

Primary color mixing

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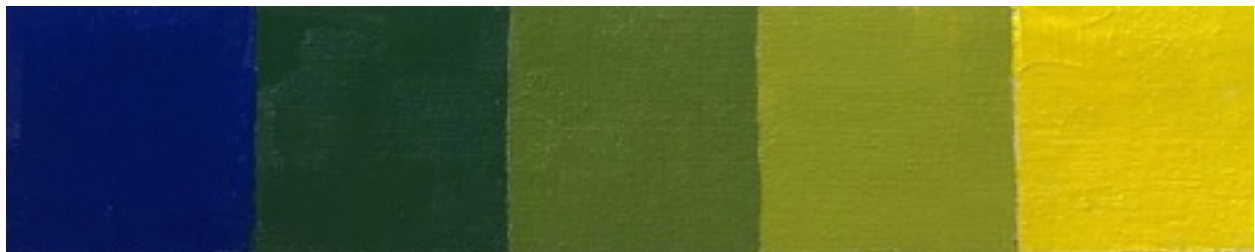
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Color mixing experiment 1

The 3 primary color I have selected are: cadmium red light, cadmium yellow lemon, and ultramarine blue.



I mixed between these primary colors to generate the secondary and tertiary colors. The color swatches are shown below.

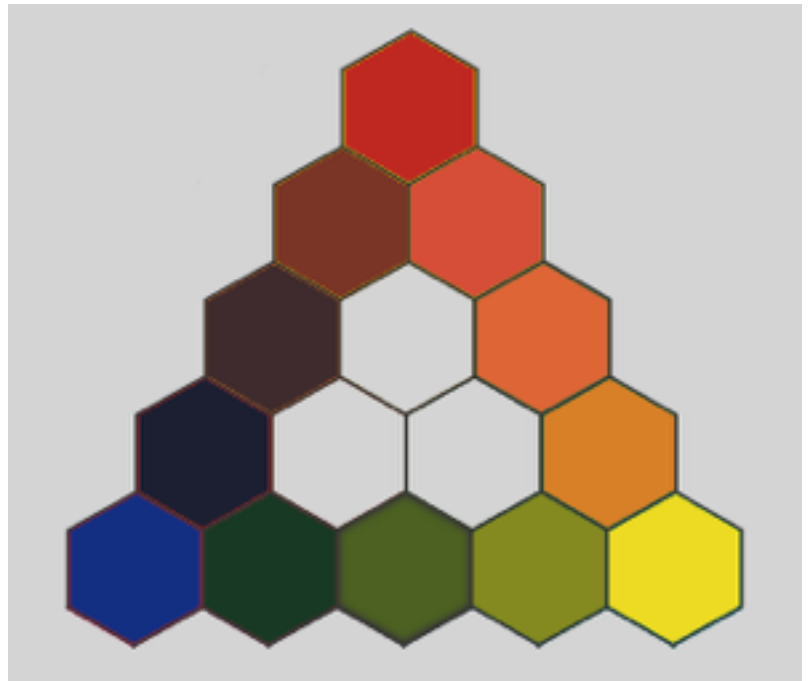


We present the above color swatches in a form of color triangle shown on the right. Visual observation is telling us:

The mixed secondary colors have lost their chroma significantly. The purple color suffers the most, then is the green color. The orange looks OK.

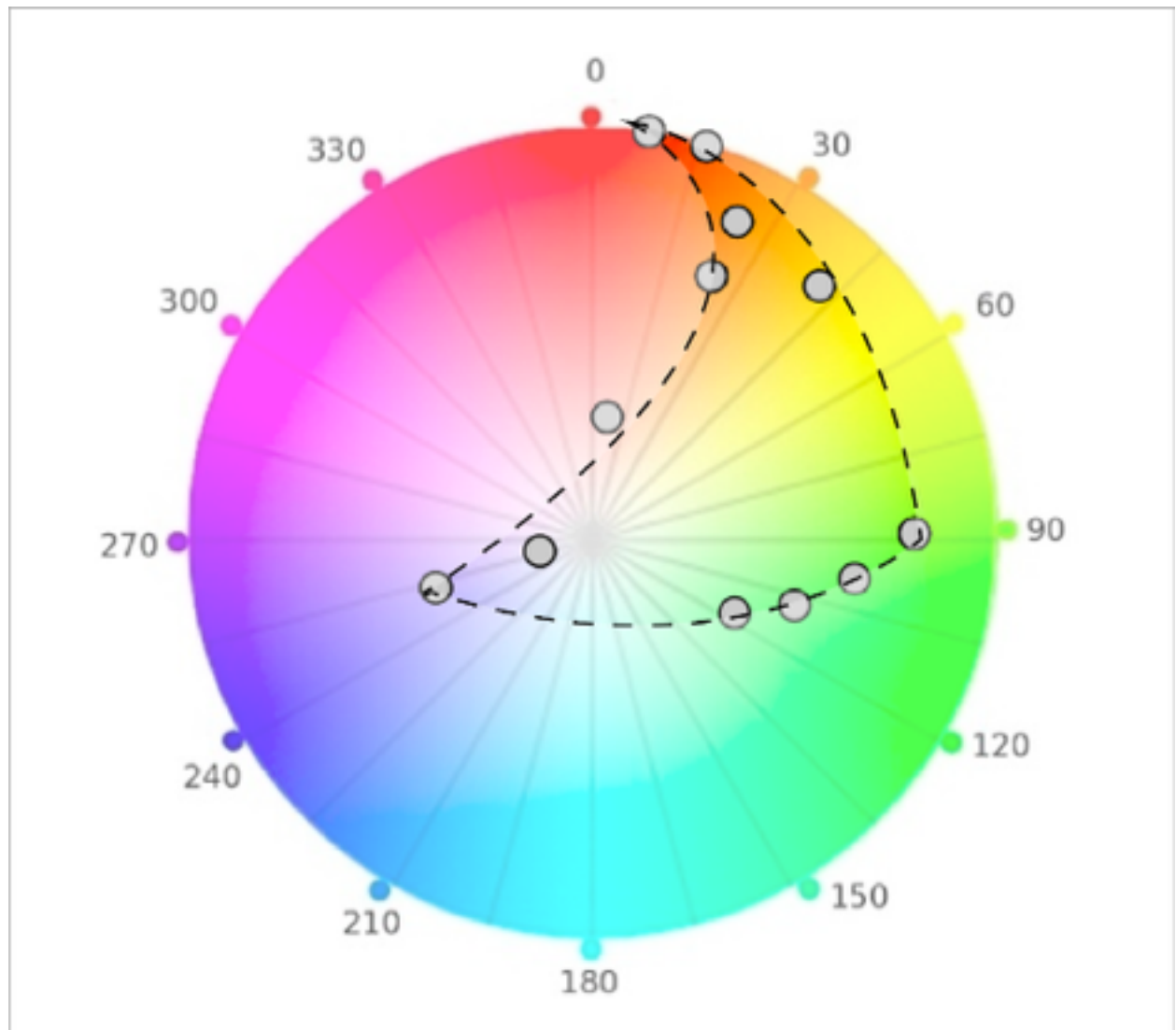
Quantitative Measurement:

We measured the Munsell value of all the mixed colors and converted them to computer color value. The measurement data has been tabulated below:



	Munsell	Hue	Chroma	Value
Red	7.5R-6/14	9	100	60
Yellow	10Y-9/12	90	85.7142857142	90
Blue	5PB-2/6	252	42.8571428571	20
Orange	2.5YR-7/12	27	85.7142857142	70
Green	5GY-5/8	108	57.1428571428	50
Purple	7.5R-3/4	9	28.5714285714	30
Orange Red	10R-6/14	18	100	60
Yellow Orange	7.5YR-8/12	45	85.7142857142	80
Green Yellow	2.5GY-7/10	99	71.4285714285	70
Blue Green	7.5GY-3/6	117	42.8571428571	30
Purple Blue	5PB-3/2	252	14.2857142857	30
Red Purple	2.5YR-4/10	27	71.4285714285	40

We then plot these values on the computer color wheel and shown below.



Conclusions:

We conclude that yellow and blue do make green. However, the green is a low chroma one. Using Cadmium Red Light, Cadmium Yellow Lemon, and Ultramarine Blue as the 3 primary colors is NOT a good idea in mixing all the hues. These 3 colors can not make rich purple and green. The color gamut is very limited.

Color Mixing Experiment 2

The 3 primary color I have selected are: quinacridone magenta, cadmium yellow lemon, and cobalt teal.



I mixed between these primary colors to generate the secondary and tertiary colors. The color swatches are shown below.



We present the above color swatches in a form of color triangle shown on the right. Visual observation is telling us:

This color triangle is much balanced. The chroma of the secondary colors are much higher. The green and blue are quite rich. The red chroma is slightly lower.

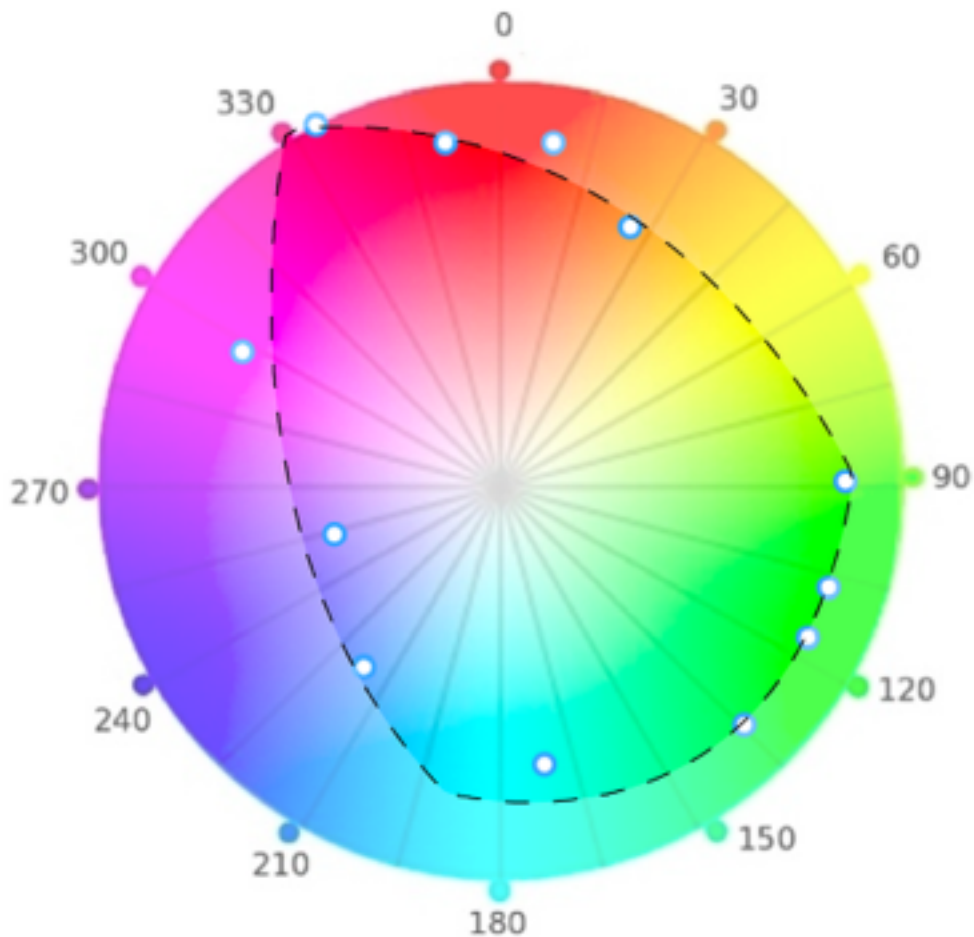
Quantitative Measurement:

We measured the Munsell value of all the mixed colors and converted them to computer color value. The measurement data has been tabulated below:



	Munsell	Hue	Chroma	Value
Magenta	7.5RP-4/14	333	100	40
Red Purple	2.5R- 4/12	351	85.7142857142	40
Red	7.5R-4/12	9	85.7142857142	40
Orange	2.5YR-5/10	27	71.4285714285	50
Yellow	10Y-9/12	90	85.7142857142	90
Green Yellow	5GY-8/12	108	85.7142857142	80
Green	7.5GY-7/12	117	85.7142857142	70
Blue Green	2.5G-6/12	135	85.7142857142	60
Cyan	5BG-5/10	171	71.4285714285	50
Blue	5B-5/8	216	57.1428571428	50
Purple Blue	5PB 4/6	252	42.8571428571	40
Purple	7.5P-4/10	297	71.4285714285	40

We then plot these values on the computer color wheel and shown bellow.



Conclusions:

The CMY primary system is much better. The color gamut is much larger. We can make most of the hues with relatively high chroma. That is the reason why the printing industry uses CYMK color mixing.

Now we understand, it is arbitrary to choose “primary” colors. You may pick up any 3 colors to create your own color gamut. However, the size of color gamut varies according to your “primary” choice. At least we know: the red, yellow, and blue group is a bad choice, while, the cyan, yellow, and magenta group is a good choice.