# Some Things to Think About When Using Your FifeX Colour Mixer

- And short answers to get you going!

We recommend the following website for information on colour mixing
http://www.rgbworld.com/color.html

## Normal Setup

- **What are the primary colours of light and what are the secondary colours?**
  - Primary colours: Red, Green and Blue.
  - Secondary colours: Cyan, Magenta and Yellow

- **What are the primary colours of paint, pigments and dyes etc?**
  - Cyan, Magenta and Yellow

- **How do these relate to additive and subtractive colour mixing and what is the difference?**
  - Additive colour mixing is the term used to describe colour mixing with light
  - Subtractive colour mixing is used to describe colour mixing with dyes and pigments
  - Both these types of colour mixing are different. Green and Blue light will not give the same result as mixing Green and Blue paint.
  - In additive colour mixing, the addition of a new colour adds to the mix, increases brightness and brings the mix colour closer to white.
  - In subtractive colour mixing, the addition of a new colour removes reflected colour from the mix, making the mix less bright and bringing the overall colour closer to black. *See the absorption section below for more on this.*

- **Why do we, in this experiment, represent all the colours of the visible spectrum with only Red, Green and Blue?**
  - The spectrum can be roughly split into these three main colour bands

- **What happens when we put on two colours, why do we see the secondary colour**?
  - In the cone theory, it is assumed that our eyes have an R, G and B cone. When we turn on the Red and Green LEDs we stimulate the R and G cone in our eyes – our brain tells us this is yellow. *Again see the absorption section for more on this.*

- **What happens if you are Colour Blind, why do some people perceive colours differently?**
  - Some people have a deficiency in their cones meaning that how they perceive colours is inaccurate. A few people have one cone that is completely deficient.

## Surface Colouration Setup

- **If an object is yellow, why do we see it as yellow**
  - It is reflecting red and green light and absorbing blue
  - N.B. yellow light does exist and our eyes can not distinguish between yellow light and mixture of red and green
  - In this experiment we can see that if the room is dark, and all three LEDs are on, there are ONLY three colours present (R, G and B and NO yellow). Therefore, the yellow that we see is made entirely of red and green

- **What happens if we only shine blue light onto it**
  - It will be perceived as being black (It cannot reflect anything that we are shining at it, therefore it appears black)

- **Bearing this in mind, how do you explain subtractive colour mixing**
  - Something that is yellow is reflecting red and green and absorbing blue. Something that is magenta is reflecting blue and red and absorbing green. Therefore mixing yellow and magenta will give you red because both green and blue are being absorbed. (This is of course very simplified and doesn't take into account the amounts of each pigment or indeed the shade). Note that using this theory, you should be able to make black by mixing all colours, in reality most printers have a black cartridge because making black by mixing colours is never really satisfactory, it tends to be a darkish brown.

- **Can you trick your brain to think of something as a different colour than what it actually is?**
  - It can be very convincing but there must be no light at all in the room, otherwise it will not work. **N.B. caution must be taken over this to ensure that it is completely safe to darken all lights in the room.**

- **What objects work best for this**
  - We have tried using bananas, daffodils, and brightly coloured objects, so that there is a marked difference when they are black. Multi-coloured objects also work well as changing the colours will completely alter how they look. Aim for an object with colours that are roughly the same as the primary or secondary colours (R, G, B, C, M, and Y) as other colours may not work as well.

- **Can you write a coloured code that is illegible in white light, but makes sense with only certain colours turned on?**
  - This can be good fun to get students interested, but de-coding will again require complete darkness. Hint: green ink reflects green light. In light that does not include green, it will appear black. **N.B. caution must be taken over this to ensure that it is completely safe to darken all lights in the room.**