Analysis of Color Schemes of Some Characters of My Little Pony: Friendship is Magic

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1 Tips on Reading These Graphs

For completeness, I showed every color that is neither a pure (or nearly pure) shade of gray, nor a color of body stroke. As a consequence, some very minor colors are also shown in the hue graphs (e.g. "Eye Highlights" and "Eye Gradients"). To read out the general color scheme, only read the colors of body and hair. The minor colors are also important, but they do not determine the general color scheme.

The same tip applies for reading the scatter plots.

Note that I’m going to assume familiarity with HSV Color Space. If you don’t know what it is, take a look at it here.
2 Analysis of the Hue Graphs

First, take a look at the raw color wheel, which should be a familiar sight. The conventions I’m going to use is that there are 360 different hues, from 0 to 359, with red designated as 0. In the figure below, red is on the top.

![Figure 1: The raw color wheel.](image)
Next, the color harmonies. To save space, I’m going to refer you to an external link that explains color harmonies better than I do. Skim that, Google some more if you feel like it, then return to this document.

Let the analysis begin!

2.1 Pinkie Pie

Pinkie Pie’s hue graph shows that her color scheme is a split-complement with perfect symmetry, with 335 being the dominant hue. It provides strong visual contrast, which matches her party-loving poniablity. Also note the small amounts of cool color in her eyes and the middle balloon of her cutie mark, balancing the overall warm color of pink.

Figure 2: Pinkie Pie’s Hue Graph.
2.2 Fluttershy

Fluttershy’s hue graph shows that her color scheme is mostly semi-tetradic, meaning that the two dominant hues, 55 and 335, are 90° degrees apart (since there are 360 degrees of hue, the analogy between angle and hue is very useful). However, her eyes are in a color that is almost a direct complement with that of her hair, making her eyes to stand out. Another way to describe this hue scheme is to say that her eyes’ and her body’s colors are in a semi-triadic relation.

Figure 3: Fluttershy’s Hue Graph.

Semi-tetradic, with a dash of complement
2.3 Applejack

Ah, good ol’ AJ, so plain and simple. Just that, analogous. Analogous colors usually match well and create serene and comfortable designs, and they are often found in nature and are harmonious and pleasing to the eye. This is just what the cowgirl is like: naturally charming, comfortable, familiar.

Figure 4: Applejack’s Hue Graph.
2.4 Twilight Sparkle

Twilight Sparkle's colors are tightly centered around the purple region. In other words, her color scheme is almost a pure monochrome. Monochrome color schemes tend to be elegant and clean. Her cutie mark is a prominent pink, which is in the exact same color as the streaks of pink in her hair. This pink creates some contrast, preventing monotony, yet still analogous enough to be soothing.

Figure 5: Twilight Sparkle’s Hue Graph.

Monochrome, with a dash of analogous
2.5 Rainbow Dash

Rainbow Dash is awesome, radical, and pentagonal. I have to say, color harmony theory doesn’t work well when analyzing her color scheme, since that is bonded by the traditional view on the six colors of rainbow. I think it is of some interest to note that the traditional view does not distribute the colors evenly on the color wheel.

As an aside, note the sequence of her hair color: red, orange, yellow, green, cyan, purple. Also note that her cutie mark reuses three colors from the aforementioned six, namely, red, yellow, cyan.

Figure 6: Rainbow Dash’s Hue Graph.
2.6 Rarity

Unfortunately, since all shades of gray, white and black inclusive, are by definition without hue, Rarity’s body color is almost unable to be shown on the hue graph. Fortunately, her body is actually an extremely light tint of cyan, which is very close to the hue of her cutie mark.

I really don’t know how to interpret her color scheme with color harmony theory, except noting that, somehow, she shares the same color harmony with Applejack.
2.7 Other Ponies

Now try your hooves at analyzing the rest of the hue graphs yourself. Due to some lack of skills with \LaTeX, I had to put them separately. Please find them in the compressed file.

3 Analysis of Saturation and Value

Now, let’s take a look at the saturation and values of ponies’ colors. Since I really know nothing about the nuances of saturation and value’s effect on aesthetics, I’m just going to make an elementary analysis using scatter plot.

![Figure 8: Value and Saturation of the Color Schemes - Mane Six](image)

This is the scatter plot for the colors of the mane six. The color codes are: purple for Twilight Sparkle, pink for Pinkie Pie, yellow for Fluttershy, blue for Rainbow Dash, orange for Applejack, black for Rarity.

Not much pattern to see, except that none of these data points are at the lower triangle region. Let’s plot all the data points and see what we will get.
Yes, it seems that the observed pattern was indeed true. All the points are crammed in the upper triangle. To put this fact mathematically, we have

\[ \text{Saturation} + \text{Value} \geq 100 \]

It also seems true that these ponies’ colors tend to have a very high value, while their saturation is, on average, not as high. This is probably the reason they look so pastel, soft and cute.

### 4 Easy Steps for Creating a Color Scheme for Your OC

Just to be clear, I’m not even an experienced hobby artist. I’m just a physicist who has an obsessive-compulsive habit of analyzing everything in a scientific matter, and try to deduce conclusions from it. The following advices are only my personal suggestions after studying the color schemes of these ponies for three days, and I certainly think that everyone can and should form one’s own opinion about the proper way to construct a color scheme.

First, try to figure out the poniality of your OC, and use that to determine her colors. If she is calm and relaxed, then you can use monochrome or analogous. If she is energetic and vibrant, then consider split-complement, triadic or semi-triadic.
After picking the color harmony, determine two dominant colors, one for body color and another for hair color. If her hair has multiple colors, then choose only one dominant color to be the body color, and use two or more sub-dominant colors as hair color.

After the body and hair are dealt with, turn to experiment with the small things a bit, including the eye and the cutie mark. These small details can make a huge difference, so take care. You can use colors that are analogous to the dominant colors, and create a sense of stability, or use their complement colors to create some contrast, which attracts the eye.

Some more things to bear in mind:

\[ \text{Saturation} + \text{Value} \geq 100 \]

This keeps them cheerful and pastel-looking. DO NOT, I REPEAT, DO NOT use pure black or indeed any color that has a low brightness, unless you know what you’re doing! Do use high values and middle to low saturation.

In effect, what I said was this: make your OC a cute pastel soft bright pony, not a dark edgy and garish pony! A dark, edgy and garish pony does not belong to Equestria!

And no, no piercings, tattoos, strips or spots, unless you know what you’re doing.

Some case studies will be helpful.

## 4.1 Good Color Schemes

![Figure 10: Monochromatic, with a bit of bluish-gray to spice things up a bit, and to balance the overall warm color. He gave me the feeling of warm, comfortable, easy-going, and being generally a real nice guy. Source](image)

Source
Figure 11: Sisby’s OC, Widefire! Her body color is in low saturation and high value, while her hair is in middle saturation and low value. Her colors are closely analogous. Not for the aggressive poses she have, I would probably see her as a soft and delicate one. [Source]

Figure 12: Snowdrop! Her color scheme is obviously monochrome. Her colors have really high value and really low saturation, making her extra-pastel-looking. These also closely resembles the colors of snow itself. [Source]

Figure 13: I tried. I really tried. But of all the OC’s I have seen, only Milky Way successfully used complement colors, so I have no choice but to include her. Her body color is orange, in full value, moderate saturation. Her hair is blue, which is the direct complement of orange, but surprisingly, it is not jarring at all, despite that both orange and blue are both used in large doses. The resulting color scheme makes her very vibrant and unique. [Source]
4.2 Bad Color Schemes

Figure 14: Never ever use the infamous black-and-red color scheme. Using large doses of pure white is also risky, unless you have designed Rarity and Sweetie Belle.

Figure 15: Again, don’t use black in large doses, and refrain from adding distracting accessories. Also note that the pink is oversaturated.

Figure 16: The pure red, combined with its complementary color cyan, is too jarring. It also suffers from oversaturation.

Figure 17: Kind of cute, but he needs to brighten up. Increasing the values to 60 to 90 would help greatly. However, be careful not to cause a jarring effect, since his main hues are orange and blue, which are two complementary colors. (Compare this to Milky Way, the only OC that successfully used a complement color harmony)
5 Credits

I consulted exclusively the color guides created by kékafloyd for the color scheme of: Applebloom, Applejack, Cheerilee, Derpy Hooves, Fluttershy, Lyra Heartstrings, Octavia, Pinkie Pie, Princess Celestia, Princess Woona, Rainbow Dash, Rarity, Scootaloo, Sweetie Belle, Twilight Sparkle, Vinyl Scratch.

The screencaps from which I took colors directly are from color-corrected episodes uploaded to Youtube by MysteriousBrony2012.

6 Technical Information

When I have to measure from a screencap, I try to find one where the lighting is normal daylight (that’s why I measured Luna not in S2E04, but in S3E01), and I measure multiple points to even out errors. Also, I try to avoid edges since that’s where compression artifacts tend to appear.

Princess Luna’s outer layer of hair has transparencies, therefore I had to measure its surroundings to find out its “true color”. My measurement and subsequent data analysis shows that it has an alpha value between 0.48 and 0.52. Since it would have been easier for the animators to remember the value 0.5 rather than, say, 0.4818, I deduced that 0.5 is the alpha value used by the animators for Luna’s outer hair. Using this value, I calculated the true color of Luna’s outer hair to be #4B2EC2.

The formula and raw data are shown below.

\[
\begin{bmatrix}
R' \\ G' \\ B'
\end{bmatrix} = \alpha \begin{bmatrix}
R_0 \\ G_0 \\ B_0
\end{bmatrix} \times (1 - \alpha) \begin{bmatrix}
R' \\ G' \\ B'
\end{bmatrix}
\]

\[
\begin{bmatrix}
82 \\ 63 \\ 155
\end{bmatrix} = \alpha \begin{bmatrix}
R_0 \\ G_0 \\ B_0
\end{bmatrix} \times (1 - \alpha) \begin{bmatrix}
89 \\ 80 \\ 111
\end{bmatrix}
\]

\[
\begin{bmatrix}
156 \\ 135 \\ 216
\end{bmatrix} = \alpha \begin{bmatrix}
R_0 \\ G_0 \\ B_0
\end{bmatrix} \times (1 - \alpha) \begin{bmatrix}
237 \\ 224 \\ 238
\end{bmatrix}
\]

\[
\begin{bmatrix}
98 \\ 78 \\ 170
\end{bmatrix} = \alpha \begin{bmatrix}
R_0 \\ G_0 \\ B_0
\end{bmatrix} \times (1 - \alpha) \begin{bmatrix}
125 \\ 114 \\ 148
\end{bmatrix}
\]

From these, it is trivial to compute the 6 experimental values of \( \alpha \). (There are only 6 independent values of \( \alpha \) derivable from these set of measured data.)

\[
\alpha = 0.4889, 0.4818, 0.4822, 0.5000, 0.5000, 0.5197
\]

Assuming that \( \alpha = 0.5 \), we get three possible sets of color values of Princess Luna’s transparent hair.

\[
\begin{bmatrix}
R_0 \\ G_0 \\ B_0
\end{bmatrix} = \begin{bmatrix}
75 \\ 46 \\ 199
\end{bmatrix}, \quad \begin{bmatrix}
75 \\ 46 \\ 194
\end{bmatrix}, \quad \begin{bmatrix}
71 \\ 42 \\ 192
\end{bmatrix}
\]
I chose the second set, since it was derived from the most accurate data points. (The other data points were all slightly fluctuating at an amplitude of about 1.)

In the spreadsheet, you’ll notice entries like "Hair 1", "Hair 2", "Hair 3" etc. If an element has a few analogous colors, these colors are usually numbered by their perceived brightness ("lightness" in Munsell’s color system). But really, I probably lost track of this sometime ago. Sorry about that.

Since all shades of gray (white and black inclusive) have no hue, I can’t show them on my graph, but will hoofnote about them when they are of particular interest.

I can’t analyze the colors of the strokes, because I simply don’t have enough time. After all, I’m doing this only because I want my ponysona, Cosmia Nebula, to look good colorometrically, and not look like another garbage OC.

The code I used to assist me in creating this series of graphs is written in Python 2.7.3. Feel free to guess what it means since I do not plan to reuse it, and therefore didn’t write helpful comments for it.

```python
>>> def hue_radian(n):
...     return n / 180 * 3.1416

>>> def chart_xy(n):
...     x = 100 + 75.6875 * sin(hue_radian(n))
...     y = 100 - 75.6875 * cos(hue_radian(n))
...     return (x,y)

>>> chart_xy(335)
(68.014018197650046, 31.403392034374349)
```

All the raw data can be found in the compressed file, in the form of an .xlsx file, so that if you want to do your own analysis, you can start doing so right away.

If you find anything unclear, don’t hesitate to ask. My deviantArt page is http://kopaleo.deviantart.com