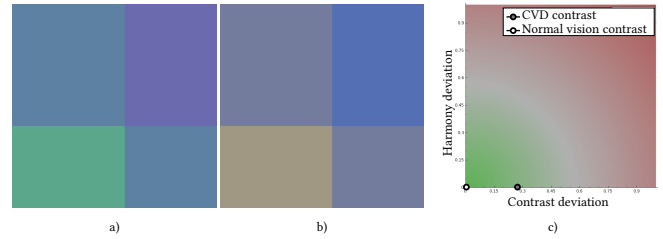


Fig. 5. Feedbacks provided to the user for task 1.

Additional results. Figure 6 presents the error distributions for the (a) harmony, (b) extended harmony and (c) CVD-aware extended harmony templates.

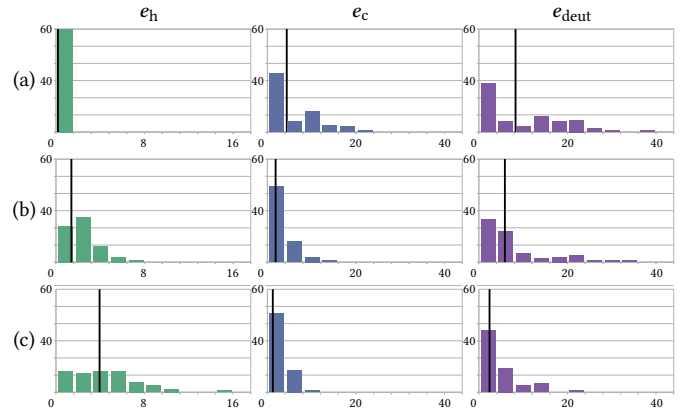


Fig. 6. Error distributions for the three tested palettes: (a) Harmony, (b) Augmented harmony and (c) CVD-aware extended harmony. Vertical bars show the distributions mean given in the paper.

4 RESULTS

4.1 Constraint graphs

The constraint graphs of Harmonization and Cell scenes are illustrated respectively in Figures 7 and 8. As described in the paper, both graphs have been generated automatically from the input image and simple user inputs.

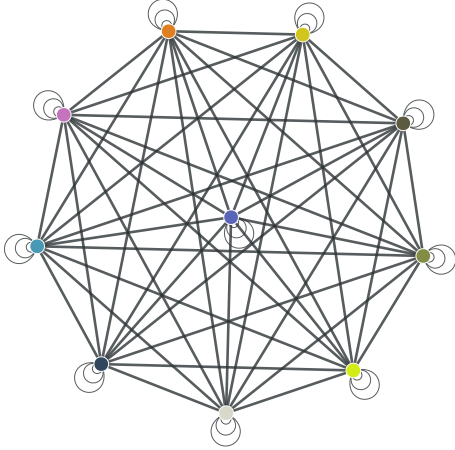


Fig. 7. Constraint graph of the Harmonization scene, composed by a complete constraint graph and unary anchors constraining the initial saturation and value components, while conforming the hue components to the input template.

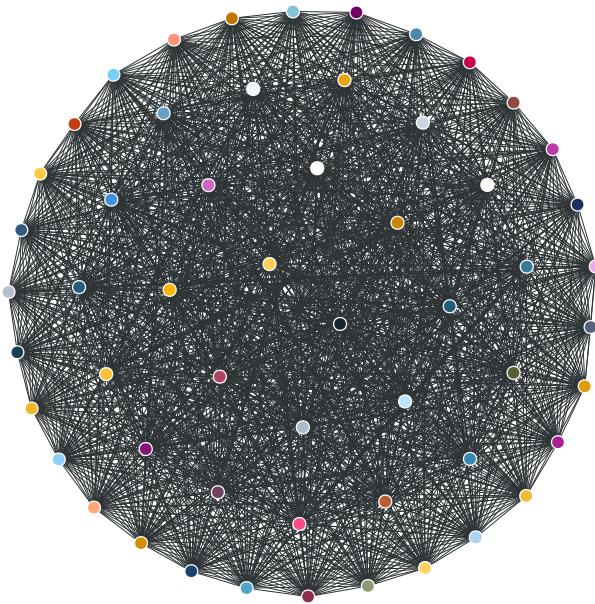


Fig. 8. Constraint graph of the Cell scene.

4.2 Additional results

Figure 9 shows an example where the energy consumption on a topographic map is optimized for the sea, the background and the vegetation. This could be computed once for all or adapted during navigation. Maps resulting from this exploration preserve both cartographic constraints and energy consumption. Moreover, resulting maps provide interesting symbolizations in a dark night context of visualization.

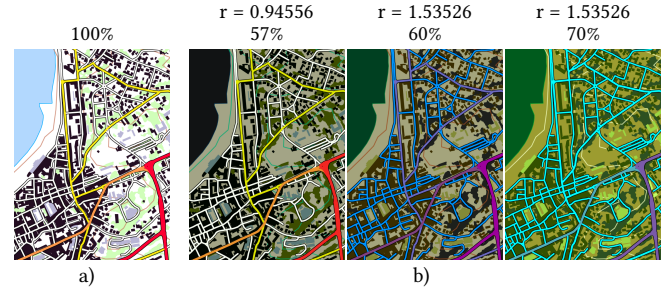


Fig. 9. Palette exploration using cartographic constraints and three energy saving constraints on the sea, vegetation and background colors, corresponding to a) blue, white and green in the input palette. b) Each optimized palette application is associated to its residual conformity score and the energy consumption estimation on the resulting anti-aliased map.

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