The Role Of Computer Graphics In Working With Colors In Design

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Abstract: This article discusses the role of computer graphics in working with colors in design. Describes models that work with colors in computer graphics. Information is provided on the convenience and capabilities of the models.

Keywords. design, computer graphics, colors, color models, raster, vector

Introduction

The inception of design is closely related to the emergence of writing and the creation of handwritten books. The beginning of the era of typography contributed to its widespread distribution throughout the world. However, the history of graphic design is only a little over a hundred years old, since its birth as a science occurred during the industrial revolution of the late 19th century, and reflects the entire course of scientific and technological progress.

Graphic design connects art and technology in a single creative process. In the 20th century, a computer was invented, which later became one of the most important tools for the artist and opened new horizons for creativity, thereby transferring the designer's activity to a new level.

Main Part

Not a single self-respecting publication (whether it be an article or a book) on graphics ignores the discussion of the peculiarities of the presentation of graphic information in a computer. And this is not a tradition, this is fundamental knowledge that should not be neglected.

Raster and vector. There are two fundamentally different ways of presenting graphic information in a computer: raster and vector graphics.

In vector graphics, an image is represented as a set of objects (primitives), the geometry of which is described by mathematical formulas. This set includes simple geometric shapes: points, lines, arcs, polygons, ovals and some other shapes. Thus, it becomes possible to store only the coordinates of primitive nodes and their properties (color, connection with other nodes, etc.).

Some uses for vector graphics include: logos, emblems, brand names, advertising lettering, diagrams, blueprints, clothing sketches, and more.

Key benefits of vector graphics:
• Good scalability
• Small sizes of graphic files
• High processing speed

• Low requirements for computing resources

And there are only two fundamental disadvantages:

• Inability to create realistic images

• Complexity of geometry description

In raster graphics, any image is represented as a collection of dots of the same size - a raster, each of which is described separately. These elementary parts of the image are called pixels (from the English "picture cell"). A pixel description is a description of its color. A lot of small pixels at some distance is perceived as an integral image, and not as an array of points. The more there are, the visually better the image and the larger the file size.

Bitmap is typically used for images with a lot of detail or tints. A collection of points can be used to represent a landscape photograph, a photographic portrait, a digitized drawing, and much more.

When editing bitmap graphics, its quality may change. Changing the size of such pictures in any direction usually degrades the quality: when decreasing, small details are lost, when increasing, the sharpness and brightness of the image deteriorate. Loss of quality is also possible when turning and tilting.

The properties of the vector and the raster complement each other: the strengths of one way of describing are the weaknesses of the other, and vice versa.

Color models. The bitmap dot description is binary information about the color and brightness of the dots. A color model is a specific algorithm (or set of rules) for interpreting and processing point codes.

For emitting objects (televisions, computer monitors, video projectors and many other graphic output devices), an additive synthesis principle is used, when the required color is formed by mixing the basic color shades.

The most famous additive type model is the RGB model (Fig. 1). Its name is formed from the first letters of the base color coordinates Red (red), Green (green), Blue (blue). By mixing these three primary colors in a certain ratio, most of the colors perceived by a person can be reproduced.
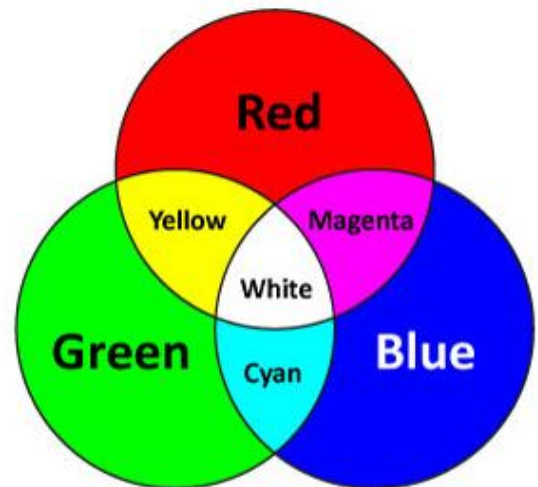

Fig 1. Additive model RGB

Obtaining colors as a result of additive mixing:

Green + Red = Yellow

Green + Blue = Cyan

Blue + Red = Magenta

Blue + Red + Green = White

No light = Black

The color of non-self-luminous objects (paper prints) is formed according to the subtractive principle of synthesis, that is, by subtracting various color components from the light reflected by white paper. Removing all components results in black.

The most common subtractive synthesis model is CMY, which is widely used in the printing industry. Its name is formed by the first letters of the color coordinates Cyan, Magenta, Yellow (Fig. 2). Black is added to this model when printing to

save color dyes, and then the system takes on the form of CMYK.

It is often explained that the letter k in this abbreviation is the last letter of the word black, and is taken not to be confused with blue from the RGB model. It actually stands for key color. In English speaking countries, the term key plate refers to a black ink plate.
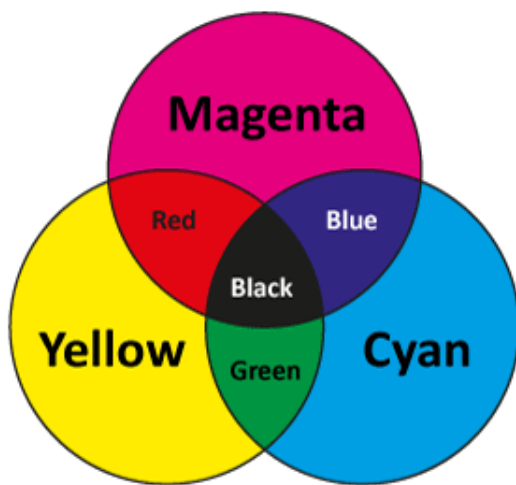

Fig 2. Subtractive CMYK

Ink in printing acts as a filter, that is, when applied to paper, it absorbs a certain color, it is "subtracted" from white light (consisting of red, green and blue). Thus, the other two components are reflected off the paper, and their additive combination gives the color that we see.

Getting colors with subtractive color reproduction:

Cyan + Yellow = Green
Yellow + Magenta = Red
Magenta + Cyan = Blue
Cyan + Magenta + Yellow = Black
No color = White

The colors of one model are complementary to the colors of the other model.

Complementary (complementary) colors are colors that add up to pure white, pure black, or a shade of gray. Blue is complementary to red, since blue is obtained by mixing green and blue. Complementary for green is magenta (magenta = red + blue), for blue, yellow (yellow = red + green).

Bitmap model. Only one binary bit is assigned to each point in the image of the Bitmap model. That is, it is possible to represent only two states of a pixel. Typically, these states are black and white, so the images shown in this model are referred to as black and white or monochrome. The model does not provide the ability to present smooth tonal gradations. It is sometimes called Black and White, LineArt.

Indexed Color Model. As in the Grayscale model, each pixel in the Indexed Color model (Fig. 5) is represented by an eight-bit codeword. But it does not record information about grayscale, but data about color. The set of all available colors forms a palette of 256 elements. This model can be called Paletted, 256 Colors, Web Colors.

Fig 3. Model Indexed Color

RGB model. RGB is the most popular way to represent graphics. In this system, any color is formed by combining red (Red), green (Green) and blue (Blue) colors of different intensities.

Zero value of all components corresponds to black color (no luminosity), and white color gives a mixing of values of limiting intensity.

Since there are three color coordinates in the RGB system (8 bits are allocated for each description of the codes), there are 24 binary bits per pixel. It is sometimes said that the color depth in this system is 24 bits. This allows for the presentation of over 16 million colors.

HSB model. In the HSB model, all colors are defined by three coordinates: Hue, Saturation, and Brightness. The model name is formed from the first letters of the English names of color coordinates. The undoubted advantage of the HSB system is its independence from the hardware.

A hue or hue is a spectrally pure color of a specific wavelength, such as pure red or pure green.

Brightness characterizes the intensity, energy of the color. The change in brightness can be thought of as a mixture of pure tone and black. The high content of black makes the color shaded, not intense. As the percentage of black decreases, the illumination increases. A sunbeam is an example of bright light, the glow from a firefly is very low in brightness. Black has zero brightness and white is absolute.

Saturation describes the purity of a color. The same tone can be dull or saturated. Changing saturation can be thought of as diluting a pure color with white. The higher the white content, the more faded the color becomes.

CMY and CMYK models. The CMY model describes a way to obtain colors not by adding, as in RGB, but by subtracting the base color coordinates from white. Therefore, the CMYK model is called subtractive. In this model, the reference colors are cyan, magenta, yellow. The CMYK color model is used in the printing industry to form images intended for printing on paper.

The synthesis of colors in the CMY system and the explanation of why this model takes the form of CMYK was mentioned a little above.

Many graphics packages treat color coordinates as dyes that are applied to the surface of the paper, so the intensity of each coordinate is measured as a percentage from 0 (no ink) to 100 (maximum ink intensity).

Conclusion

General recommendations for choosing a color model are as follows: for display on a computer monitor or TV screen, the RGB system is better; for transmission to a printing house, the CMYK system should be preferred.

List of used literature

1. Schwarz M. W., Cowan W. B., Beatty J. C. An experimental comparison of RGB, YIQ, LAB, HSV, and opponent color models //ACM Transactions on Graphics (TOG). – 1987. – T. 6. – №. 2. – C. 123-158.

2. Foley J. D. et al. Computer graphics: principles and practice. – Addison-Wesley Professional, 1996. – T. 12110.

3. Couclelis, Helen. "People manipulate objects (but cultivate fields): beyond the raster-vector debate in GIS." *Theories and methods of spatio-temporal reasoning in geographic space.* Springer, Berlin, Heidelberg, 1992. 65-77.

4. Zakirova S. A., Pîrvan L. R., Zunnunova U. G. CHALLENGES AND PROSPECTS IN ART HIGHER EDUCATION OF UZBEKISTAN AND ROMANIA.

5. Zakirova, Sayyora Abdulhakovna. "Computer graphics as a tool for the development of students' creative and

intellectual abilities in classes on the basics of information technology." *ACADEMICIA: An International Multidisciplinary Research Journal* 10.6 (2020): 1419-1423.

6. Abdullaeva Nasiba Burronovna. (2020). Integration Of Scientific And Rational And Artistic And Aesthetic Aspects In Design And Art. International Journal of Advanced Science and Technology, 29(8s), 1334 - 1336.

7. NafosatZikirova,Nasiba Abdullayeva, Ozoda Nishanova, Baktior Djalilov, Enajon Nishanbayeva. (2020). Issues On Using Interactive Strategies In Teaching Process. Journal of Advanced Research in Dynamical and Control Systems, 12 (02), 2753-2756.

8. Nafosat, Z., Nasiba, A., Ozoda, N., Baktior, D., & Enajon, N. (2019). Interactive strategies and methods of education.

9. Abdullaeva, N. B. (2015). THE ESSENCE AND CONTENT OF THE AESTHETIC COMPONENT IN DESIGN. *ISJ Theoretical & Applied Science*, *9*(29), 169-171.

10. Абдуллаева, Б. (2014). Диалектическое видение эстетического компонента в дизайне. *Credo new*, (3), 14-14.

11. Абдуллаева, Н. Б Дизайн как фактор формирования культурного пространства. Фалсафа ва ҳуқуқ, 2/4/2017, 70-72.

12. Якубжанова, Х. Я. (2019). Анализ зарубежного опыта в развитии экотуризма: на примере Ферганского экономического района. *Региональная экономика: теория и практика*, *17*(8), 1593-1606.

13. HY Yoqubjonova. ECOTOURISM IN THE ECONOMY OF THE REGIONS. Форум молодых ученых, (3) 2019. 57-61.

14. Yakubjonova, H., Boyto'rayev, O., & Shodadaliev, B. (2018). МАЛАЙЗИЙСКИЙ ОПЫТ РАЗВИТИЯ ЭКОТУРИЗМА. *Экономика и социум*, (2), 92-95.

15. Yakubjanova, H. Y. (2018). ENVIRONMENTAL ECOTOURISM IN UZBEKISTAN INNOVATIVE WAY. *Теория и практика современной науки*, (3), 108-110.

16. ХЁ Ёкубжанова, АМ Сохадалиев. Foreign experience in the development of ecotourism in Uzbekistan. Молодой ученый,(5) 2016. 858-861

17. Tuyboevna, K. S. (2020). Interactive method – one of the most popular types of today's pedagogical technologies. *European Journal of Research and Reflection in Educational Sciences*, 8 (11), Part II, 83-92.

18. Karimova Sanobar Tuyboevna. (2020). Using the educational electronic resource phet in the teaching of physics. ACADEMICIA: An International Multidisciplinary Research Journal. 10 (6). 1424-1426.

19. Karimova Sanobar Tuyboevna. (2021). About the use of interactive method and phet electronic resource in educational process. Middle European Scientific Bulletin, 8. https://doi.org/10.47494/mesb.2021.2.164