Subtractive synthesis and Additive synthesis
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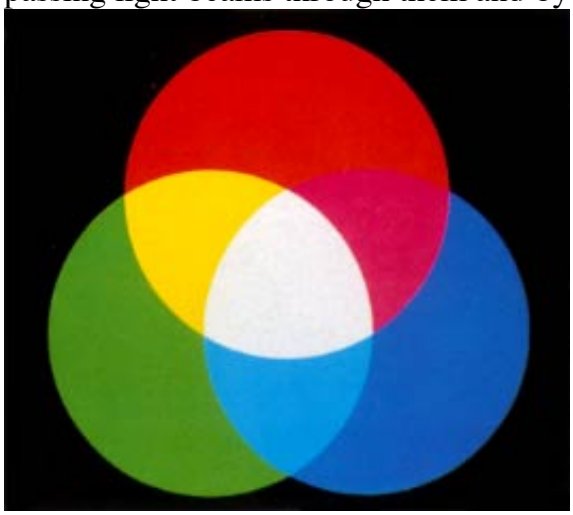
Topic: Educational Lighting Site

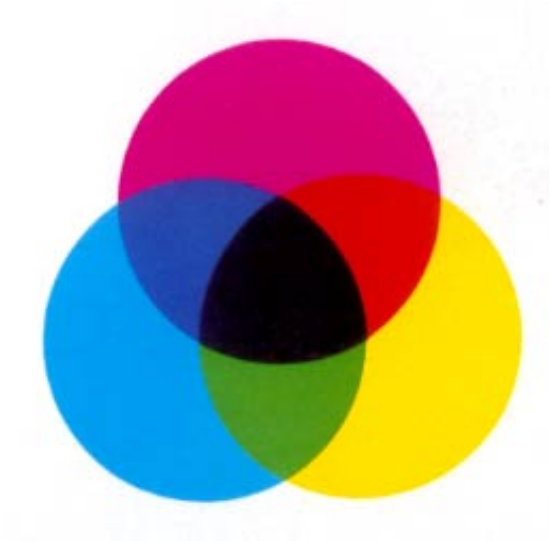
Thomas Young was a doctor and scientist who continued the studies on colour started by Isaac Newton. Newton hypothesized that each sensation of colour was supposed to correspond to a different wavelength perceived by the human eye.
Young, starting from the fact known at the time of the existence of three primary colours (by mixing them it is possibile to obtain all the other colours), did not try to explain them on the basis of the properties of light, but on those of the human eye. And this was the key that led to its understanding.
Young put forward the hypothesis that there are only three types of receptors for day vision and that to each one of them corresponds a primary colour. Any other colour would be obtained by stimulating simultaneously the three types of receptors.
He based his experiments on the blending or additive synthesis of colours and by using three filters that did not differ to much from Bright red, Green and a Blue that verged on violet (filters that, indeed, more or less correspond to the sensitive areas of the three types of retinal cones), he managed to produce all existing colours by superimposing the filters and passing light beams through them and by appropriately mixing their relative intensities.



Therefore our brain elaborates three signals that are rigorously characteristic of a colouration, the colouration associated with the light radiation that arrives on the retina and that stimulates all three cones, in a different way, obviously depending on the spectrum composition associated with the radiation.
Thus, a specific colour can be created with many combinations of light bands.
White, in particular, can be obtained by blending three primary colours: Green, red and blue, but with the right proportions, so that they generate the same three-fold stimulus as the sunlight. White can also be obtained by using a different set of three colours, derived from the dual combination of the three primary colours:
yellow = green+ red
cyan blue = green+ blue
magenta red = blue + red.
Black cannot be created with additive synthesis because it corresponds to the total absence of light.
Finally, it is important to remember that additive synthesis, apart from the vision mechanism, takes place only in few circumastances of our daily life. For instance, in colour television or all those events when intelligent floodlights equipped with dichroic filters can be superimposed with a rotation mechanism and produce coloured light beams.

In conclusion, additive synthesis can be defined as the mixing mechanism of primary colours to obtain all other colours because it is based on the sum of light thus verging on white.

Subtractive Synthesis



Subtractive synthesis is very important, because it intervenes in the common experience of observing colours. The colouration of things implies the existence of subtractive mechanisms, since it is based on their ability to absorb chromatic components of the light that illuminates, rather than emitting its own components. Colour is created by those components that are not absorbed. In his experiment, Young superimposed three coloured filters, Yellow, Cyan and Magenta (complementary colours of the primary ones) and made them pass through a single beam of white light. With such disposition, each filter subtracts from the white light that particular area of the wavelength that it is able to absorb. Where the filters superimpose the subtracting effects mount up, in this way the result is completely different from the additive method. While with the latter, white was obtained by mixing a pair of complementary colours, for instance Red and Cyan, with the subtractive method this same pair creates black.
In conclusion, pigments and coloured objects, are such because when they are struck by light they only reflect the light corresponding to “their colour” while they absorb all the remaining light.