



Color Theory

Mr. Brautigam • July 2019

+ Summary



- What is color?
- Prism
- Color Wheel
- Primary colors
- Complementary colors
- Warm vs. cold colors
- Tints, Shades, and Tones
- Color Harmony

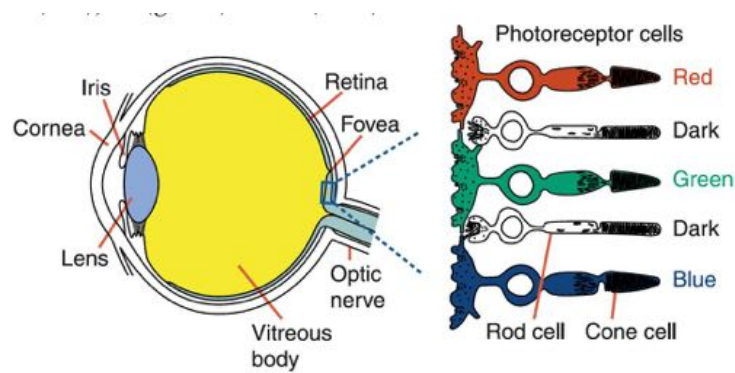
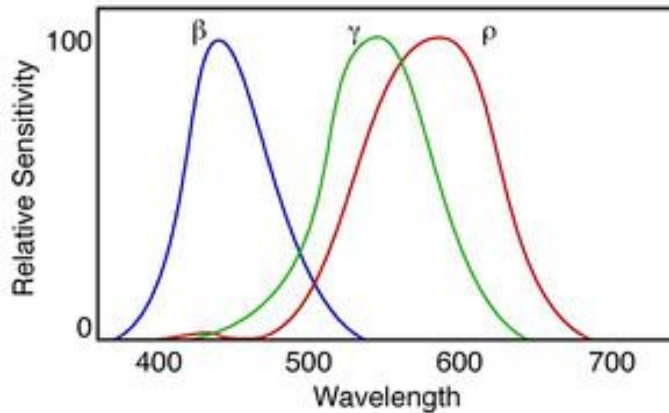
+ What is color?



- Color is caused by very high frequency (short wavelength) *vibrations*.
- Other examples of vibrations: earthquakes, sounds, radio waves, microwaves, x-rays.
- Different pigments absorb and reflect different wavelengths of vibrations.
 - Long wavelength: Red 564–580 nm (nanometers, one billionth of a meter)
 - Medium wavelength: Green 534–545 nm
 - Short wavelength: Blue 420–440 nm
- If an object absorbs blue light, it will reflect yellow light, and vice versa.
- If an object absorbs red light, it will reflect green light and vice versa.
- A black object absorbs all wavelengths and reflects none.
- A white object reflects all wavelengths.

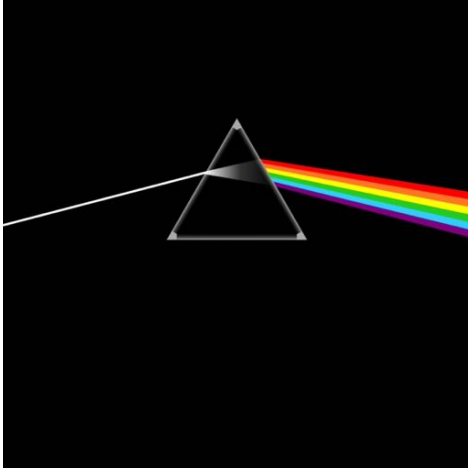
+ The Eye

- Cone cells in the eye detect the amount of red, green, and blue light entering the eye. The red, green, and blue cells detect different wavelengths of light.



+ Isaac Newton's Prism Experiment

- In 1666, Isaac Newton demonstrated that a prism separates white light into many colors.



Pink Floyd album cover from 1973, *Dark Side of the Moon*

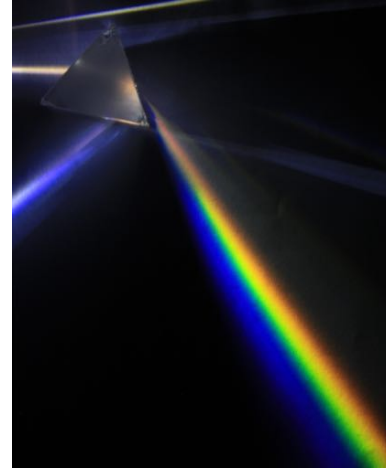
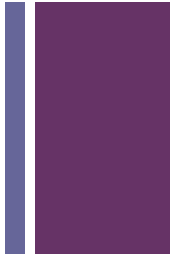
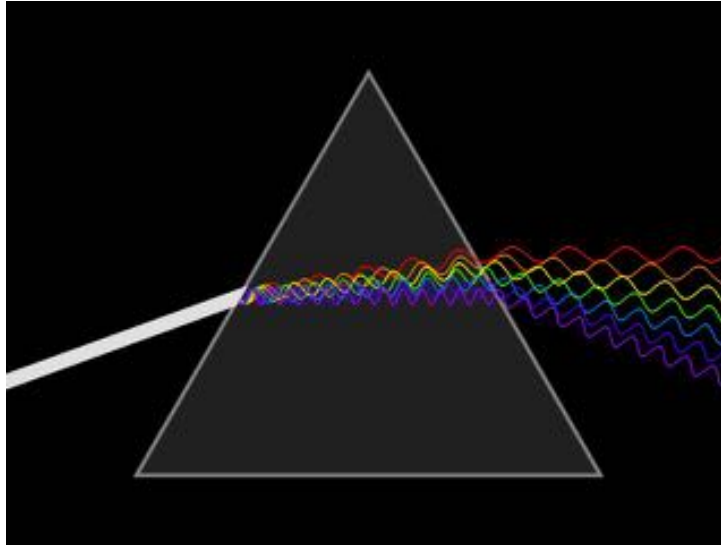


Photo of actual prism



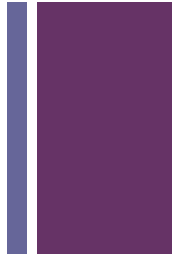
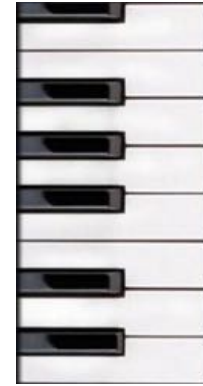
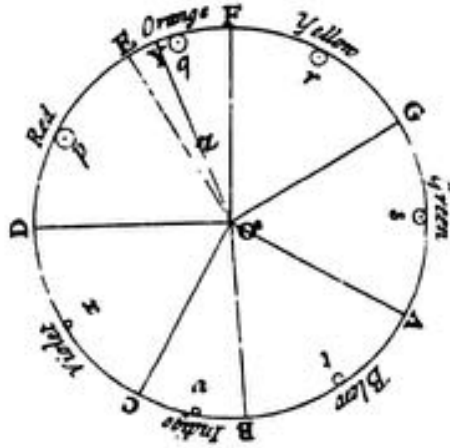
+ Refraction

- Different wavelengths of light bend at different angles.
- Longer wavelengths bend less.
- Shorter wavelengths bend more.



+ Newton's Color Wheel

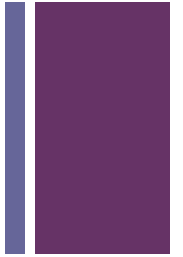
- Red
- Orange
- Yellow
- Green
- Blue
- Indigo
- Violet



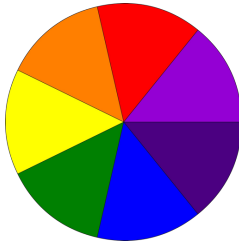
Notes:

- Newton did not know color names, so he asked a friend to identify the colors created by the prism.
- Newton wanted seven colors because there are seven notes in the musical scale, seven days in the week, etc.

+ Newton Disc



- A spinning disc with all colors will appear to reflect white light if you spin it fast enough. This demonstrates that we can re-create white light by combining all colors.
- (It also demonstrates *persistence of vision*, the idea that human vision cannot distinguish details of high speed movements.)



+ Primary Colors

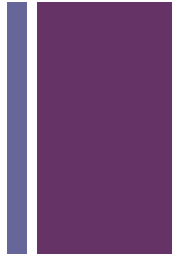
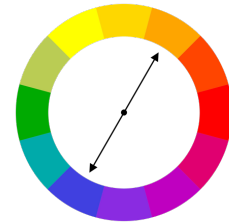
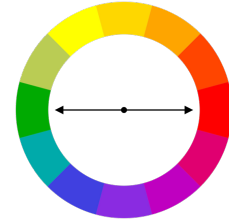


- Which colors are primary colors?
 - For painting, the primary colors are red, yellow, and blue.
- Why do we call them primary colors?
 - If you have only the primary colors, you can create all the other colors.

- Orange = Red + Yellow  =  + 
- Green = Yellow + Blue  =  + 
- Violet = Blue + Red  =  + 

+ Complementary Colors

- Complementary color paints have high contrast (stand out against each other), and when mixed, they form a dark gray or brown.
- Colored light and its shadows have complementary colors.
- Afterimages contain complementary colors.
- Famous painters like Monet, Renoir, Cezanne, and especially van Gogh used complementary colors purposefully.
 - Red and green
 - Yellow and violet
 - Blue and orange (especially)



+ Warm Colors



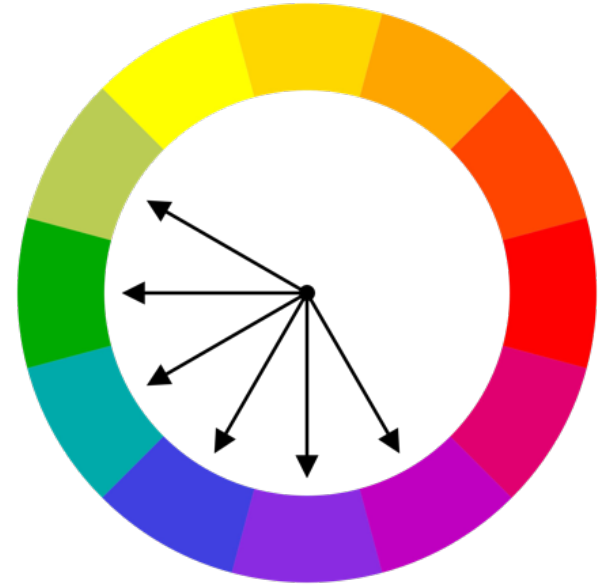
- Red, Orange, Yellow
- Warm colors are energizing. They show enthusiasm and passion.
- Warm colors have a physiological effect where they will accelerate one's heart rate and breathing.
- Warm colors come forward from a cool background. So they can be used to create a focal point.



+ Cool Colors



- Green, Blue, Violet
- Cool colors are relaxing. They show calm and professionalism.
- Cool colors have a physiological effect where they will slow one's heart rate and breathing.
- Cool colors recede into a warm background. So they can be used to give accent colors to a design without drawing the eye unnecessarily.



+ Color Harmony

- Monochromatic
- Analogous
- Complementary
- Split Complementary



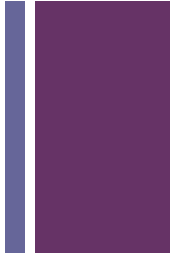
+ Monochromatic



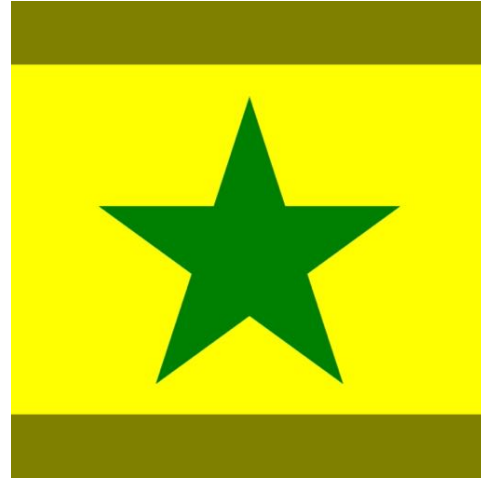
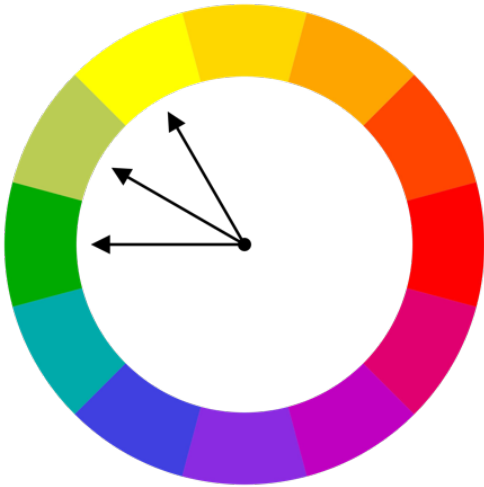
- Different shades (dark) and tints (light) of one basic color.



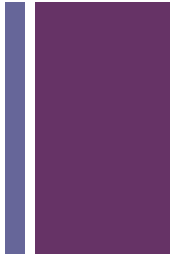
+ Analogous



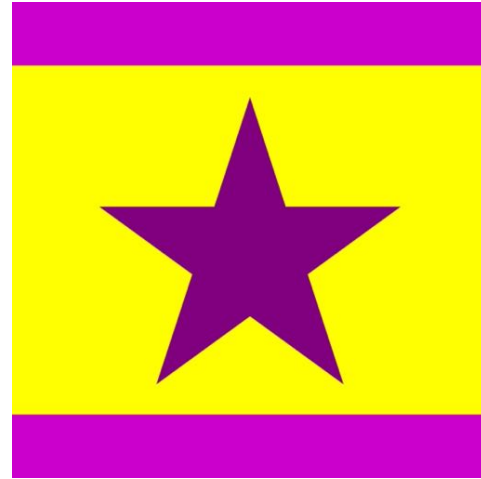
- Using colors that are next to each other on the color wheel.



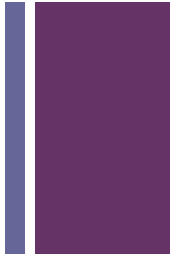
+ Complementary



- Using colors that are across from each other on the color wheel.



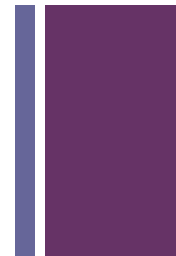
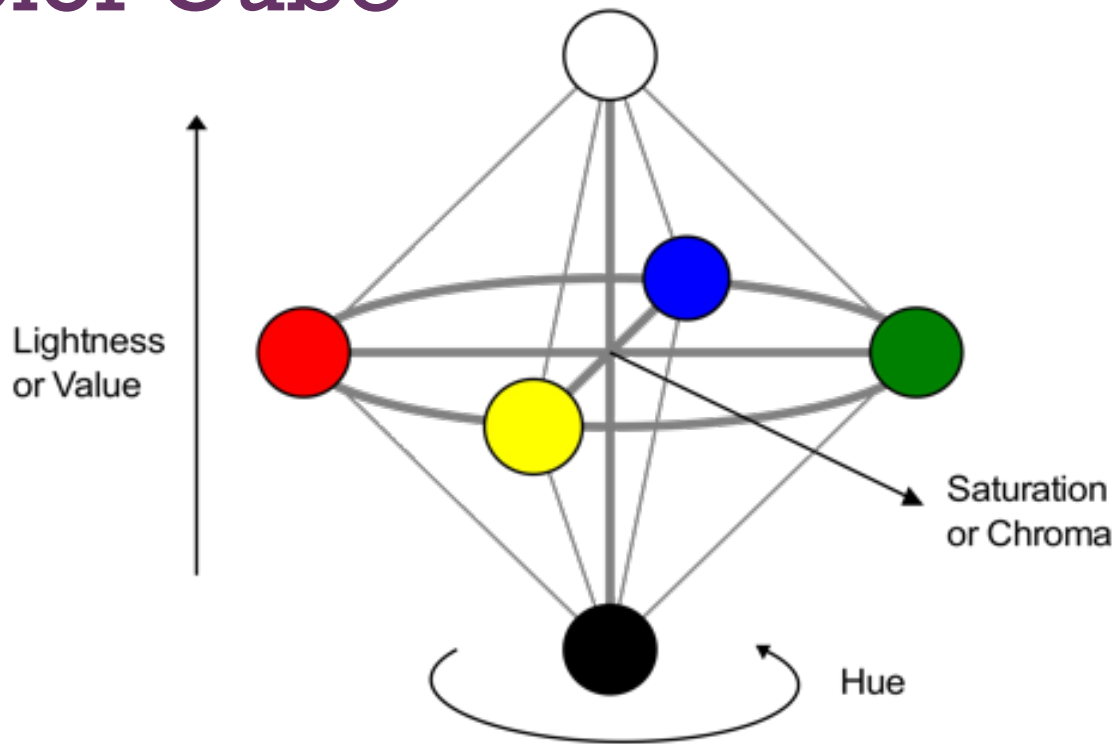
+ Split Complementary



- One color and the colors adjacent to the complementary color.



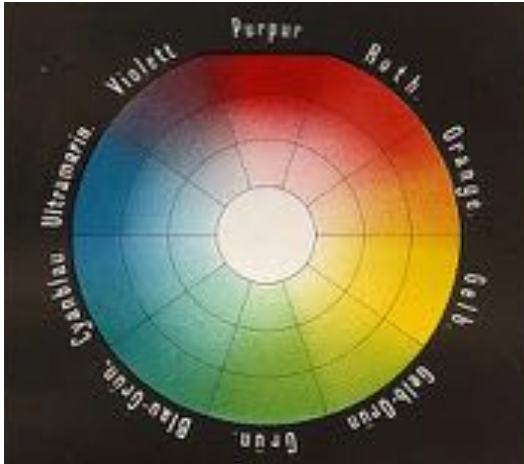
+ 3D Color Cube



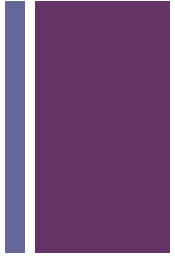
+ Tints and Shades















- Wilhelm von Bezold's 1874 *Farbentafel*



+ Tints, Shades, and Tones



Hue	Tint (Hue + White)	Shade (Hue + Black)	Tone (Hue+White+Black)
			
			
			
			
			
			

+ Avoid Blue on Red

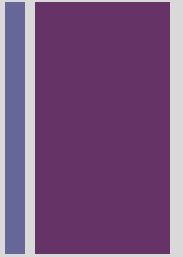
- Blue has a short wavelength and red has a long wavelength. This causes a depth of field, which makes it hard for your eyes to focus on them when they are next to each other.
- If you look closely, you may see the edges of the letters vibrating.

Don't do this!

Don't do this!



+ Monochrome



Andy Warhol

+ Analogous



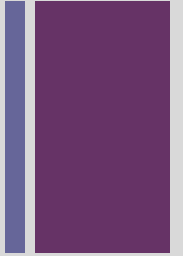
Georges Braque



+ Complementary



Vincent van Gogh



+ Complementary and Analogous

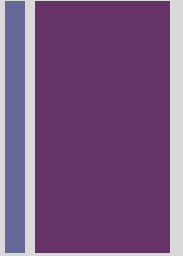


Paul Cezanne

The Basket of Apples



Complementary and Analogous



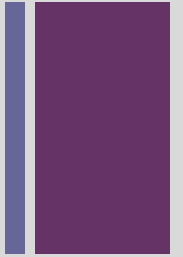
Willem Sandberg

From MOMA (Museum of Modern Art)

+ Double Complementary



Paul Signac - The Papal Palace

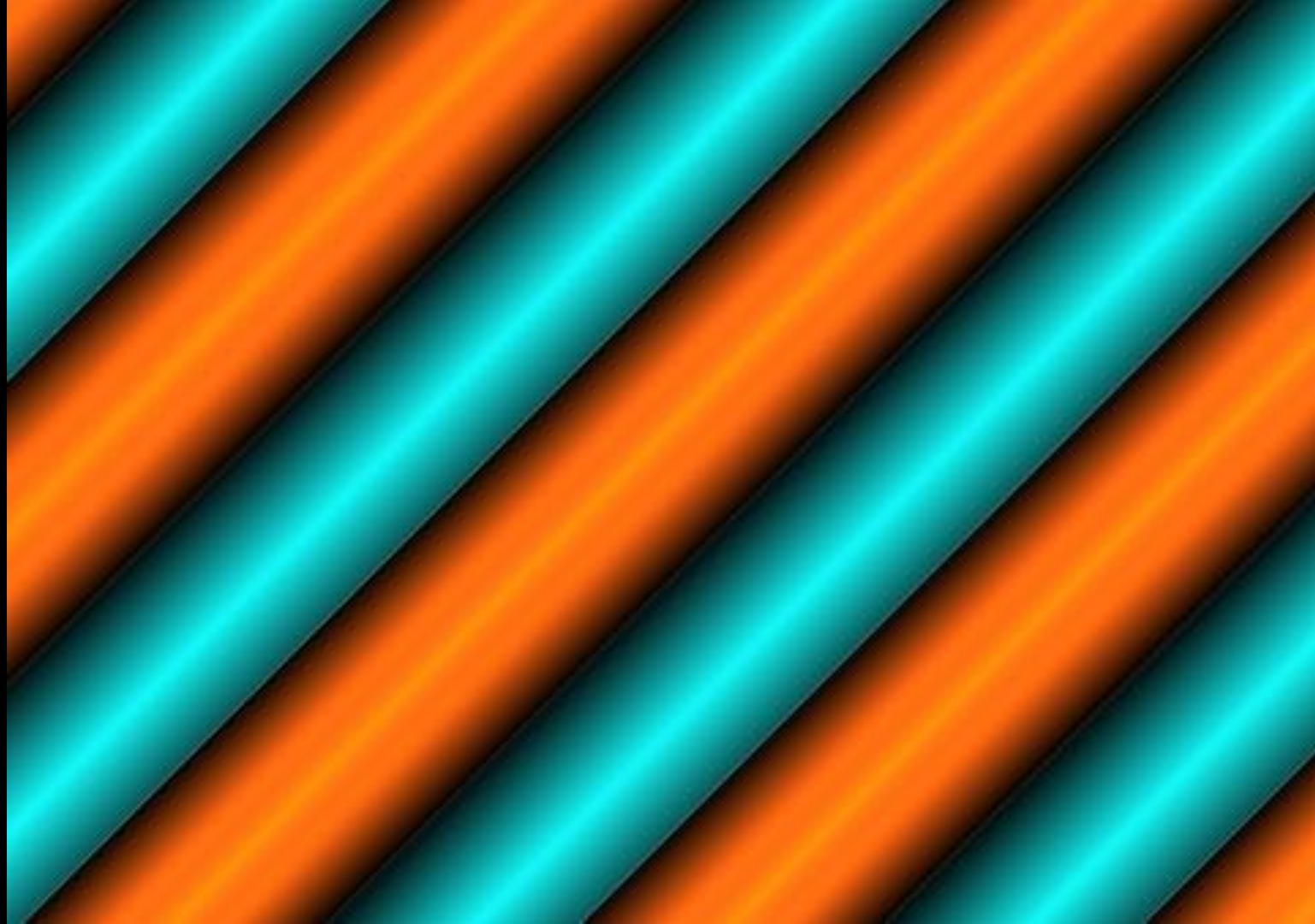












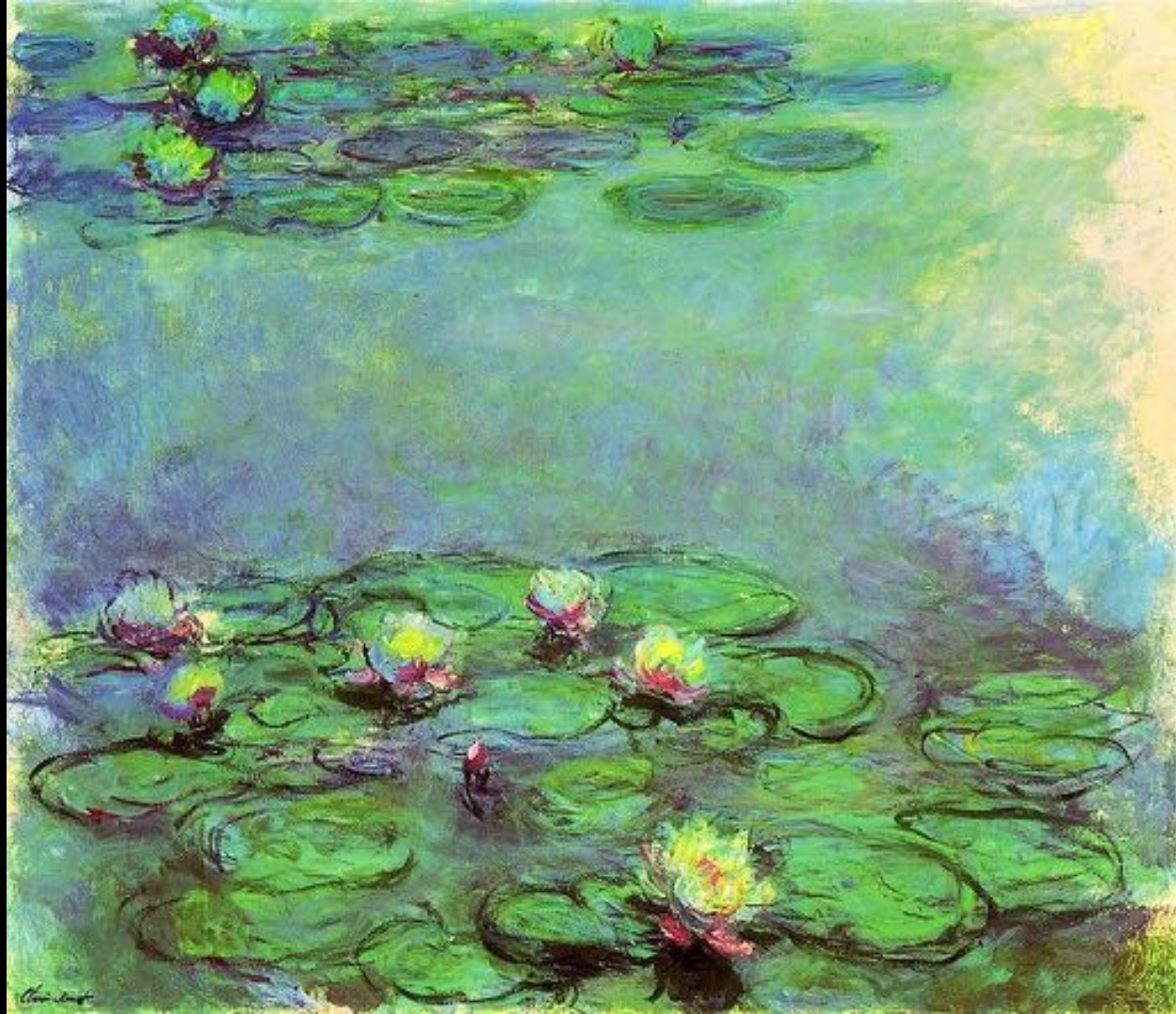






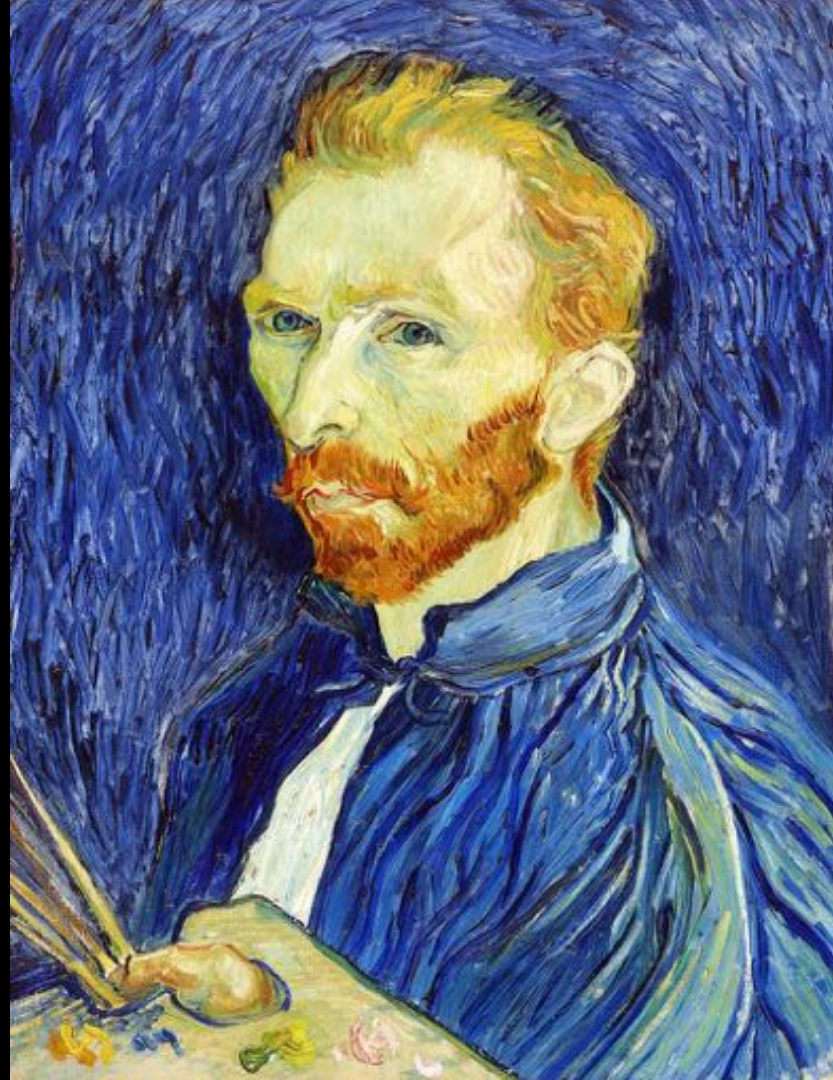
















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