The Link to the Online and Constantly Updated Version of this Document HERE

Color Mixing

There are multiple ways colors mix.
1. Additive → Like Lights Mix → used by computers → **RGB**/CMY
2. Subtractive → Like Pigments Mix → used by printers → **CMYK** and **RYB**/GPO

We want to be able to mix colors
1. mix colors… as in multiple colors
2. additively -and- subtractively
3. with -or- without taking quantities into account
4. and for now without caring for the A (alpha or transparency) of RGBA

We are also including **RYB**/GPO color space because regular subtractive color mixing is not intuitive. This is because in grade school most people were taught that the primary colors were Red, Yellow, and Blue… in other words… most people were taught how to work within the RYB Color Space

Basic Colors (RYB Color Space)
(As Taught In Grade School)

Primary Colors
Red, Yellow, Blue

Secondary Colors
Orange (R+Y), Purple (R+B), Green (Y+B)

Other Important Colors
Black, White, Grey (B+W)

So there are 9 Basic Colors in Total + 2 = 11 (IF you include [Magenta and Cyan])

These 11 Colors are Easily Recognizable and any other color is simply in between these

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Color Spaces

There are Multiple Ways to Represent Colors.
A **Color Space** -or- **Color Model**.is a way to represent a range of color as tuples (finite ordered list) of numbers. Learn More in Wikipedia.

I am specifically focusing on
- Red Green Blue (RGB)
- Red Yellow Blue (RYB)

- Cyan Magenta Yellow Key (CMYK)

Assuming the range of values for the component of each color is (0→255)
We can arrive at "2 more color spaces" equivalent to RGB and RYB respectively

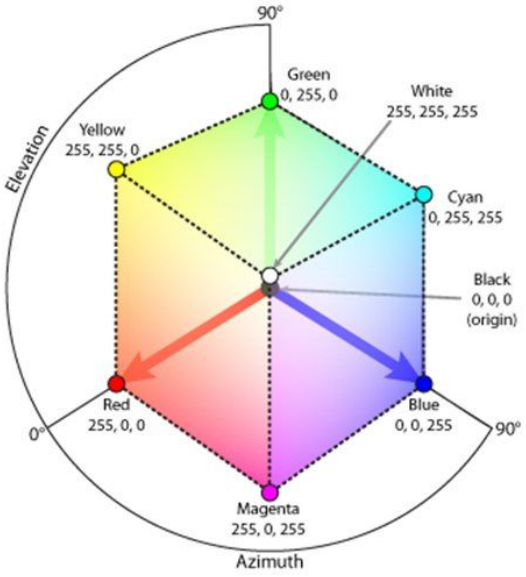
- Cyan Magenta Yellow (CMY) = (255-R, 255-G, 255-B) [RGB]
- Green Purple Orange (GPO) = (255-R, 255-Y, 255-B) [RYB]

Color Cubes

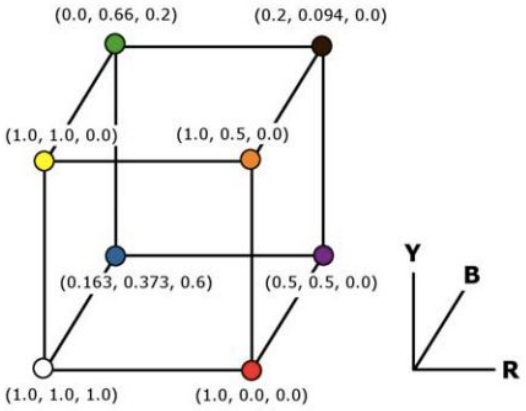
You can Represent Both **RGB**/CMY -and- **RYB**/GPO color spaces with a Color Cube because...

- they have 3 components and can be viewed as a cube in 3 dimensional space
- each component can make an equivalent difference that can be replaced by no other component (unlike CMYK where… 0% C, M, and Y and 100% K -gives you the same results as- 100% for C, M, and Y and 0% for K)

RGB/CMY



RYB/GPO



The Cubes have 27 Key Points

- 11 important colors (indicated below) are Capitalized for each color space
- 27 key points come from = 1 center + 8 corners + 6 face centers + 12 edge centers.
- Ideally the primary and secondary colors are in the center and corners.
    - RGB doesn't meet that requirement.
    - RYB almost does. (Ideally RYB colors space would mix Red + Blue into Purple)

	Color ID	**Color Code (255)**	**in RGB/**CMY	**in RYB/**GPO
1.	**1 Center**			
	1.1. 0	(128,128,128)	GREY	GREY
2.	**8 Corners**			
	2.1. 1	(0,0,0)	BLACK	BLACK
	2.2. 2	(255,0,0)	RED	RED
	2.3. 3	**(0,255,0)**	**GREEN**	**YELLOW**
	2.4. 4	(0,0,255)	BLUE	BLUE
	2.5. 5	**(255,255,0)**	**YELLOW**	**ORANGE**
	2.6. 6	(255,0,255)	MAGENTA	MAGENTA
	2.7. 7	**(0,255,255)**	**CYAN**	**GREEN**
	2.8. 8	(255,255,255)	WHITE	WHITE
3.	**6 Face Centers**			
	3.1. 9	**(128,128,0)**	**olive**	**brown**
	3.2. 10	(128,0,128)	PURPLE	PURPLE
	3.3. 11	**(0,128,128)**	**teal**	**in RGB (0,128,0)**
	3.4. 12	**(128,128,255)**	**some blue**	**in RGB (128,128,255)**
	3.5. 13	**(128,255,128)**	**some green**	**in RGB (255,255,128)**
	3.6. 14	**(255,128,128)**	**some red**	**in RGB (255,128,128)**
4.	**12 Edge Centers**			
	4.1. 15	(0,0,128)	navy blue	navy blue
	4.2. 16	**(0,128,0)**	**some green**	**in RGB (128,128,0)**
	4.3. 17	**(0,128,255)**	**some blue**	**CYAN**
	4.4. 18	**(0,255,128)**	**some green**	**some green**
	4.5. 19	(128,0,255)	some purple	some purple
	4.6. 20	**(128,255,0)**	**some green**	**some orange**
	4.7. 21	(128,0,0)	maroon	maroon
	4.8. 22	**(128,255,255)**	**some blue**	**in RGB (128,256,128)**
	4.9. 23	(255,0,128)	some pink	some pink
	4.10. 24	**(255,128,0)**	**ORANGE**	**some orange**
	4.11. 25	**(255,128,255)**	**some pink**	**in RGB (255,128,255)**
	26	**(255,255,128)**	**some yellow**	**some light color**

Asset Purpose

There are Multiple Ways of Mixing Colors.

ADDITIVE: Since people are used to working with pigments over light… Additive Mixing has limited applications. (but it is trivial and included in the asset)

SUBTRACTIVE: For that reason this kit's primary purpose is to find a "good" Subtractive Mixing Algorithm that only requires the information a computer needs.
Namely a color that can also be represented by the RGB color space.

Unfortunately, the physically accurate way to mix colors (subtractively) using the Kubelka Munk Transformation requires more information per color than RGB can represent. Which makes it...

- INACCURATE since we would have to imply a lot of information to convert RGB into a Kubelka Munk Color (assuming we could even find a conversion by implying values)
- EXPENSIVE since we would be impling information that we would be discarding completely after we convert back to RGB -and- we would be mixing with a lot more than just 3 values (assuming our conversion is accurate)

That fact that it's expensive and could still be inaccurate makes it unusable for most simple digital applications.

Consequently, many have created equations that simply approximate what subtractive color mixing should look like… but these algorithms are subjective…

So this Asset puts together all those algorithms and allows the user to determine what color mixing algorithm they want to use for their game, software, etc.

Additionally it modifies the Algorithms so that they take into multiple colors and quantities (given that most of these equations where only created with 2 colors of equal proportion in mind). Ultimately we realize that an approximation is… well… an approximation. And if we base ourselves off of just a simple equation there will be combinations that still don't mix the way we would expect them to.

For that reason Color Kit [FUTURE PLANS] shows I will be adding in a set of algorithms that work off of your expectations of how color should mix to create a color space.

For now the Color Kit [MANUAL] will describe how this particular asset works in more detail