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A New Approach for The Teaching of Practical Color Theory

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Abstract —In the traditional teaching for color theory, each pure color (primary or secondary) is assumed to be similar.Therefore the current practical training system like split complementary colors[1], triadic colors[2] or tetradic colors[4] are usingthis assumption.Each pure color can be placed into practical field just like any other pure color based on this guideline. However, in practical situation, different pure colors occupy different size of practical color space as illustrated by Munsell's color tree. Munsell color tree is a practical color system that represents the actual application range of color tone and hue. Munsell color system[6] has not been comprehensively introduced to the educational training of colors. Its strength has not been maximized especially in the teaching of practical color theory. This research paper uses Munsell color theory as the backbone to develop a more robust training of practical color theory to fulfill the needs of current visual art education. Munsell color system introduces transition tertiary colors directly with a practical objective in mind. Therefore it serves as a good system to allow beginners or painting artists to plan their color rhythm logically without too much effort wasted on trial and error processes.

Keywords –Practical color theory, Munsell, Color wheel.

1. INTRODUCTION

Visual artists are generally taught with scientific color theory that sees each color being an equal entity. However, in practical terms, colors are like vector components. We may imagine each color as a type of foreign currency. Just like different currencies do not represent the same relative values; colors do not perform through their attributes equally. Therefore practical color theory for visual artists is to be taught with colors' true practical capacity based their three attributes[5]; namely tone, hue and intensity. Munsell color system is used as the skeleton in this development of a new teaching approach to address the weakness of traditional teaching of practical color theory. Of the three attributes, tone and hue are practically more important than intensity. High intensity colors or pure color are generally not used in abundance when we have the luxury of changing tones and hues. Therefore the focus of discussions here will be placed on tone and hue of colors.

2. COMPARISON OF TRADITIONAL AND NEW APPROACH IN THE TEACHING OF COLOR ATTRIBUTES

Tone has been the most critical attribute since there is history of visual art. It is fundamental of visual contrast when the other two attributes are rarely in abundance neither inclassical drawing /painting materials nor in nature. In the classical painting era before impressionist period, most of the natural substances were in earth colors. There was no artificially fabricated material. These earth materials were

used as painting pigments like what we see in Rembrandt's paintings. The intensity is low and the hue change is small as well. Therefore tone had been the most important attribute until the Impressionist period when industrially manufactured chemical colors that offered higher intensive and hue range had become available. Therefore until today, tonal drawing of casts and figures still serves as an important part of foundation in visual art education worldwide.

Since tone is one of the main factors in visual art fundamentals, we therefore have to address the tonal character of each color. Munsell color system in Figure 1 illustrates clearly that each color has a different tonal range. Therefore these colors are not equivalent in tonal application practically. This immediately addresses the first weakness of the concepts of split complementary, triadic and tetradic color system. The later color systems do not address this practical difference at all.For example, yellow is practically light in tone. When a yellow is darken in tone, it will deviate from yellow hue to other hue depending on which dark hue to added to it to make it darker. One example is when black hue is added to yellow hue, yellow hue slowly turning into green hue. Hence we can find out that yellow has not dark tone or pure yellow hue is intrinsically bright in tone. Section 2.1 will illustrate the learning process of tones of colors.

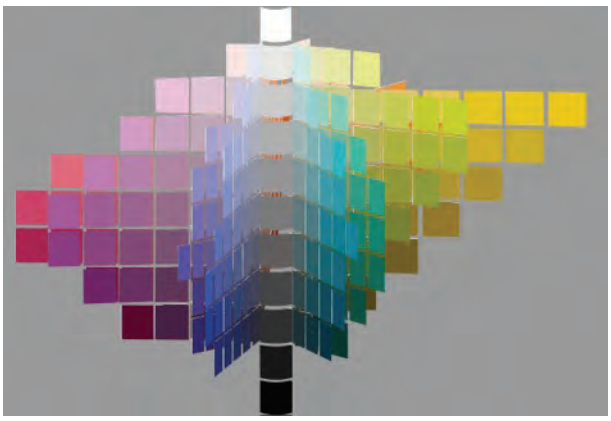

Figure 1[7]. Munsell color tree shows a Munsell practical color system. Each color occupies a different amount of color space in different vector directions. It clearly illustrates that each color is unique in its color attributes.

Figure 2. The dark blues colors show wider tonal range as compared to orange, red or yellow, while yellow has very narrow tonal range. Each color has different tonal range.

Generally it takes a long period of practice for a visual artist to master the tone of each color because the conventional systems mentioned in section one do not provide essential and logical training approaches. Therefore visual artists develop their skills solely through long period of practical experience.

Here, a new step-by-step approach has been developed to resolve this issue. With the help of digital medium, we can simplify this difficult and time consuming training process to a simple exercise for beginners. Section 2.1 with the help of Figure 3 and 4illustrate the sequential steps to learn the tonal range of colors.

Figure 3. A trial that illustrates the process of matching each pure color to its respective tone in gray scale on the top row.

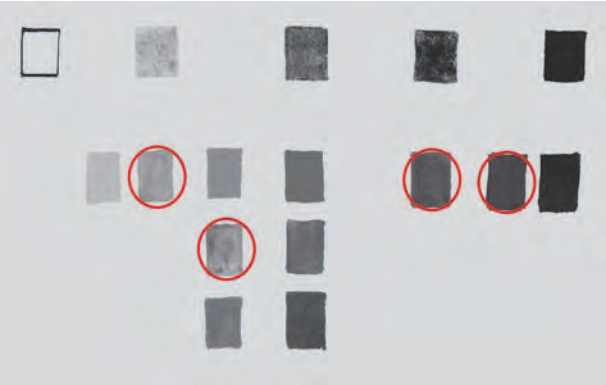

Figure 4. Mismatches of tonal value are identified after changing the color image in Figure 3 to gray scale in a Photoshop.

2.1 Practical steps of learning the respective tonal value of each color

(i) First we paint the top row leftmost corner with white and rightmost corner with black as shown in Figure 3.

(ii) By looking at the tone of white (tone 1) and black (tone 9), we can then decide the middle tone 5. So tone 5 is then determined.

(iii) Tone 3 and Tone 7 can then be determined similarly by looking tone 1 and tone 5, and tone 5 and tone 9 respectively.

All these 3 steps can also be easily achieved with the help of fixed gray scale tonal markers in the market or a desktop printer

(iv) After having the approximately correct tonal scaleson the top row, we can then try to decide the tone of each color by painting each color beneath the tonal gray scale that we believe is right. As shown in Figure 3 for example the selected yellow is though to be tone 2, so it is painted between tone 1 and tone 3 gray scale. The selected red, green and brown are thought to be tone 5. So they are painted beneath tone 5 gray scale. The result is not confirmed to be correct until we see the converted gray scale of every colors painted beneath the top row tonal scale reference.

(v) All the painted color swatches can then be converted into gray scale to verify their correctness in comparison to the original reference grays we prepared at the top row as shown in Figure 4.

(vi) Figure 4 indicates four colors (circle in red) after converted into gray scale, show different tonal value as compared to their top row tonal scale reference. The mismatch shows that the decision is wrong.Repeat step (i) to (v) until all colors are judged correctly in their respective gray scale.After the exercise, a student can immediately understand the actual tonal range of each color one is using in a practical situation.

This process shortens the learning path from having to practically carry many times painting to gain that experience through trial and errors. A beginner grasps the respective tonal range of each color through this exercise. Therefore a better color choice can be made based on original tonal decision.

To further illustrate the weakness of traditional guidelines in the application of tones, we use a split complementary color system as an example in Figure 5. A split complementary pairing of a red-orange with a bluish green is chosen from a conventional color wheel. The guideline shows that by rotating along the color wheel, a new pairing of a purple-blue with a yellow can be found to present a similar visual result. However, the tonal range of these two sets of pairings is different. Therefore in practical reality, the two pairings work differently. The red/orange-green pairing has a narrower tonal range as compared to the blue/purple-yellow pairing. Blue/purple-yellow pairing can stretch from tone 2 (yellow) to tone 9 in their purest form to their mixture form. On the contrary, red/orange-green pairing can only stretch from tone 4 to 7 approximately with the same working approach.

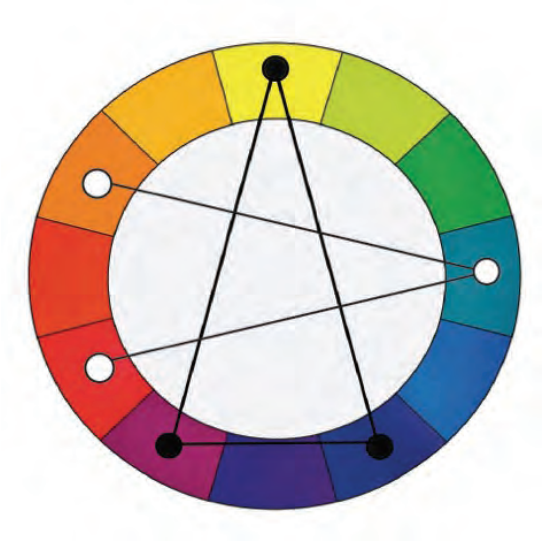

Figure 5[8]. A split complementary color system is shown with a traditional color wheel. The white circles are the initial pairing of red/orange-bluish green pairing while the black circles illustrates the rotated new pairing of purple/blue-yellow pairing.

3. HUE OF A COLOR AND ITS COLOR VECTOR SPACE

A conventional color wheelas shown in Figure 7 distributes each pure color evenly across of the wheel. It gives a beginner an impression that each hue has similar capacity in application. In reality, yellow, orange and red together occupy a smaller color space as compared to blue, purple and green while green occupies the largest color space. Therefore the capability of green color in hue term can never be achieved by any other colors. A painting can be done easily with just green colors and it is able to carry a wide range of hue change. However, this cannot be achieved easily with an orange color or a red color or a yellow color alone.

In practical terms, greens stretch through three different zones in color wheel, namely bluish green, greenish green and yellowish green zone. These three categories of green colors not only present hue difference, they also have different tonal rangelike what has been discussed in section 2. Therefore when a green color is applied, we have to be cautious which hue range of green we are using. This again shows the weakness of the current training system that assumes every color occupies similar size of color space.

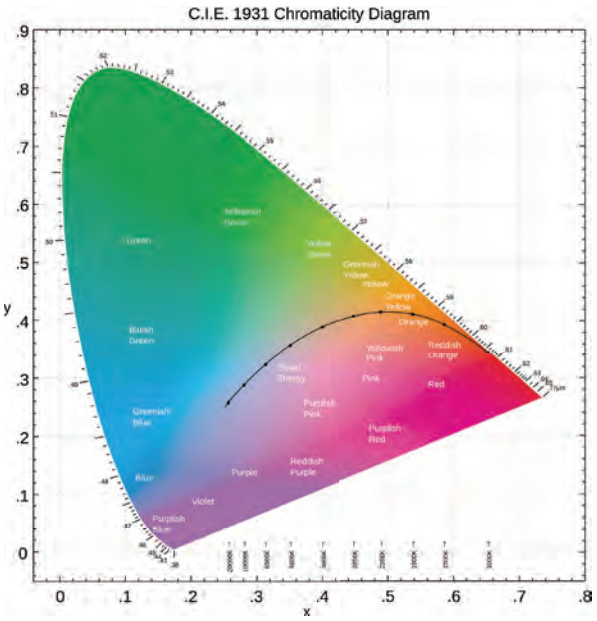

Figure 6[9]. A commonly use Pantone Color Space in the practical industry.

Figure 6, a Pantone color space diagram shows the area covered by green hue is larger than any other colors. Even if we add up the area occupied by red hue, orange hue and yellow hue, the final area is still small than just the area covered by green hue. Therefore the conventional color wheel that assumes each hue having equal practical capacity is misleading to beginners learning color attributes.

Figure 7[10]. A conventional color wheel

To make good hue choices, we thereforehave to pay attention to the asymmetrical nature of color space as shown in Figure 6. A three-dimensional Munsell Color Tree as shown in Figure 1 also indicates this asymetrical property of each color. To overcome this issue, a new practical system is developed through the study of design for color rhythm. It involves the understanding of each pure color and its repective tertiary brown or gray color acting as a transition color. Section 4 explains this concept.

4. TERTIARY COLORS AND DESIGN OF COLOR RHYTHM THROUGH COLOR TRANSITION

Here for practical purpose, three dimensional Munsell Color Tree is simplified down to Munsell Color Wheel as shown in Figure 8. This eases the difficulty for beginner to visualize three dimensional color space. This simplified two dimensional Munsell Color Wheel further allow beginners to visualize tertiary colors, namely browns and grays. These are important colors in practical fields.

Figure 8. A two dimensional version of Munsell Color Wheel simplified from three dimensional Munsell Color Space

The equivalent brown or gray of each primary and secondary color has to be understood in the application of Munsell Color Wheel. These browns or grays are known as the tertiary colors that are heavily related to the design rhythm of colors. These tertiary colors serve as transition colors in the design of color rhythm.

Using pure colors (primary and secondary colors) only allow hue difference with strong intensity difference to form. In order to create different visual rhythm in an image to allow different viewing experience, tertiary colors are necessary. Combining tertiary colors with pure colors, the adjustment of viewing speed can then be possible. Hence the equivalent brown or gray of each primary and secondary color has to be understood. Figure 8 shows five basic equivalent browns / grays nearer to their respective pure colors.

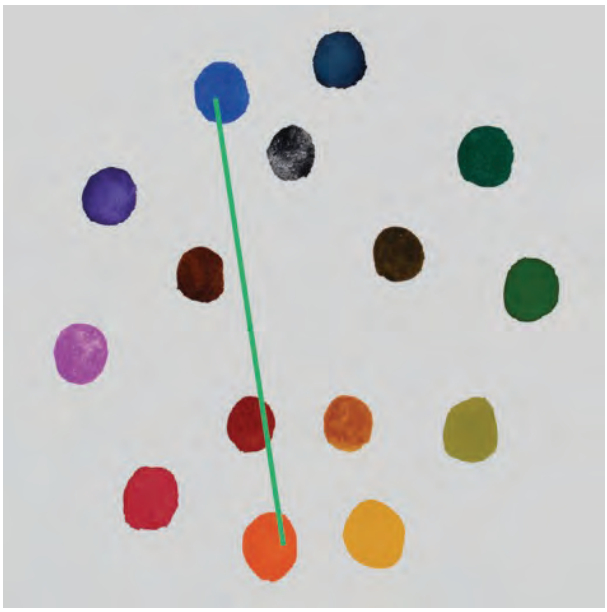

Figure 9. The green line connecting blue and orange passes through a region linearly where a range of linear transition tertiary of blue-orange mixture can be found.

If we draw a linear vector on a color wheel as shown in Figure 9 from one pure color to another pure color that is located far away from the first color, a whole range of tertiary colors can be found. In this process, it is done through mixing two different colors on palette to find their intermediate tertiary colors. Figure 8, the green line connects a pure blue and a pure orange. Along the green line a whole range of tertiary browns are formed by varying the proportion of blue and orange. To apply these linear transition colors directly, it

will not achieve very sophisticated design rhythm through colors. Therefore a painter generally deviates away to discover more transition colors as show in Figure 10. Along the red line and the blue line are two different ways will find a range of transition browns / grays between a pure red and a pure blue.

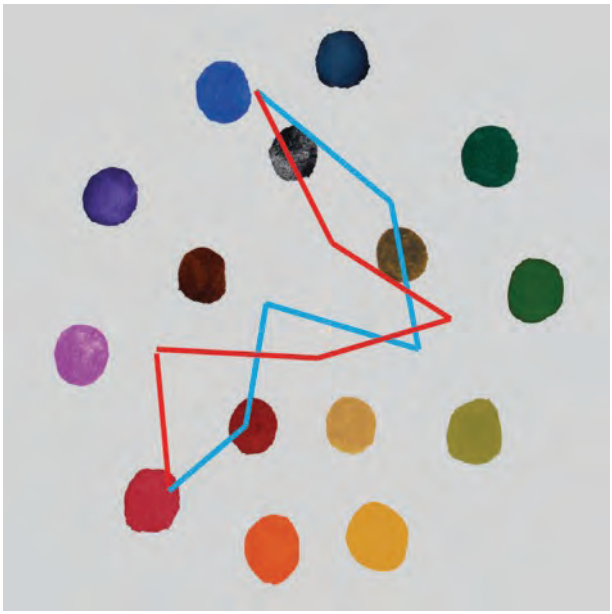

Figure 10. The red and blue color vector lines show that there are many ways to find a range of transition tertiary colors between pure red and pure blue.

This vector system of finding transition color is very scientific but harder to be visualized physically. Therefore a practical method has been developed here. The system is called a *Friend – Enemy Color Design System*.

Friend colors are defined as colors that are nearer to each other on the color wheel while Enemy colors are colors that are further from the major group of colors in the design plan. Figure 11 illustrates one design sample

Group 1 are*Friend* colors. They are located nearer to each other on the Munsell Color Wheel.

Group 2 is nearer to the main group (Group 1, the *Friend* colors); therefore colors falling into group 2 have weaker *Enemy* character. Colors falling in group 3 are further away from group 1 therefore they are stronger *Enemy* colorsagainst group 1. How does that help in the design of color rhythm?

Figure 11. The large circle shows the main group of Friend colors while the other two small circles are the enemy colors.

Basically, in color rhythm design, we are trying to identify various level of transition from one color to another color depending on the required contrast for on a design objective. This approach allows us to immediately identify the level of changes from one region to another on a color wheel.Colors further from the major group of colors, will create more hue contrast to the main group.

Besides this advantage, it does not have the weakness of the current practically system because it does not make any assumption thinking that colors are practically similar. The Munsell Color Wheel is an empirical system. Therefore it is closer to the exact practical situation, especially with all the equivalent tertiary colors present. Transition colors (tertiary colors in between any two pure colors) can be obtained logically through direct observation within the Munsell Color Wheel along any vector directions. Therefore practical design decisions can be made based on this system. Here, a few common requirements can be resolved based on this system.

(i) Color unity or harmony: *Friend* colors from the same region in color wheel without any doubt will be in perfect harmony or unity since they all carry a similar major hue component.

(ii) Color complementary result does not have to come from colors on the opposite side. The colors can come from any region within or on the edge of the color wheel as long as they are not too closed to this region of *friend*colors. The further it comes from the stronger the complementary result it creates.

(iii) Transition colors can easily be identified by looking at this color wheel. These colors will create a bridging zone for friend colors and enemy colors so that they can co-exist in the same picture in harmony

(iv) Decision of design rhythm can be achieved easily using generally more *friend* colors and fewer *enemy* colors for beginners.

An interesting analogous guideline can be used for the application*Friend – Enemy Color System*.

'With more friends life will be better. However, if you only have friends and have no enemy, life will be boring and without any driving force. On the contrary, life with too many enemies will be too difficult, but that doesn't stop you from surviving, if you are truly strong.'

Therefore a more common color system that can arrive at color harmony is with more *friend* colors and a few *enemy* colors. A few *enemy* colors are necessary to create some interesting complementary hue. If an image is filled with mainly *enemy* colors, to arrive at image harmony, it will be very demanding. A great amount of effort in image design has to be employed in this case. Therefore the later case is for more advanced artists who have high level of sensitivity for design of visual tension through combination of various visual elements where color is only one of them. Image balancing requires the artist's sensitivity to transition colors, visual tension of size and shapes of each color placed on the picture plane. Nonetheless, this *Friend – Enemy Color System* does provide a good starting point for practical issues as well as advanced training requirements.

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