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Analysis of the process of coloring objects based on the optical properties of objects

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ABSTRACT

Color is a certain spectrum contained in a perfect light (white). The purpose of this study is 1). Can determine the cause of the color of the object (what causes a different object than the other color) 2). Can observe the color that occurs when two or more colors are mixed. The benefit in order to inform readers about what actually causes the color of the object and what if two or more colors are mixed. Mixing colors for color RGB, the colors Red to Green produce colors orange, blue color to produce a color Sian Green, Red color with blue produce magenta, and Red, Green with Blue produces white color. For CMY color mixing, the colors Cyan with yellow produce green color, magenta with yellow produces red color, the color Cyan by Magenta produces blue, and the colors Cyan, Magenta produces yellow Gray (Brown). Color objects can be invisible to the eye because of the reflection of the color of the object illuminated by light.

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1. INTRODUCTION

Colors begin to be recognized by humans from an early age. Humans know colors from the environment they see, human knowledge about colors begins to develop long before they start formal education. The application of color can improve the ability to remember [1]. Knowing colors can develop one's intelligence and imagination [2]. Each color is able to give a certain impression and identity according to the social conditions of the observer [3]. For example, white gives the impression of being holy and cold in the West because it is associated with snow. While in most Eastern countries the color white gives the impression of death and is very frightening due to its association with a shroud (though theoretically white is not actually a color) [4].

In fine arts, color can mean a certain reflection of light that is affected by the pigments found on the surface of objects [5]. For example, mixing magenta and cyan pigments in the right proportions and being exposed to perfect white light can produce a sensation like red [6]. In everyday phenomena, things that have been considered normal so far contain extraordinary secrets in the field of color, namely, first, why is the sky blue, why is the sea blue, and so on, which are inseparable from human life [7].

Basically, the sky is colorless, but because of the sun, the sky turns bluish. The sun emits light waves by emitting certain frequencies [8]. Part of this frequency is the visible light frequency that can be captured by the human eye [9]. If the spectrum of sunlight that hits our eyes still consists of the entire visible light spectrum, the sun looks white, and this visible light spectrum illuminates the earth's atmosphere [10]. Earth's atmosphere is composed of gases containing various particles and elements [11]. The first two elements contained in the Earth's atmosphere were oxygen and nitrogen [12]. These two elements are very effective at scattering the

visible light spectrum which has high frequencies or short wavelengths [13]. As a result, the Earth's atmosphere easily scatters the high-frequency blue, purple, and indigo color spectrum [14]. The human eye is more sensitive to blue than to indigo and purple, so the sky is blue [15]. This paper offers an example of an application for detecting red, green, blue, cyan, magenta, and yellow or RGB-CMY colors in an input color image. The principle used to detect color is to look at the color range of each pixel in the red, green, and blue channels. If within the color intensity range, a pixel in each channel is within a certain color range according to the set color range rules, then the pixel is a certain color.

2. METHODOLOGY

In investigating the cause of the color of objects optically, an experiment was carried out according to the design in Figure 1. The scientific ability that you want to do is the activity of mixing colors. Color mixing activity is a child's ability to create new color combinations. The ability of children to combine colors can generate new ideas that are continuously honed from an early age. The color mixing activity is a complicated trait, namely a child can create spontaneously because the child already has an element of scientific ability. It is highly recommended to do this experiment in a dark room to avoid unnecessary light in this experiment.

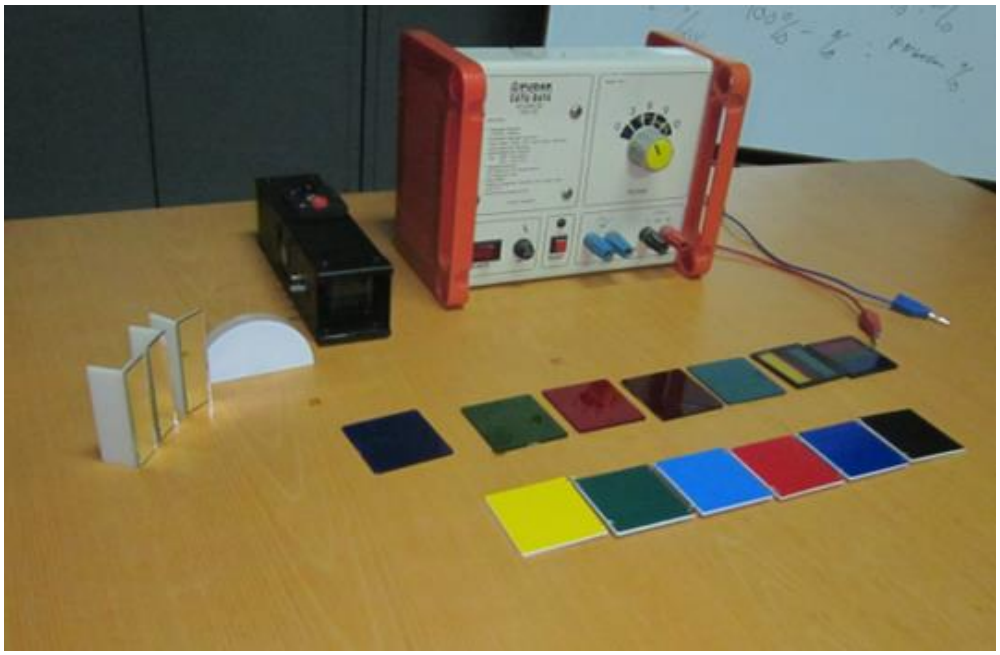

Figure 1. Experimental design

At this stage, an in-depth study of the color intensity values that appear in each of the main color channels, namely the red, green, and blue channels, is carried out. The expected result of this step is the discovery of the basic color intensity that builds an image. The color intensity found will be the main clue when an image is entered, in which part of the image has the dominant basic colors.

3. RESULTS AND DISCUSSION

The researcher chose primary and secondary colors as the characteristics to be recognized, namely red, magenta, blue, cyan, green, and yellow. To find the color intensity of each color in this study, observations were made on the color intensity spectrum of the selected colors. Figure 2 shows an example of the green color spectrum when viewed in its value range. After all, the values in the channel are observed, and the green color intensity is determined, which is selected from the lowest value to the highest value in the color intensity range. Table 1. provides a summary of the results of a simple study regarding the color intensity range for each color selected in this study. If an object can emit light and the object emits red light waves, then the object looks red. Meanwhile, if an object cannot emit light, then the object looks colored according to the color spectrum that is reflected by the object [16]. Meanwhile, the color spectrum that is not reflected is absorbed by the atoms or molecules that make up the object. For example, when exposed to white light, the leaves reflect the green spectrum and absorb light other than the green spectrum, so the leaves appear green.

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Figure 2. Conditions for capturing RGB and CMY data.

Table 1. Investigating the Color of Objects

Object Color (Color chips in white light)	Color objects with colored light filters					
	Red	Green	Blue	Cyan	Magenta	Yellow
Red	Red	Red	Red	Red	Red	Red
Green	Black	Green	Green	Green	Black	Green
Blue	Black	Violet	Blue	Blue	Violet	Blue
Yellow	Orange	Yellow	Yellow	Yellow	Merah	Yellow
Cyan	Black	Blue	Cyan	Cyan	Violet	Cyan
Magenta	Black	Black	Black	Black	Magenta	Magenta

Based on the range of color intensities found, then color matching can be easily carried out from the input image, so that at the same time it can be calculated how many pixels meet the requirements for a certain range of values according to the choice. Color is a certain spectrum contained in a perfect light (white). The identity of a specified color wavelength of the light as shown in Figure 3. For example, blue has a wavelength of 460 nanometers. The color wavelengths that can still be captured by the human eye range from 380-780 nanometers.

Figure 3. Illustration of mixing primary colors to produce RGB and CMYK

For this absorption to occur only if the energy of the incident photon matches the energy required to move the outermost electron of the atom or molecule from the ground state to the excited state (or from the valence band to the conduction band in a solid). So, the absorption of the color spectrum by the atoms or

molecules that make up an object causes the object to reflect only certain colors. The color spectrum that is not absorbed is reflected. And this reflected color spectrum is what is visible, and makes the object colored.

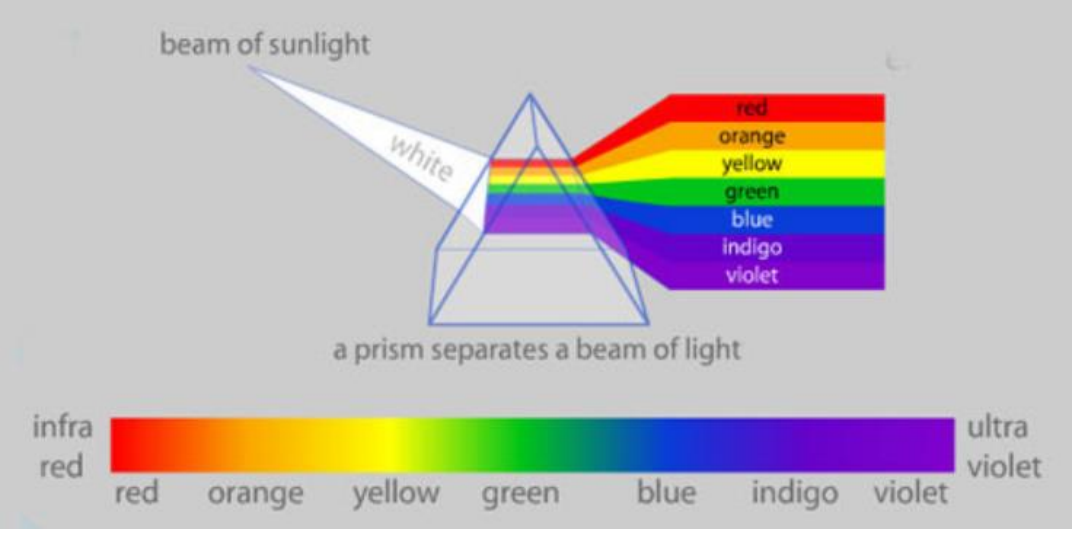

Figure 4. These various colors originate from sunlight

The sunlight is white. Even though the light is white, the sun's light reflects all colors. If decomposed into rainbow colors. Sunlight consists of many waves. When sunlight hits an object, the object will reflect some or all these light waves as shown in Figure 4. When an object reflects waves with a wavelength of 400 nanometers (1 nanometer = one billionth of a meter), these waves will hit our eyes. By our brain, this wave is interpreted as blue. So that the younger siblings will see that the object is blue. If the reflected wavelength is 700 nanometers, the object will appear red. An object will appear white if it reflects all waves and will appear black if it absorbs all waves [17]. Of the many waves of light, some of which we can see, and others are waves that cannot be seen with the naked eye. The light waves that we can see are white light [18]. Located between ultraviolet and infrared [19]. It is important to know, light waves are electromagnetic waves [20]. Regarding why leaves reflect green color, of course, because of the content of substances contained in these leaves, such as chlorophyll, and related to color differences, humans can change their perception of color.

According to information from the fact that the more you learn about different colors, the more sensitive you are in separating those colors. Like a designer, they often know the details of different colors even though for different people the colors are the same. In conclusion, perhaps this color is an illusion. The color that you believe is red, maybe other people call it differently [21]. Objects in the environment if we are, maybe colorless if there is no sunlight. Even though at night you can still see colored objects with the help of electric lights, the brightness will be different from direct sunlight. The combination of the sky looks blue. The blue color itself comes from sunlight which has a large wavelength. When it enters the Earth's atmosphere, the wavelengths shrink and scatter [22]. The new wavelength is the same size as the blue wavelength, so the sky looks blue. In fact, this event is like light passing through a prism. The incoming light is refracted into several primary colors: purple, indigo, blue, green, yellow, orange, and red. Purple has the highest wavelength, and red the smallest, hence the terms ultra-violet and infrared.

4. CONCLUSION

In summary, from the results that have been done, it is found that the color of objects can be seen by the eye because of the reflection of the color of objects that are illuminated by light. Sunlight is actually white, due to the refraction of blue waves in the atmosphere so that the remaining combined color waves appear in yellow.

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