

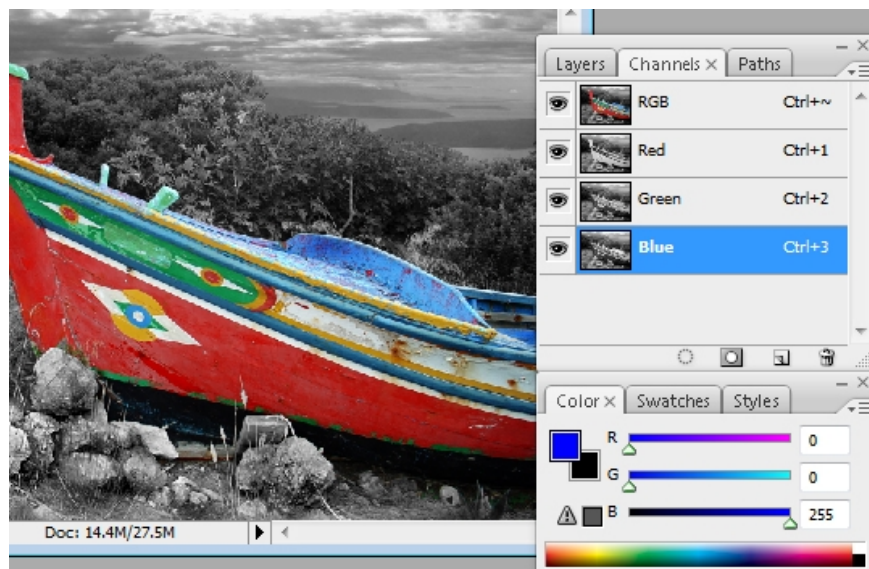
A quick guide to colour depth

by Mark Wallman

This is a simple explanation about colour depth and terms that are bandied about. A long time ago computers could only display limited colours. Nowadays they can display 16.7 million colours. This is called 24 bit on your graphics card. You might have noticed that there are generally three options on your windows graphic card. 16 bit, 24 bit and 32 bit.

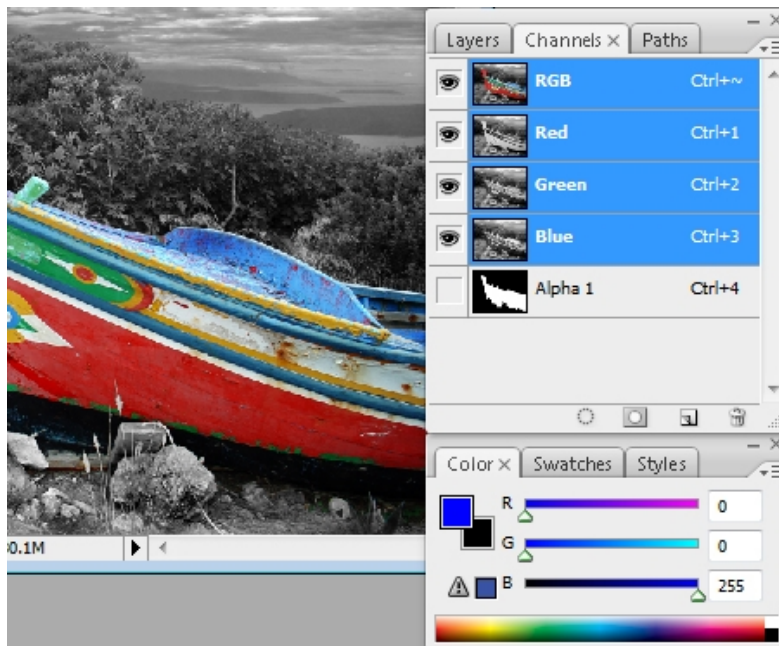
So if everything I said is true and computers display 16.7 million colours which is 24 bit what on earth is 32 bit?

Well in order for your graphics card to do transparency effects it uses 32 bits. To understand this better download a JPG from the internet and load it in Photoshop and bring up your channels window. You should see three channels, an R, G and B (red, green and blue).



Here is a picture I made. You can see that there are three channels. The top one "RGB" shows you all the three channels combined into one.

If you add a fourth channel this will become what is called your alpha. Take a look at the image below and you can see I have made an alpha for the boat.



Alphas can be used for transparencies and mattes. JPEG can only store three channels so If you wanted to save your new four channels you would have to save in a format like tga, PSD, Tif or EXR.

If I saved the above image and took it into AfterEffects you would see the boat but the background would be transparent as AfterEffects would read the alpha and assume the black is transparent.

Right now I'm going to confuse the whole issue. Nowadays images like JPG which we know display 24 bit colour are often called 8 bit...

"What" I hear you cry, "I thought you just said they are 24 bit so what on earth are you calling it 8 bit for".

If we go back to our untouched basic JPG downloaded off of the internet and have another look at the channels (r,g,b) there are three. Each channel holds 8 bits of colour information.

$8+8+8=24$.

This is where we get our 24 bit from. When people say 24 bit they mean the actual amount of colours your can see on screen that the image is displaying.

adding another channel such as our alpha that you cannot see but gives the image extra information takes our 24 to 32 giving us 32 bits.

"Hooray" you say. "I've got it."

Well this all used to work quite nicely to talk about computer images. Not any more (sorry).

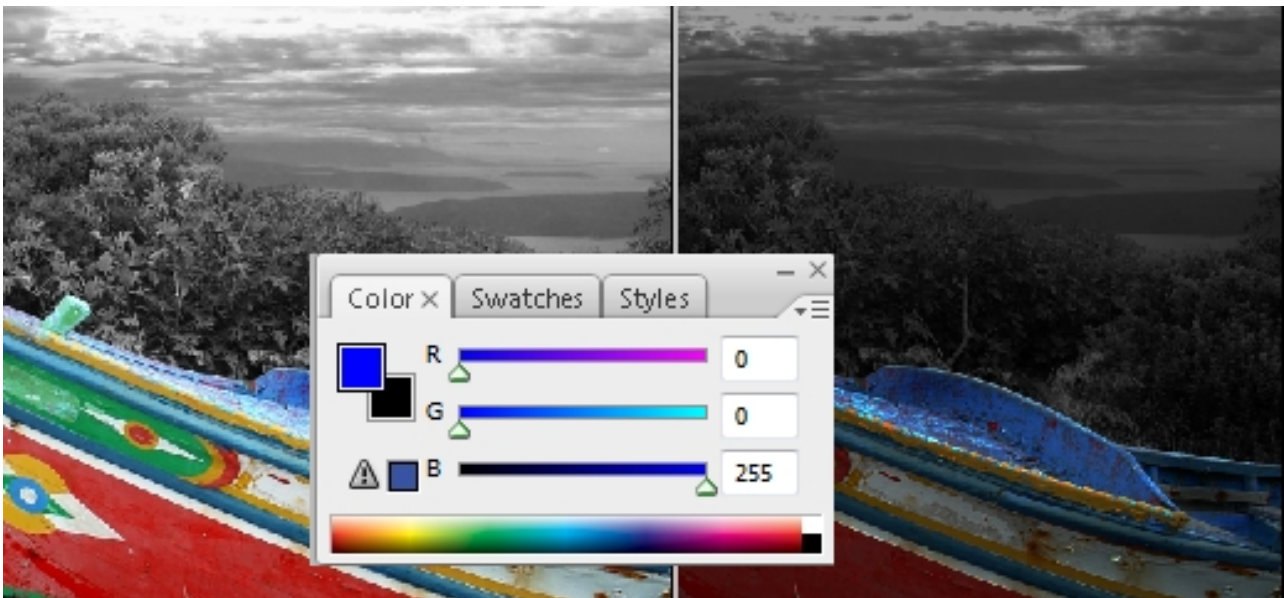
Nowadays modern formats such as EXR can have more than just alphas so you can have more than four channels. If you were rendering a 3d image you can for example you have your R,G, B and Alpha channel but also loads of extra channels such as specular, reflection, occlusion, shadow, coloured mattes and so on. This is why calling an image 24 bit (8+8+8) is a bit old hat. We have to really talk about the bit depth per channel to get an accurate idea of what the image is. So your JPG image can really be called an 8 bit image.

So what is beyond 8 bit?

Lets start with a JPG image.

If you have ever tried adjusting the colours of your JPG in Photoshop or used the colour picker you will see that the values range from 0 to 255 giving you a choice of 256 levels of change in each channel.

There are many reasons why you would want more than 256 values to choose from. Let us suppose that you want to change the colour of your over bright sky on your lovely JPG image or you want to make a dark corner brighter.



If we take the first example and assume that our sky is just white, lowering the brightness will not help as the sky just goes a mushy grey. Try the same thing on highlights and you get the same result.

Once the image becomes darker the top of the clouds become darker. The trouble is there is no detail in the brightest part of the clouds so when we darken them it just turns to flat grey and rubbish. Have a look at the top part of the image where the cloud is the brightest. Imagine if this was a highlight on someone's face and you darkened the image. It would just turn into a flat block of colour.

Have a look at the image below.



Here I have lowered the brightness of the JPG image but oh dear, look at the sky there was not enough information in the JPG and the sky has got are really odd looking banding on it.

This is where we get into what is beyond 8 bits per channel.

Lets have a look at an image that has 32 bits per channel. Below is a EXR 32 bit image which Photoshop sees it as 32 bits per channel.



Now lets take this image and make it a bit darker, see below.



And finally lets look at what would have happened if this image was 8bit (like a JPG), see below.



Look at the towel, light and wall. Horrid indeed.

This is the big advantage to using images that have a higher bit depth than 8.

So now you know all of this you might be thinking “apart from compositing how does this affect me”.

Well even in computer games images with a higher bit depth than 8 are being used to help give dynamic lighting effects. It is everywhere nowadays, games, films, TV and the internet.

A big reason for using 32 bit and 16 bit images is for displacement textures generated from packages such as Mudbox and Zbrush. If you used 8 bit images for displacement textures you would see funny stepping in the rendered model. 16Bit images will give you a nice smooth displacement map.

You are probably wondering how to make these kind of images for normal image and render manipulation. That will be for another guide. For starters though most modern digital cameras can use the RAW image format which holds extra colour information compared to JPG (they are 12bits).

Included with this PDF is the table EXR file along with a JPG version so you can have a play and see the difference.

-All pictures taken by Mark Wallman-
-Software used:- Photoshop CS3