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| **Introduction to Color and Color Perception**    Everyone who can perceive color, knows what color is.  However, when asked to define color, they realize how little they actually know about color and the process of perception.  For lack of a better definition, some text books actually refer to color in a very simple minded way, defining it as the perception by which we can tell two objects apart when they otherwise have the same attributes of shape, size, texture, etc (Munsell Color Science Laboratory).  Yet, to many color researchers this is a very unsatisfying definition since color is a subjective experience, only perceived after many intricate steps involving the human eye and brain.  Therefore, putting a scientific definition on something that only exists in our minds is an extremely difficult task.  In fact, many researchers refer to color as a paradox since it only exists in light, which to the human eye appears almost colorless (Dada).  Color results form the interaction of a light source, an object, and a viewer.  For color to be present light must be modified by an object in such a way that the viewer, such like the human visual system, perceives the modified light as a distinct color (X-rite). These three elements are essential to color perception; without them, color as we know it would not exist.  Without a doubt, light is the most important element in color perception, because color, in a sense, exists because of the light. Light is the visible part of the  electromagnetic spectrum and is described as a series of waves, which are identified by their wavelength. Lights of different wavelengths appear to us to have different colors.  Only a small fraction of the electromagnetic spectrum is visible to the human eye, which can only detect wavelengths ranging from 400 to 700 nanometers. The image below, obtained from the CCRS-Fundamentals For Remote Sensing website (http://www.ccrs.nrcan.gc.ca/ccrs/eduref/tutorial/chap1/c1p3e.html) depicts the tiny slice of gigantic electromagnetic spectrum which is visible to the human eye.      It was in 1672 that Isaac Newton discovered that white light is mixture of all wavelengths of the visible spectrum when he passed sunlight through a prism, which broke down creating a rainbow spectrum (Seeing Color Lecture Notes). Colored objects appear colored because they reflect specific wavelengths of light.  For instance, a red apple appears red because it reflects mainly rays from the red end of the spectrum and absorbs rays from the opposite end of the spectrum, the blue end (Breaking the Color Code).  The light sensors in our eyes are sensitive to the visible spectrum s wavelengths, and when light waves hit these sensors, signals are sent to the brain.  Our brain processes these signals and we perceive a particular color.  But as stated before, the color we perceive is dependent upon the composition of the wavelengths of the light waves.  It is important to remember, however, Isaac Newton s words The [Light] Rays to speak properly are not coloured; In them there is nothing else than a certain Power and Disposition to stir up a Sensation of this or that Colour&   Or in other words, the colors we see associated with different wavelengths are not contained in the light itself, rather they are created by our perceptual system in response to these wavelengths (Seeing Color Lecture Notes).  The wavelengths of light, which stir up a sensation of color , must also be manipulated by the object in view before color can be perceived.  Light waves which strike an object, are manipulated when the object s surface absorbs some of the spectrum s energy, while reflecting other parts back from the object (X-Rite).  This new modified light that is reflected from the object has a completely new composition of wavelengths, which therefore determines the color our brain perceives because it is the wavelengths that are reflected from the object that are translated into color (i.e. the red apple is red because it reflects red wavelengths).  Since each object affects light in a specific way, there are as many colors as there are object surfaces.  It is even possible to measure the unique wavelengths that are reflected form an objects surface; a graph of these reflected wavelengths is called the spectral data of the object.  Finally, to complete the process of color perception, there must be a viewer, which in the case of humans is the visual system involving the eyes and brain.  To summarize the process, the light provides wavelengths, which are in turn modified by the object, and then reach the viewer, who initiates a sensory response that registers the wavelengths as a unique color.  An interesting question addressed by scientists is If a red rose is not seen, does it have color?   To the surprise of many people, the answer is no.  Without a viewer, the rose is actually colorless. It reflects the wavelength composition necessary for us to see red, but the color we sense and remember as  red only happens in our minds. (X-Rite). When light waves strike the sensor in our eyes, they respond to different wavelengths by sending unique electrical signals to the brain, which will process these signals into the sensation of light and color.      ([Intro1](http://docs.google.com/introduction.html))([Intro2](http://docs.google.com/intro2.html))([Intro3](http://docs.google.com/intro3.html))([Intro4](http://docs.google.com/intro4.html))  [[Home](http://docs.google.com/home.html)][[Introduction](http://docs.google.com/introduction.html)][[Hypothesis](http://docs.google.com/hypothesis.html)][[Procedure](http://docs.google.com/procedure.html)][[Data](http://docs.google.com/data.html)][[Conclusions](http://docs.google.com/conclusions.html)][[Bilio/Links](http://docs.google.com/biblio.html)]  [2002 Projects][2001 Projects][2000 Projects][1999 Projects][1998 Projects] |