

Designing a nice XML colour matrix for EDHM

By CMDR GeorjCostanza (psychicEgg on the [EDHM discord](#))

Overview

I usually start designing a HUD with the XML colour matrix before applying custom colours to anything else, since your XML will be on your panels, and you'll be looking at them quite a lot.

So here's a quick XML colour matrix lesson.

Background Information (but still important)

Each colour pixel on the screen consists of a mix of three primary colours: red, green, and blue (RGB).

This is different to paint colours where the primary colours are red, blue and yellow .. so if you're a non-PC artist you'll need to 'unlearn what you have learned'.

Each of the screen RGB colours have a range from 0 to 1, where 0 is off, and 1 is the highest brightness/intensity.

So RGB(1, 0, 0) = full strength red, all other colours off, and looks like this:



and RGB(0.5, 0, 0) - half-strength red - looks darker, like this

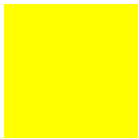


So with these three colours, RGB, we can combine them to make any other colour.

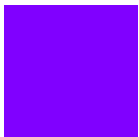
For example, pink is equal strength red and blue, RGB(1, 0, 1)



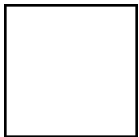
Yellow is equal strength red and green, RGB(1, 1, 0)



Purple is full-strength blue and 50% red, RGB(0.5, 0, 1)



White is full strength of all colours RGB(1, 1, 1)



At the following link is a chart that shows the output from all the different RGB colour combinations:

<https://www.tug.org/pracjourn/2007-4/walden/color.pdf>

Now you know the basics of screen colour theory, you can apply that to the XML matrix.

The Elite XML

So what's the dominant colour on the Elite HUD? **Orange**

The RGB of orange is red, and approximately 50% green, RGB(1, 0.5, 0)



You'll find that particular colour in the linked PDF, at the bottom of page 10 in the left-hand column.

Just a fun fact, the base Elite orange is RGB(1, 0.4352, 0), but it varies across elements.



So now we know the RGB combination that dominates the Elite HUD, what colour channel is the strongest?

Red is the dominant colour because it's the dominant colour in orange RGB(1, 0.5, 0)

Now let's look at the XML matrix.

The XML matrix defines a relationship between multiplier values from an external source (such as the *GraphicsConfiguration.xml* file, or our *XML-Profile.ini* file), and the colour channels in an image.

That is, the numbers in the matrix represent multiplier values that will be applied to the colour channels in the current image, providing an adjusted colour output.

Formula:

Custom RGB values * current image RGB values = output RGB values

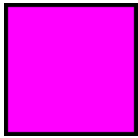
For example, imagine we had a white square, which has a RGB(1, 1, 1)

But we decide we want that white square to be pink.

So, in our *colour.ini* file, we would define our Pink Square as RGB = (1, 0, 1)

Then when we apply the formula above:

Custom RGB values (1,0,1) * White Square (1,1,1) = Output (1,0,1) = Pink Square



That's essentially how an XML file works

So the standard XML matrix you'll find in *GraphicsConfiguration.xml* (elite-dangerous-64 folder) is:

	Multiplier values (from external file)				
	R	G	B		Output
Red Channel	1	0	0	=	
Green Channel	0	1	0	=	
Blue Channel	0	0	1	=	

Each value represents the RGB multiplier for each colour channel in the image (each horizontal line)

So the default matrix simply multiplies the matching colour channels in the current image by 1 (and therefore, there's no change to the image).

But that's easier to understand if you see it in action.

Recall red is the dominant colour channel in Elite orange RGB(1, 0.5, 0), so let's **define our red output by changing the values along the top line of the XML matrix.**

For example, if we wanted **pink** to be the dominant colour on our HUD, let's set the red channel multiplier (top line of the XML) to RGB(1, 0, 1)

	Multiplier values (from external file)				
	R	G	B		Output
Red Channel	1	0	1	=	
Green Channel	0	0	0	=	
Blue Channel	0	0	0	=	

(click the link to see it in action)

https://arkku.com/elite/hud_editor/#theme_1_0_1_0_0_0_0_0_0

Maybe we want purple to be the dominant colour, so we set the red channel output to RGB(0.5, 0, 1)

	Multiplier values (from external file)				
	R	G	B		Output
Red Channel	0.5	0	1	=	
Green Channel	0	0	0	=	
Blue Channel	0	0	0	=	

https://arkku.com/elite/hud_editor/#theme_0.5_0_1_0_0_0_0_0_0

Or if we want dominant green, set the red channel output to RGB(0, 1, 0)

	Multiplier values (from external file)				
	R	G	B		Output
Red Channel	0	1	0	=	
Green Channel	0	0	0	=	
Blue Channel	0	0	0	=	

https://arkku.com/elite/hud_editor/#theme_0_1_0_0_0_0_0_0_0

So when designing your XML, choose your dominant colour first, and put it along the top line of the XML matrix (red channel), and zero all the other channels.

For our example, let's go with a nice light blue colour RGB(0, 0.5, 1) = 0% red, 50% green, 100% blue

	Multiplier values (from external file)				
	R	G	B		Output
Red Channel	0	0.5	1	=	
Green Channel	0	0	0	=	
Blue Channel	0	0	0	=	

https://arkku.com/elite/hud_editor/#theme_0_0.5_1_0_0_0_0_0_0

Next, we need to decide what our secondary colour is going to be. Remember, the green channel is the secondary colour on the Elite HUD (full red + 50% green = orange).

So, on orange elements, our green channel output will be weaker than our red channel output (because, on average, green is 50% weaker than red in an orange image).

However, on green elements, this green channel custom colour will become the dominant colour (green elements will swap to the new colour).

Now let's configure our secondary channel, and I think I'd like a nice mix of light blue (dominant) and pink (secondary) RGB(1, 0, 1)

	Input (from external file)			
	R	G	B	
Red Output	0	0.5	1	
Green Output	1	0	1	
Blue Output	0	0	0	

https://arkku.com/elite/hud_editor/#theme_0_0.5_1_1_0_1_0_0_0

So everything that was green before (or has a green channel stronger than the red channel), now becomes pink.

But note, since orange consists of both red and green, your green channel will also contribute to your dominant HUD colour, but to a lesser extent than your customised red channel.

In this case, it will add a little pink to our light blue.

In the example below, notice how the reputation bar now has a bit of pink added to it?

Elite orange (100% Red channel, 50% Green channel, 0% Blue channel)



100% light blue (on the red channel)



100% light blue (on the red channel) + 50% pink (on the green channel)



(I've actually added the pink in photoshop to accentuate the effect)

That's why XML matrices are so complicated, as the colour outputs mix together in the same proportions as the original colour channels. So our orange elements now have 100% light blue RGB(0, 0.5, 1) plus 50% pink RGB(1, 0, 1).

Now the third line in the XML is the blue channel, and in the Elite HUD, the blue channel is mostly zero for all orange elements. Therefore, this blue channel line in the XML matrix won't have much (or probably no) effect on the orange elements on the HUD (anything multiplied by 0, = 0)

However, the blue channel will have an effect on other elements that are white (an equal mix of all colour channels), and will be the dominant colour on blue/cyan elements, such as the shield and certain icons.

Have a think about how you want your blue elements to look, and let's say we want them to be yellow RGB(1, 1, 0)

	Multiplier values (from external file)				Output
	R	G	B		
Red Channel	0	0.5	1	=	
Green Channel	1	0	1	=	
Blue Channel	1	1	0	=	

https://arkku.com/elite/hud_editor/#theme_0_0.5_1_1_0_1_1_1_0

Notice how the orange elements weren't influenced at all by this blue channel change, because the blue channel is zero in the orange elements.

But also notice some elements have become yellow (such as the shield and the optimal speed indicator on the speed bar), because the blue channel is dominant in these elements.

You can also use negative numbers if you want to strengthen a particular colour (click the range button on the bottom left of the screen in the arkku editor).

For example, if we wanted our yellow colour to be stronger in the blue channel, let's reduce the blue output by 50% (-50) in the blue channel:

	Multiplier values (from external file)				
	R	G	B		Output
Red Channel	0	0.5	1	=	
Green Channel	1	0	1	=	
Blue Channel	1	1	-0.5	=	

https://arkku.com/elite/hud_editor/#theme_0_0.5_1_1_0_1_1_1_-0.5

Designing a good XML that makes you happy usually requires time and experimentation, but hopefully the above information will steer you (slightly) in the right direction.

In summary:

- Start with your primary HUD colour and put that RGB on the top row (red channel)
- Choose your secondary colour on the second row (green channel), which will mix with your primary colour in a weak way, but will dominate any element with a green channel
- Finally, choose your blue channel RGB, which will be the dominant colour for blue elements