

ROSE BRUFORD COLLEGE  
SOUND & IMAGE DESIGN

## **Desktop Publishing Unit**

---

# **BIT DEPTH**

**By Dane Ramshaw**

---

21st February 2000 Semester 2a - Course Year 1

For (Tutor) Matt Ottewill

# Contents

---

Page 1	<b>Part I - Introduction &amp; Bit Depth</b>
Page 2	<b>Part II - Storage &amp; Palettes</b>
Page 3	<b>Part III - Comparisons between formats</b>
Page 4	<b>Part IV - Alternative Methods</b>
Page 5	<b>Part V - Printing &amp; Photoshop</b>
Page 6	<b>Bibliography</b>

## Introduction

In order for me to fully explain '**bit depth**' and its uses, I will firstly present a sound definition of the term 'bit'.

As we all know, computers are controlled purely by a series of 0s and 1s. This code is known as '**binary**'.

A bit is in essence, simply a switch which has two positions, either on '1' or off '0'. This stems from positive or negative electrical charges, (as opposed to decimal or hexadecimal).

Computers deal with chunks of information known as bytes. A byte is a group of 8 bits, all of which can be either on or off. Each bit in a byte has a value twice that of its neighbour.

Therefore, the bits in a byte have individual values of:

**1, 2, 4, 8, 16, 32, 64, and 128.**

If all 8 bits in a byte are on, they then produce the largest 8-bit value, i.e. **255**.

For example, 2 bits can be arranged in four different ways,

**00 01 10 11**

In the case of an image, this could be used to provide a small palette of four colours or shades. e.g. four shades of green.

## Bit Depth

Bit depth also known as pixel depth or colour depth - refers to the amount of colour information used by an image.

Greater bit depth, i.e. more bits of information available for each pixel, makes more colours available, and thereby the digital images produced are capable of depicting a more accurate representation.

A pixel with a bit depth of 1 has two possible values, e.g. black and white. A pixel with a bit depth of 8 has a full byte's worth of possible values, i.e. 256.

Whereas, a pixel with a bit depth of 16 dramatically leaps to around 32 thousand, and a pixel with a bit depth of 24, has approximately 16 million possible values!

Bit depth	Colours contained
1	2
2	4
3	8
4	16
5	32
6	64
7	128
8	256
16	32,768
24	16.7 million

Prevalent values for bit depth, have a range varying between 1 to 64 bits per pixel.

## Storage

As with resolution, bit depth determines file size. The higher the depth, the greater the file size.

Do not be confused with the amount of actual colours within an image. You could create an image which in fact only utilises 25 colours, but you may set up the image to be 16 bit, therefore, having thousands/millions of possibilities.

This would obviously result in the file size being far greater than necessary.

A thorough understanding of bit depth is vital to any graphic or multimedia designer. It is with such knowledge that One can control One's project's appearances in both print and different end user systems.

This is also extremely important for web designers. Due to the need for swift and easy file transfer, file sizes are kept to a minimum for use on the Internet.

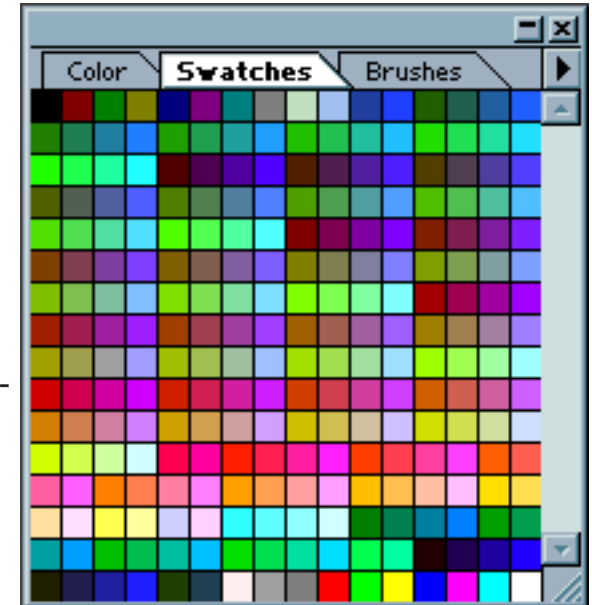
As we have already learned, a pixel with a bit depth of 8, carries 256 potential values, this is considered by many to be the standard form of graphics for use on the web, and is known as '**Indexed Colour**'.

These are the colours available for the standard web graphic format, '**GIF**'.

However, there is one clear difference between simply making an 8-bit, '**indexed**' colour image for general use, and making one which is '**Web Safe**'.

This is due to the fact that the three main computer operating systems, i.e. **Windows**, **Mac OS**, and **UNIX** have only **216** colours in common.

Therefore, to make an image which will display the same on all three systems, One must choose from the common '**Web Safe**' Palette.



## Palettes

**Indexed Colour** shares many similarities to '**True Colour**' or 24 bit colour, but with one important difference.

Although the full 24-bit colour range (of 16.7 million colours) is initially available, you must then select from this an 8-bit "**palette**" (CLUT, 'Colour Look Up Table', on Macintosh) of 256 colours. The image must then be created exclusively using colours selected from your chosen, 'Indexed' palette.

In many cases the final result will not be drastically inferior when compared to a true 24-bit image. Particularly if the image does not need to contain a great deal of subtle shading, e.g. skintone.

## **Postive Apects Of Indexed Colour**

- Images have the advantage of being smaller on disk because they are 8 bit.
- Indexed colour, is the colour mode of the GIF files found commonly on the Internet.
- Cross operating system/web compatibility, (216 / 256 colours).
- Compatibility between systems with differing hardware capability.

## **Negative Apects Of Indexed Colour**

- If the image you are trying to produce contains more than 216/256 colours, the end result will become increasingly inferior to a true colour counterpart, in relation to the true number of colours required.
- Certain functions, within high-end art packages, e.g. Adobe Photoshop, require a minimum bit depth of 16. Functions such as 'Anti-Aliasing' and 'Smudge' would necessitate the creation of colours not available in the 'Indexed' palette.

## **Postive Apects Of True (24bit) Colour**

- The image will be a 'true to life' representation.
- A Palette need not be chosen.
- Ease of editing, as all functions of High-end art packages should be available.

## **Negative Apects Of True (24bit) Colour**

- Large file size, this will result in slow Web downloads, and may also be a factor when loading from CD-ROM.
- No cross operating system/web compatibility, (216 / 256 colours).
- No compatibility between systems with differing hardware capability.

## Alternative Methods

Although an indexed image may be the final desired result, all initial design and editing procedures can be undertaken in 24-bit colour, and then converted to contain only 256 colours. This can be achieved either within Photoshop, or by the use of another application, e.g. Macromedia Fireworks.

Programmes such as Fireworks, or Adobe ImageReady can process a series of images, and then create a global palette in order to comply with the designer's specifications.

Another colour model is Grayscale, which consists of 256 shades of grey. This mode can be useful as it offers images of high quality, whilst utilising a comparatively small file size.

If so desired, the two colours from which the shades are drawn, do not necessarily have to be black and white.

This is called 'duotone' in which the designer has chosen alternative colours, e.g. purple and white.





## Printing & Photoshop

**RGB** (Red Green Blue), is the colour model for screen (a subtractive model), whereas **CMYK** (Cyan Magenta Yellow Black), is the colour model for print (an additive model).

A common misunderstanding amongst Adobe Photoshop users, is that RGB True or 24-bit colour, is referred to as 8-bit. This is due to the fact that Photoshop separates the respective colour models into channels.

**RGB** has 3 channels, Red, Green and Blue, i.e. 3 channels x 8 bits = **24 bits**.

Whereas, **CMYK** has 4 channels, Cyan, Magenta, Yellow and Black, i.e. 4 channels x 8 bits, = **32 bits**.

Photoshop can provide up to 16 bits for each channel in an image, which can allow greater subtlety when altering colours. However, One should then convert back to 8 bits per channel for general editing purposes.

Another factor that graphic designers must be aware of, is the probable discrepancy between screen colour and print colour.

In order to be sure of the outcome, One must first employ the use of a tint chart. Each box contains a unique colour, and carries a unique value. This number can then be entered directly into the art package.



## **Bibliography**

### **Books**

Campbell, A. *The New Designer's Handbook*. London, UK.  
Publisher: Little, Brown & Co. 1993.

Bale, D. *Computer Science*. Singapore.  
Publisher: Longman Singapore Publishers. 1997

### **Internet**

URL: [http://macenroe.cs.wits.ac.za/training\\_course/part5/photoshop.html](http://macenroe.cs.wits.ac.za/training_course/part5/photoshop.html)