Design-By-Example:

A Schema for Designing Visualizations Using Examples from Art

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1 Introduction

We present a design schema for generating data visualizations using examples from art. With this approach a user: 1.) chooses a composition or detail from a favorite painting, 2.) generates a template by extracting characteristics or brushstrokes suitable for representing data variables, 3.) generates a pre-visualization of the data using a rendering framework [Sobel 2003] and, 4.) transfers the features from the painting using the Image Analogies, Texture-By-Numbers algorithm [Hertzmann et al. 2001].

Our process eliminates the need for a user to design a visualization from scratch since compositional elements such as color, contrast, lighting and texture have already been worked out by the painter or artist. The user can then focus on adjusting the relationships among graphical elements in the pre-visualization image (Figure 1c) to make sure the output image (Figure 1d) is effective for use in analysis.

2 Process

First Step: Select a Source Image. The user chooses a source image from classical or abstract painting, graphic art or photography. However, in any source image choice, the detail that will be used to represent data must have primitive features that can be easily extracted to signify data elements. In the example source image (Figure 1a), we chose a small detail from a larger painting by the author because it had features such as circular glyphs and distinct brushstrokes ideally suited to represent our fluid flow dataset.

Second Step: Label Source Image. Label the component textures of the source image by applying a specific color to each distinct area. In Figure 1b, the blue areas represent yellow regions of the source image and red areas indicate black regions. The two colors (blue and red) in Figure 1b will be used together to represent velocity and magnitude of two-dimensional fluid flow. The green areas indicate the greenish brushstrokes of the source image; they will be used to represent vorticity.

Third Step: Generate a Pre-Visualization Image. We generated this image with a rendering framework from Sobel [2003]. We based it on graphics from the original painting by the author.

Fourth Step: Transfer Features from Source Image.
We used a texture transfer algorithm introduced by Hertzmann et al. to apply features from the painting to our pre-visualization image.

3 Results

The resulting image (Figure 1d) is a meaningful representation of our dataset and it exhibits some of the most inspiring qualities of the painting. In addition, by using an example from art, we generated a much more sophisticated result than if we had attempted to design the visualization from scratch.

4 References

HERTZMANN, A., JACOBS, C. E., OLIVER, N., CURLESS, B., SALESIN, D.H., "IMAGE ANALOGIES", In *Proceedings of ACM SIGGRAPH 2001*, ACM Press / ACM SIGGRAPH, New York. E. Fiume, Ed., Computer Graphics Proceedings, Annual Conference Series, ACM, 327–340.

SOBEL, J. 2003. A Descriptive Language for 2D Multivariate Scientific Visualization Synthesis. Master's thesis. Brown University.

Figure 1a: *Source Image. Detail from a painting by the author, inspired by a painting by Gustav Klimt.*

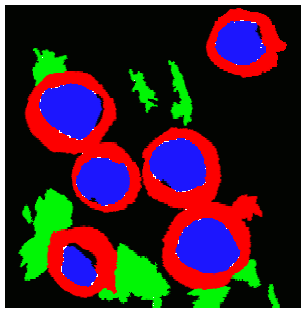

Figure 1b: *Labeled Source Image. Shows areas to be transferred to resulting image in various colors.*

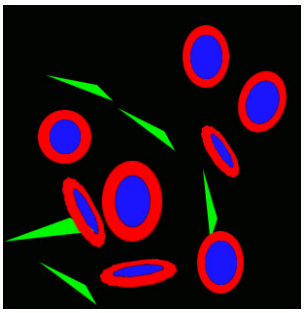

Figure 1c: *Pre-Visualization Image. Glyphs represent velocity, magnitude and vorticity.*

Figure 1d: *Resulting Image. Using Hertzmann, et al. algorithm to transfer texture from source.*

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