Color: How It Enhances Television Production

If you were color blind, how would it affect your life? Approximately 8% of the male population are color blind and some 0.4% of women have color recognition defects. Things look very different to them than they look to the rest of the population.

People who are color blind are unable to distinguish differences in shade or tonal values of certain colors. Some are unable to distinguish one color from another — this is problematical because, unlike someone who is blind, these people have a functional disability which until it is recognized can cause them to make judgement errors. These errors could range from the simply annoying (say being unable to distinguish between one blue sock and one green sock) to the life-threatening, such as being unable to distinguish between clear vinegar and yellow weed spray.

Color is all around us and is an important part of our daily lives. We use color unconsciously to aid us in depth perception, to distinguish one product from another, and to make ourselves look more attractive or more businesslike.

"See" With Our Brain

As is the case in real life, in the world of television we use color to recreate reality.

Since we "see" with our brain as well as our eyes, our vision is subject to a number of phenomena that I will indicate here. Our eye and brain work together in concert to render an image. Our eyes are the optical receptors which convert light energy into an electrical stimulus that is conveyed by the optic nerve to the brain, where it is interpreted.

Our sight is an optical/electrical process. Light, which is energy, excites the photoreceptive chemicals in the retina, which is composed of elements called rods and cones. Rods, which form the bulk of the receptors in the eye, are ultra-sensitive to light but unable to resolve fine detail. They are insensitive (or blind) to colors of which light is composed, except for the blue portion of the spectrum. Cones, which are less sensitive to light, are the focus for our ability to recognize color, shape and position. These cones are most responsible for color vision.

There actually are three types of cones, each responsible for resolving a particular part of the visible light spectrum. Some cones are responsive to light which is violet to blue in light value, some are responsive to green to yellow light, and some are responsive to the orange to red portion of the spectrum.

These elements (the rods and cones) are joined to the brain by the optic nerve. Since the brain is an interpretive centre it is readily influenced by factors other than those that directly impinge on vision. For example, we have emotional responses to certain colors that have little to do with the colors themselves. We associate certain colors with certain emotions — red is the color of anger, power, empathy, strength; green is associated with greed, envy, mystery or the macabre; blue with other worldliness, aloofness; black is regarded as the color of gloom, sorrow, mourning, skulduggery; white is regarded as representing purity of intention, grace, elegance.

Eye Adaptation

The eye is adaptive and is constantly in motion.

Binocular vision — vision that has two slightly offset viewpoints — facilitates the creation of three dimensions and depth perception. This takes place when the two images are interpreted by our brain and fused together to produce a single image. All of this leads us to the point that our eye-brain vision system is adaptive, constantly changing to accommodate present conditions. An example of this would be the color response of the eye.

Since vision is a photochemical reaction it is affected by the amount and quality of light that impinges on the optical system. Our eyes actually have two distinct responses to light stimulus, scotopic and photopic.

Photopic vision is what we use during daylight hours and provides us with the full spectrum of colors. During the twilight hours, and in instances of low light, our vision switches to scotopic or twilight vision. This enables the rods, which are more blue sensitive; the red-orange end of the spectrum is diminished. Peculiarly enough this is the reason why we perceive moonlight as being blue and why we don't see color in night scenes.

Blue light is often used in television and film to convey moonlight and to nullify color in a scene. This is just one flaw in the eye-brain system's ability to adapt. It can be fooled by things like optical illusions, which lead us to make incorrect or non-specific judgements because of our eye-brain attempts to visualize and interpret at the same time.

Color Adaptation

One example of the phenomenon by which our eye-brain can be fooled is color adaptation.

When we view objects we perceive them to be the color that past experience has told us they are. For example, a white sheet of paper always looks white despite different lighting conditions. As long as the light source illuminating our white sheet of paper has a reasonably even spectrum, we will perceive our paper as being white even though it really is another color or shade.

It stands to reason then that a problem can arise. Since we often perceive an object to be a certain color based on past experience, we can see a familiar object as being a color that it isn't under prevailing lighting conditions. Since a camera lacks this interpretive ability, if we were to rely only on our eyes and not use any auxiliary color measurement devices we would often end up with pictures that were not as we saw them. The adaptability of our eye/brain system continuously compensates for variances in color, making them far less obvious to us than they actually are in nature.

Another example of this is when two colors, one cool and one warm, are mixed together in the same frame. Our eyes tend to mediate the two colors, adapting the result into some intermediate color that is a blend of the two separate colors. This is the fundamental principle behind the theory for area lighting developed by Stanley McCandless in 1923. In his system:

"One side of the stage was lit in a warm color and the other in a cool color. When tints of the color are used, they tend to mix toward white on the central planes of the object or person and make shadows and highlights at