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Trends in the development of the colorimetric systems until 1830

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Abstract: *The article discuses the main trends of various types and forms of colorimetric systems until 1830 used in creating and building digital images.*

Keywords: *colorimetric systems, color models, colors.*

I. Development of the colorimetric systems until 1830

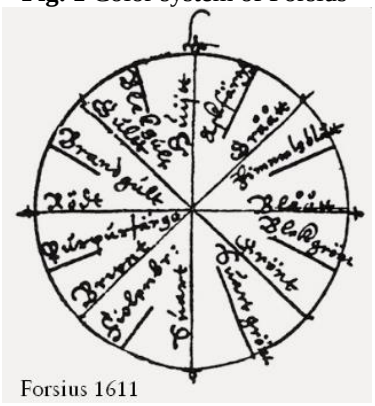
Since time immemorial, man has constantly been studying color and its meaning the way colors have been perceived. The colors have always captured people's imagination since ancient times and have been seen as one of the greatest mysteries of life. So this article attempts to invastigate the key trends (development) of color systems over the years.

In the fourth century, Aristotle defined as primary two colors - blue and yellow. Originally, he associated them with the two opposites of life, but later with the four elements: fire, water, earth and air. These are the principles that artists followed until the 19th century when Newton's discoveries turned round ideas about color.

Hipocrates, who was Aristotle's contemporary and the father of medicine used colors in his medical practice and recognized some therapentic effects of colors. His knowledge and expertise in this field were very limited.

The first attempts to display the colors as a system date back to 1593. The oldest known color system was developed by the respected astronomer Aron Forsius. It is shown in fig. 1 [5].

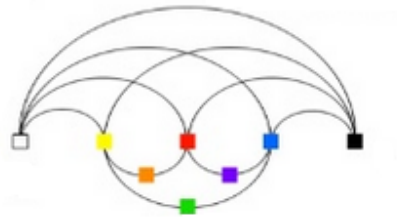
Fig. 1 Color system of Forsius



In his color circle between the black and the white color, red is located on one side and other is blue, on the other then yellow is located between white and red, pale yellow is located between white and yellow, orange - between yellow and red.

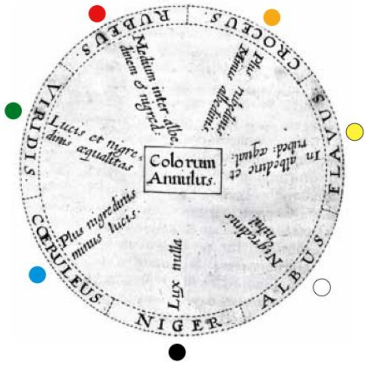
Later, in 1613, d`Aguillon created a system using three primary colors and thus it can be considered as a precursor to other systems whose functions are similar. d`Aguillon discards the fourth color (green) from the pure color combination. Green was the color causing difficulties of Leonardo da Vinci. However, he reserved a special place for it. In the same way as red, green is situated in the middle. Therefore, the two colors are opposite each other as shown in fig. 2.

Fig. 2. d`Aguillon's system [4]



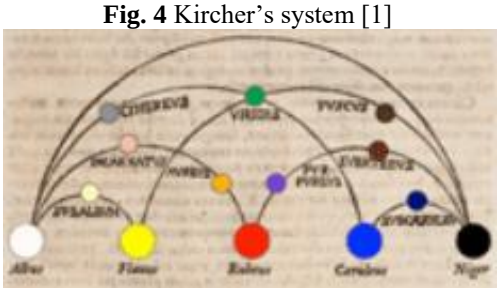
Not long after wards, in 1629, Robert Fludd created a new color system or the so-called color circle. This circle consists of seven colors in tone sequence between white and black. He describes the red and green as intermediate colors with equal proportionality of white and black. In fig. 3 a Fludd's color circle is shown [2].

Fig. 3. Robert Fludd's color circle [2, 4]



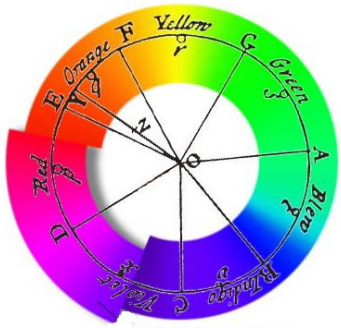
In 1646, Kircher published a book in which he drew attention to the colors and the combination of them. Based on this, he created and a new system with another look at the distribution of primary and secondary colors. In fig. 4 his color system is shown.

Fig. 4 Kircher's system [1]



Sixty years later, Isaac Newton, based on fundamental spectral decomposition of a shaft of rays, created a circle diagram. In it the main colors are located radially. At the center of this diagram is the white light. In fig. 5 Newton's color circle diagram is presented.

Fig. 5 Newton's circle diagram [3]

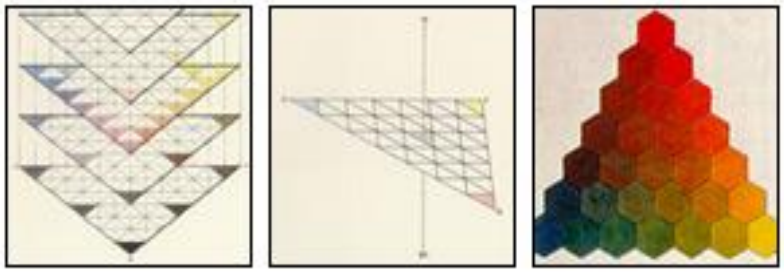


Humanity is basic knowledge about the nature of color is due to Newton's efforts. His experiment caused drastic change in people's understanding and perception of color.

Newton categorically defines a seven-color spectrum. Before him other researchers also worked with prism, watched a beam of light decompose into many such rays, but in reality no one came to the classification of the color spectrum. Also, Newton detected the source of colors as well. In practice, this happens when a beam of light is blasted through a prism and it decomposes into the color spectrum, and then this spectrum is run through a second prism that restores the original look of the beam of white light.

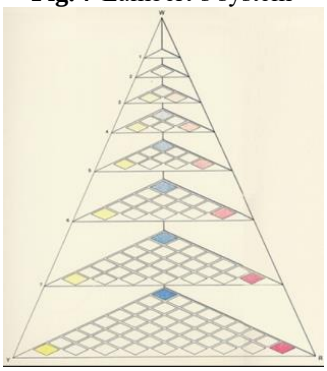
Forty years later, Tobias Mayer created so-called tetrahedral space with the primary colors yellow, red and blue located at the corners of a central triangle. The edges of the triangles are filled so that they can be perceived as identical. Fig. 6 shows the tetrahedral space of Mayer.

Fig. 6. Mayer's triangle



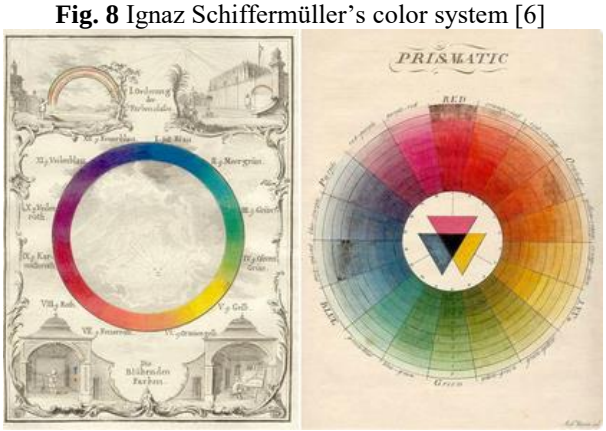
Not long after wards, Waller and Lambert created the square and the pyramidal system of color. Specific about Lambert's pyramid color system is the fact that is located at the top white. In fig. 7 a Lambert's pyramidal system is shown.

Fig. 7 Lambert's system



It is assumed that in 1772 Ignaz Schiffermüller created the first color circle with continuous gradations of the colors. The four basic colors - red, blue, green and yellow are situated on the periphery of the color circle, along with the secondary colors. In fig. 8. a color circle with continuous gradations of color is shown.

Fig. 8 Ignaz Schiffermüller's color system [6]

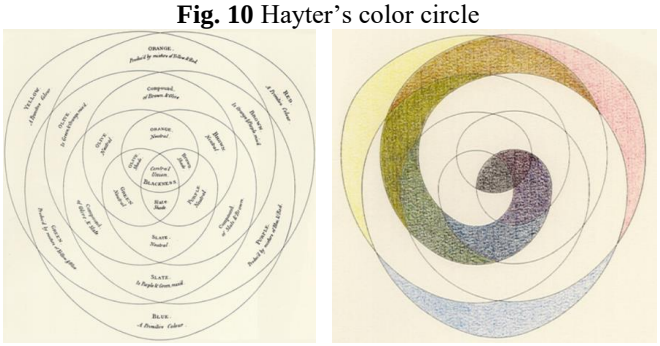


Thomas Young unified the three primary colors RGB, and based this decision on his research on the nature of color perception. In 1810, Otto Philipp Runge created the first spherical colorimetric system. It is characterized by the fact that white is on one pole, and - black is on the other. This system is a simple model similar to the Earth. Another feature of the spherical system of Runge is that along the equatorial zone the pure colors are located. For the first time we talk about black. The system consists of six primary colors, which are located symmetrically along the equator of the sphere [1]. In fig. 9 Otto Philipp Runge's spherical colorimetric system is shown.

Fig. 9 Runge's spherical colorimetric system

The same year, Johann Wolfgang von Goethe created a color circle, consisting of six colors: crimson, orange, yellow, green, blue and violet, without dark blue which mandatory in Newton's system. When this color system appears, it is the first diagram to pair residual complementary colors.
Johann Wolfgang von Goethe wrote the book "Theory of Colours", which had significant influence, first in the field of art on the Pre-Raphaelites, as is reflected in painting, architecture and applied arts.
Twenty years later, in 1830, Charles Hayter created a color circle, resembling the shape of rose petals. He uses three primary colors - red, yellow and blue, three secondary colors - orange, green and purple and three tertiary colors - olive, brown and slate gray.
In fig. 10 Hayter's color circle is shown.

Fig. 10 Hayter's color circle



II. Conclusion

Humanity knows the nature of colors more than ever, but still does not have enough knowledge to explain some physical and psychological characteristics related to their perception by the human eye. Colors and psychology are widely discussed nowadays. Esoteric beliefs about the colors also gaining more and more influence and it becomes clear that science and the esoteric are moving towards a common purpose - knowledge of the features and characteristics of the colors.

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