

Einführung in die Farbwissenschaft

History of Color Science

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- **antiquity**
 - ◆ color as part of natural philosophy
 - ◆ linear color models
- **middle ages**
 - ◆ variations of linear color ordering systems
- **Renaissance and beyond**
 - ◆ development of two- and three-dimensional color models in lockstep with the development of natural science

Antiquity: Linear Model of Aristoteles

- colors are assumed to be a mixture of white and black
- colors are sorted according to their perceived brightness
- partly motivated by philosophical beliefs
- partly derived from observations of the sky
 - ◆ typical for Greek natural philosophy
 - ◆ mixture of white and black yields red
- places black and white on a level equal to the color hues
- wrong prediction of how colors mix

Late Medieval and Renaissance

- iterative improvements of the linear model
- **Grosseteste** (1230): first separation of chroma from hue
- **Alberti** (1435): 3D color space
- **Leonardo** (1510): work on color - questions:
 - ◆ whether green is a primary
 - ◆ whether white is a „proper color“
- **d'Aguilon** (1613):
 - ◆ color mixing theory

Isaac Newton (1672)

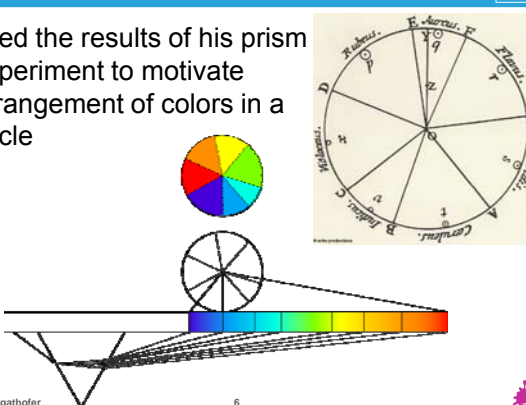
- **Newton** – first to draw the correct conclusions from the fact that white light can be broken up into the colors of the rainbow by a prism

Newton: Proof of Assertion

- the second part of Newton's proof was to recombine a split beam to white light
- he correctly classified light as being a „heterogeneous mixture of different colors“

Newton: First Color Circle

- used the results of his prism experiment to motivate arrangement of colors in a circle

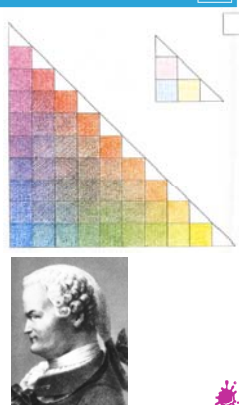


The image shows Newton's first color circle, a circular arrangement of colors labeled with letters A through Z. Below it is a diagram of his prism experiment, showing a beam of white light passing through a prism and being dispersed into a spectrum of colors. A second inverted prism recombines the colors back into white light.

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Johann Heinrich Lambert - 1760

- attempted to describe all colors as a mixture of red, blue and yellow
- effectively a precursor of the subtractive CMY models
- failed because not all real colors can be generated through subtractive mixture

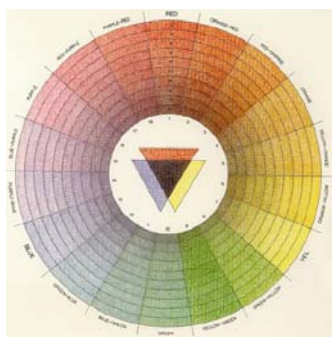


The image features Lambert's color triangle, a triangular grid of color patches representing mixtures of red, blue, and yellow. A small inset shows a simplified version of the triangle. To the right is a black and white portrait of Johann Heinrich Lambert.

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Color Wheels: Moses Harris (1776)

- 100 years after Newton, Harris and others made the wheel arrangement of color systems popular
- restricted to two dimensions

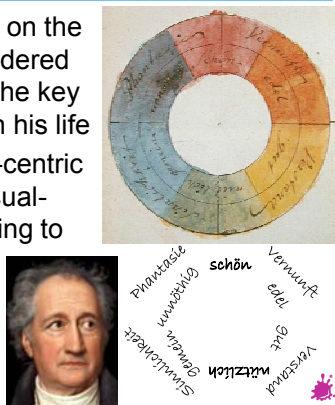


The image shows Moses Harris's color wheel, a circular diagram with multiple concentric rings of color patches. A central triangle is inscribed within the wheel.

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Johann Wolfgang Goethe (1810)

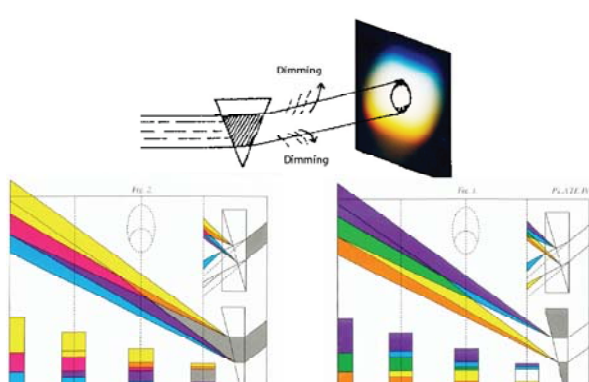
- wrote ~2000 pages on the topic of color; considered these to be one of the key accomplishments in his life
- proposed observer-centric approach with sensual-moral effects seeming to contradict Newton
- wanted to bring order to the aesthetic aspects of color



The image shows Goethe's color wheel, a circular diagram with handwritten text around it. To the right is a black and white portrait of Johann Wolfgang Goethe.

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Goethe: Edge Colors, „Dark Light“

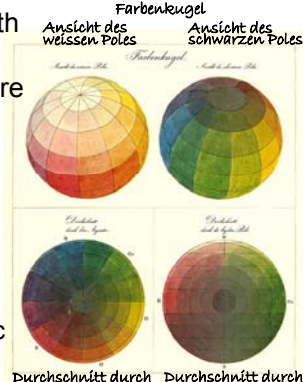


The image shows Goethe's experiment on edge colors. It includes a diagram of a prism with a slit, showing light passing through and being dispersed. Below the diagram are two color spectra, labeled Fig. 2 and Fig. 4, showing the colors of the spectrum. The text 'Dimming' is written above the spectra.

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Otto Runge: Color Sphere (1810)

- a painter → worked with a subtractive model
- red, blue and yellow are the only primaries
- the spherical arrangement was intended to:
 - provide a practical guide for mixtures
 - serve as an ideal geometric model



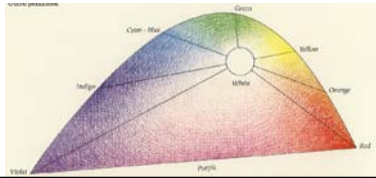
The image shows Otto Runge's color sphere, a spherical diagram with four views: 'Ansicht des weissen Poles' (top), 'Ansicht des schwarzen Poles' (bottom), 'Durchschnitt durch den Äquator' (left), and 'Durchschnitt durch die bejden Pole' (right). The text 'Farbenkugel' is written above the sphere.

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Helmholtz: 1st Curve of Spectral Colors



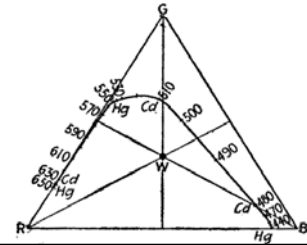
- Helmholtz 1857: *"The eye cannot separate combined colors from each other; it sees them as an unresolvable, simple sensation of one mixed color. It is therefore of no consequence to the eye whether basic colors of either simple or complicated conditions of oscillation are combined in a mixed color. There is no harmony in the same sense as with the ear; there is no music."*



Maxwell: Color Triangle



- „Theory of Colour Vision“ (1859) is acknowledged as the **origin of colorimetry**
- first two-dimensional color system based on psychophysical measurements



Munsell (1905): Irregular Color Tree



- color tree based on circle with 10 segments
- **Munsell Color Atlas** (1915, 1929)
- still in use today

