CS 345 Software Engineering
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Project Vision Document

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Problem

Visual artists need to understand color so they can represent reality and make beautiful artifacts. This often requires figuring out where colors are with respect to other colors. A *color space* is a spatial organization of colors, usually in either two or three dimensions. A color space can help artists place color samples in the space and in relationship with other color samples.

There are various kinds of products for exploring color spaces. Various graphics programs have color pickers, for example. Color pickers usually use the RGB color space and 2D representations. Unfortunately the RGB color space does not lend itself to the needs of artists, and 2D representations of RGB color spaces are hard to work with. There are also many phone apps for recognizing colors in pictures, either for picking house paints or finding the RGB or HTML color codes for them. Neither of these tasks is useful for visual artists. There are a few phone apps for finding color harmonies and for simulating color mixing, which are both quite helpful.

The Munsell color space is a 3D color representation system that is very useful for visual artists. Munsell color books that show samples from the Munsell color space are available and quite useful. A small Munsell color book with about 60 color samples cost roughly $80, but the large Munsell color book with hundreds of samples cost over $1000 dollars. Besides being very expensive, Munsell color books (being physical objects) are somewhat awkward to use. There are a few phone apps that show various representations of the Munsell color space.

Vision

A color explorer would use the Munsell color space because it is familiar to visual artists and easy to understand and use. It would allow artists to investigate the Munsell color space so that color samples could be placed accurately into the color space. A color sample placed accurately in a color space allows artists to understand what color they are seeing, and how it fits with other colors with similar hue, value, and chroma. It also would make it easy to find color harmonies. A color explorer would help artists see what results when colors are mixed. Finally, the color explorer would be a digital tool that is portable and easy to use. Such a tool would have features exceeding those of any product currently on the market.

Product Features

1. As an artist, I want to see the colors in a Munsell hue arranged systematically by value and chroma so that I can explore similar colors in the Munsell color space.

2. As an artist, I want to see the Munsell color space in a 3D representation that can be rotated and tilted so that I can explore colors in the Munsell color space.
3. As an artist, I want to see the standard Munsell values from black to white so that I can plan the values in a composition.
4. As an artist, I want to select pixels in images and identify their Munsell color so that I can know what colors comprise an image.
5. As a painter, I want to specify paints on my palette and then see what colors result when I mix them so that I can explore what colors I can achieve when I mix various paints.
6. As a painter, I want to specify paints on my palette along with a desired color, and then be told how to mix paints to achieve that color.
7. As an artist, I want to specify a color and then see harmonious colors, including complementary color, analogous colors, triad colors, tetrad colors, and square colors.
8. As an artist, I want to take color tests so that I can determine my sensitivity to color and increase my skill in seeing colors.
9. As a marketer, I want the product (Spectrum) to be written in Java so that I can market it as a desktop product with more features and better usability than similar phone-based products.
10. As a marketer, I want Spectrum to have a graphical user interface to that it is attractive to potential users.
11. As a Java developer, I want to use Swing for the GUI so that I can take advantage of technology I know.

Terminology

complementary color—the complement of a color is the color with the opposite hue (the Munsell color hue number plus 50 mod 100) but the same chroma and value.

analogous colors—the analogues of a color are two colors equally distant in hue from a given color (the same distance around the Munsell color space in opposite directions) with the same chroma and value.

triad colors—triad colors are three colors equally spaced around the Munsell color hue dimension, but with the same chroma and value; if h is the hue of a color, then the hue numbers of the others in the triad are (h+33.3) % 100 and (h+66) % 100.

split-complementary colors—the split complements of a color are any two colors analogous to the complement of a color.

tetrad colors—tetrad colors are any four colors consisting of two pairs of complementary colors; also called **rectangle colors**.

square colors—square colors are four colors equally spaced around the Munsell color hue dimension, but with the same chroma and value; if h is the hue of a color, then the hue numbers of the others in the square are (h+25) % 100, (h+50) % 100, and (h+75) % 100.

Munsell color space—a three dimensional polar coordinate color representation in which hue (the color family, like blue or red) is the angle around the origin, chroma (the saturation of a color) is the radius from the origin, and value (the lightness or darkness of a color) is the distance above the plane. Hue ranges from greater than 0 to 100, chroma ranges from 0 (gray) upwards, and value ranges from 0 (black) to 10 (white).