Using the Colour Triangles

<u>Pigment Mixing Triangle:</u>
Purely used to understand mixing pigment colours together.

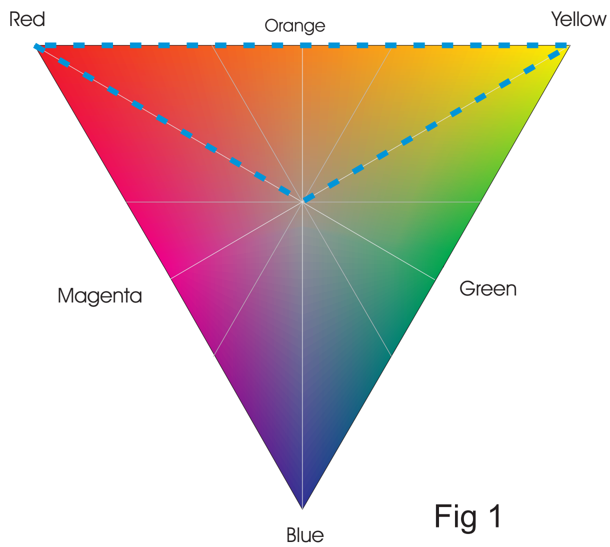

Fig 1

Primary colours Red, Yellow and Blue are at the corners and the secondaries Orange, Green and Magenta lie between them on the edges.
All available colours can be mixed to a large extent with the primary colours Red, Green and Blue.

(Note: Fig 1 Shows the purest forms of the colours that can be represented on a computer and don't represent the values that the colours come out of the tubes, or the values you would get if the colours were mixed. For example, although mixing Red and Blue would produce magenta, it would be much darker than seen here.)
It is the resulting hue and chroma that is important.

The centre is neutral, which could be black, white, or any value of grey.
The closer a hue is to the centre, the less chroma it will have.
Eg: a point half way between Red and Neutral will be Red-Grey.

The main triangle is divided up into three smaller triangles, one of which is shown at right in dotted lines.
Any two colours within one of these triangles can be freely mixed together without significant loss of chroma. That is, one colour within a sub-triangle will move toward another colour within the same sub-triangle in a straight and predictable manner.
The most predominant one here is Red mixed with Yellow will produce a high chroma orange.

Mixing two colours from different sub-triangles will reduce chroma.
Eg: Orange mixed with Blue should pass through neutral and Orange mixed with Magenta will produce a Red-Grey.
(Note: If the opposite colours aren't true complementary, the path will not pass through neutral. Even though you may get a colour that is close to neutral, the actual hue may be very different from what you were trying to achieve.

<u>Light Mixing Triangle:</u>

This is the triangle to use when adding light sources together.
Eg: If you had a blue light source from above and an orange light source from below, you could calculate the mid colour where an object would receive light from both sources.
Other uses would be adding reflection to an object or adding a haze (aerial perspective) to atmosphere or water.

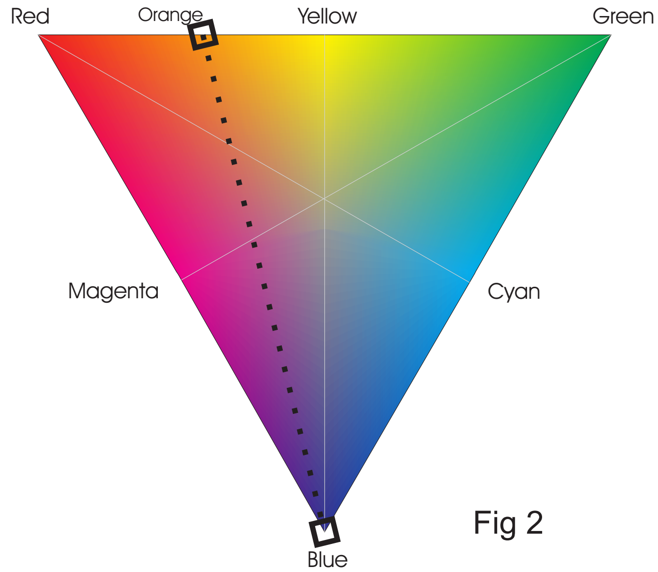

Fig 2

This triangle is very similar to the subtractive triangle, and in fact it could be used in place of it although the subtractive triangle will give you a better idea of the relative chroma that a mixture should be when calculating the colour of an object under a particular light source..

Fig 2: Shows the path that orange would take on its way to blue. (Or blue to orange,)
This is where light behaves very differently from pigment. Note that if you mixed orange and blue pigment, the path would pass through neutral, however, yellow is the opposite to blue in light.
Also note that Green light mixed with Red light will produce Yellow light which is very different from pigment.

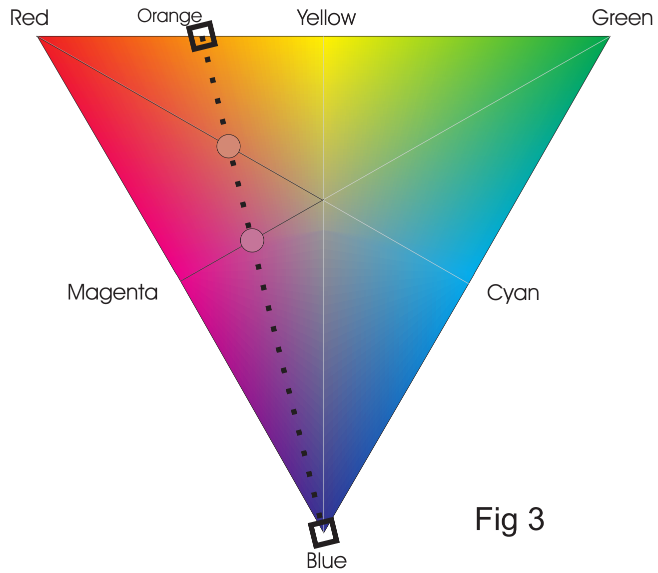

Fig 3

To calculate the hue at any particular point along that path, draw a line from the centre through the point and extend it until it touches the outside edge of the triangle. This will show you the hue of the colour at its highest chroma.

<u>Fig 2:</u> Shows two points along this line.
The first is a Red-Grey, and the second is a Magenta Grey.

Imagine you wanted to paint a sky where the colour near the horizon is orange and the colour up higher is blue.
If you wanted to mix a series of colours between orange and blue, you couldn't just mix orange and blue pigments because light doesn't behave that way.
If you refer back to the pigment mixing triangle you will see that Red and Blue are in the same sub-triangle. That means that you <u>can</u> mix those colours together without loss of chroma.
Also, Red and Orange are within the same sub-triangle.
Because Red is adjacent to both sub-triangles, (it belongs to both sub-triangles), it can be used as a bridging colour.
Therefore, if you mix a Red-Grey, you can use it to mix into the Orange as well as into the Blue.

<u>Subtractive Mixing Triangle</u>

Use this when working out what colour something should be under a coloured light sources.
An example would be skin that is lit by blue light from the sky.

This works in exactly the same way as the light mixing triangle except that it is upside-down. You can plot colours in the same manner as the light mixing triangle, and indeed you will get the same hue, but this will give you a better idea of the resulting chroma.

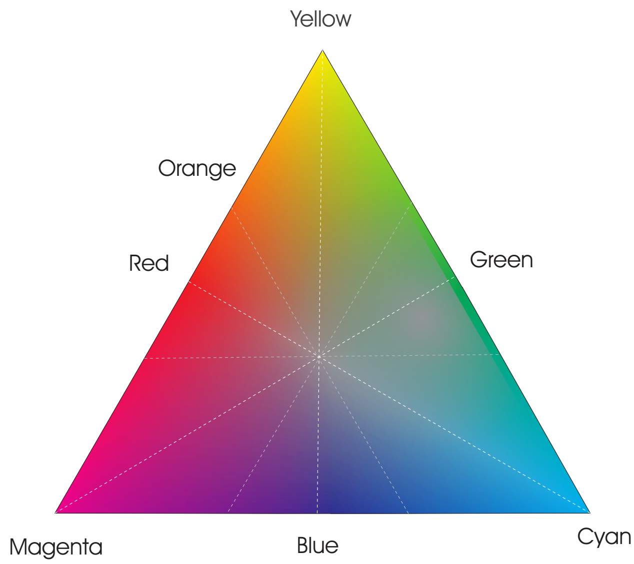

Fig 4

<u>Appendix:</u>
For those of you that are interested in knowing why these triangles work and why additive and subtractive are different, then I'll try to explain.

Adding Yellow and Cyan in the light mixing triangle (previous page) would give you a low chroma green. (A light green).
Why? Yellow is a combination of Red and Green light, and Cyan is a combination of Blue and Green light. So what we are actually doing when adding these lights is adding:
(Red + Green) + (Blue + Green). Or (*Red* + *Green* + *Blue*) + Green
As Red + Green + Blue = White, we can re-write the above equation as:
White + Green
So we get light green and it confers with the triangle calculation.

But notice in the Subtractive Triangle that there is a straight line between Yellow and Cyan, giving you a *fully saturated* Green.
This is because, light gets absorbed rather than added.
Say we have a Yellow light illuminating a Cyan object.
That is the same as saying our light source is Red + Green, and the object is Blue + Green.
The object *reflects* Blue and Green, and *absorbs* Red.
Therefore, it absorbs the Red component from our light source and reflects the Green.
As there is no Blue in the light source, the only colour reflected is Green.
This also confers with the subtractive triangle calculation.

But this subtractive model is far from perfect and will give a false result in *extreme* cases.
For example, the mid point between Red and Blue is Low chroma Magenta.
But, if you had a primary Red light (full saturation), illuminating a primary Blue object (also full saturation), the result should be black. This is because the Blue object reflects nothing but Blue and so can't reflect any of the Red.
In real life however, it would be very rare to have such intense colours, and anything less intense will give you a low chroma magenta.

These systems will allow you to calculate the hue very well, the chroma to a lesser degree, but not values.