

# THE PROCESS OF COLORIZING A DATA VISUALIZATION

- Know your data.
- Select Color Space & Rule.
- Build Color Scheme.
- Check for Color Deficiency & Pre Existing conditions
- Apply Color Scheme to Data & Modify per Review.

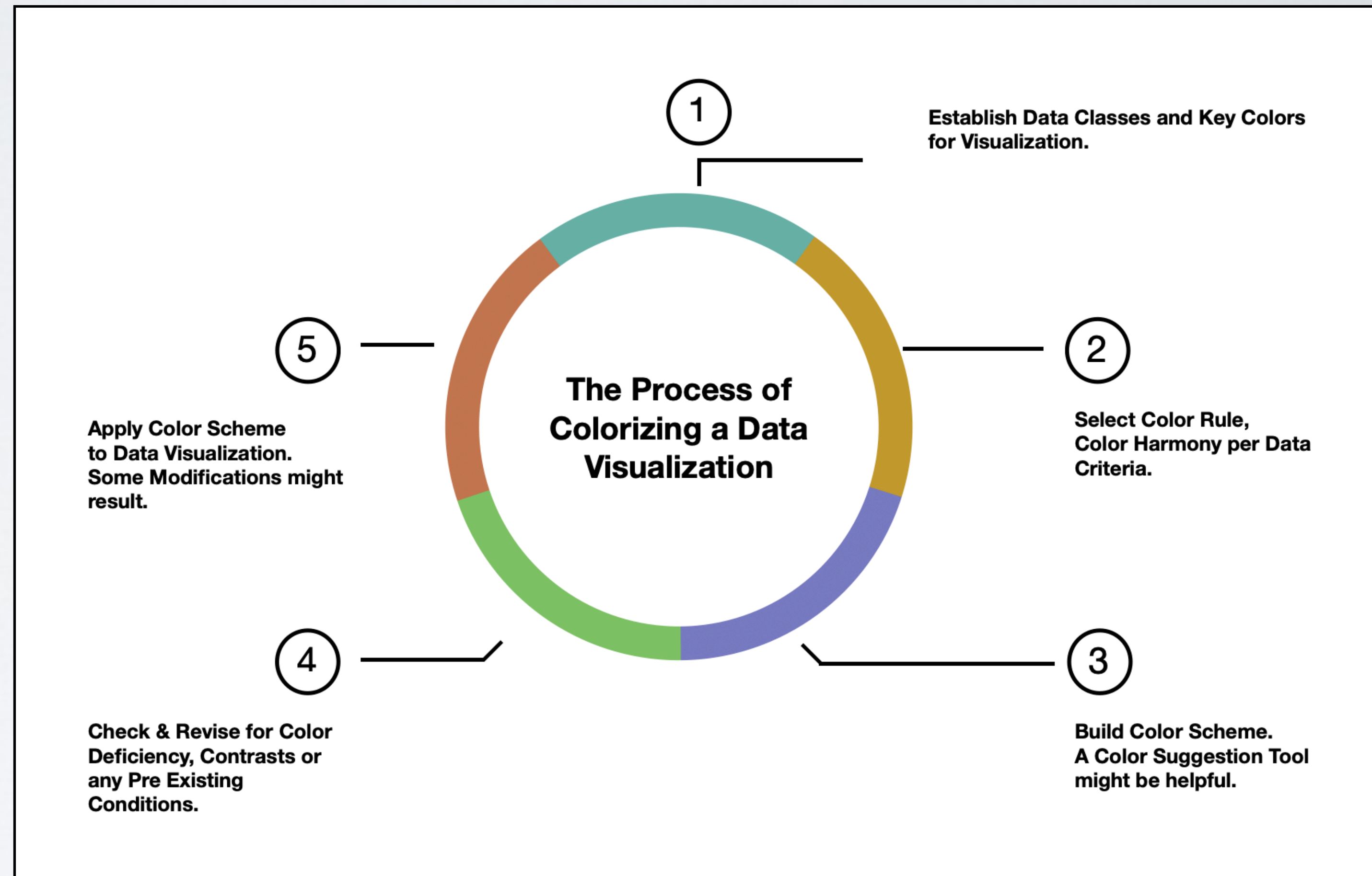


Image: Theresa-Marie Rhyne 2021

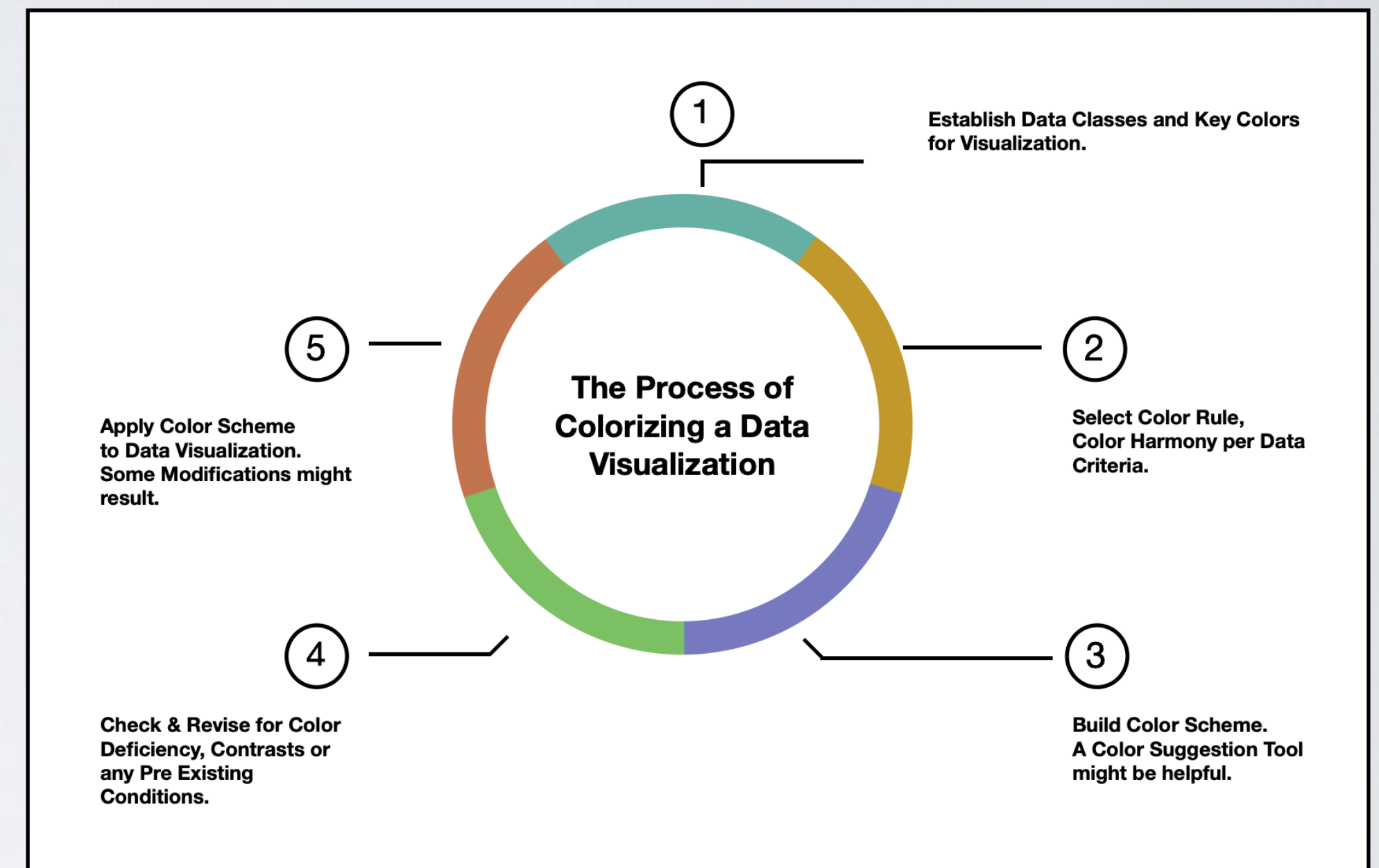
• Theresa-Marie Rhyne - Color Maven/Visualization Expert/Author



[theresamarierhyne@gmail.com](mailto:theresamarierhyne@gmail.com)

# (1) KNOW OR IDENTIFY THE NATURE OF YOUR DATA

- Nominal - name/no order-e.g. eye color.
- Ordinal - rank - low, medium, high - no info on degree of difference.
- Interval - differentiated by degree of difference - numerical values have positive, negative or zero.
- Ratio - data distinguished by the degree of difference - Age, Height, Duration
- Discrete - only whole numbers & some kind of count
- Continuous - data take any value - computational model
- Binary/Dichotomous - 2 possible values- Yes or No



Level	Measurement resolution	Measure property
Nominal	Lowest	Classification, membership
Ordinal	Low	Comparison, level
Interval	High	Difference, affinity
Ratio	Highest	Magnitude, amount

Chart prepared by Georges Hattab, see: Ten simple rules to colorize biological data visualization by Hattab, Rhyne & Heider, <https://journals.plos.org/ploscompbiol/article?id=10.1371/journal.pcbi.1008259>





# (1) KNOW OR IDENTIFY THE NATURE OF YOUR DATA

For the example I will work through in this talk:

I want to build a set of bar charts using the 5 point Likert scale of Strongly Agree, Agree, Neutral, Disagree and Strongly Disagree.

Magenta is my Key Color.

- Ordinal - categorical attributes of a variable differentiated by order (rank, scale, or position)
- Key Color: Magenta (#FC56FF in Hex Code)

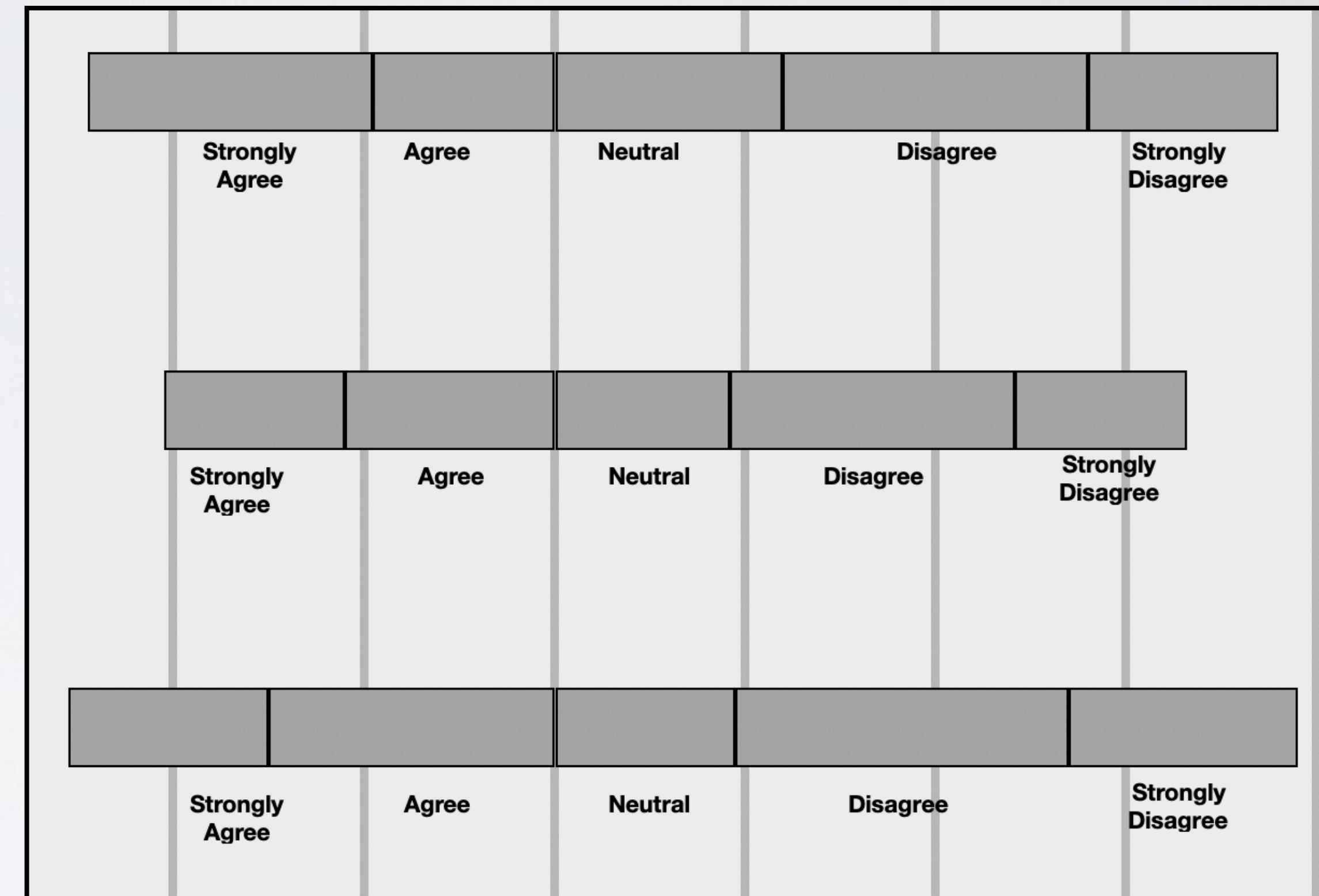


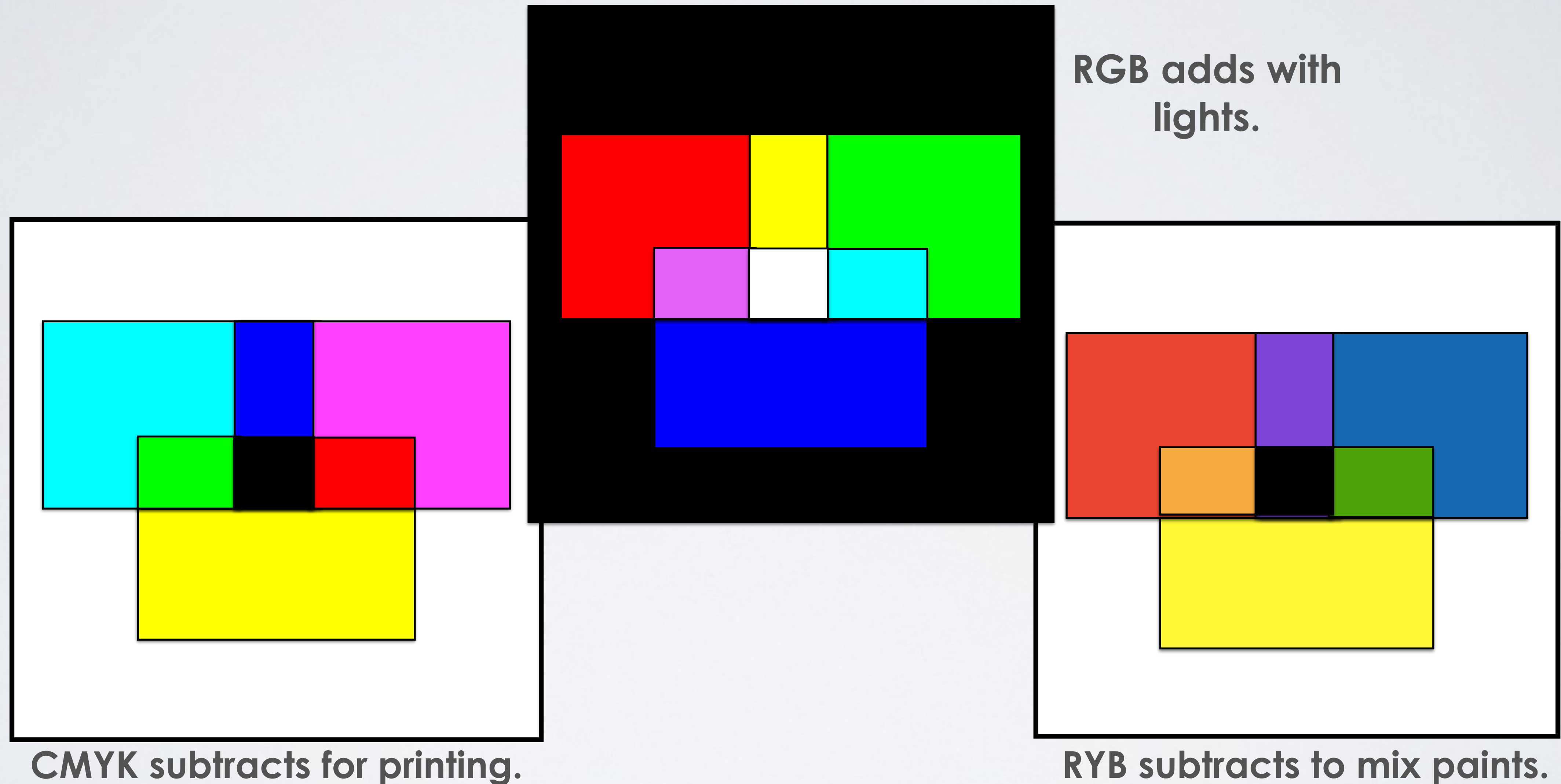
Image: Theresa-Marie Rhyne 2021

Getting it Right in Black & White.



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# (2A) SELECT COLOR SPACE & RULE: 3 CLASSIC MODELS

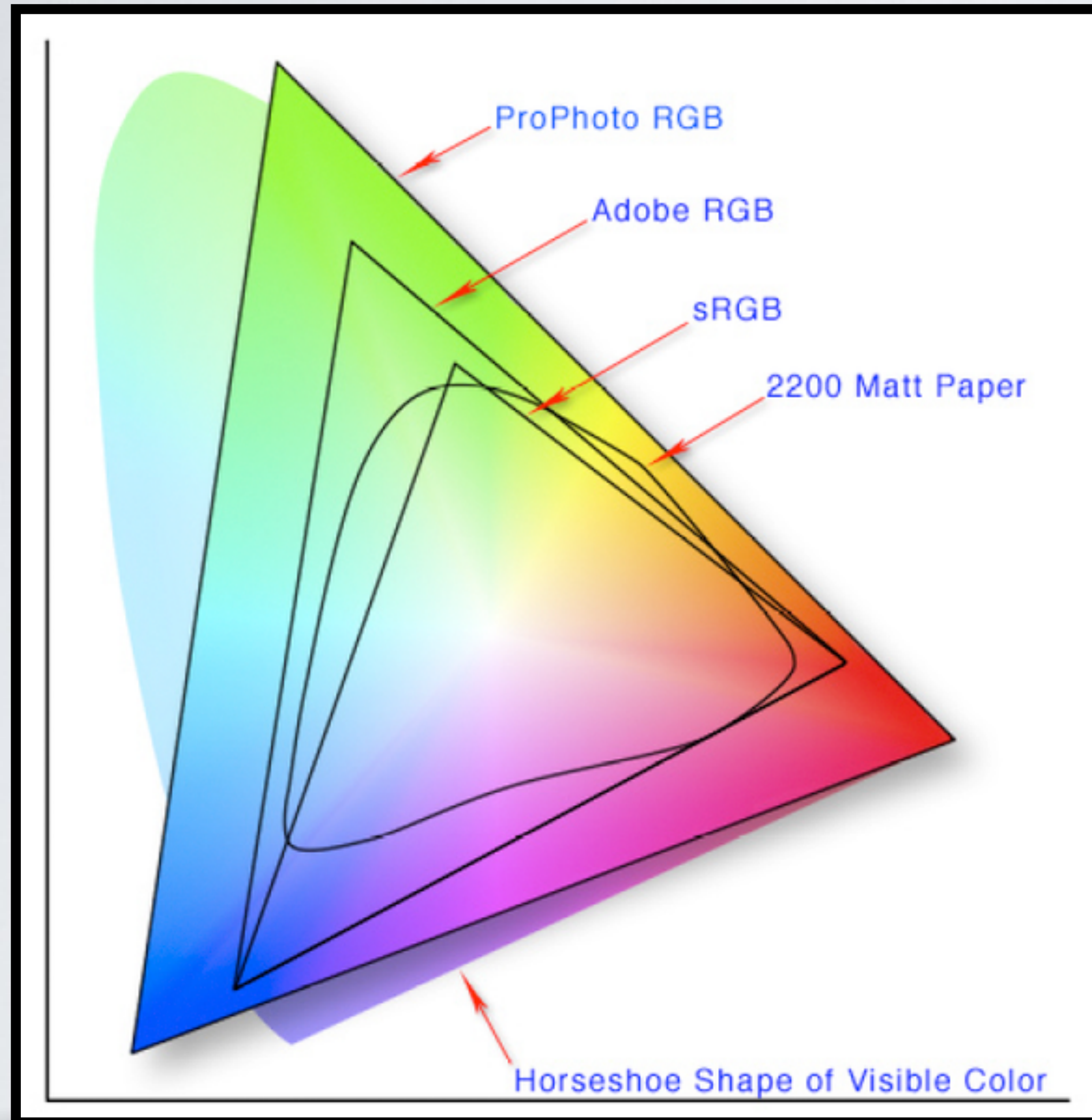




# COLOR MODEL + COLOR GAMUT = COLOR SPACE

## RGB Model + Color Gamut = Color Space

Comparison of the color spectrum (shown as the large oval in the back) with RGB color spaces. This image shows the sRGB, Adobe RGB, and ProPhoto RGB color spaces. The CMYK color space is labeled as Matt Paper.



Open Source Image available at Wikipedia and created by Jeff Schewe, see: <http://en.wikipedia.org/wiki/File:Colorspace.png> and <http://www.schewephoto.com/>.



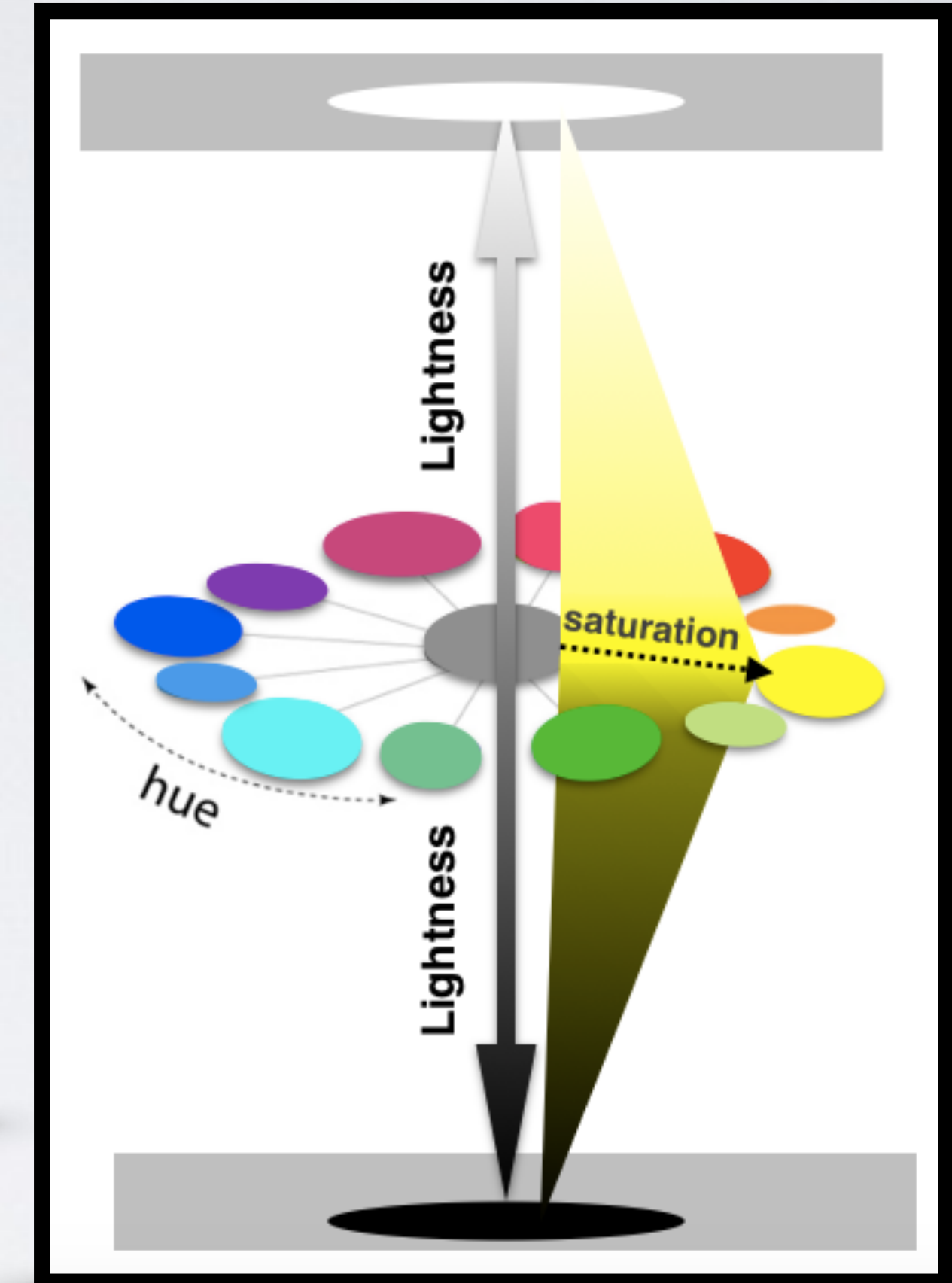
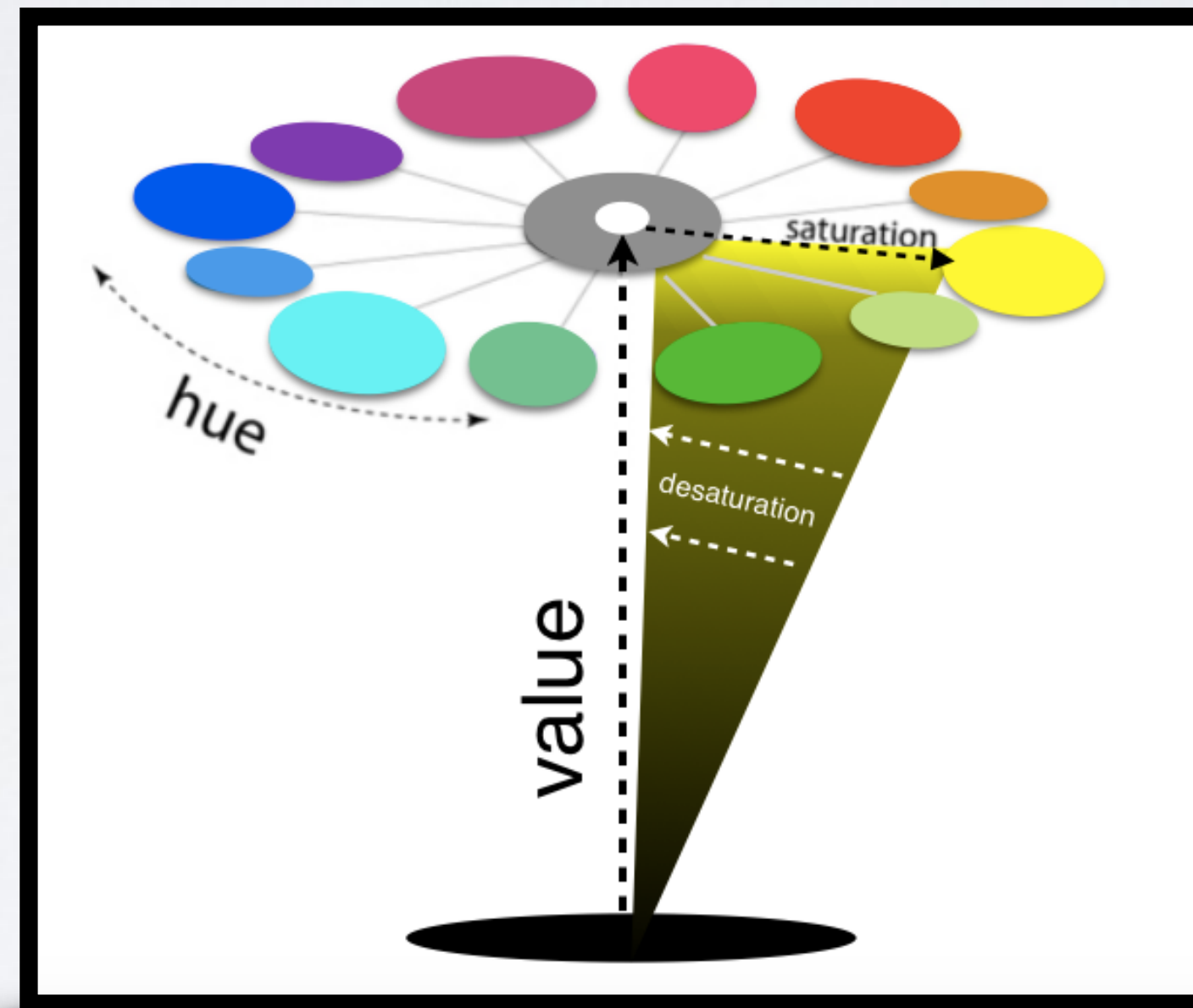
# (2A) OTHER OPTIONS: CYLINDRICAL COORDINATE REPRESENTATIONS OF RGB: HSV & HSL

- Cylindrical Coordinate representations of points in the RGB Color Model:

Hue, Saturation & Value (HSV)

Hue, Saturation & Lightness (HSL)

- Attempts to be more intuitive and relevant than the cartesian representation of RGB.
- Developed in the 1970s and published in papers at SIGGRAPH 1978.
- Frequently used in color picker and image editing software.



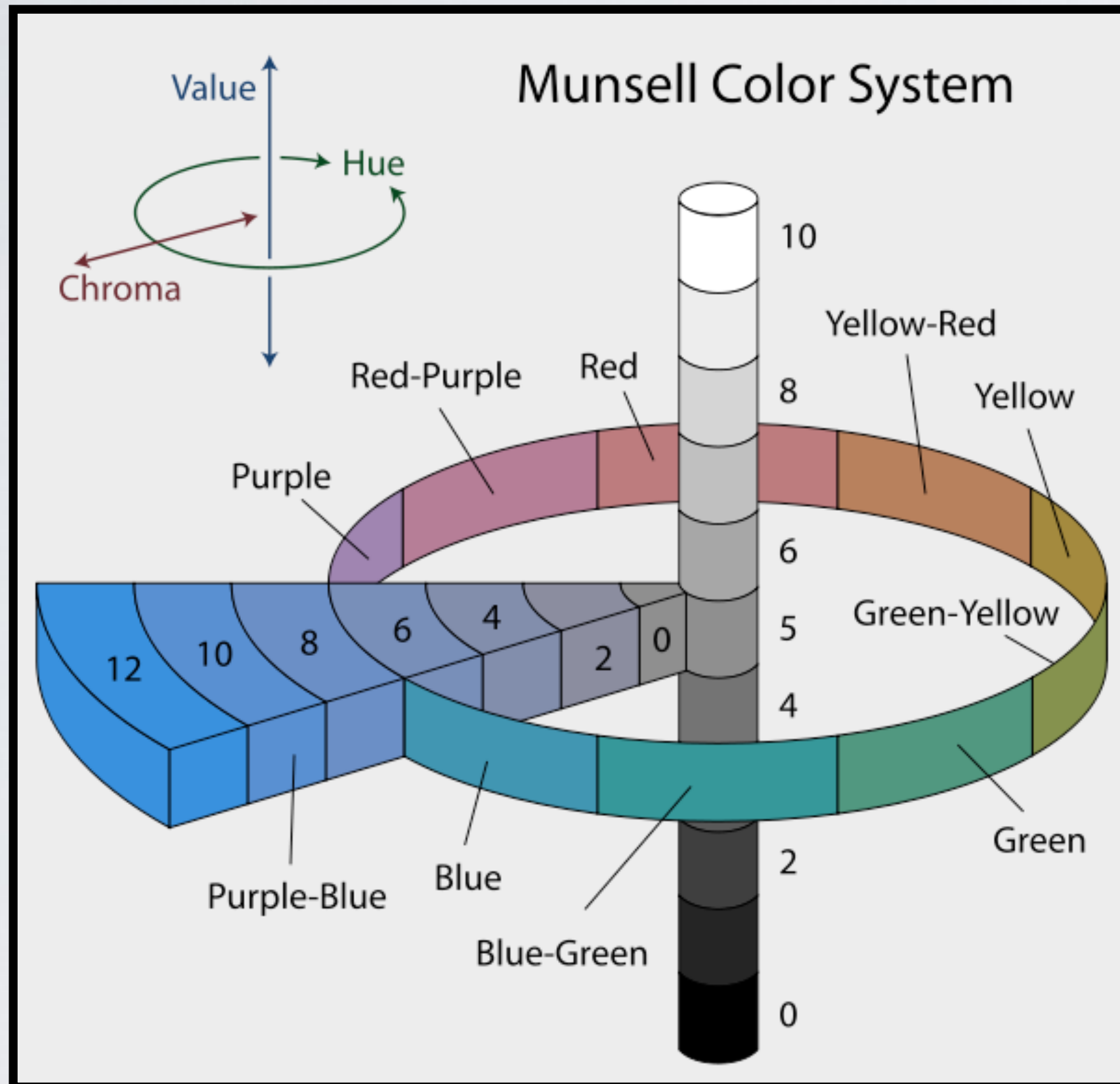
HSV and HSL Color Model Illustrations by  
Theresa-Marie Rhyne, 2015.



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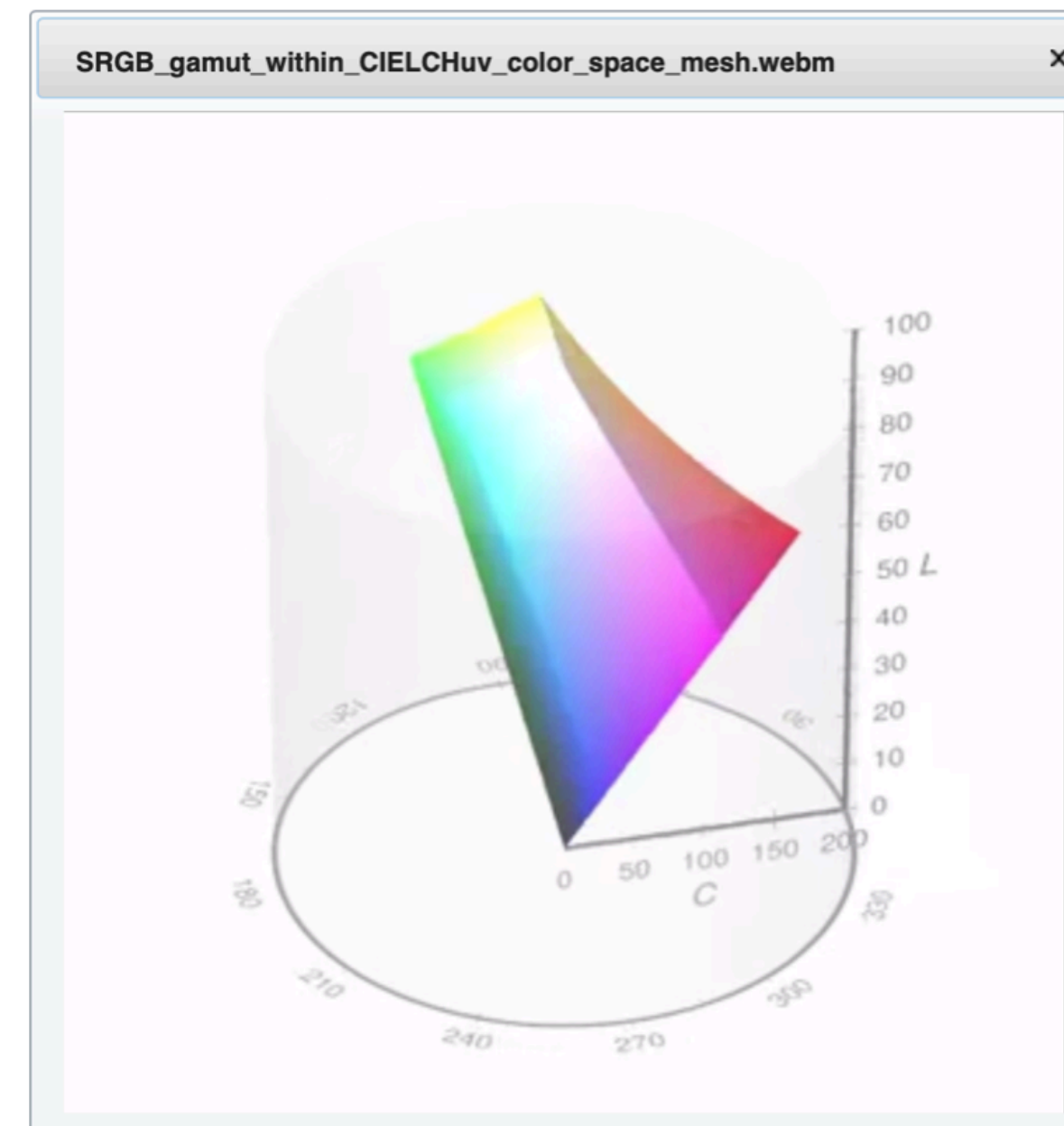


# (2A) OR CONSIDER: PERCEPTUAL UNIFORM COLOR SPACES LIKE MUNSELL AND HCL

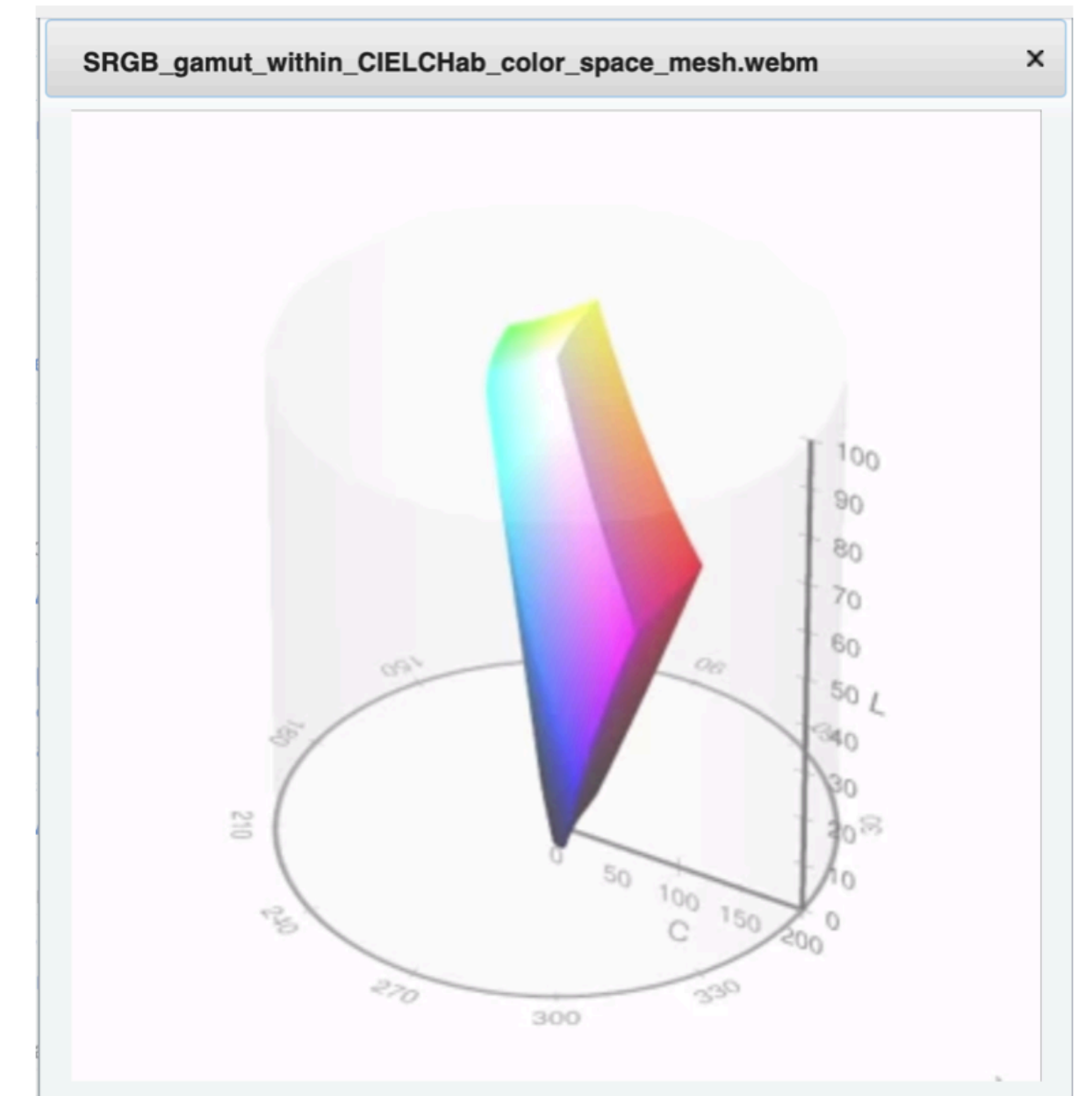


Open Source Image available at Wikipedia and created by Jacobolus, see: <http://en.wikipedia.org/wiki/File:Munsell-system.svg>

## Two Versions of Hue Chroma Luminance (HCL)



HCL: Polarized version of CIE Luv



HCL: Polarized version of CIE Lab

Screen Capture (as of 2020) by Theresa-Marie Rhyne using Michael Horvath's 3D Open Source animations by on Wikipedia: [https://en.wikipedia.org/wiki/HCL\\_color\\_space](https://en.wikipedia.org/wiki/HCL_color_space)

# (2A) CHOOSING YOUR COLOR SPACE

RGB adds with lights.

For my example in this talk:

My solution works for either the RGB or the Munsell Color Spaces.

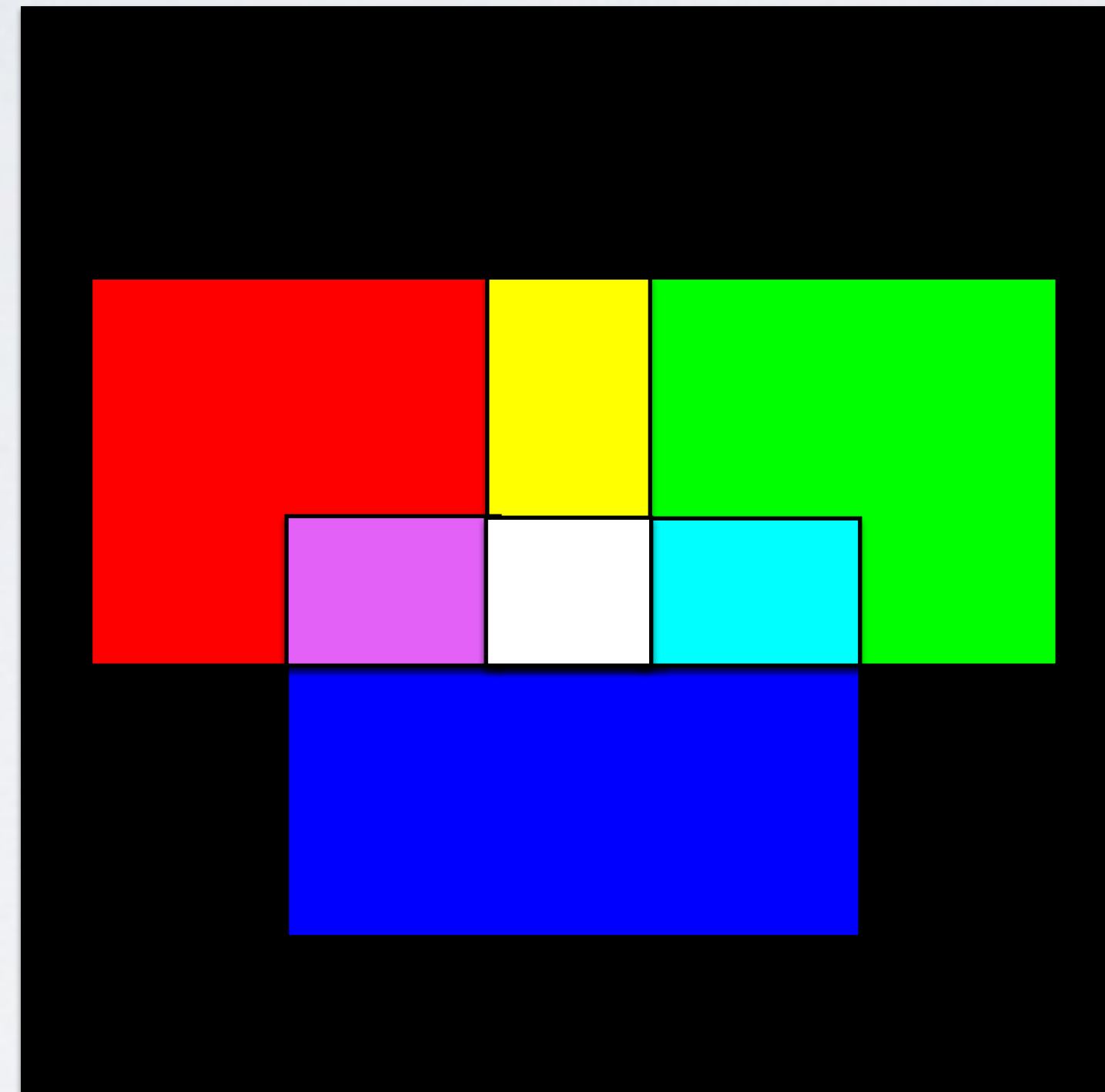
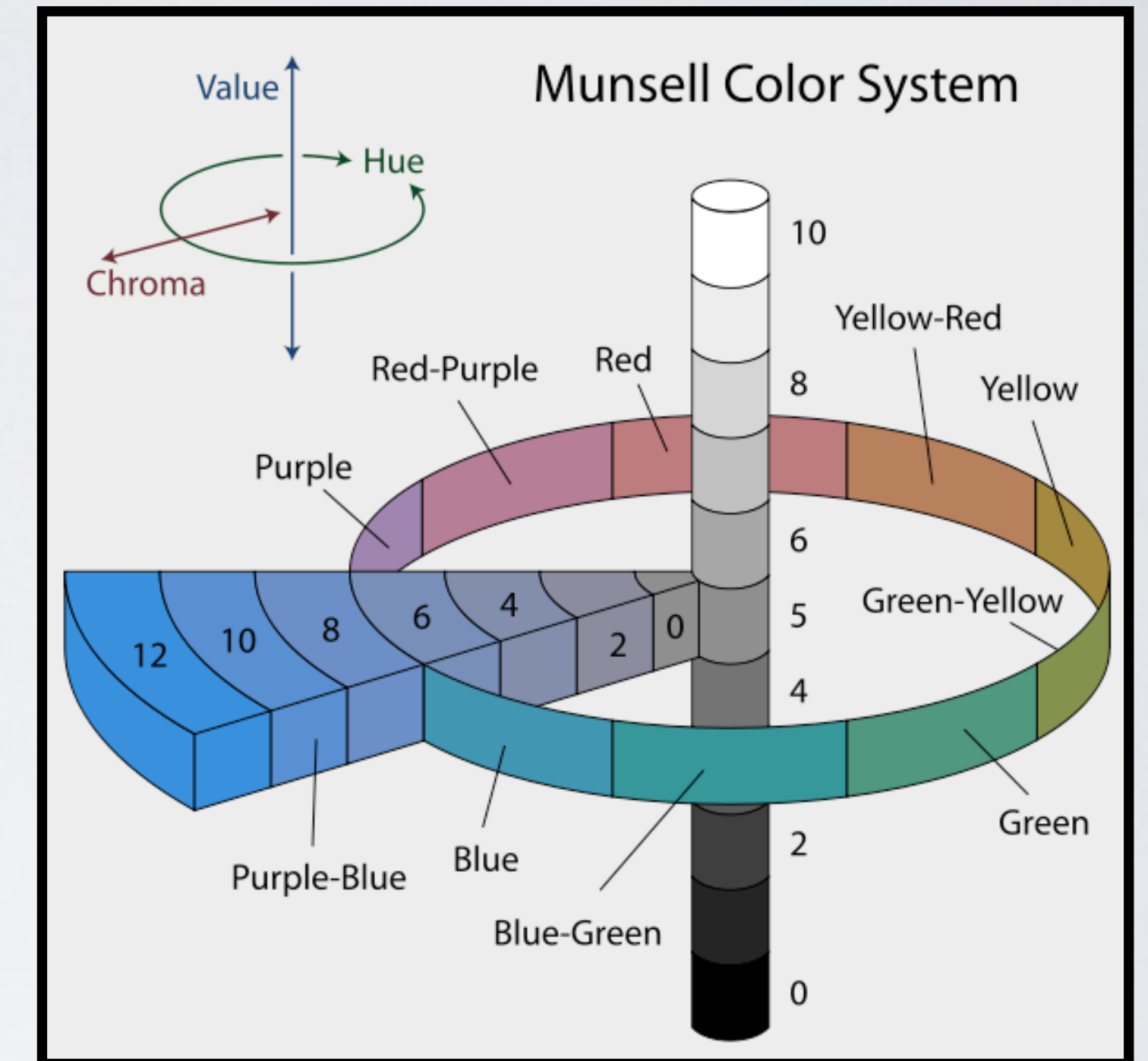


Image: Theresa-Marie Rhyne 2015



Open Source Image available at Wikipedia and created by Jacobolus, see: <http://en.wikipedia.org/wiki/File:Munsell-system.svg>

Applies to the RGB Classic Color Model and the Munsell Perceptual Uniform Color Space.

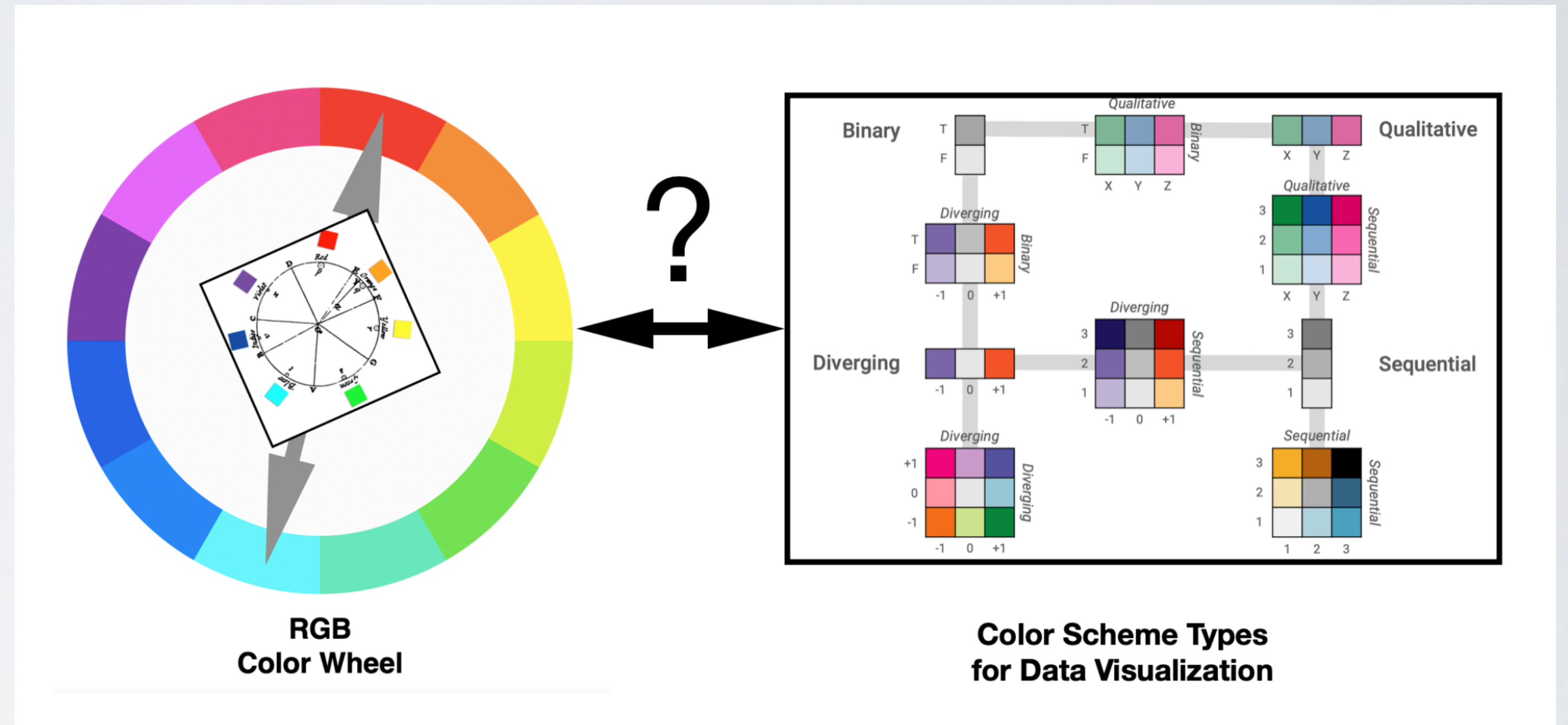




# (2B) DETERMINE YOUR COLOR RULE OR HARMONY

- **Color Harmony:** based around combinations on the Color Wheel that help to provide common guidelines for how Color hues will work together.

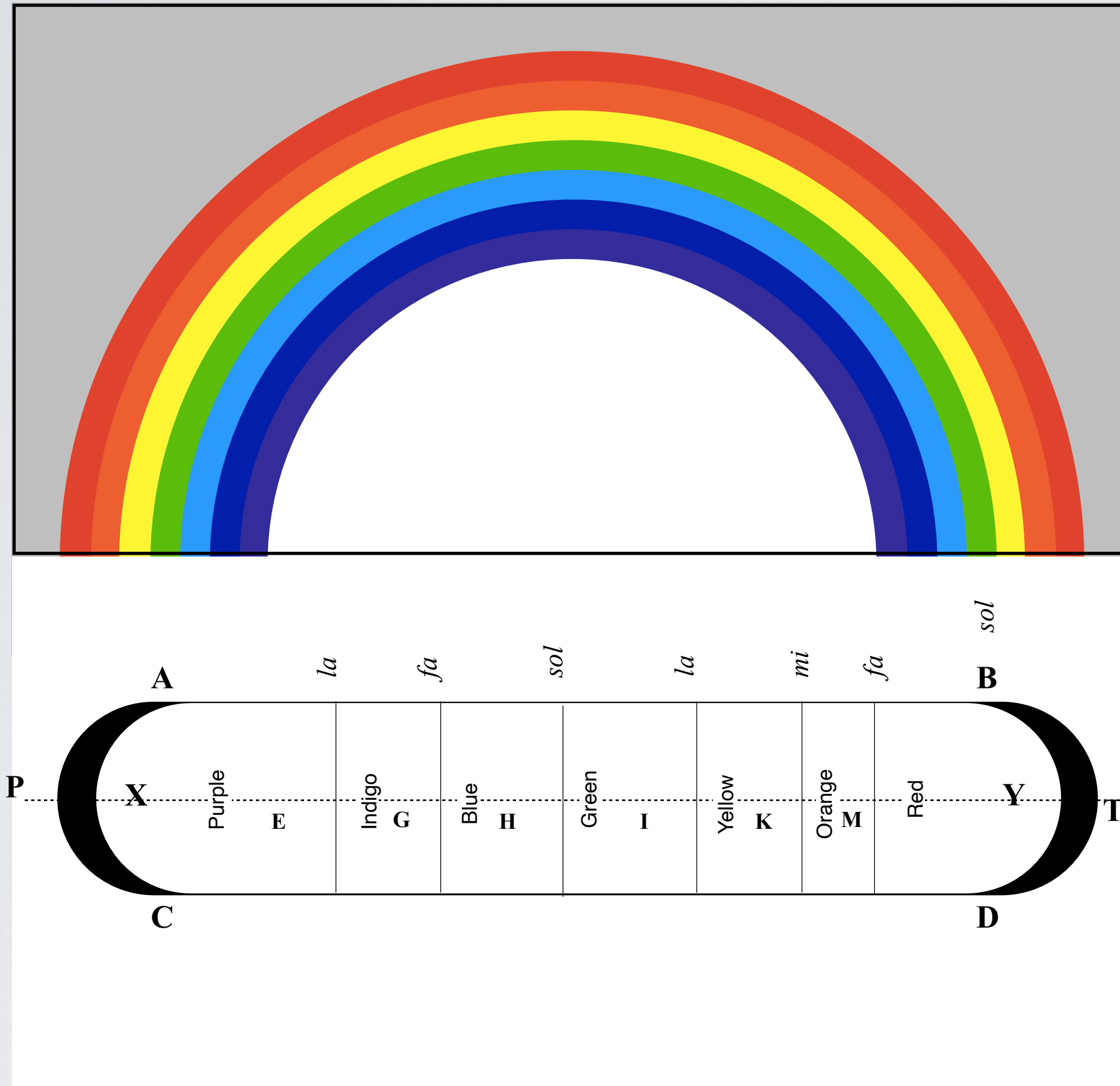
- **Color Schemes for Data:** classify Color Schemes according to three types of data: Sequential, Diverging and Qualitative.



Harmonic Resolution : See my recent writing on how these two approaches can work together - <https://medium.com/nightingale/harmonic-resolution-18202193f5e5>



# (2B) COLOR HARMONY HISTORY:



In 1666, Isaac Newton developed the Color Circle as a simplified model of the color spectrum - Red, Green, Blue Color Space. The color wheel starts at red and cycles clockwise through the hues to violet.

Color Rainbow diagram by Theresa-Marie Rhyne. Black and White versions of Spectrum Diagram redrawn from Newton's "Optiks" book by Theresa-Marie Rhyne, 2015. Color Circle is from Newton's "Opticks" book, pp 165. Color Squares or Swatches added by Theresa-Marie Rhyne, 2015.



# (2B) COLOR HARMONY: BASIC TYPES



**Monochromatic**



**Analogous**



**Complementary**

In Key Color of Cyan

**Monochromatic: 1 Color with its Tint (White added), Tone (Gray added), and Shade (Black added).**

**Analogous: 3 or more Colors adjacent to each other on the Color Wheel.**

**Complementary: 2 Colors opposing each other on the Color Wheel.**

Images Theresa-Marie Rhyne, 2020

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For more details see: Ten simple rules to colorize biological data visualization by Hattab, Rhyne & Heider, <https://journals.plos.org/ploscompbiol/article?id=10.1371/journal.pcbi.1008259>





# (2B) COLOR SCHEMES FOR DATA: ORIGIN COLORBREWER



- Sequential Schemes: optimized for ordered data from low to high. (*similar to monochromatic & narrow analogous color harmonies*)
- Diverging Schemes: places equal emphasis on mid-range critical values as well as extreme values. (*some complementary color harmonies used in colormap options.*)
- Qualitative Schemes: does not imply magnitude differences and suited for representing nominal or categorical data.
- These Color Schemes for Data are based on the Perceptual Uniform Munsell Color System.

The ColorBrewer tool is a free online tool for color advice for maps and data visualization. It was conceptualized by Cynthia A. Brewer with interface design and software development by Mark Harrower and others (in the Department of Geography at Pennsylvania State University).  
See: (<http://colorbrewer2.org/>).



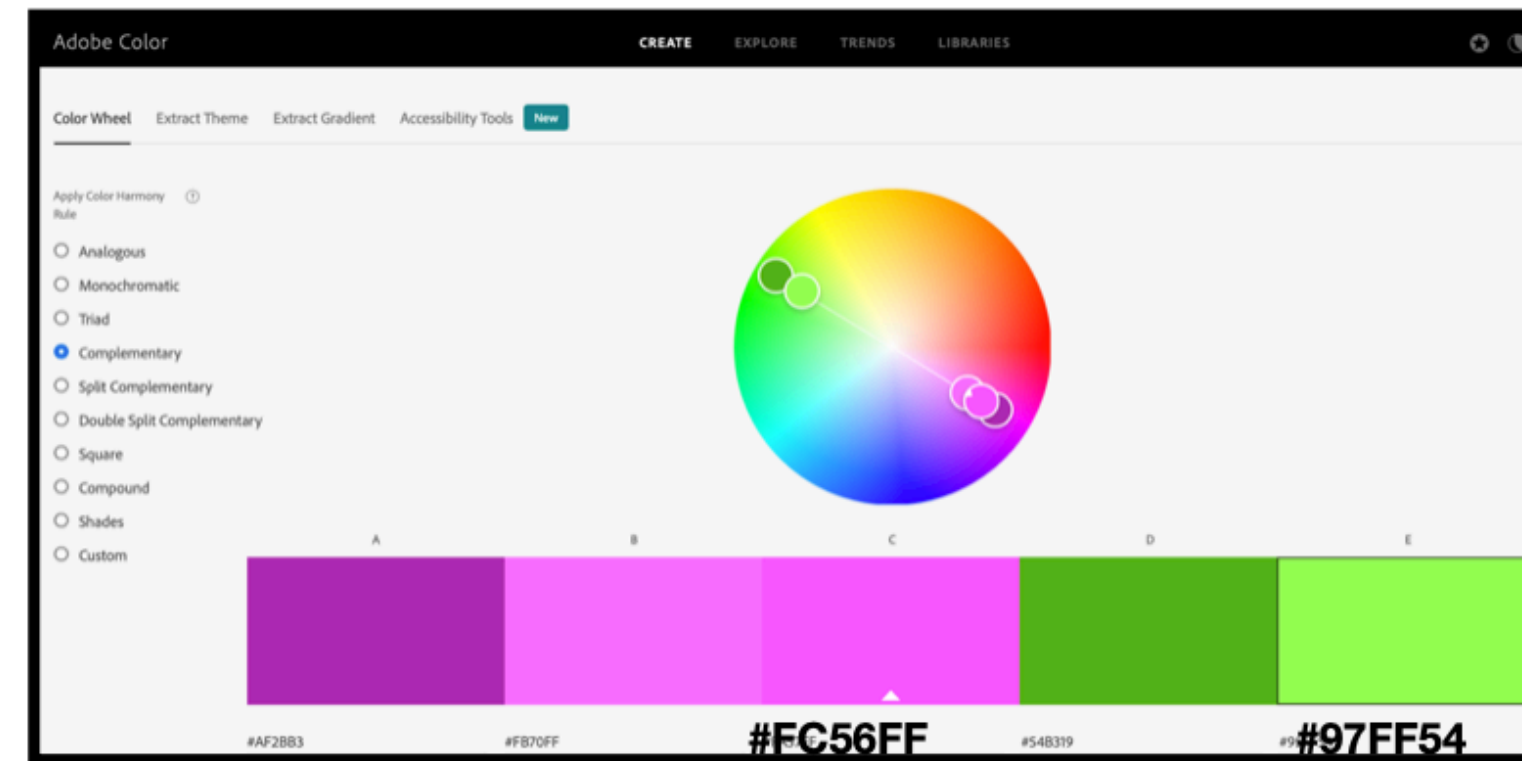


# (2B) DETERMINE COLOR RULE OR HARMONY

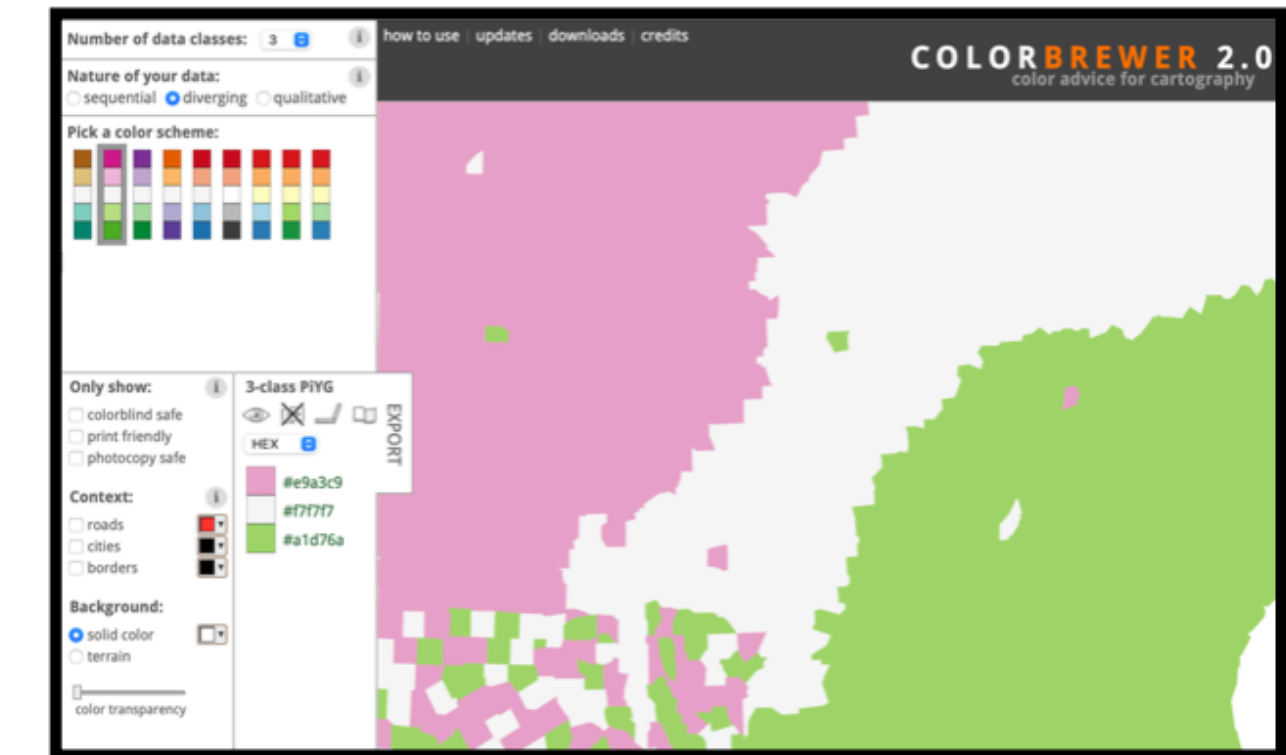
For my example:

I select the Complementary Color Harmony where Green opposes Magenta on the Color Wheel.

There is also a similar Diverging Color Scheme in ColorBrewer.



Adobe Color's Complementary Color Harmony of Magenta #FC56FF and Green #97FF54 .



ColorBrewer's Pink Yellow Green (PiYG) color scheme - 3 data classes shown as default.

Image: Theresa-Marie Rhyne 2021

- Key Color: Magenta (#FC56FF in Hex Code)
- Complement: Green (#97FF54 in Hex Code)

For more details see: Complements that Diverge by T-M. Rhyne  
<https://medium.com/nightingale/complements-that-diverge-fa487e843674>



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# (3) BUILD YOUR COLOR SCHEME

For my example:

I use Adobe Color to build a 5 element Magenta Green Color Scheme with a White neutral element.

Or select the Pink Yellow Green option with 5 data classes in ColorBrewer.

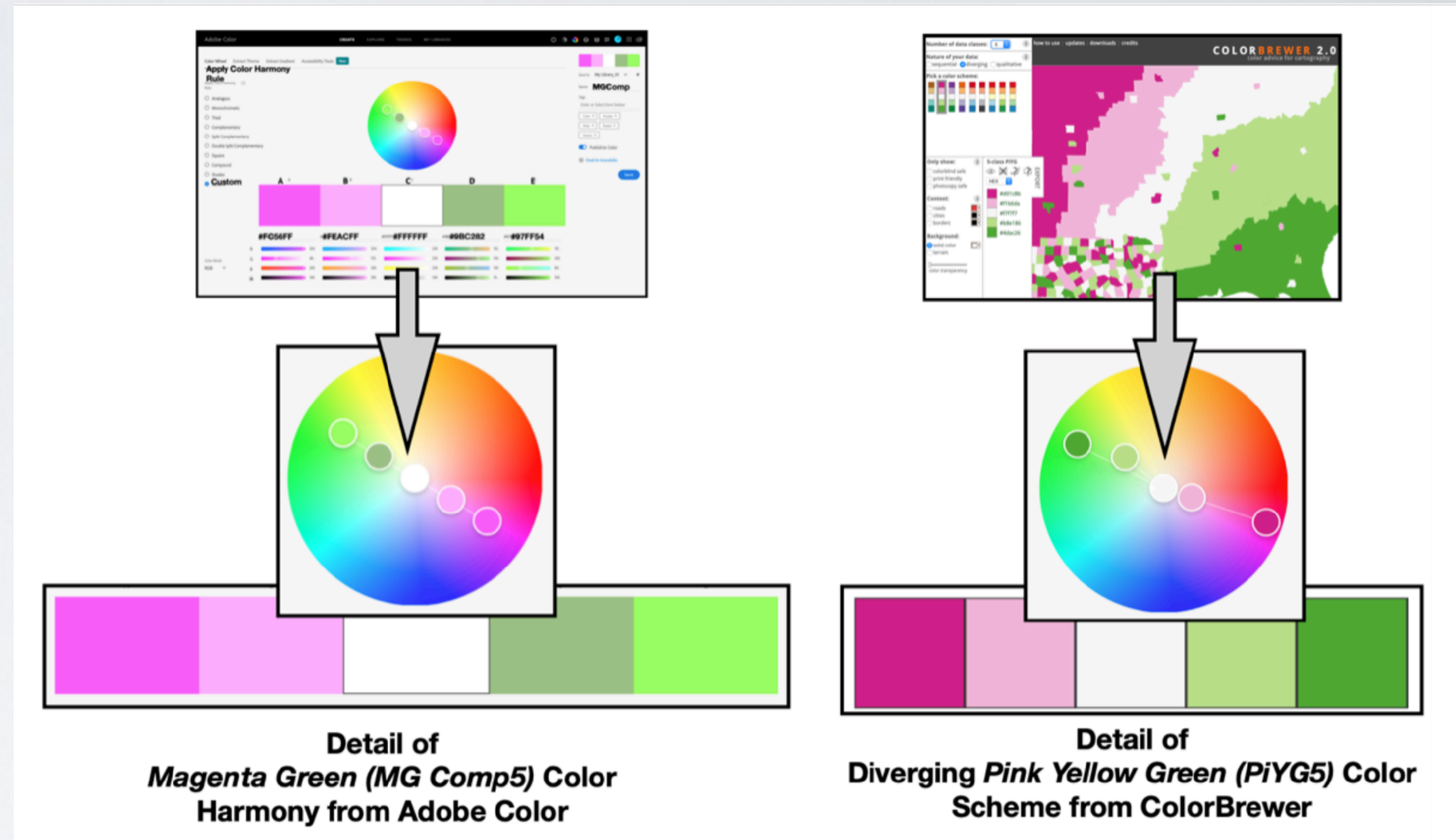


Image: Theresa-Marie Rhyne 2021

- Key Color: Magenta (#FC56FF in Hex Code)
- Complement: Green (#97FF54 in Hex Code)

For more details see: Complements that Diverge by T-M. Rhyne  
<https://medium.com/nightingale/complements-that-diverge-fa487e843674>



# (4) CHECK FOR COLOR DEFICIENCY

## 3 Key Types of Color Vision Weaknesses:

- Protanope: Red retinal photoreceptors absent.
- Deuteranope: Green photoreceptors absent.
- Tritanope: only medium and long cones present. Confuse Blue with Green and Yellow with Violet.

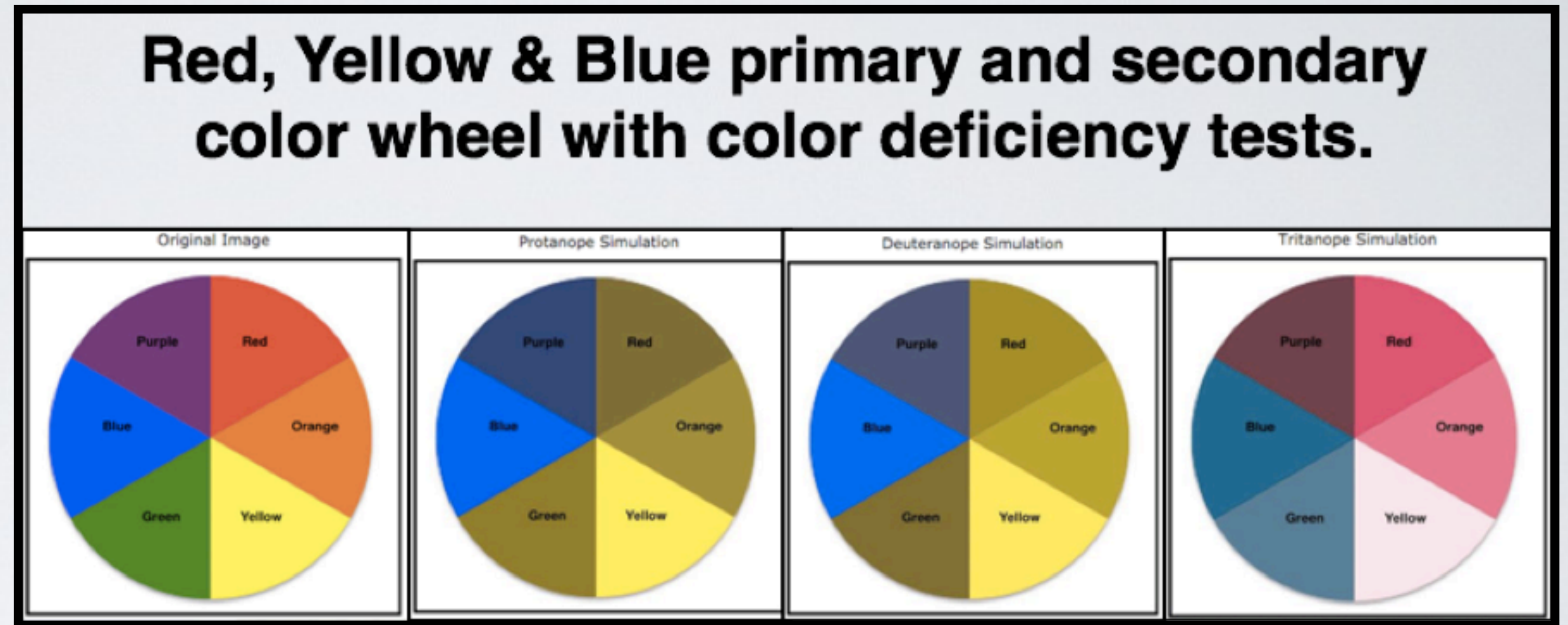


Image: Theresa-Marie Rhyne 2021

- Here, we show the RYB color wheel under color deficiency tests. Individuals with deficiencies cannot easily differentiate between respective hues.

Color Blindness Simulator - Coblis used to evaluate results.

<http://www.color-blindness.com/coblis-color-blindness-simulator/#primary>

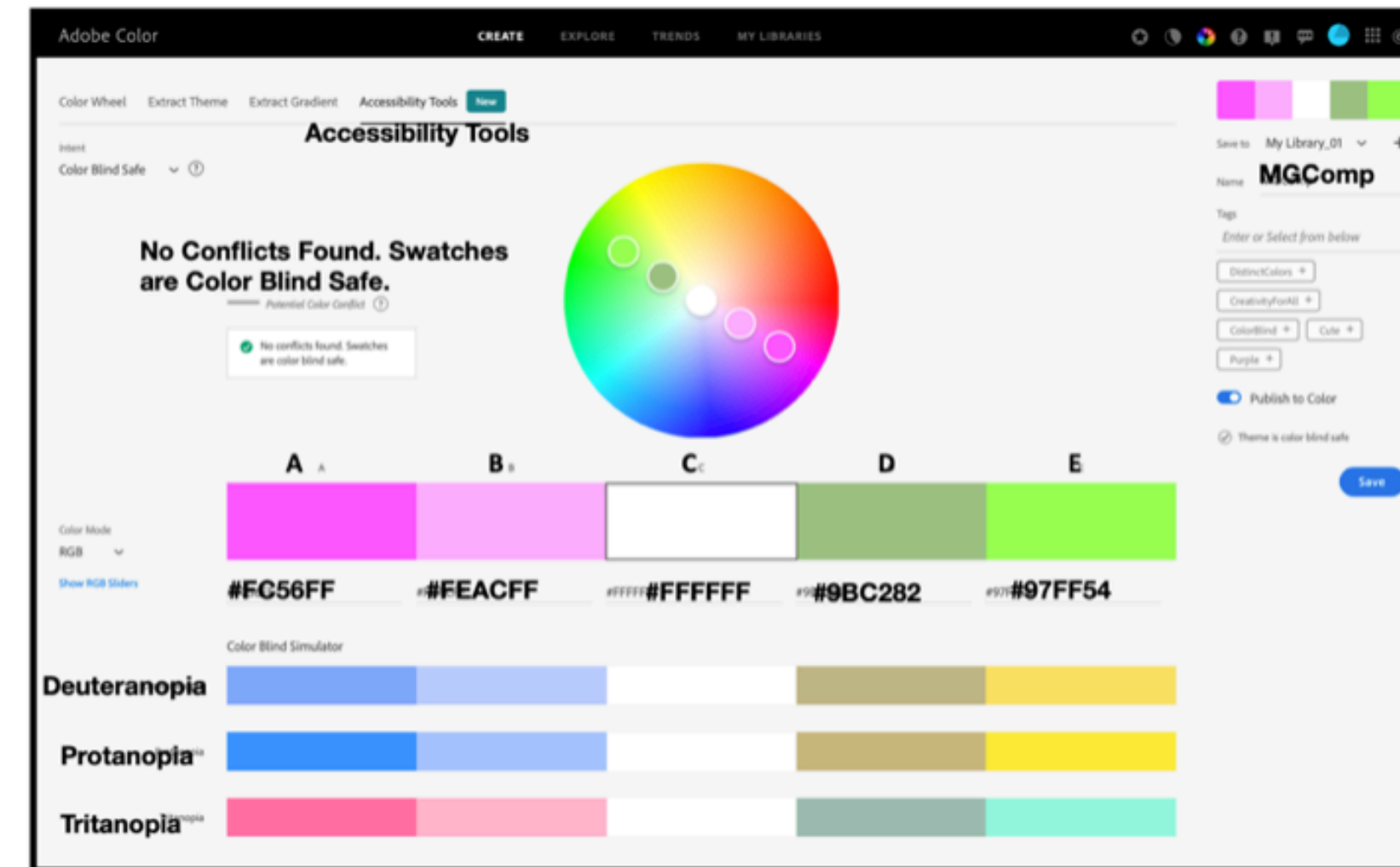


# (4) CHECK FOR COLOR DEFICIENCY

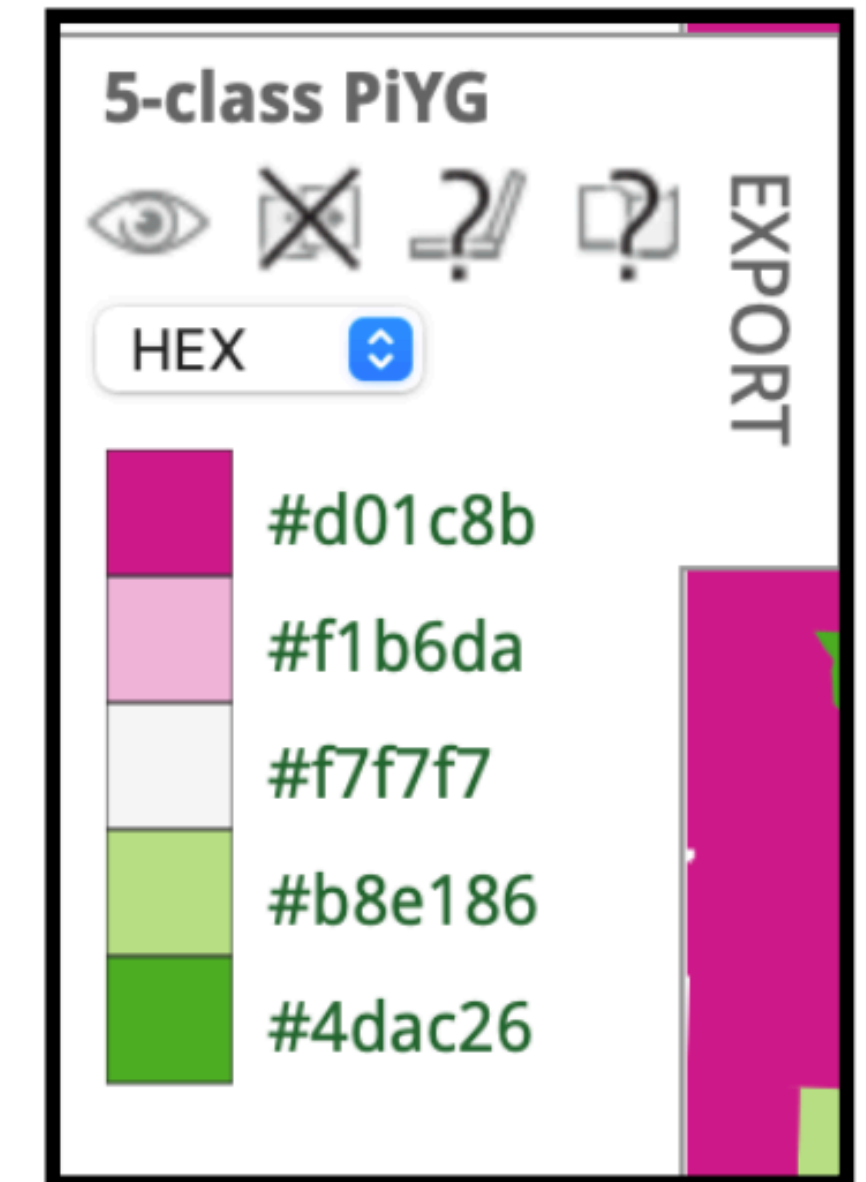
For my example:

Adobe Color provides an Accessibility Tools Function.

Similarly, ColorBrewer provides an icon for “color blind friendly”.



**Adobe Color's Complementary Color Harmony of Magenta #FC56FF and Green #97FF54 passes Color Deficiency Checks .**



**ColorBrewer's Pink Yellow Green (PiYG) color scheme is Color Blind Friendly since no X over Eye Icon.**

Images: Theresa-Marie Rhyne 2021

For more details see: Complements that Diverge by T-M. Rhyne  
<https://medium.com/nightingale/complements-that-diverge-fa487e843674>



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# (5) APPLY YOUR COLOR SCHEME TO DATA

The Magenta / Green  
Complementary/  
Diverging Color  
Scheme

Is built for the 5 point  
Likert scale of

Strongly Agree,  
Agree, Neutral,  
Disagree and  
Strongly Disagree.

Notice the initial color deficiency  
analysis via Adobe Color.

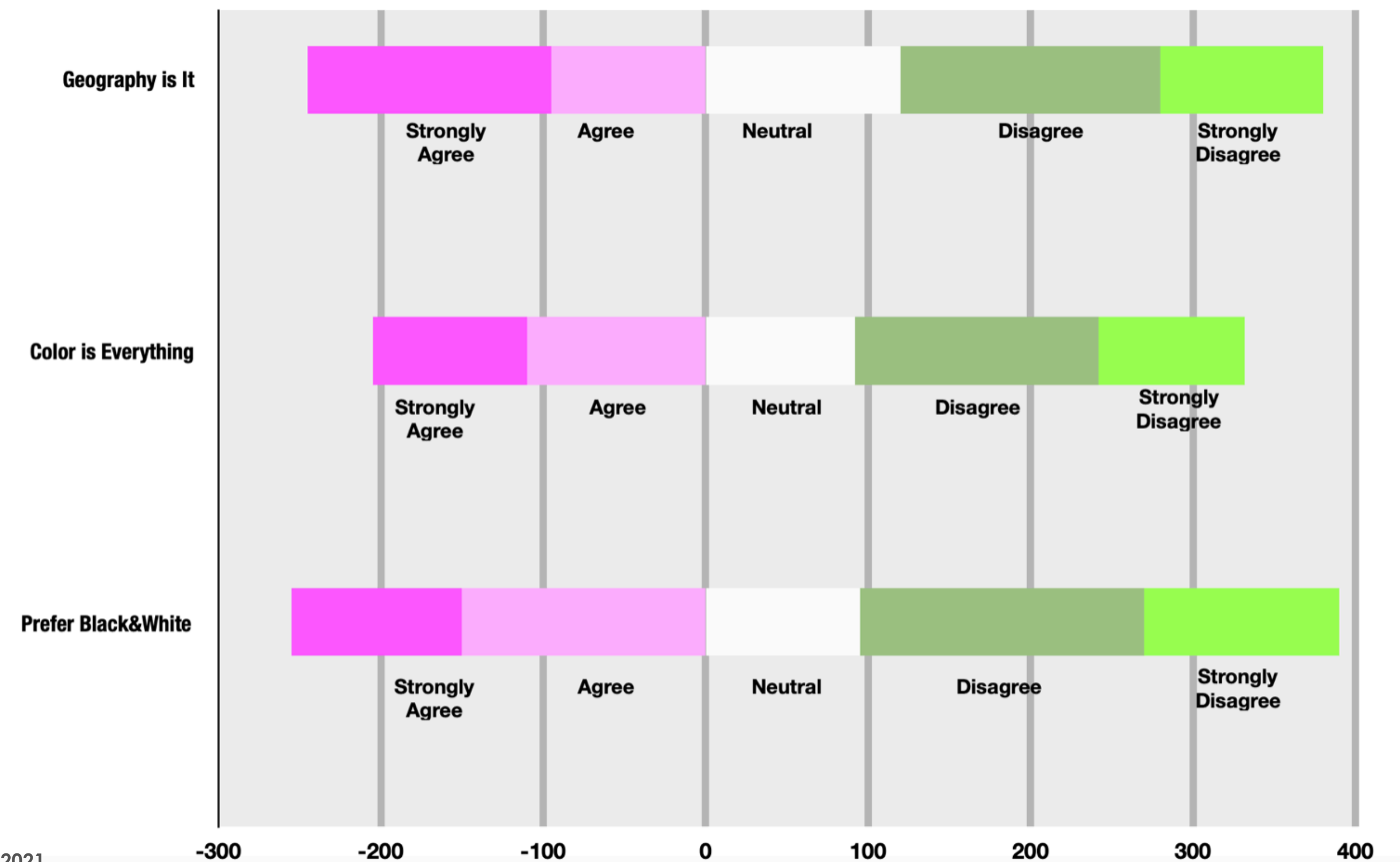
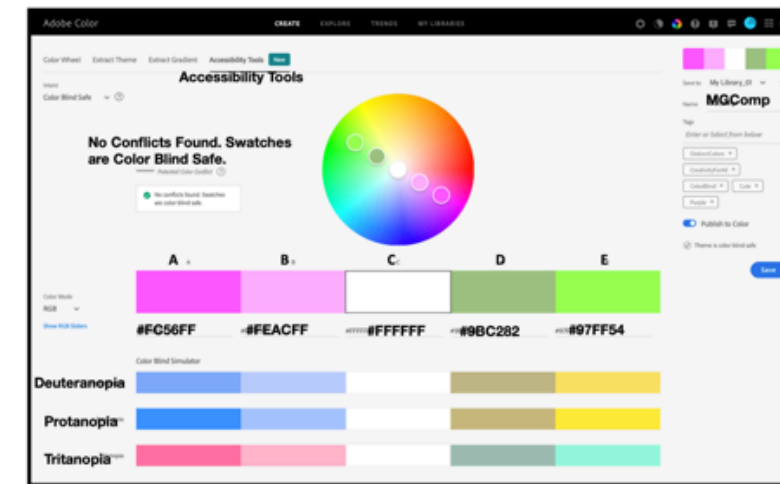


Image: Theresa-Marie Rhyne 2021

For more details see: Complements that Diverge by T-M. Rhyne  
<https://medium.com/nightingale/complements-that-diverge-fa487e843674>



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# (5\*) CHECK ACTUAL VIZ FOR COLOR DEFICIENCY



**Normal Vision**



**Protanopia:  
Loss of Red Cone**



**Deuteranopia:  
Loss of Green Cone**



**Tritanopia:  
Loss of Blue Cone**

- To be safe, the actual visualization is checked for Color Deficiency.

Color Blindness Simulator - Coblis used to evaluate results.

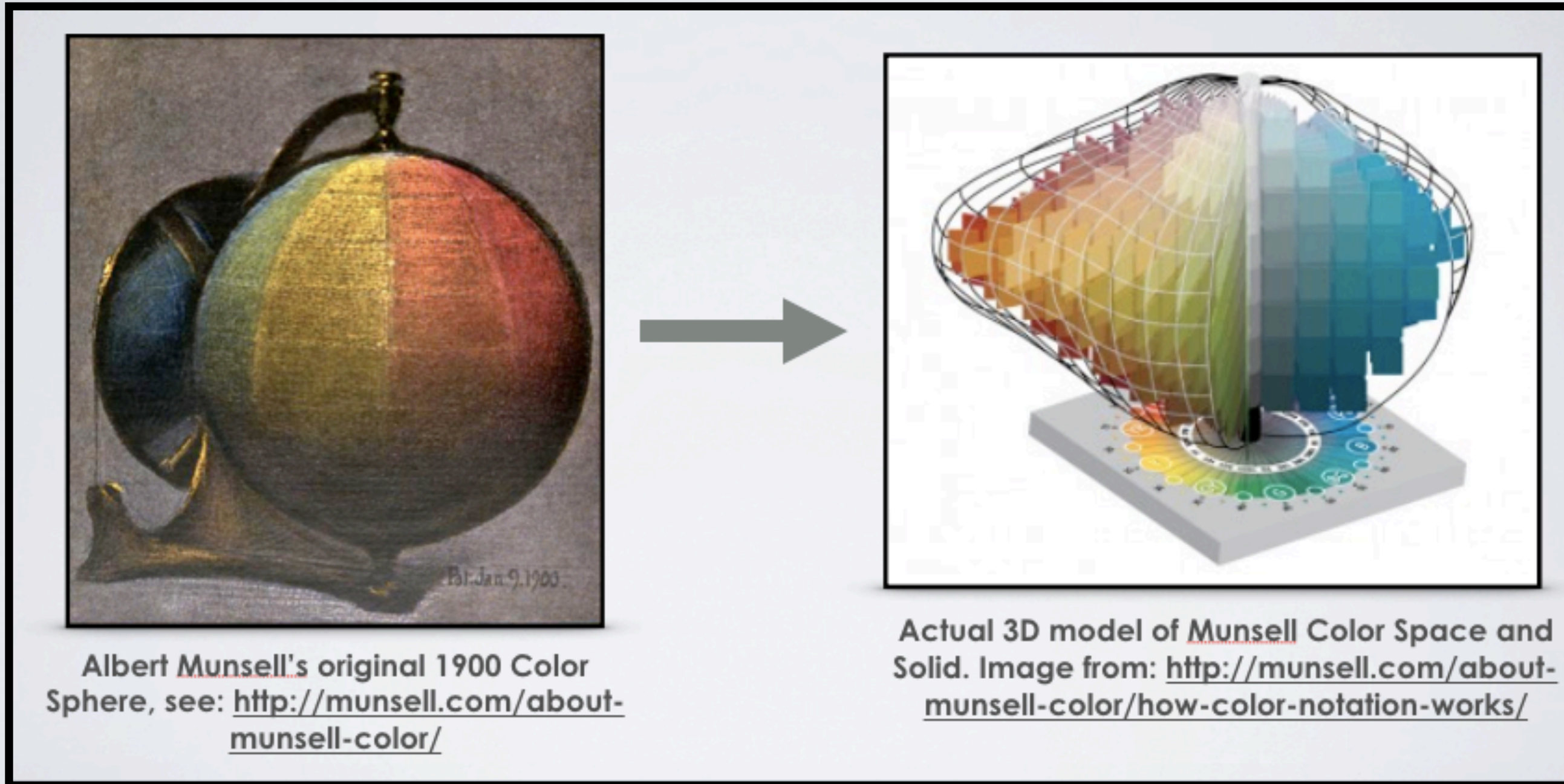
<http://www.color-blindness.com/coblis-color-blindness-simulator/#primary>

For more details see: Complements that Diverge by T-M. Rhyne  
<https://medium.com/nightingale/complements-that-diverge-fa487e843674>

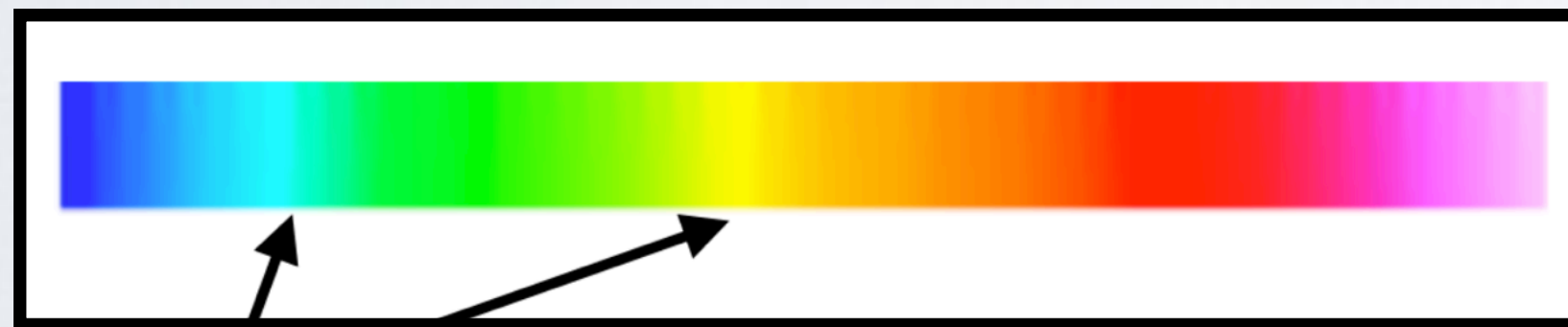




# WAIT: WHY CARE ABOUT PERCEPTUAL STUFF?



The 3D Color Model of a Sphere to describe how humans see color is perceptually incorrect.



The Traditional Rainbow Colormap carries artifacts that influence data analysis when the Colormap is used.



- The Traditional Rainbow Colormap carries artifacts when it is used & is non-perceptually uniform.
- Albert Munsell in the early 1900s discovered that Human Perception is Geometrically imperfect.
- Humans see a wider range of Red Orange hues than Blue Green hues.
- So a 3D color space model of a Sphere is perceptually incorrect for humans. Munsell described the 3D color space as an irregular branched Tree.
- Today, some prefer the Hue Chroma Luminance (HCL) model for perceptual uniformity.



# COMPARING A NON-UNIFORM AND A UNIFORM RAINBOW COLOR SPECTRUM

## Non Perceptual Uniform Colormap



Features of the Colormap not of Changes in Data

## Perceptual Uniform Colormap



Images created by  
Theresa-Marie Rhyne,  
2020.



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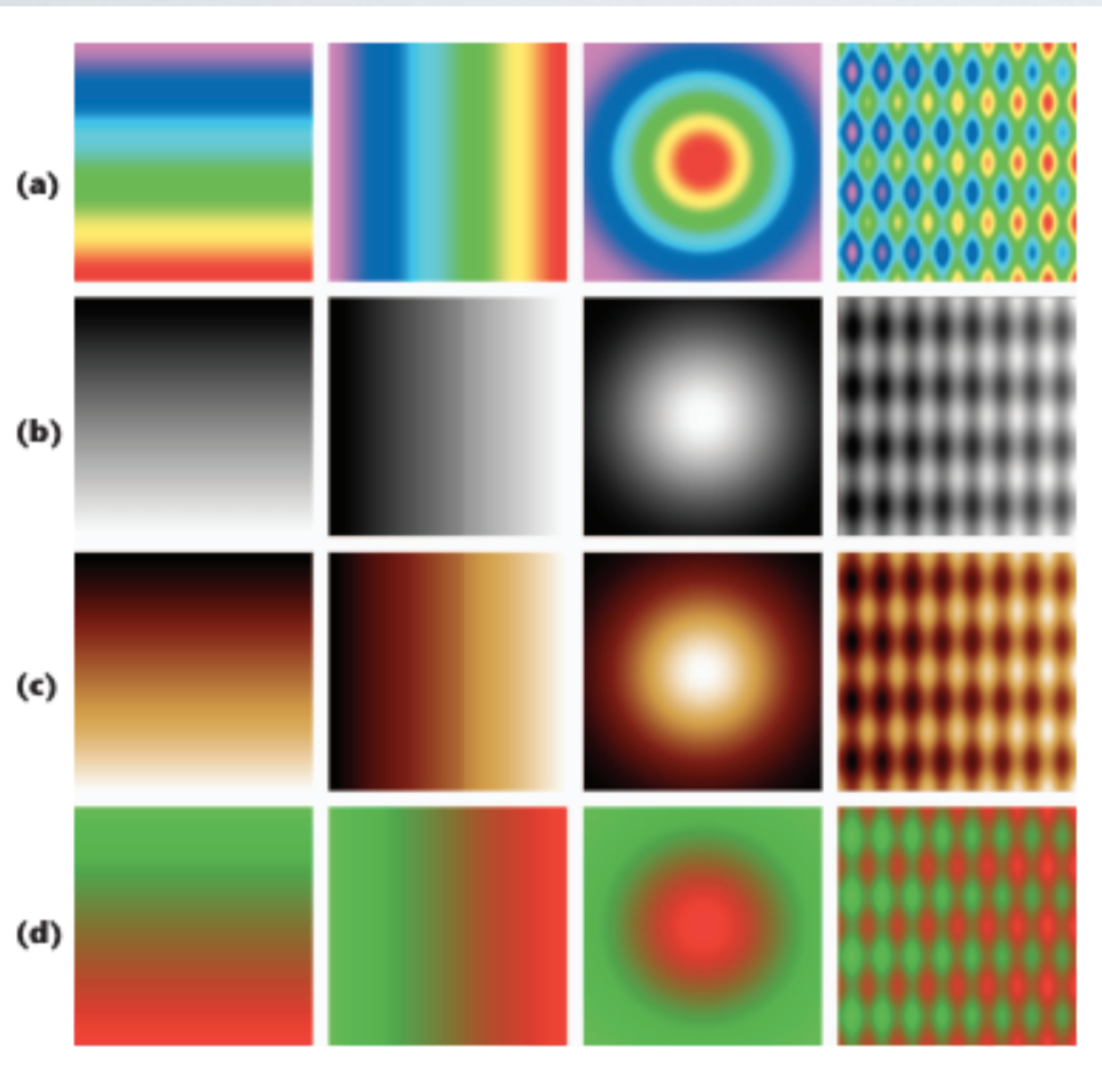
# COMPARING RAINBOW & OTHER COLOREMAPS

Image from the [“Data Visualization: The End of the Rainbow”](#) (2007) paper by Borland & Taylor that compares four data sets visualized with

(a) Rainbow; (b) Gray-Scale; c) Radiation, & d) isoluminant Green-Red Color Maps.

Apparent sharp gradients in the data in (a) appear as Rainbow Color Map artifacts not as data features. This is apparent by comparing this row with the same data viewed using the other Color Maps.

(Image used with permission from Borland and Taylor).



# OTHER RECENT: RAINBOW COLOR MAP WORK



**Matplotlib\_viridis default colormap**

- Effort by Nathaniel J. Smith, Stefan van der Walt, and others to change the default “rainbow” colormap in Matplotlib, 2015/2016. New colormap is entitled “viridis”:  
<https://bids.github.io/colormap/>





# WHAT IS THE MUNSELL COLOR SYSTEM: A HUE, VALUE AND CHROMA COLOR SPACE

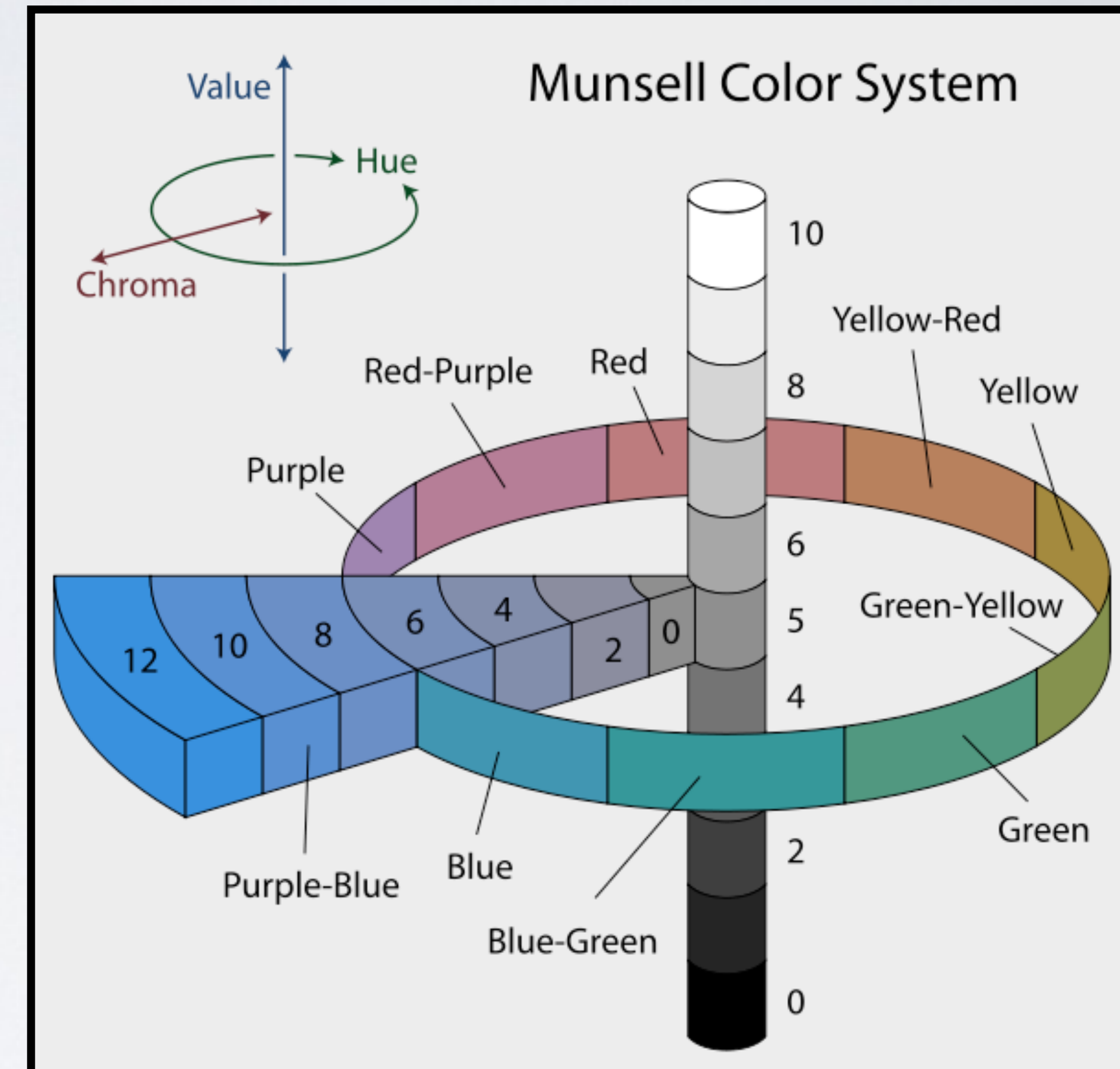
- A 3D Color Space proposed in the late 1890s and early 1900s by Albert H. Munsell.

- Hue: 5 principal hues of Red, Yellow, Green, Blue and Purple with 5 intermediate hues halfway between each principal.

Each of these 10 steps is divided into 10 sub-steps to yield 100 hues with integer values.

- Value: black (value 0) at the bottom to white (value 10) at the top.
- Chroma: measured radially from the center of each slice.

- Munsell 2018 - Centennial Color Symposium celebrated 100 years since Munsell's death: <https://munsell2018.org/>



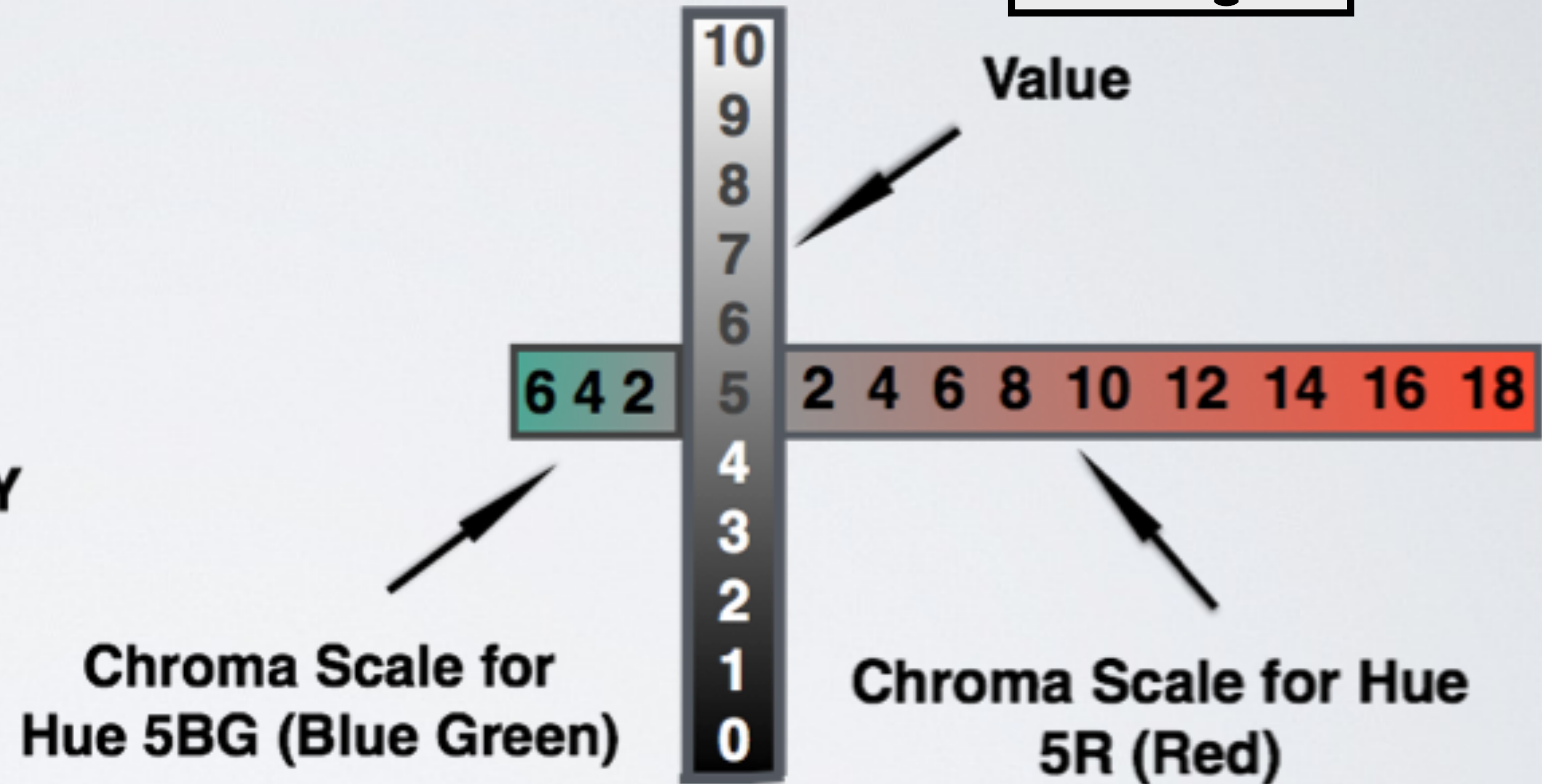
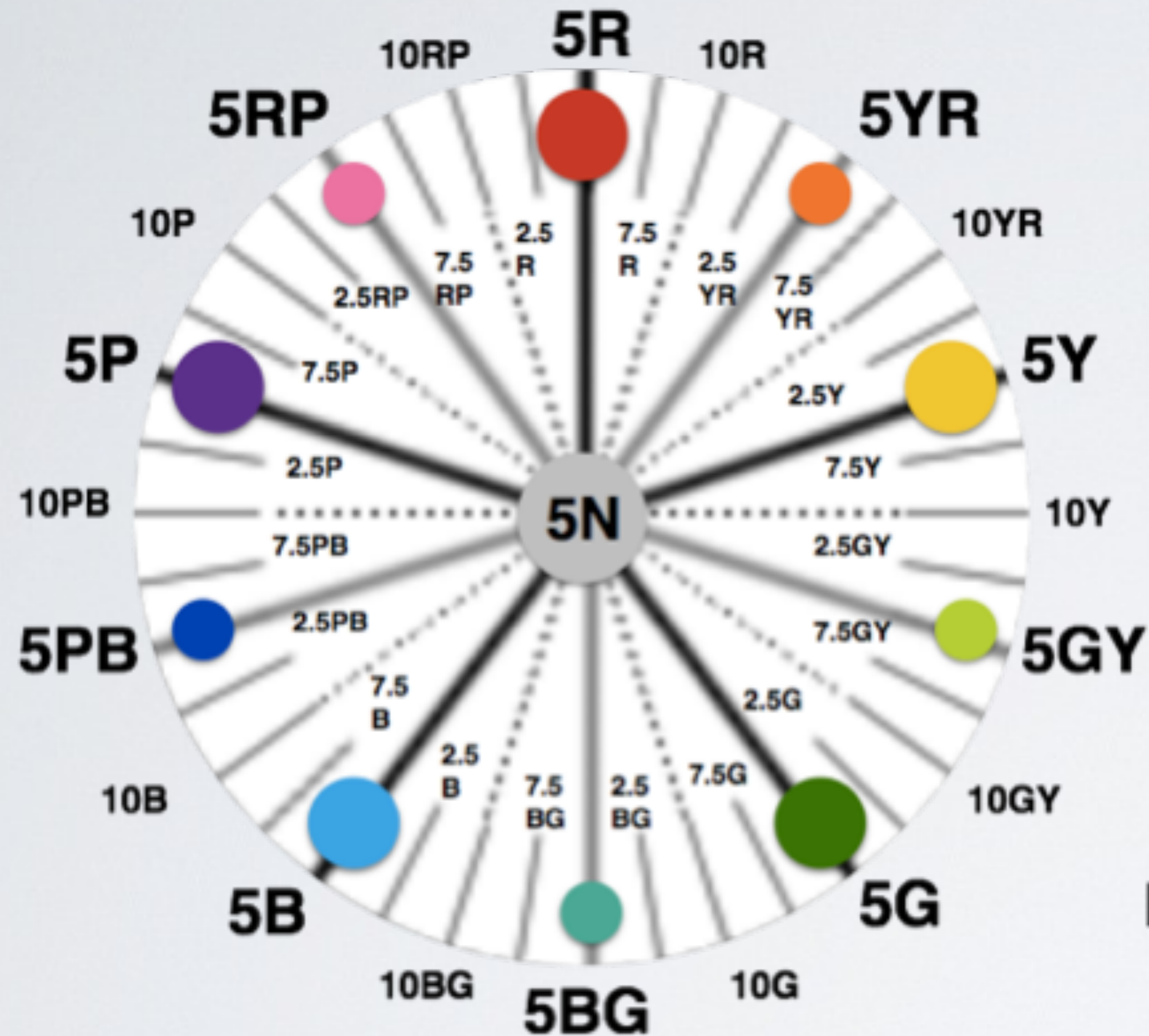
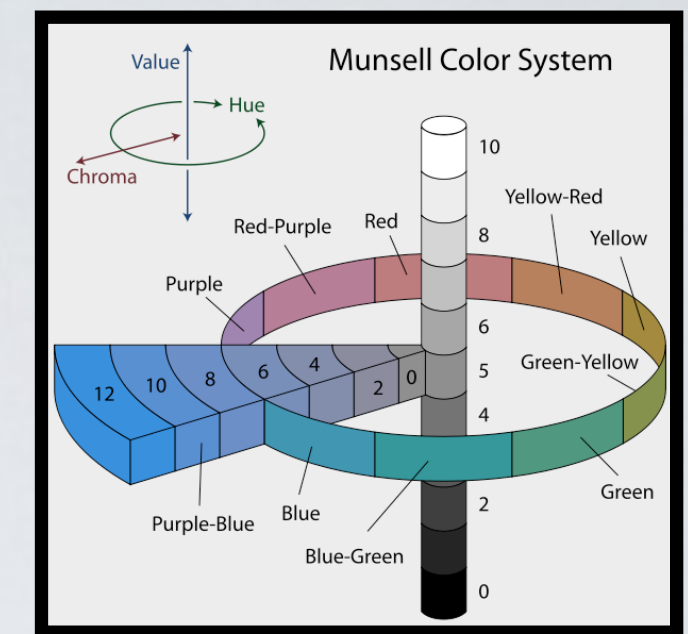
Open Source Image available at Wikipedia and created by Jacobolus, see: <http://en.wikipedia.org/wiki/File:Munsell-system.svg>



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# MUNSELL COLOR SYSTEM: A HUE, VALUE AND CHROMA COLOR SPACE



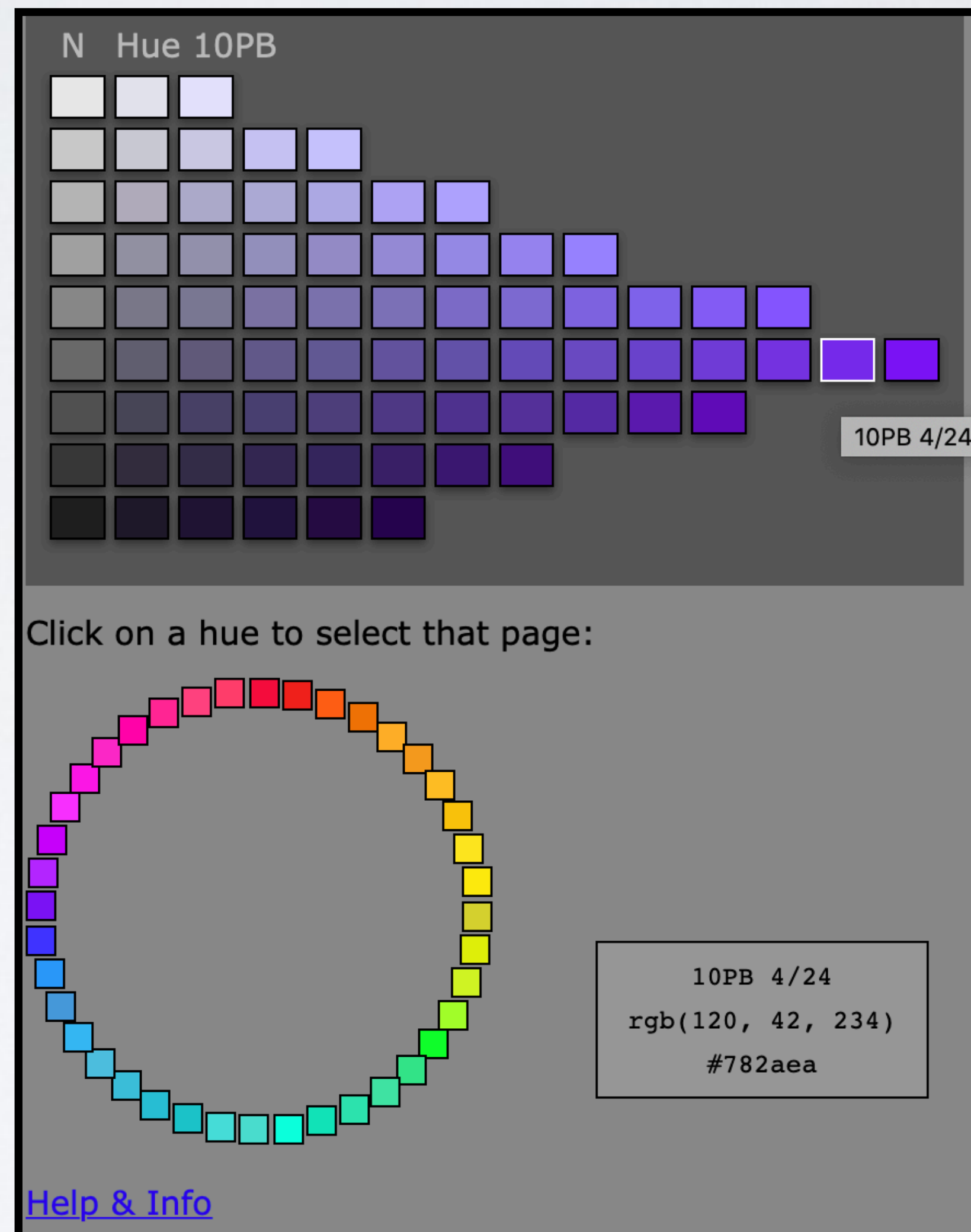
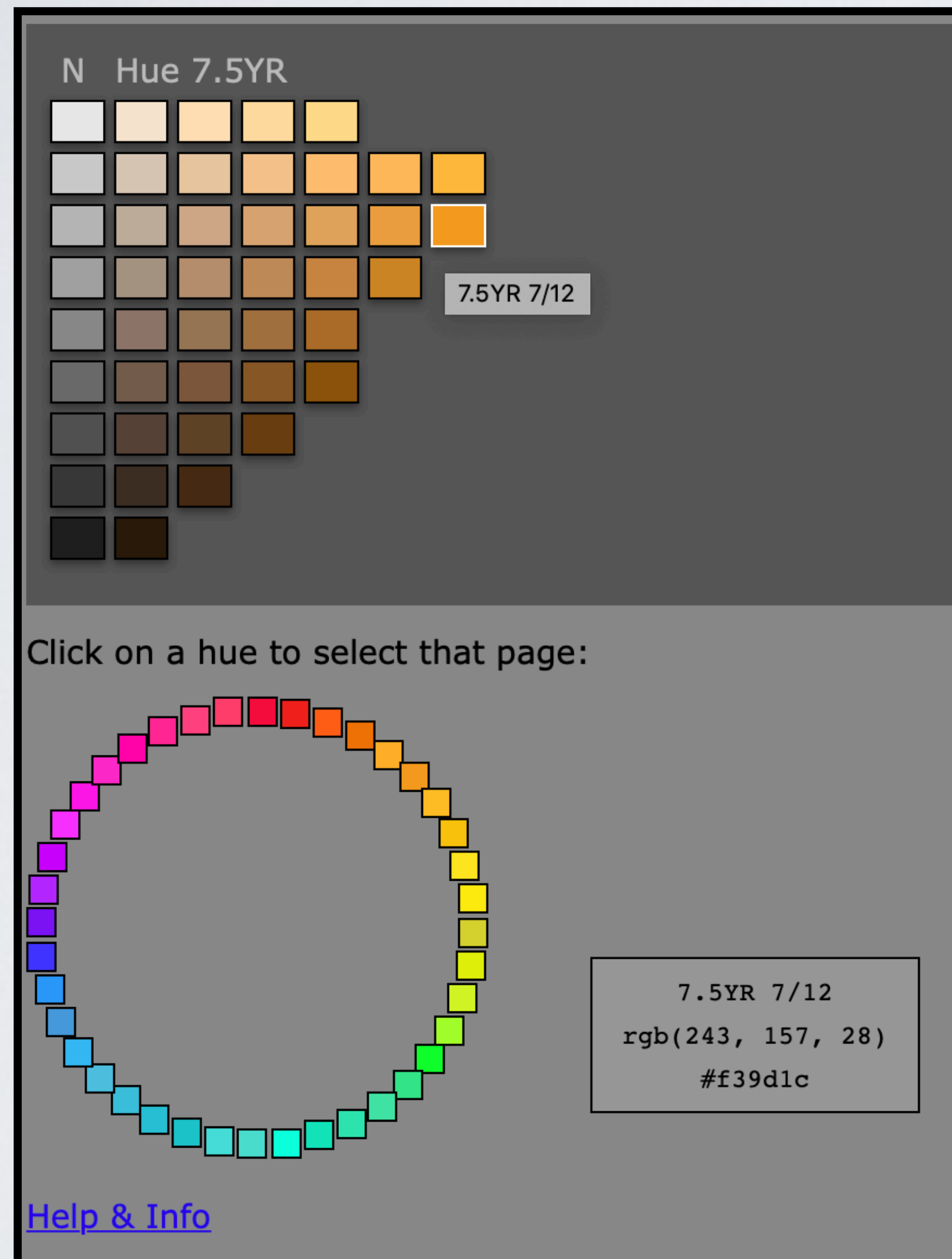
Wheel & Chroma Scale Illustrations by Theresa-Marie Rhyne, 2015

The 1929 Munsell Book of Color described the fundamentals of the color space configuration shown above. Munsell colors can be converted to CIE LAB, RGB, HSV, HSL, and other color spaces. Munsell to CIE Lab reference: <https://rdrr.io/cran/munsellinterpol/man/MunsellToLab.html>





# USE [ANDREWWERTH.COM/COLOR](http://ANDREWWERTH.COM/COLOR) AS A DIGITAL REFERENCE FOR THE MUNSELL ATLAS OF COLOR:



[andrewwerth.com/color](http://andrewwerth.com/color) is from Andrew Werth's personal web site. Noted and shown with his permission.

Special thanks for a digital version of the Munsell Atlas.

Images created by Theresa-Marie Rhyne, 2020.





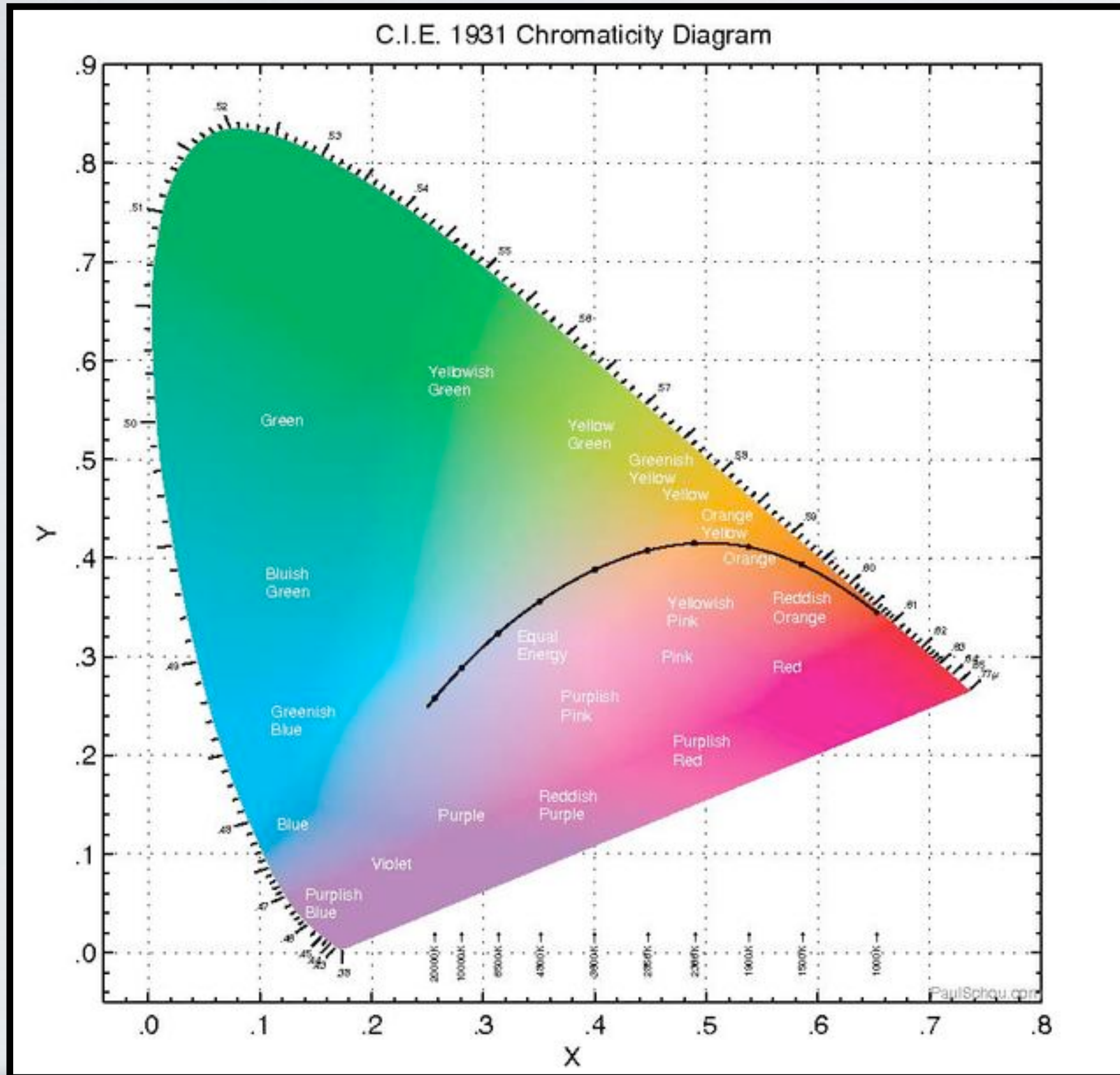
# CIE XYZ COLOR SPACE: FROM THE INTERNATIONAL COMMISSION ON ILLUMINATION

The CIE XYZ color space is based on experimental perception studies conducted by W. David Wright and John Guild in the 1920s.

The CIE 1931 XYZ color space is a device independent color space. It is designed for matching calibrated displays or printers.

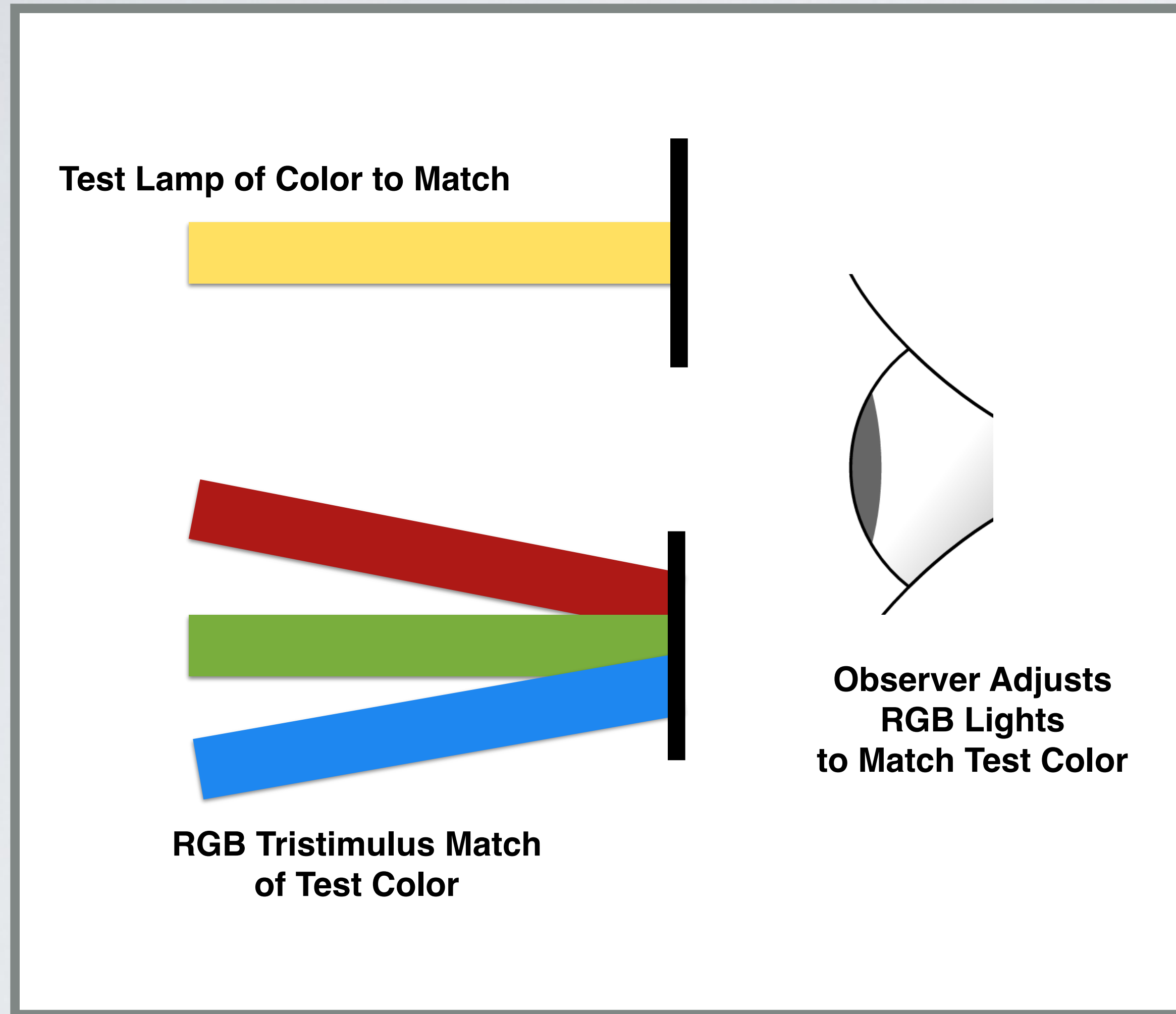
Open Source Image available at Wikipedia and created by Paulschou, see: [http://en.wikipedia.org/w/index.php?title=File:Chromaticity\\_diagram\\_full.pdf&page=1](http://en.wikipedia.org/w/index.php?title=File:Chromaticity_diagram_full.pdf&page=1).

Note: Black Body Locus or Planckian Locus: the path of an incandescent block body would take as the black body temperature changes in this chromaticity space is also shown.





# COLORIMETRY: COLOR MATCHING BY OBSERVERS



Observer adjusts Red, Green and Blue lights to match test color.

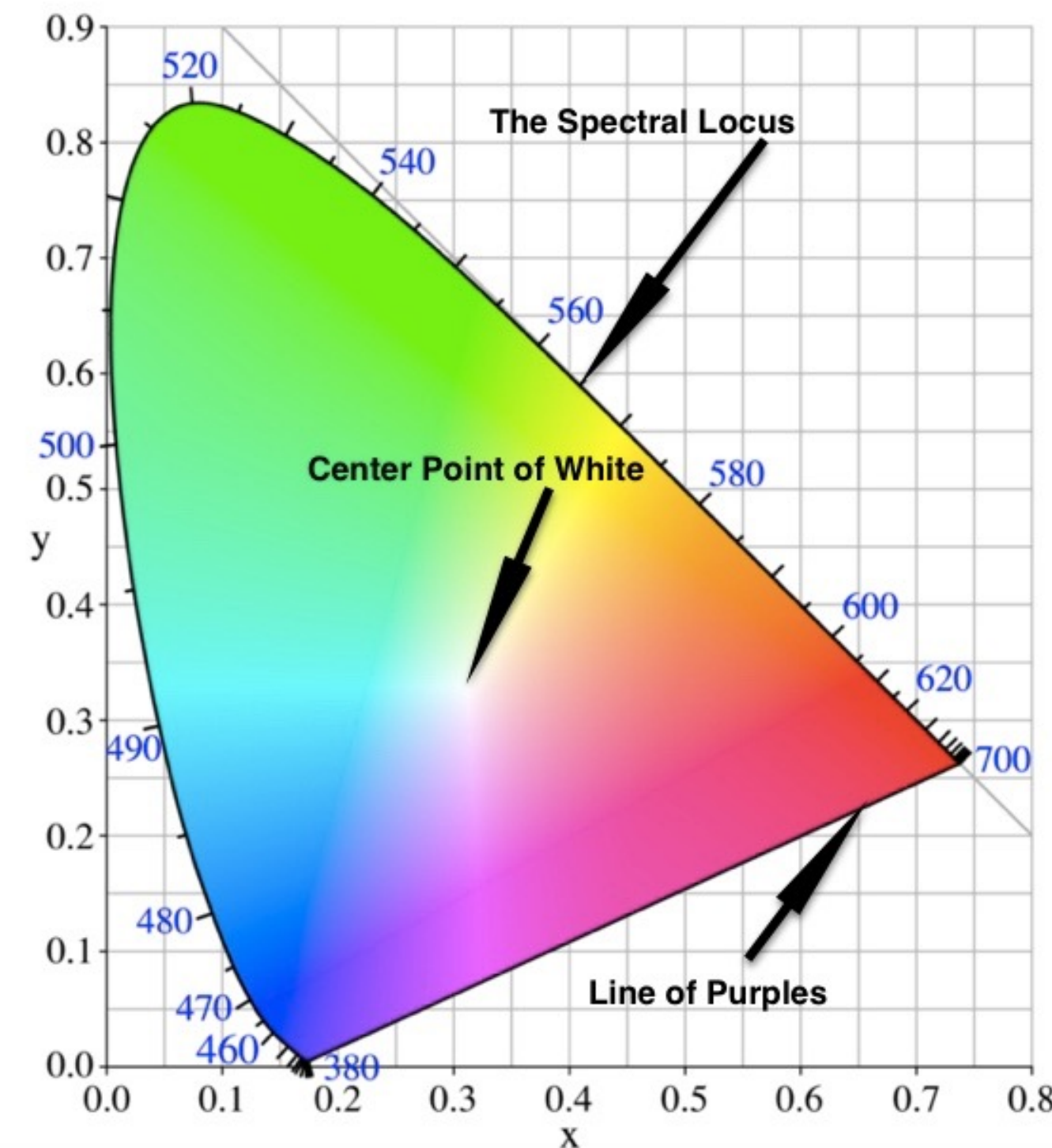
Color matching functions were then developed to create the CIE 1931 XYZ color space and other later color spaces.

Image by Theresa-Marie Rhyne, 2015: from Chapter 3, pg 42, of her book on “Applying Color Theory to Digital Media and Visualization”, CRC Press, 2016.



# UNDERSTANDING A CHROMATICITY DIAGRAM

CIE x-y Chromaticity Diagram



CIE x-y Chromaticity Diagram Equations:

$$x = \frac{X}{X+Y+Z}$$

$$y = \frac{Y}{X+Y+Z}$$

$$1 = x + y + z$$

- All visible colors to average human eyes are contained inside the diagram.
- The edge of the diagram, called the Spectral Locus, represents most saturated colors or pure monochromatic light.
- The least saturated colors are at the center of the diagram emanating from White.
- Any two colors along a given line between two points are made by mixing the colors at the end points.
- The Line of Purples: Fully saturated colors can only be made by mixing Red and Blue.

Image in public domain: <https://en.wikipedia.org/wiki/File:CIExy1931.png#/media/File:CIExy1931.png>. Annotations by T-M Rhyne



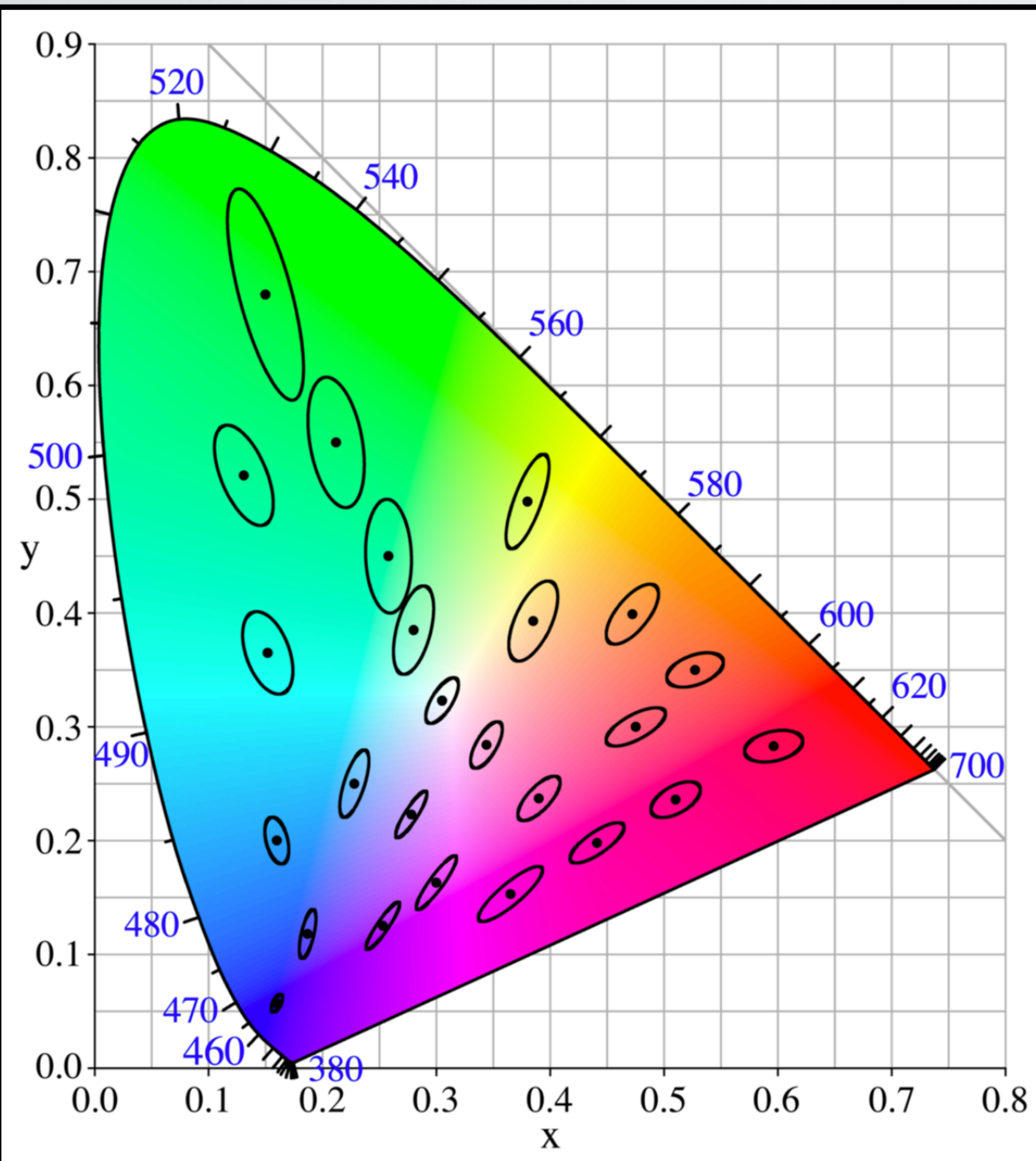
# CIE XYZ COLOR SPACE IS PERCEPTUALLY NON-UNIFORM

A color space is perceptually uniform if a change of length in any direction  $X$  of the color space is perceived by a human as the same change.

In 1942, David MacAdam showed this with ellipses defining visual distortions. Circles on the chromaticity plot indicate no distortions.

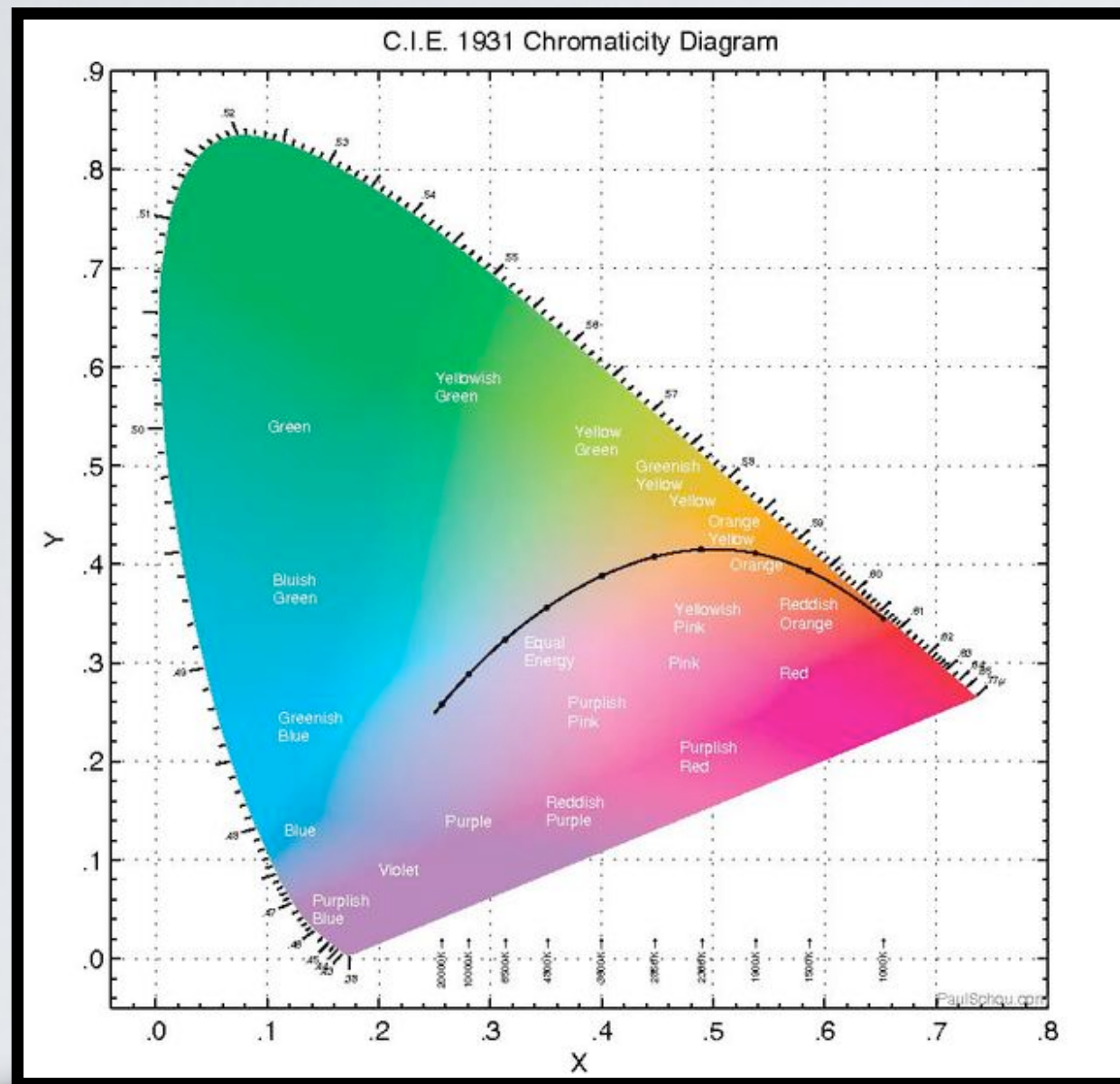
Open Source Image available at Wikipedia and Data taken from Günter Wyszecki and Walter Stanley Stiles, see: [https://commons.wikimedia.org/wiki/File:CIExy1931\\_MacAdam.png](https://commons.wikimedia.org/wiki/File:CIExy1931_MacAdam.png).

Note: MacAdam(1942) ellipses plotted on the CIE xy 1931 chromaticity diagram. Ellipses are 10 x actual size. MacAdam, David Lewis (May 1942). "Visual sensitivities to color differences in daylight" (abstract). *JOSA*. 32 (5): 247–274. doi:[10.1364/JOSA.32.000247](https://doi.org/10.1364/JOSA.32.000247)



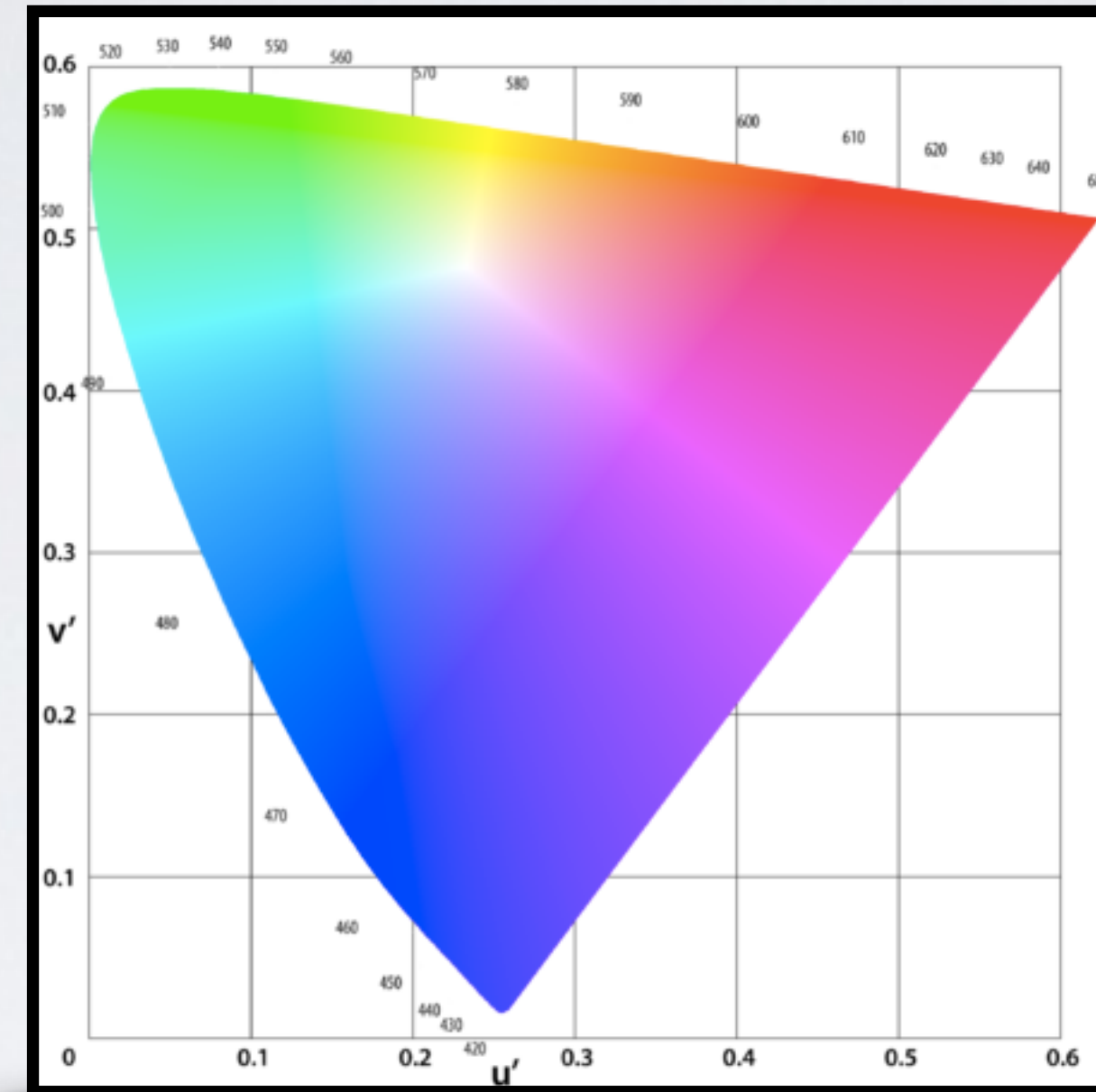


# UPDATES TO CIE XYZ COLOR SPACE



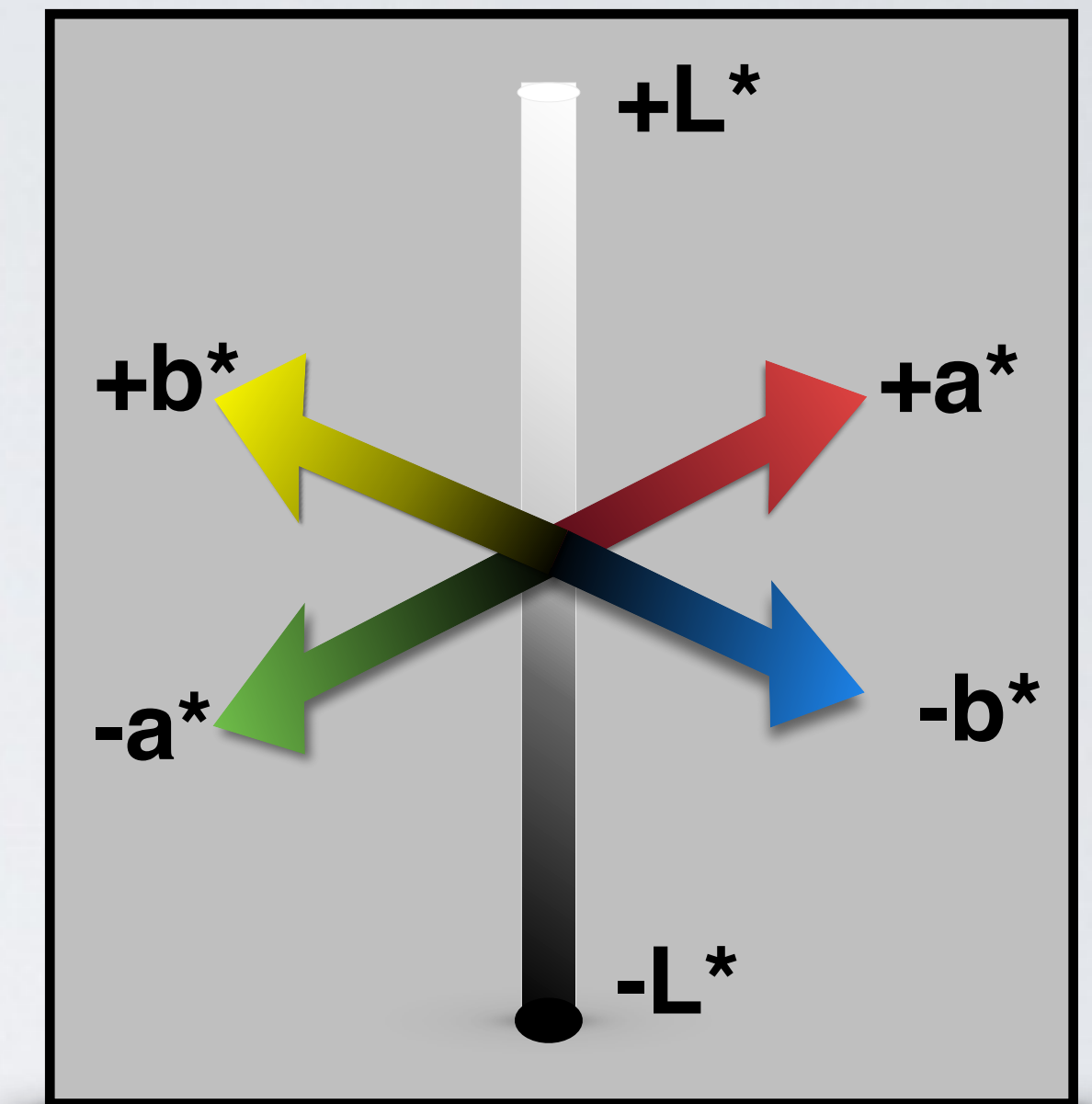
Original CIE XYZ color space, based on experimental perception studies conducted in the 1920s.

Open Source Image available at Wikipedia and created by Paulschou, see: [http://en.wikipedia.org/w/index.php?title=File:Chromaticity\\_diagram\\_full.pdf&page=1](http://en.wikipedia.org/w/index.php?title=File:Chromaticity_diagram_full.pdf&page=1).



CIE LUV color space, also known as the CIE 1976 UCS (uniform chromaticity scale) diagram. CIE LUV is useful for Display Devices.

Open Source Image available at Wikipedia and created by Adoniscki, see: [http://en.wikipedia.org/wiki/CIELUV#mediaviewer/File:CIE\\_1976\\_UCS.png](http://en.wikipedia.org/wiki/CIELUV#mediaviewer/File:CIE_1976_UCS.png).



CIE LAB does not have an associated chromaticity diagram. CIE LAB is closely related to Opponent Processing Color Theory.

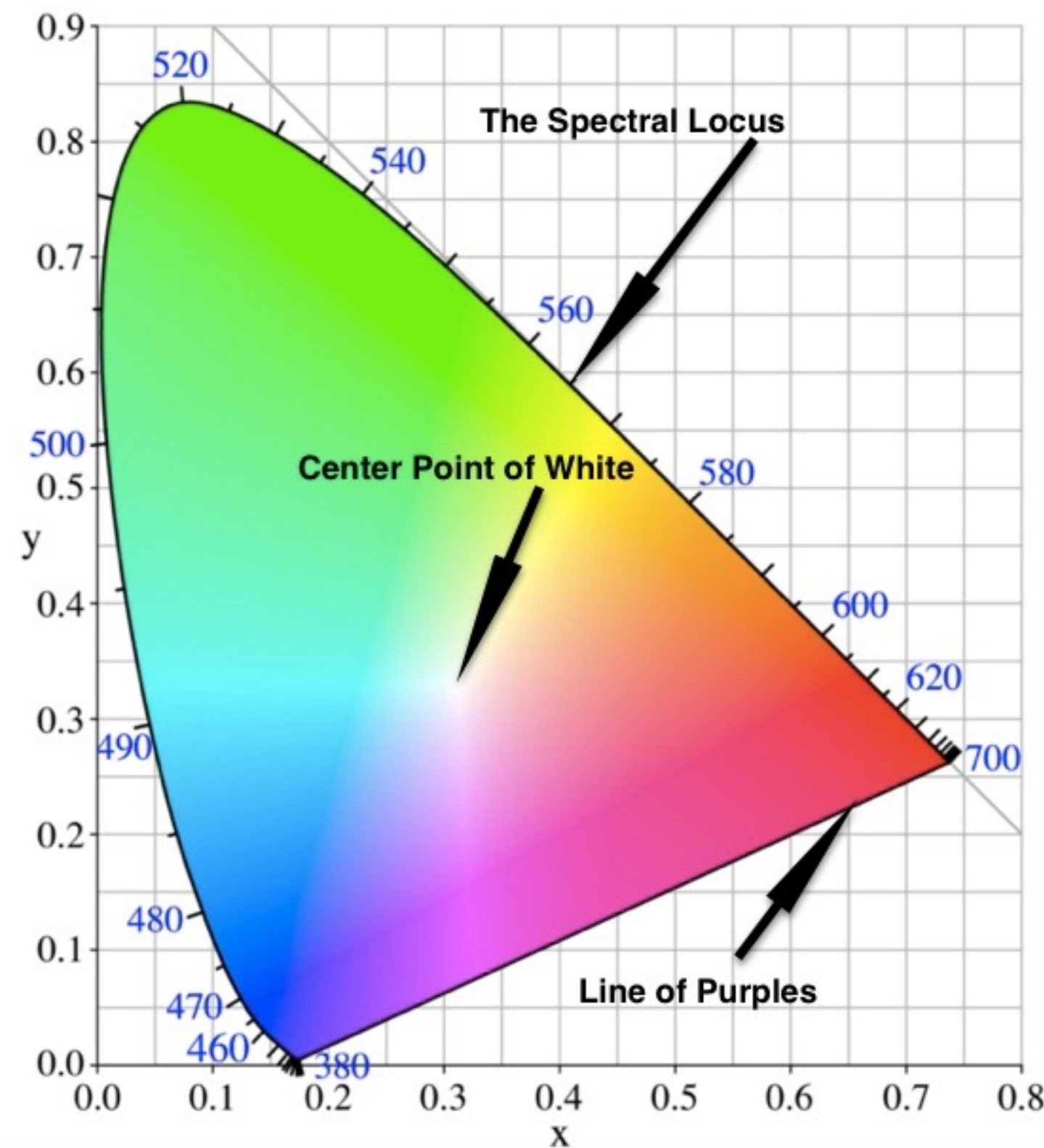
Diagram of the CIE LAB Opponent Processing Color Space by Theresa-Marie Rhyne, 2015.





# TRANSITIONS IN CHROMATICITY DIAGRAMS

CIE x-y Chromaticity Diagram



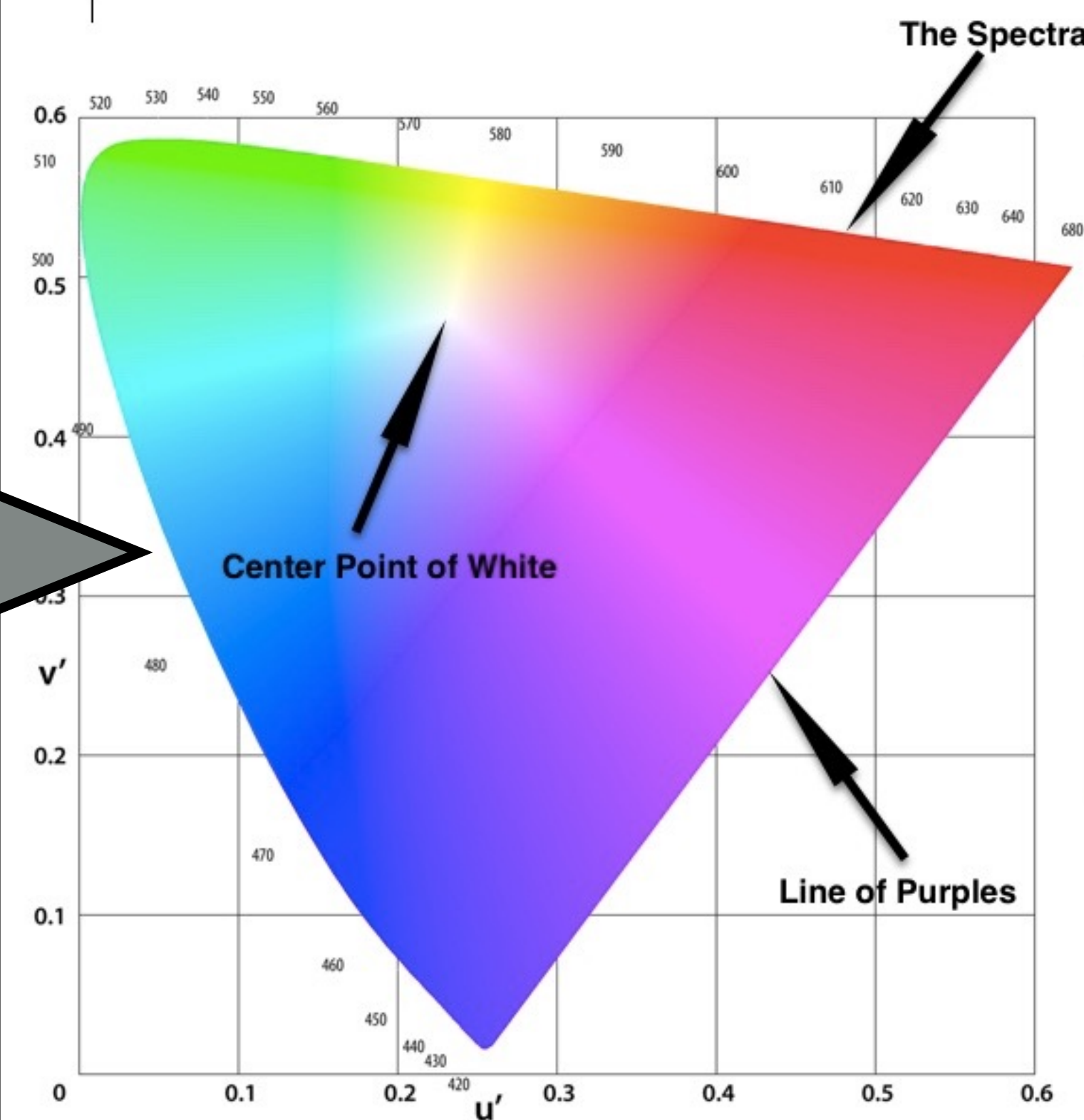
CIE x-y Chromaticity Diagram Equations:

$$x = \frac{X}{X+Y+Z}$$

$$y = \frac{Y}{X+Y+Z}$$

$$1 = x + y + z$$

CIE u'v' Chromaticity Diagram



CIE u'v' Chromaticity Diagram Equations:

$$u' = \frac{4X}{X+15Y+3Z}$$

$$v' = \frac{9Y}{X+15Y+3Z}$$

Image in public domain: <https://en.wikipedia.org/wiki/File:CIExy1931.png#/media/File:CIExy1931.png>. Annotations by T-M Rhyne

Image in public domain: [https://en.wikipedia.org/wiki/CIELUV#/media/File:CIE\\_1976\\_UCS.png](https://en.wikipedia.org/wiki/CIELUV#/media/File:CIE_1976_UCS.png). Annotations by T-M Rhyne



# WHAT IS HCL (HUE CHROMA LUMINANCE) OR LCH ?

- Similar to CIE Luv or LAB except that instead of Cartesian Coordinates, Cylindrical Coordinates are used.

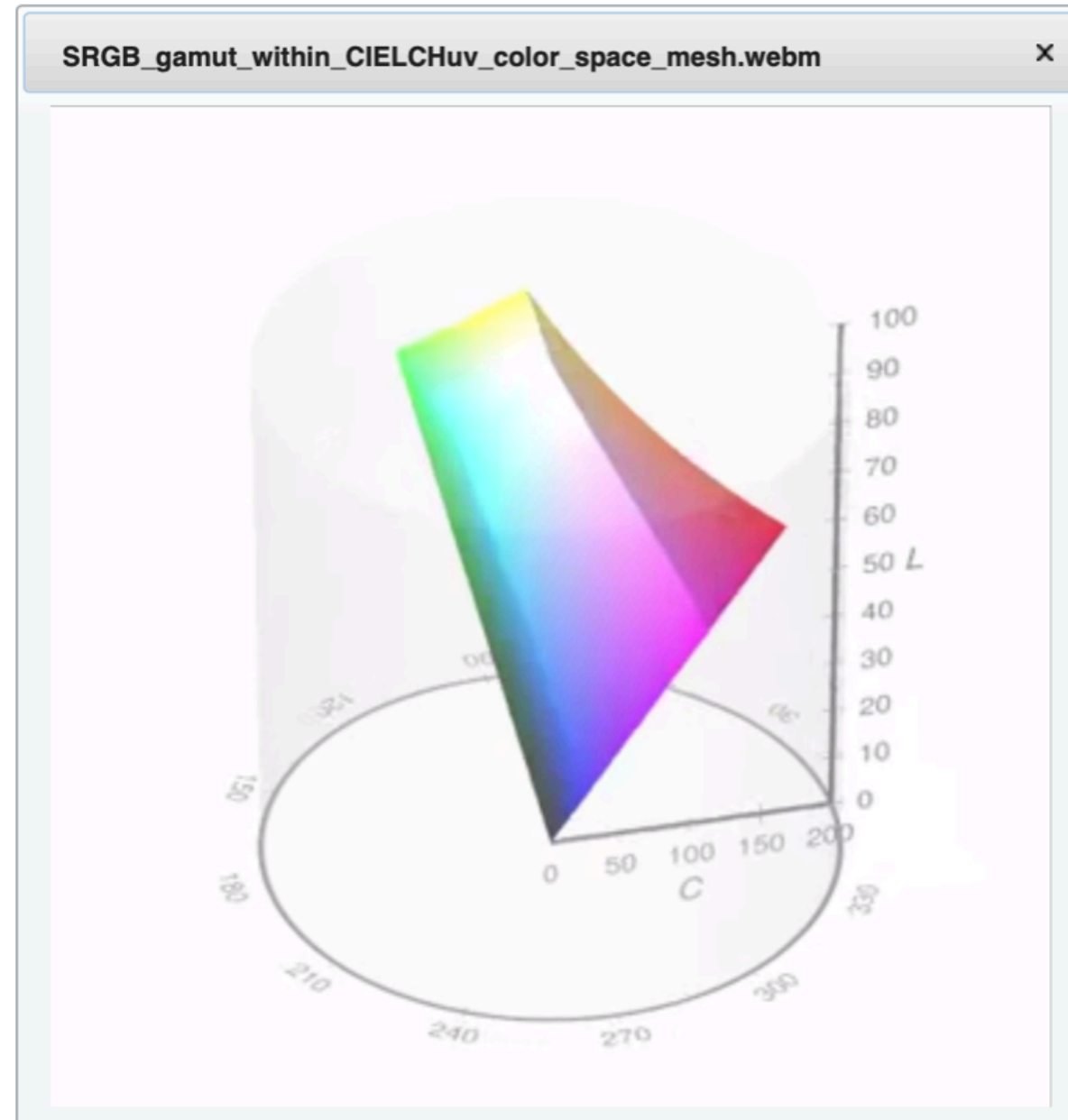
- Sometimes called “Polarized” CIE Luv or CIE Lab. Consider closest to “Perceptually Uniform”.

- HCL Color space packages appearing for D3.js, R and Python.

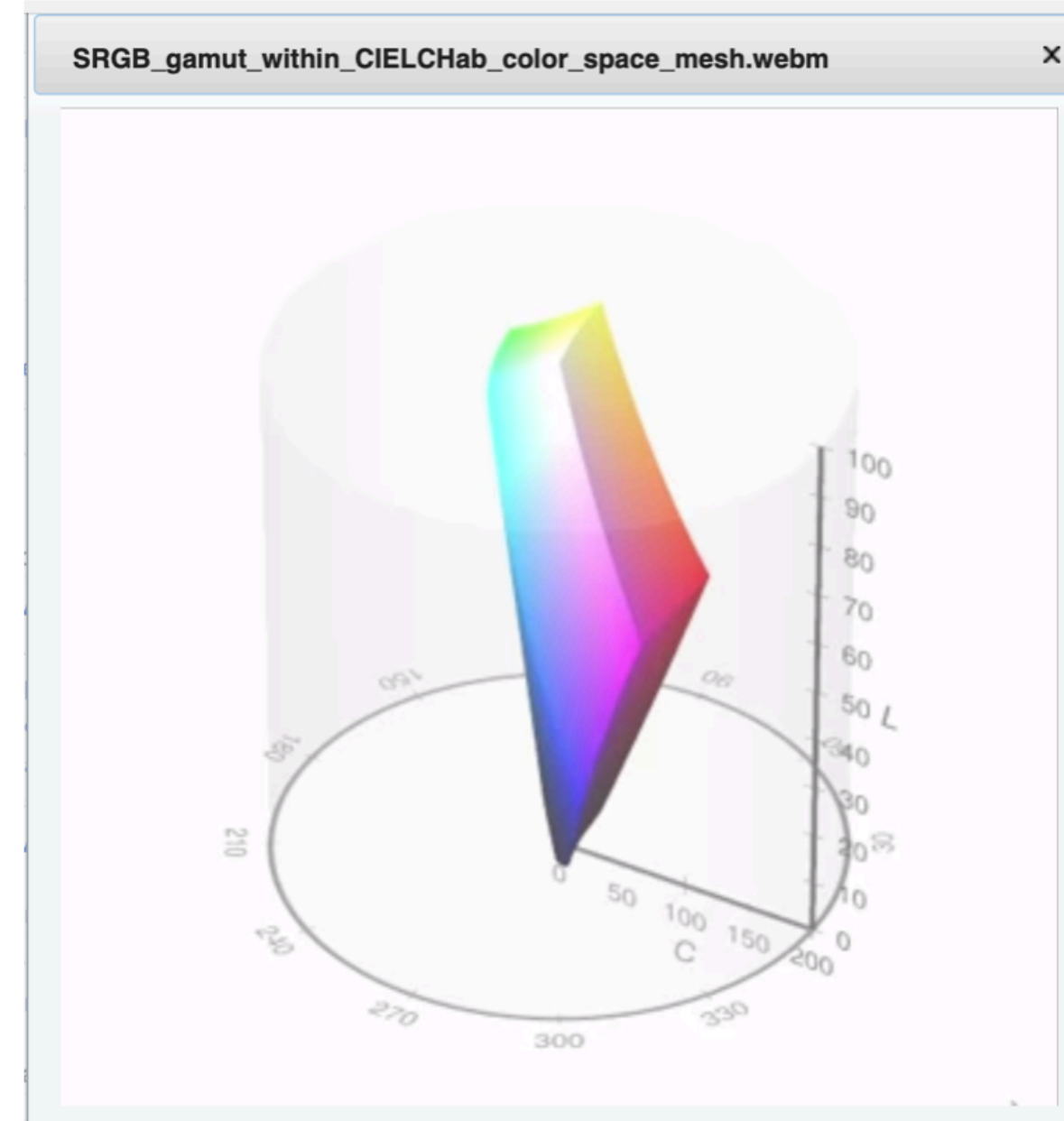
- Some visualization practitioners favor it as a color model of choice.

- Not widely used or known of in the digital design communities. (E.G. Pantone, Adobe Photoshop-Color)

## Two Versions of Hue Chroma Luminance (HCL)



HCL: Polarized version of CIE Luv



HCL: Polarized version of CIE Lab

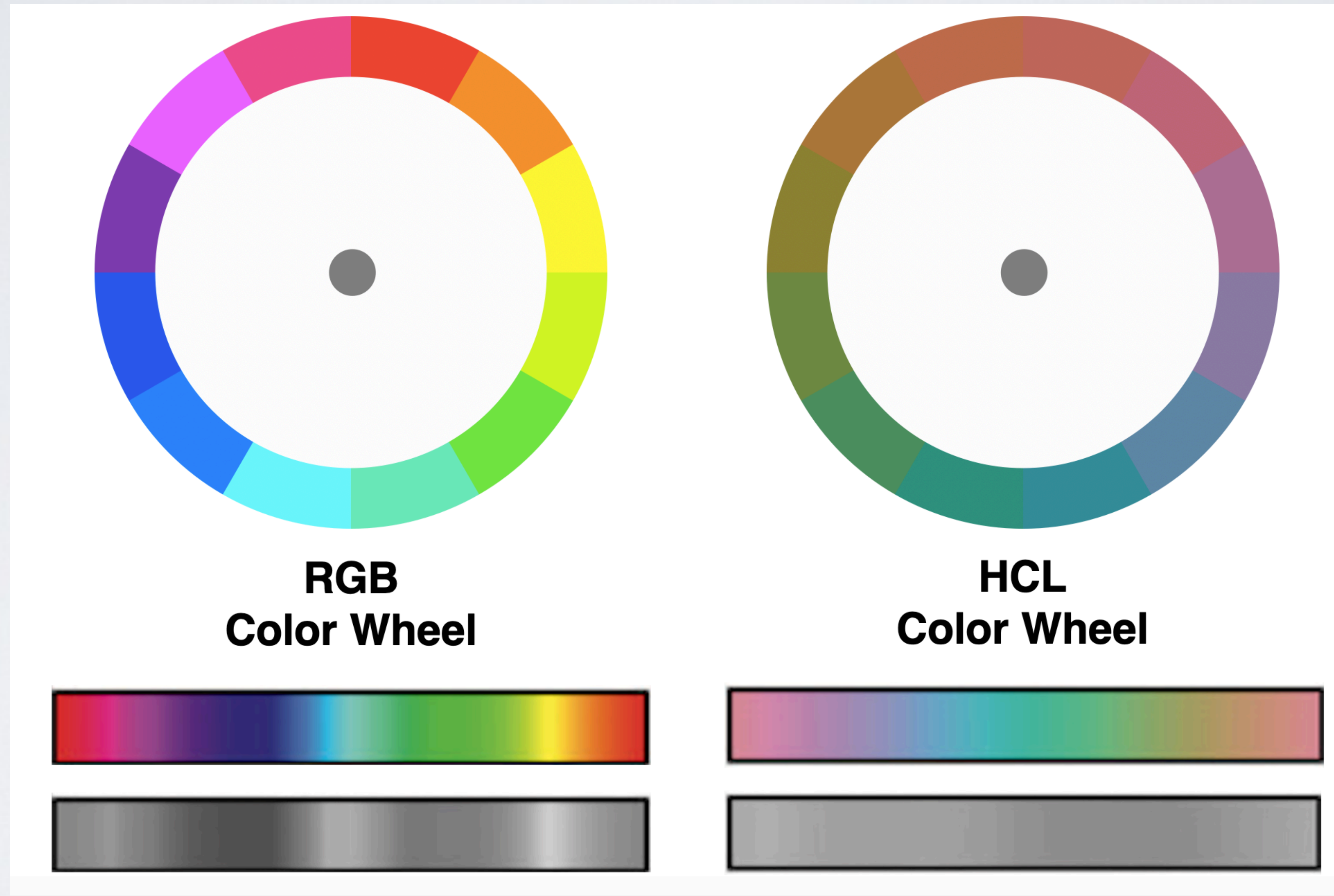
Screen Capture (as of 2020) by Theresa-Marie Rhyne using Michael Horvath's 3D Open Source animations by on Wikipedia:  
[https://en.wikipedia.org/wiki/HCL\\_color\\_space](https://en.wikipedia.org/wiki/HCL_color_space)



theresamarierhyne@gmail.com



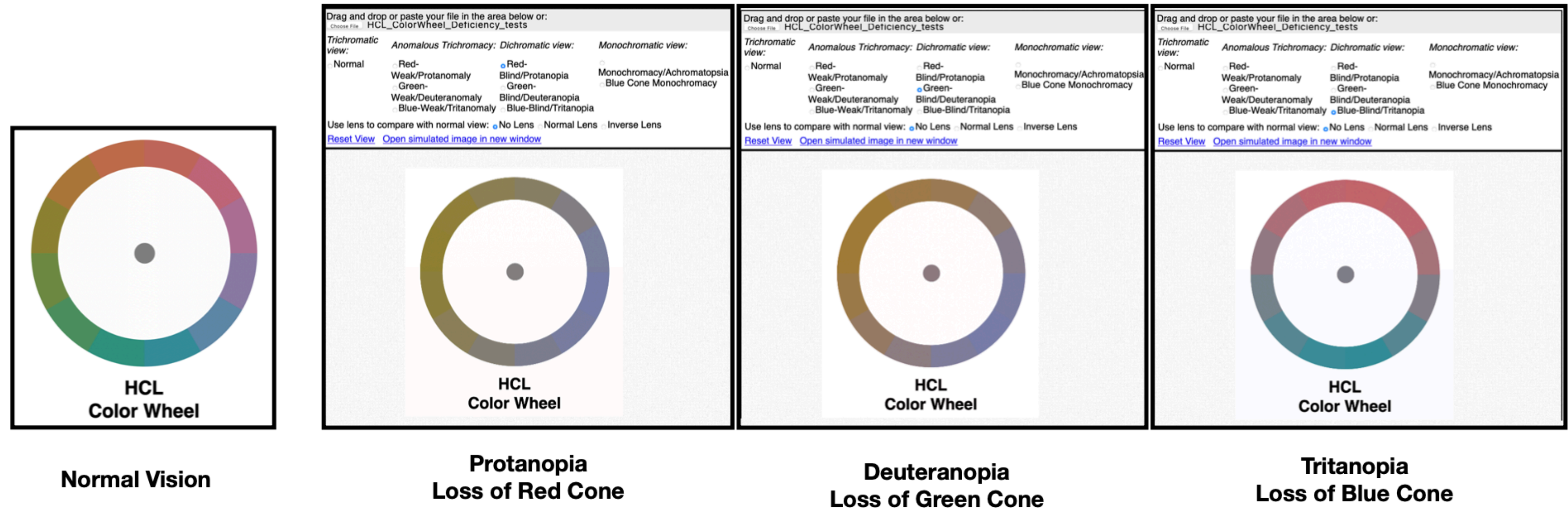
# WHAT IS THE VISUAL DIFFERENCE BETWEEN RGB AND HCL COLOR SPACES ?





# PERCEPTUAL UNIFORMITY DOES NOT ALWAYS PASS COLOR DEFICIENCY:

- Protanope: Red retinal photoreceptors absent.
- Deuteranope: Green photoreceptors absent.
- Tritanope: only medium and long cones present. Confuse Blue with Green and Yellow with Violet.



- Color deficiency tests of the HCL Color Wheel. Used Color Blindness Simulator - Coblis to evaluate results.

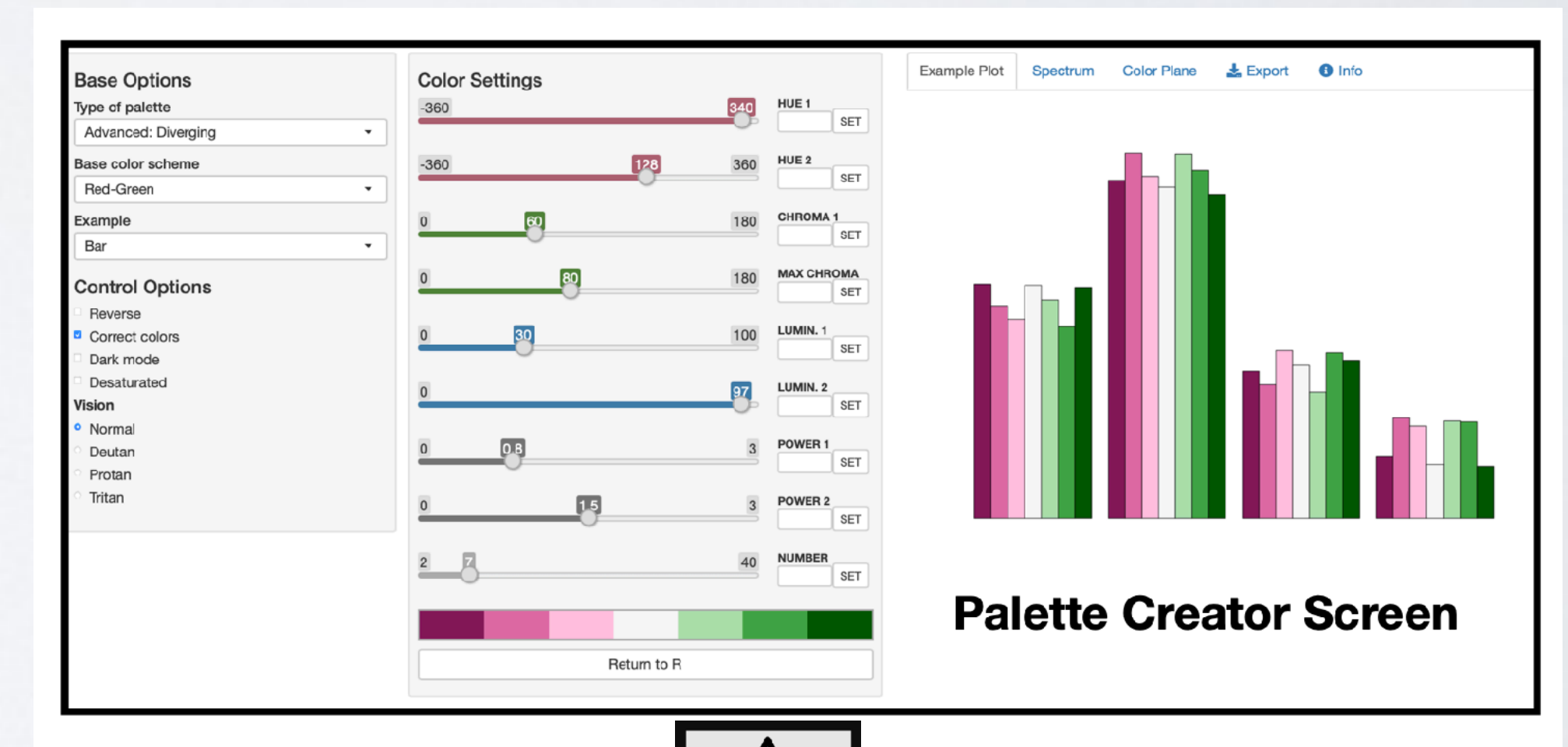
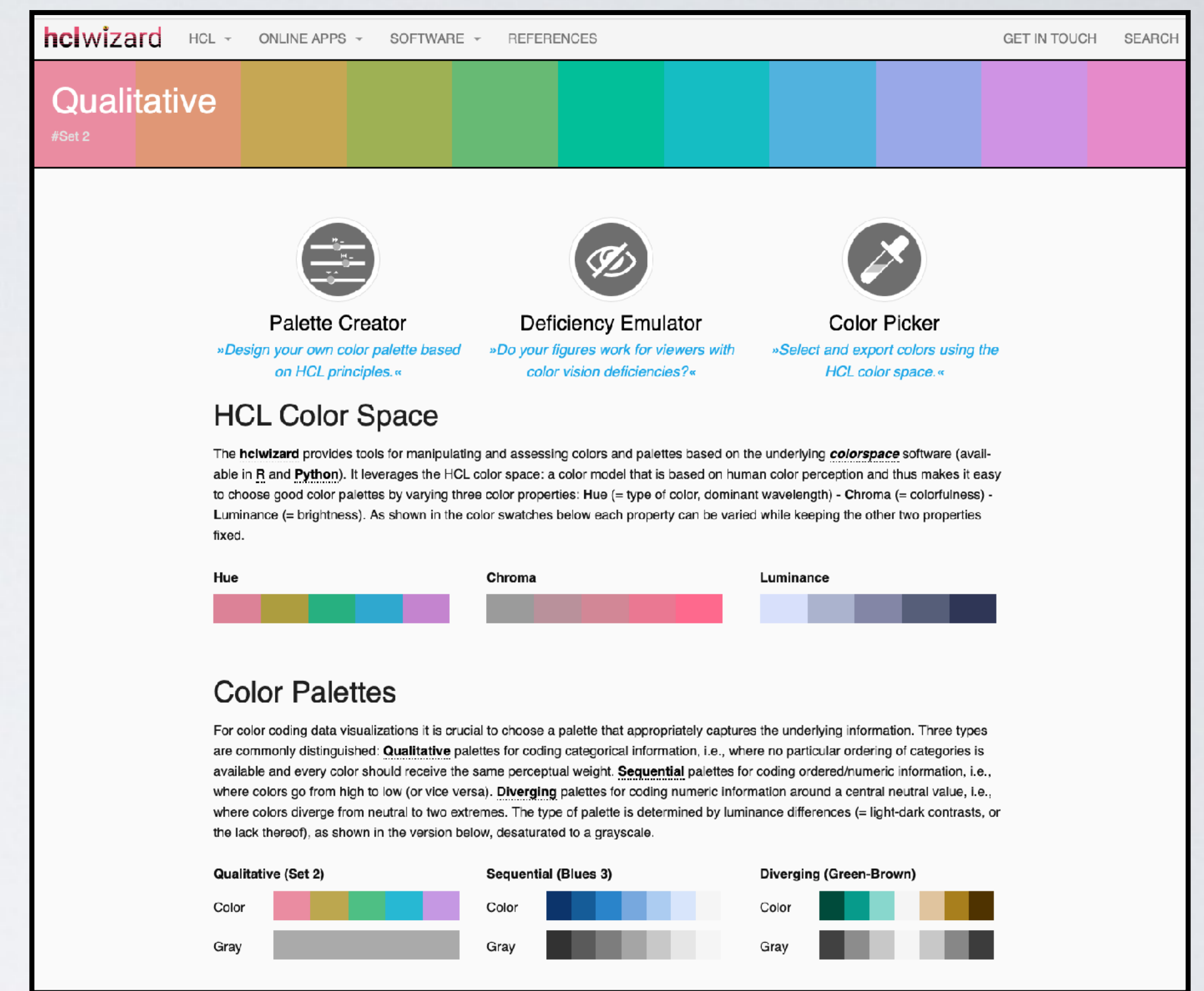
<http://www.color-blindness.com/coblis-color-blindness-simulator/#primary>



# HCLWIZARD:

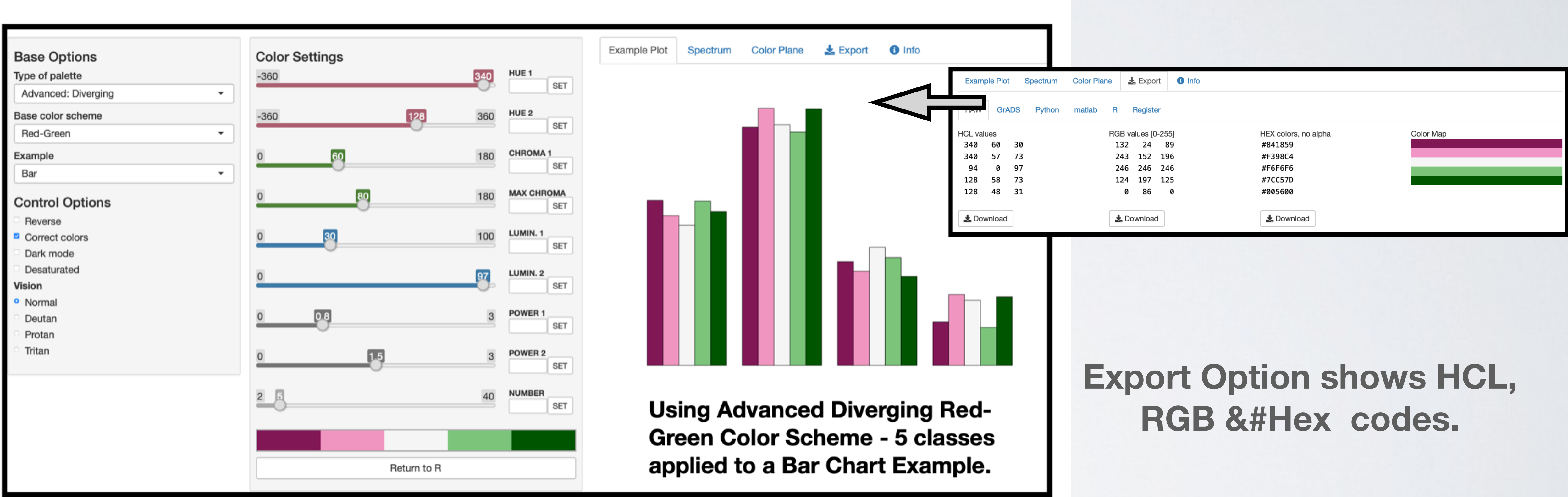
<http://hclwizard.org>

- Free HCL web app for color suggestion. Palette Creator, Deficiency Emulator, Color Picker
- Palette Creator provides Sequential, Diverging & Qualitative options to create color color schemes. Includes Deficiency checker.
- Color Palette Export option Includes HCL, RGB & #Hex, RGB codes.
- Example Visualization Options provided.
- Writings @ <http://hclwizard.org/#hcl-color-space>



# 3A: BUILD COLOR SCHEME FOR MY EXAMPLE: USING HCL WIZARD

<http://hclwizard.org>

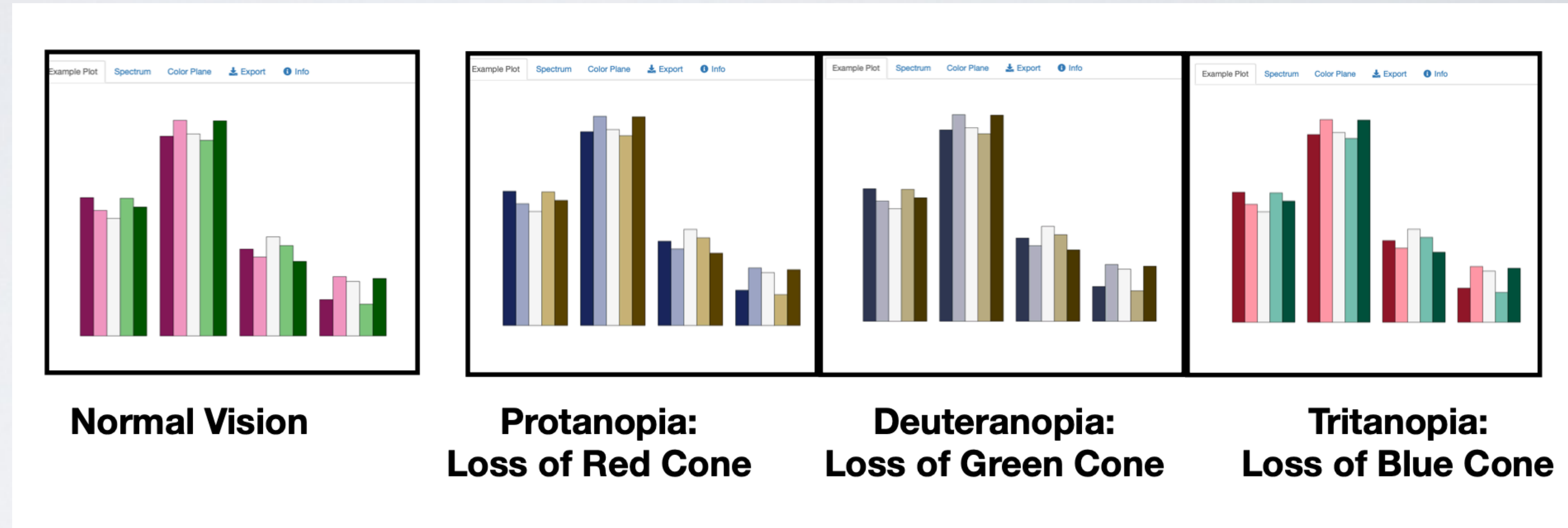




# (4B) CHECK FOR COLOR DEFICIENCY

## 3 Key Types of Color Vision Weaknesses:

- Protanope: Red retinal photoreceptors absent.
- Deuteranope: Green photoreceptors absent.
- Tritanope: only medium and long cones present. Confuse Blue with Green and Yellow with Violet.



Images: Theresa-Marie Rhyne 2021

- Using HCL Wizard Color Deficiency Tests, the Advanced Diverging Red Green - 5 classes - passes color deficiency tests.



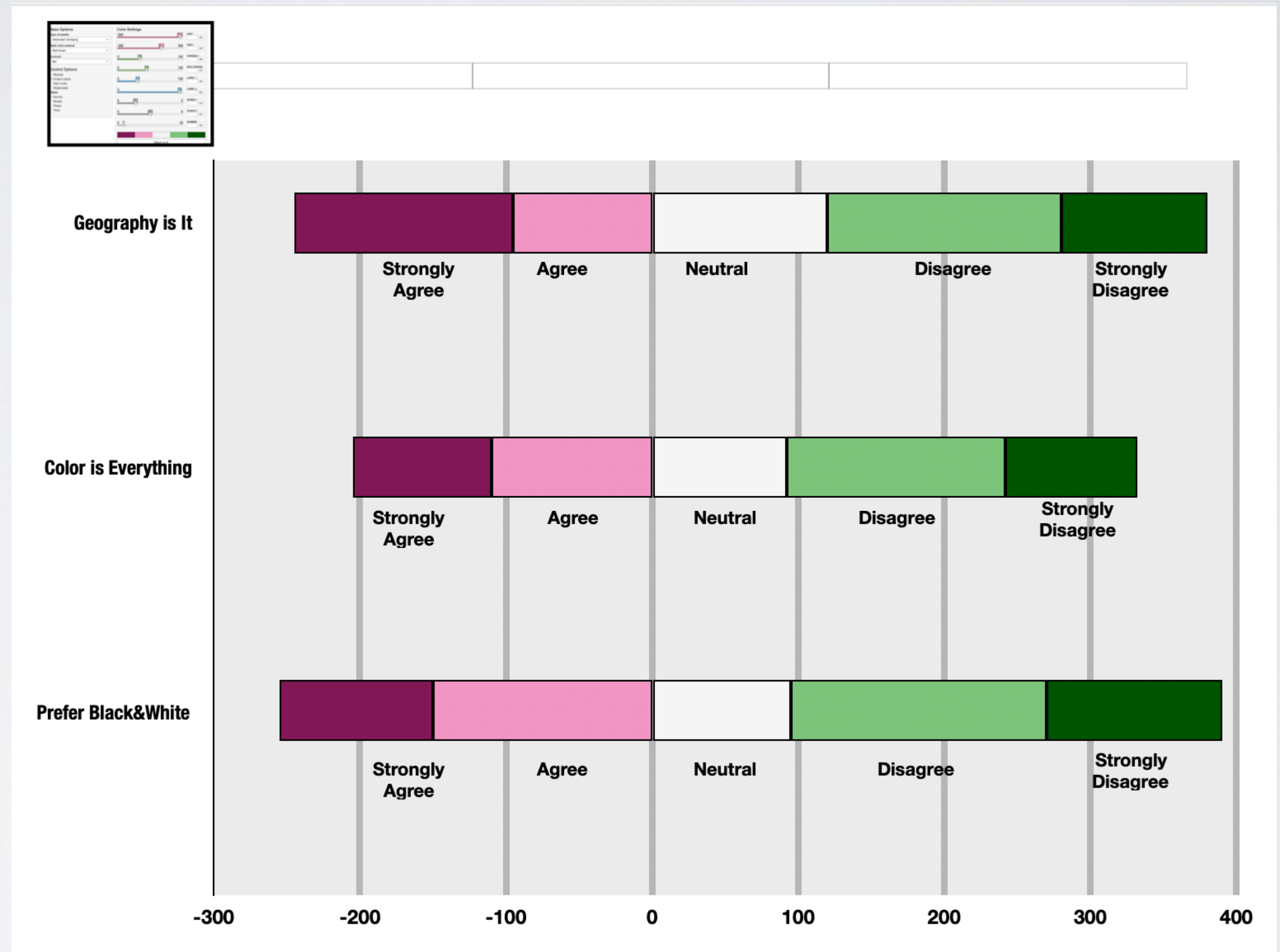
# (5A) APPLY HCL COLOR SCHEME TO MY DATA

The Red Magenta /  
Green Diverging  
Color Scheme

Is added to the 5  
point Likert scale of

Strongly Agree,  
Agree, Neutral,  
Disagree and  
Strongly Disagree.

Notice the initial HCL Wizard Red  
Green Diverging Color Map.





# IN THIS TALK, I DISCUSSED 5 COLORIZING STEPS:

- Know your data.
- Select Color Space & Rule.
- Build Color Scheme.
- Check for Color Deficiency & Pre Existing conditions
- Apply Color Scheme to Data & Modify per Review.

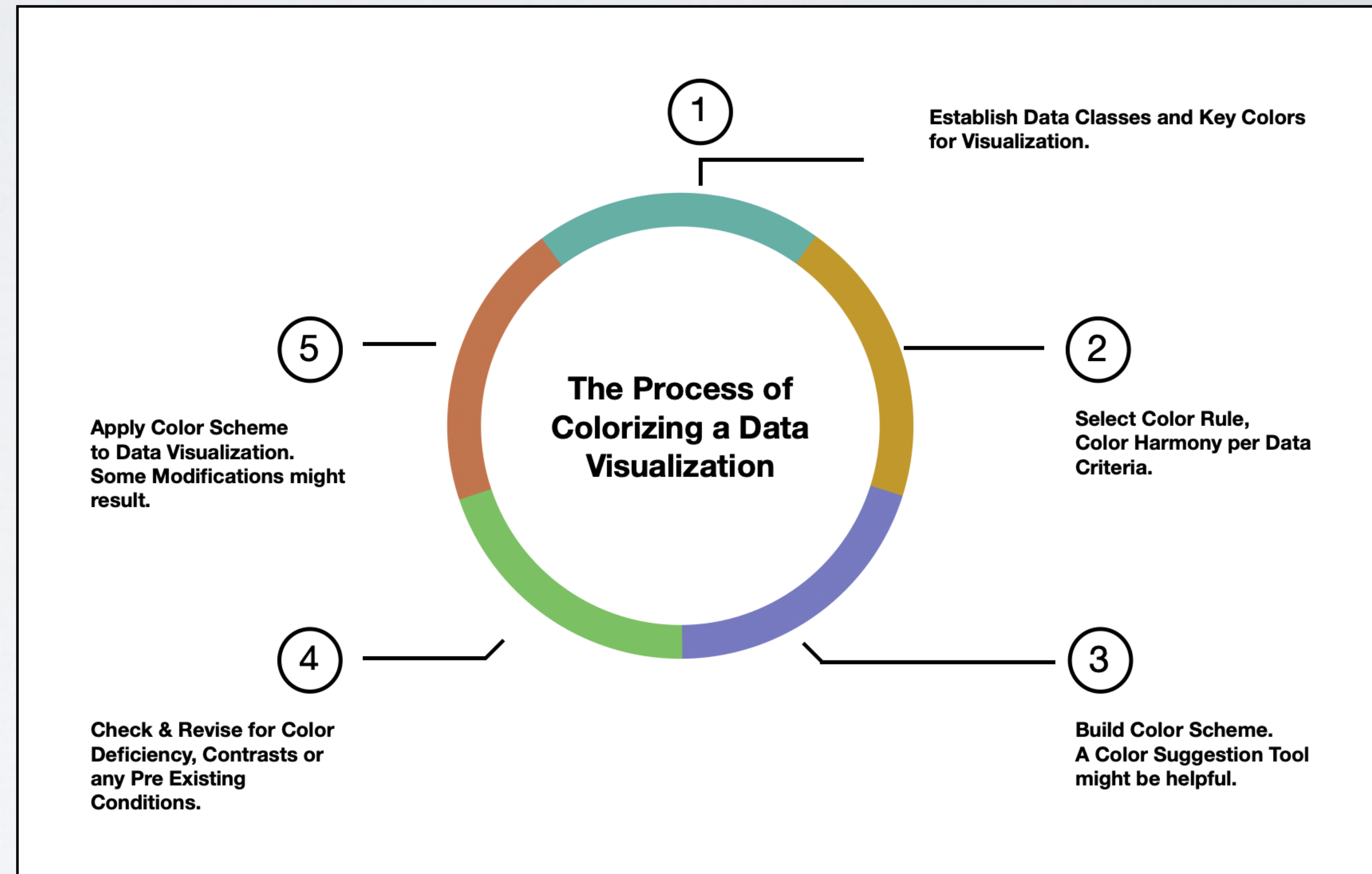


Image: Theresa-Marie Rhyne 2021



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# AND COLORIZED AN EXAMPLE - 3 WAYS:

- Complementary Color Harmony - Magenta Green - Adobe Color.
- Diverging Color Scheme - Pink Yellow Green - ColorBrewer.
- Advance Diverging Color Scheme - Red Green - HCL Wizard.

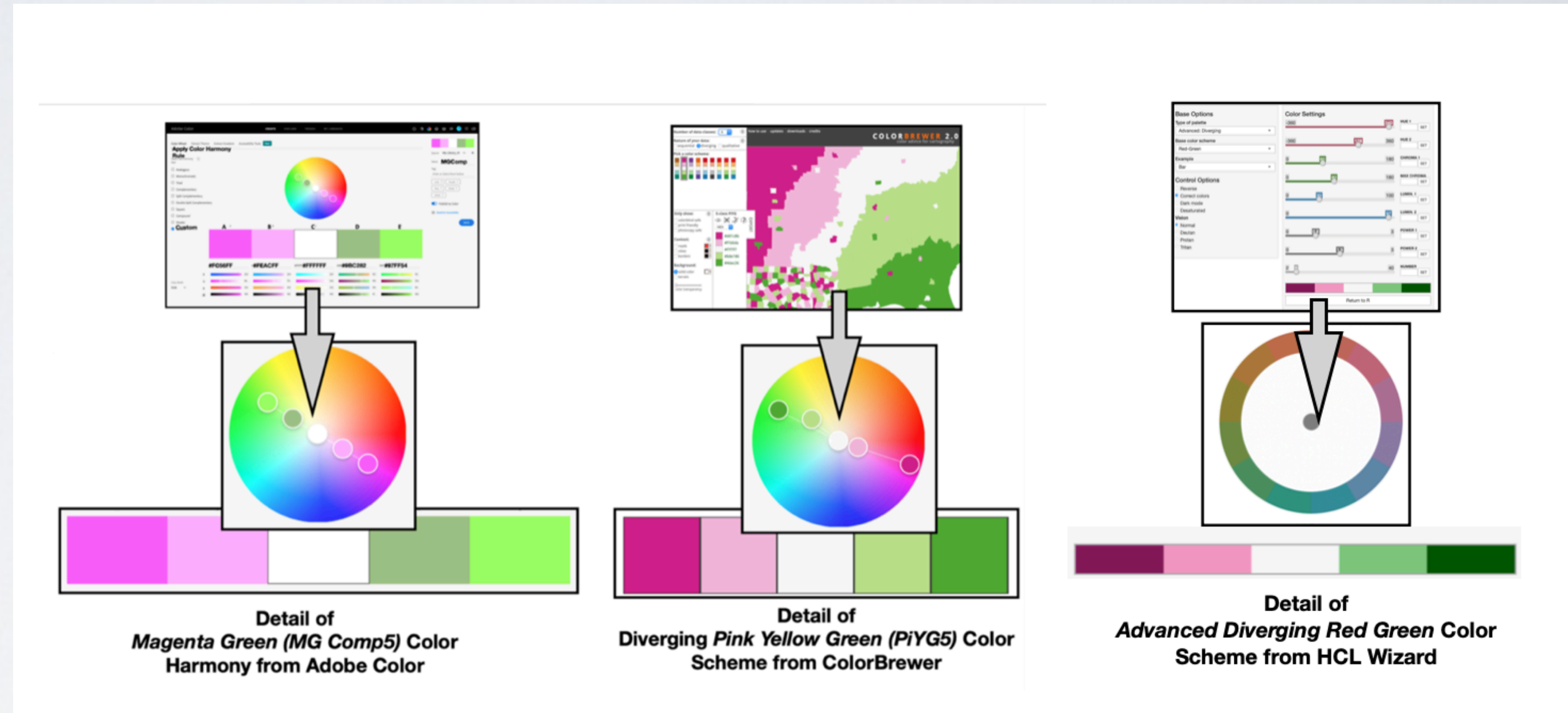


Image: Theresa-Marie Rhyne 2021



[theresamarierhyne@gmail.com](mailto:theresamarierhyne@gmail.com)

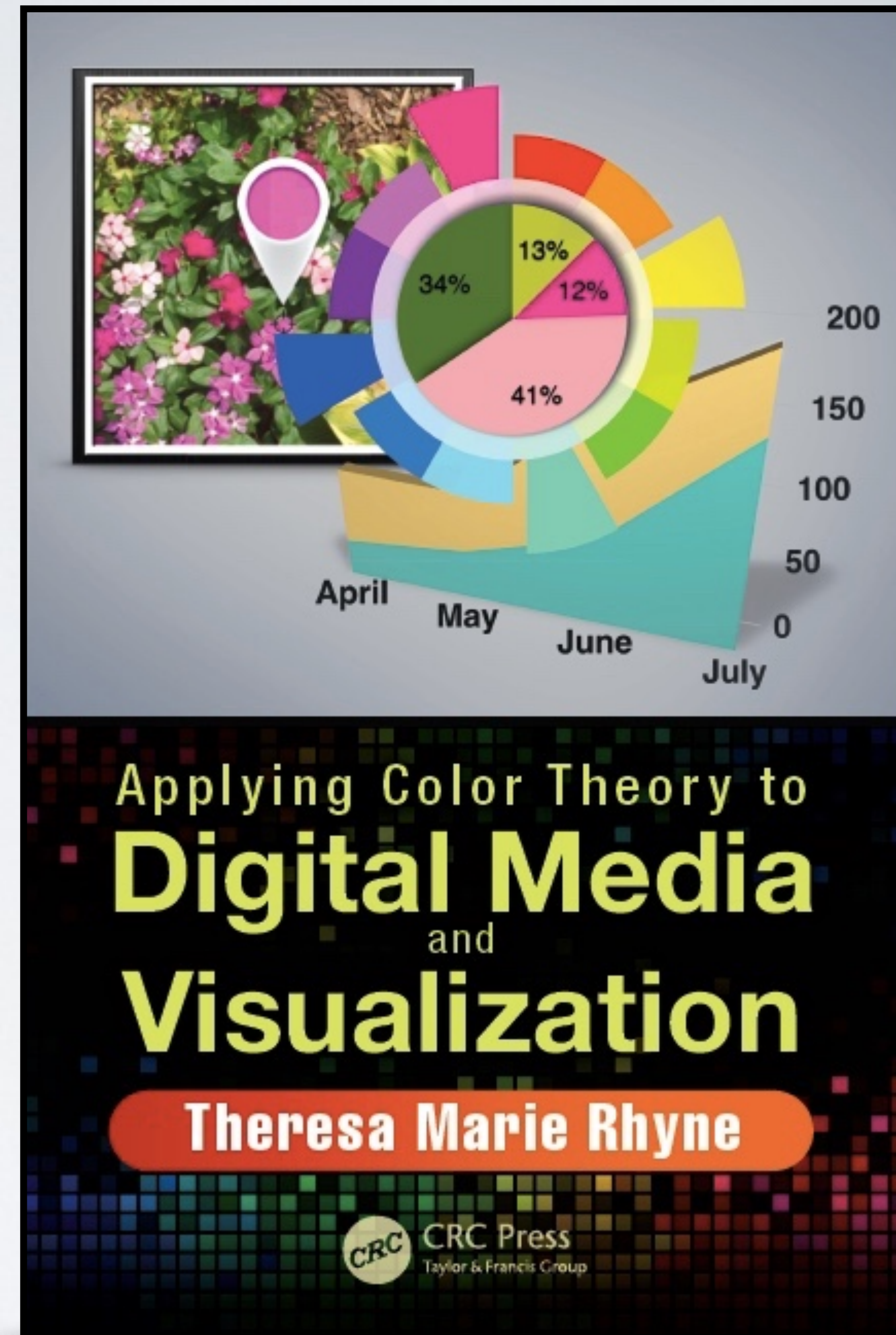


# THERE ARE MANY MORE COLOR MYSTERIES & I WROTE A BOOK ABOUT SOME OF THEM:

“Applying Color Theory to Digital Media and Visualization” by Theresa-Marie Rhyne, from CRC Press, published in November 2016.

Various Color Apps are covered for building color schemes such as Adobe Color, Pantone Studio, ColorBrewer, & Color Scheme Designer.

<https://www.crcpress.com/Applying-Color-Theory-to-Digital-Media-and-Visualization/Rhyne/p/book/9781498765497>





# ACKNOWLEDGEMENTS:



- I also actively write on Color for Nightingale, the journal of the Data Visualization Society: <https://medium.com/@theresamarierhyne>.
- Thanks to Georges Hattab and Mary Aviles for thoughtful edits of my Nightingale writings .
- As well as colleagues and family members who have encouraged me to continue exploring color over many years.

With much gratitude and appreciation.

Theresa-Marie Rhyne