What is Digital Graphics Technology?

Produced on computers, digital graphics are everywhere, from the picture on your coffee mug to the logo on your T-Shirt. While there are so many areas to discuss, I want to take you through the application of digital graphics in computer games and the technology behind it all.

Graphics today in games are getting better and better though obviously, not all graphics look the same. This can be due to the artistic style that the game uses. A common artistic style is photorealism which you can see in games such as Crysis 2 and Mass Effect. Photorealism is a style in which the artist is trying to make the scene/character as realistic as possible; as close as they can get to an actual photograph. Mass Effect is a good example of a game that shows this. Take a look at some of the characters to see what I mean.

Ever since the beginning of the Mass Effect series, the default male Shepard was designed based on a Dutch model named Mark Vanderloo.

Miranda Lawson is another example; even though the character is slightly different due to her black hair, the character was based after the character's voice actress, Yvonne Strahovski through her facial features.
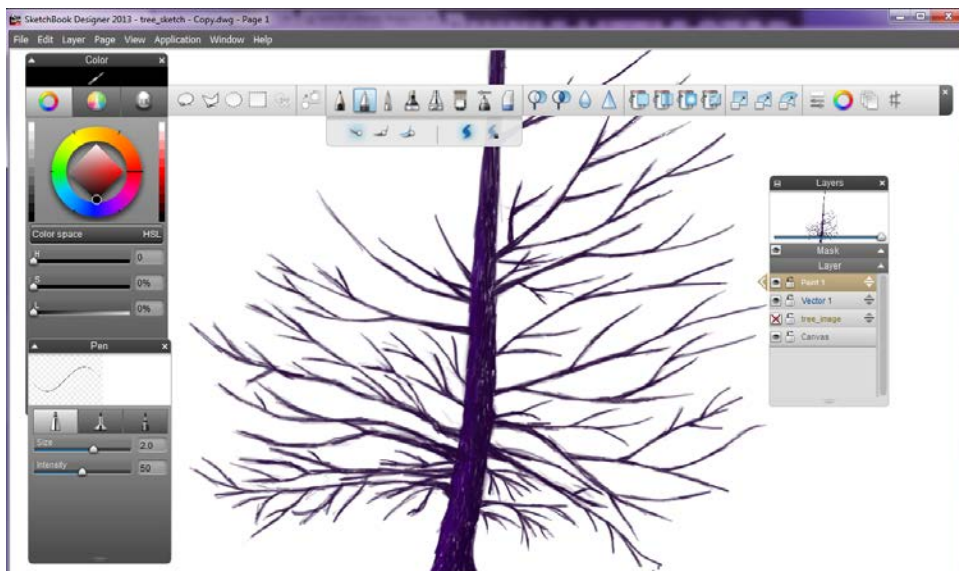
A very different artistic style is cel-shading; this is a type of non-realistic rendering designed to make the digital graphics of a game appear hand-drawn or can give the graphics a comic book appearance. Cel-shading first appeared in a video game called Doctor Hauzer in 1994 but it didn't gain much attention at this point. The style was noticed a lot more in 2000 when Fear Effect was released for the PlayStation.

Even now, cel-shading is still used in games. I think one that a lot of you will know is the Borderlands series. Now if we compare the Borderlands 2 character, Salvador with the Fear Effect image previously, you can see that even though it is the same artistic style, it can be interpreted into different variations depending what kind of game you are aiming for. The Borderlands character shows a hand-drawn style clearer while Fear Effect is following more of a cartoon/comic book style.

I could obviously go on and on about the artistic styles of games but I would like to show one more to you which is exaggeration. This can be a popular and well-sought after style for many gamers; particularly when you are looking for a game that doesn't necessarily need to always be taken seriously. Exaggeration can also be applied into different areas of the graphics depending on the game. Manga and anime styled games tend to be exaggeration in the facial features and bodies of the characters; mainly the eyes, hair and figures of the characters. A game that would use exaggeration in a different way would be Devil May Cry, only this time it is the attacks and fighting style that is exaggerated.

If I were to ask you how the application of digital graphics applies to computer games, I can bet that the majority of you would automatically think of the graphics in the game itself. But how about we delve a little deeper so that we're looking more at the pipeline? Concept art happens long before the game is created. It is the concept artist's work that is passed on through the pipeline so that the game can be produced. But with the industry being so advanced, it's not all going to be produced on paper. Digital graphics can be incorporated into concept art through the use of tools such as graphics tablets which can also act as your computer's mouse but gives you the freedom of a pen. Of course, to be able to produce high standard concept art, you obviously need to have the appropriate software. I will touch on this a lot more later on in the article but to give you an idea, a great piece of software to use for drawing would be something like Sketchbook Designer. As demonstrated on the left with a piece of my own work, the software allows you to produce drawings at a high standard and offers you the tool needed such as erasers, different types of media and colour and attribute editors.

Another area of computer games that digital graphics is applied to is the promotional materials of a game. In order to increase the interest of the public, a game will need to produce material that advertises the game in a good light; especially if the game is brand new with no previous versions. This can be done in various forms which will obviously depend on budget and what the company is willing to spend. Different software such as Photoshop can be used to create advertising posters. Digital graphics are also needed to create the case cover of the game. Software like Photoshop allows you to take the concept art from the game and edit it whether that be combining it to other pieces of concept art or changing the colouring of the images entirely. On the left, I've demonstrated this with a piece of my own assignment work; I had to create a case slip cover for the game I was creating and place it on a template of the case. Just like companies can do with their covers, I used Photoshop to tint the entire front cover blue and added text over the top and used a brush to paint the lightening on myself. Doing this changed the entire look of the cover which shows how digital graphics software can be used to change images round to make them suit the style of the game.

The resolution of an image is an extremely important part of digital graphics. The resolution refers to the number of pixels in an image. The quality of an image depends on how large the resolution is. Pictures with a higher resolution are of a better quality than those with a lower resolution.

Looking at the example above, we've started off with a 10 by 10 resolution image of the letter 'A'. As you can see, it's very pixelated and jagged. The second A has been bumped up by 5 to a resolution of 50 by 50. It is still looking jagged but the spikes on the edges are smaller. The next image has been doubled to a resolution of 100 by 100. As you can see, the more we increase the resolution of the image, the clearer it becomes. As shown in the last image, it is possible to work around the resolution by using a technique called 'anti-aliasing'. This clears up jagged lines in text and smoothes out angled lines in images. You also have to consider what resolution you need depending if the graphics are remaining on the computer screen or if they're being printed. If the graphics are remaining on screen, the resolution can be kept lower at 72 PPI. However, if the graphics are being printed onto paper, then the quality needed to be higher at a resolution of 300 PPI.

While some of you may not have heard the words 'picture element' before, it may be more familiar that you think. Picture element is where the word 'pixel' came from. As technology has improved, it has allowed the size of a pixel to become smaller. The picture element is the smallest part of an image and the number of picture elements that are present in monitors of computers and televisions are typically used to describe the quality of the monitor. When showing graphics on screen or printing them onto paper, the higher picture element count that is now available means that we can produce images that are smoother and have a better quality. As games are now produced in 720p resolution, this means that the digital graphics have to be produced so that they can work effective on this resolution.

As I promised earlier, I want to look at the software used to produce digital images. A very common piece of software is Adobe's Photoshop which allows photo manipulation. Photoshop is popular in digital graphics for creating many things such as the promotional posters and game covers that I mentioned earlier to textures. The software allows designers to create textures for games; a brick texture for example. Obviously you have to consider the software that the game is being made in when creating the textures. For example if a game is being created using the Unreal engine, to be able to import textures from Photoshop, the texture size has to have a square ratio. This means that the sizing has to be to the power of 2 e.g. 1024px by 1024px or 512px x 512px. When creating textures, changing the colouring to black and white allows you to create bump maps to make the texture appear 3D and specular maps that gives the texture a shine when applied. It is also best to save the textures as a different file type such as TGA (Targa) though if you are working in Photoshop, it is a good idea to save a copy as a PSD so you have a version in which you can still edit the layers. Adobe Illustrator is another piece of graphic manipulation software that is used regularly but is better for vector art rather than raster art. But what are the differences between vector images and raster images?
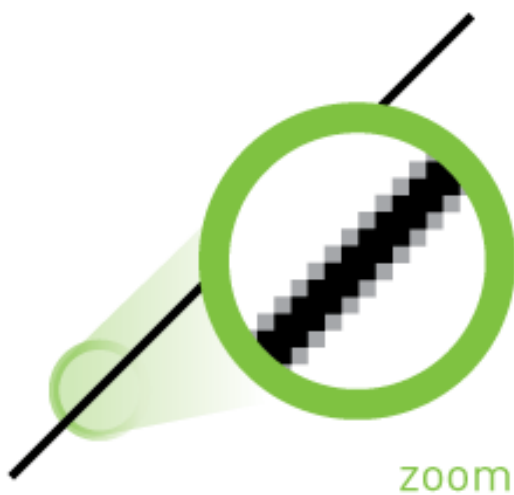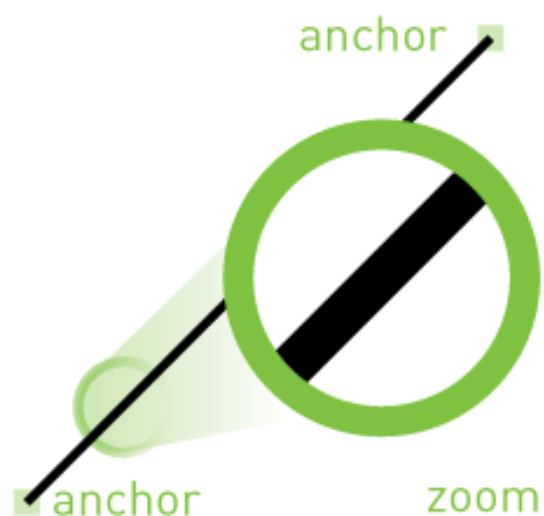
For a start, vector art can be scaled to whatever size you require. The effectiveness of this is that you can design some digital graphics in a large scale but if it is required to be smaller for the product, it can be shrunk without removing any of the quality. The difference with raster images is that they have a fixed resolution so it becomes pixelated when it is scaled; the more you scale it, the worse it becomes. An effective thing about Photoshop and Illustrator is that you can create your graphics in either software, depending on which one will produce the best graphics and the images can be opened up in the other software.

Something that often has to be done with graphics is compression. There are however, two different types of image compression. These are called lossless and lossy compression. Lossless compression preserves the file's original data; allowing you to keep the original quality of the image. Examples of lossless file formats are RAW, BMP and PNG. Lossy is different from this as some of the data is lost when the file is converted to another format. Examples of lossy file formats are JPEG and GIF. Most of the time, logos tend to be vector images because this means they can be used on posters or shrunk down for business cards without losing the image quality. However, game companies sometime take the game logo which is a vector image and convert it to a high resolution raster image in order to save on space.

Optimisation is also important for graphics as it means you can use the file that is compressed yet at a visually acceptable standard. Optimising the graphics for a game means that you can save space so the game won't have to spend as long loading the graphics of the game. Image bit depth is important for graphics as this refers to information on the image's colour. An image can store more colours as the image's bit depth gets higher. For example, a 1 bit image can only show two colours; black and white while an 8 bit image can store 256 colours. Going even higher, a 24 bit image can show about 16 million colours. If you change the image bit depth, you also change the size because as the bit depth increases, each pixel in the image has to store more colour information. Image dimensions are simple enough. These are basically the width and height of the image. This tends to be measured in pixels but some software such as Photoshop allows you to measure it in centimetres and inches. All these different method of compression and optimisation makes it easier to store images and this is vital for games due to the large number of digital graphics that are often needed.

To capture images, different tools can be used such as cameras and scanners. A camera can be used to capture photos of a reference which can then be uploaded onto a computer and be edited as it is needed. A scanner can be used to scan a game's concept art onto a computer, allowing the designer to have a digital copy and it can be edited; whether that would be in Photoshop or Sketchbook.

While you can see that digital graphics play a huge role in games today, you can also see how much work is required to make them happen. Digital graphics are needed constantly throughout the pipeline; from the concept art to applying it to the game itself. I think that the different styles of digital graphics will allow graphics to continue expanding so I expect that there will be new technologies appearing and different methods of editing graphics for games.

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