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## Assignment Cover Sheet

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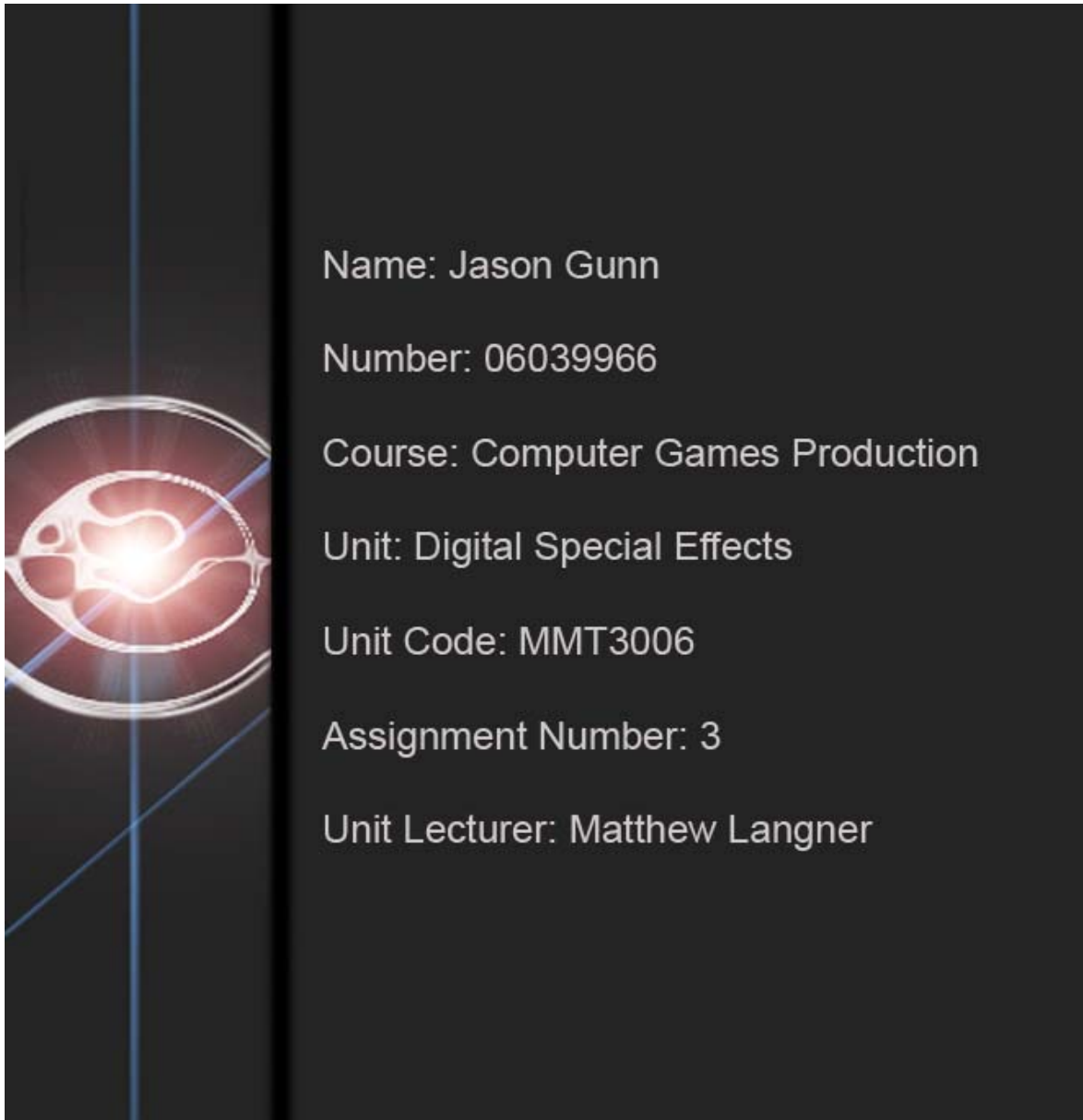
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## 1. Chroma Key Technologies

Chroma Keying enables the removal of background data from images and video and allows for it to be replaced by virtual assets, it is used in a variety of sources including TV, film and communication **Tetsuro, et al (2003)**. It enables for example an actor to be placed within a virtual world, and to enhance special effects. The RGB image data is encoded on the Y channel traditionally prevalent for use with blue and green screen technologies, this enables easier removal of background elements. Alternatives to Chroma Keying do exist, for example Luma key which simply detects the lighting differences between pixels, however due to the scope of the report this technology will not be covered in detail.

Traditionally the process of Chroma keying necessitates the need for blue or green screens as discussed further (**Grundhofer, A, 2008**) "*Blue screens and chroma keying technology are essential for digital video composition*" (p. 2). Blue and green screens come in many forms, for example paper, fabric, paint, TV studios and chromate, and each has its own advantages and disadvantages. For instance TV studios are expensive and have limited access but produce good results, while cloth is relatively inexpensive but produces poorer results due to issues, such as folds in cloth making keying less accurate.

As stated Chroma Keying has a wide range of practical uses, it enables an actor to be placed in the middle of a fire fight in a motion picture, or for a forecaster to be shown in front of the local weather forecast. The process involved in replacing the background is also known as composition, this takes assets from a variety of sources, and applies them to the footage. The produced assets comprise of a wide range of types, for example created 3D models and animations.

This technology is not without problems, lighting, clothing, and camera blur all need to be considered in the production of traditional footage as discussed further (**Vonolfen W, 1999**). Lighting for example can cause the background to only be partially removed, while incorrect clothing can cause parts of objects or actor to be mistakenly removed. However while these issues do exist Chroma Keying is an integral cog in the production of many compositions.

Due to the constantly advancing technologies involved in film, the process of Chroma keying is starting to become both easier and less problematic. Real time rendering as talked about further **Butler, D et al, (2003)** enables implementation of virtual backgrounds and the composition of assets to be achieved without the need for extensive post production, this for example has real life applications within Virtual Studios.

Some virtual studios as discussed further (**Grundhofer, A, 2008**) do not require the use of a blue screen, instead the actor is filmed on location, and via the use of projector technologies the background pixels are determined and removed. While this technology has great potential there are again issues, for example the removal of extremely bright or colourful backgrounds is still problematic. Real time Chroma keying is also taken one step further with the introduction of immersive virtual studios **Hideki, M. et al (2005)**. Traditionally an actor would not be able to see the location they were supposed to be in, however this technology projects a 3D environment around the actor delivering great potential for the production of media assets.

While real time Chroma keying is a powerful tool it is not always appropriate, ergo the necessity for post producing footage is introduced. This can be done in a variety of programs, for example Adobe Photoshop (**Adobe, 2008a**) which allows for the manipulation of still images, and frames. Photoshop is however not suited to moving images as each frame must be edited individually. Ergo alternative programs such as Adobe After Effects (**Adobe, 2008b**) tend to be more appropriate and powerful tools for use in post producing moving footage.

After Effects presents the user with a myriad of tools and functions for use in editing footage, in relation to Chroma keying the background can be removed in several ways, for example selecting pixels within a specific colour range, or brightness range. A variety of assets can then be introduced to the composition to create the final footage, for example a 3D background, and an image based foreground. There are again issues with the use of After Effects, mainly pertaining to the manual nature of editing. For example the user must continually adjust the colour range, and apply additional effects in order to produce an accurate Chroma Key. Dependant on the quality of the captured footage the use of junk mattes may be required, this is the process of masking out the background manually, and often requiring each frame to be edited to ensure a clean finish.

In summary Chroma Key technology offers great opportunities, allowing for the creation of a wide range of compositions. It has practical applications within many industries, and its technologies are constantly evolving and improving. However Post production involving Chroma Key can be a costly and time consuming process but also a worthwhile one.

## **2. Motion Tracking and Capture**

Motion tracking is exactly that a technology which tracks motion, this has multiple applications within films, game etc. In relation to film, motion tracking or camera tracking enables complex scenes to be constructed involving virtual camera pans and fake background assets. An example of this would be a distant tree, which as the camera moves stays in its original location.

Points, or (**Welch, G, (2002)** “Landmarks” are placed upon each frame of the footage, this enables the creation of data which can be tracked within the footage. These points are then animated to remain in the same location as the camera moves, ensuring that the scene appears realistic. The tracking technology allows for the integration of several assets including 3D, animation and still images. Motion tracking also involves a process known as stabilisation (**Adobe, 2009c**), this allows for more realistic effects to be produced. Stabilisation works by calculating the movement of the camera, and moving any tracked items in correlation, this is to ensure that they remain stationary in their original position.

While camera tracking allows for more creativity in producing footage, it also has some issues. These issues primarily pertain to the quality of the footage, and the complexity of the background location. Blurry, or low quality footage will present much more of a challenge in regards to implementing flawless motion tracking, this is due to elements being less clear and thus causing the placement of consistent landmarks to be more difficult.

As with most technologies motion tracking has many applications and is not just used to control cameras, it can record a multitude of motion for different purposes. Via the use of multiple cameras it is possible to track the motion of an actor (**Allen, B.D, 2005**), this motion can involve simple or complex movement. The captured motion can then be translated onto a computer, being used to scientifically analyse movement or to produce realistic animations. The production of motion captured animation allows for a much more fluid type of movement within 3D models, and can be useful to both the film and games industry. Motion can also be tracked via the use of a special suite which is covered in metallic balls, these are in essence the real life counterpart of the virtual landmark.

While this method of motion capture has many benefits, it also has some issues, these issues are mainly due to the quality of the captured data. While systems are set up to capture rapid movement, the tracking of such movement can prove problematic, although as motion tracking technologies advance so does the quality of captured data. A large proportion of motion tracking data used within animation needs cleaning up by a trained animator. While the data does make the animation process easier, it is not always completely accurate, thus movement can feel clunky or incorrect if it is not edited well. Motion tracking is also used with virtual studios to ensure that objects stay in the correct place with camera pans etc, while this is a useful tool it can also be problematic. For example objects can lose their original scale due to having been made specifically to be viewed from a single angle.

Motion tracking can also be used for more real world applications, for example the tracking and analysis of human motion for use within interactive robots as talked about further (**Jenkins, C. O, 2007**). This technology aims to give robots the ability to interpret human movement, in order to both understand it and to mimic it. Although this technology is still in the early stages of development it could ultimately allow for the creation of robots that animate in a very similar manner to human beings.

While problems with motion tracking do exist, the technologies involved in capturing the data are constantly improving. New methods and algorithms for capturing data are developed over time. For example the convex penalty method developed by **(Barron, C, 2003)**, this method aims to improve the accuracy of motion capture both for simple and rapid movement, via a process involving automatic estimation of the data **(Barron, C, 2003)**.

Many software tools exist for use in creating and editing motion tracking data, for example Autodesk Combustion, Apple Shake, Adobe After Effects and Autodesk 3Ds Max. While it is not possible to cover all of these in depth within the scope of this paper a more in depth look at Shake, After Effects and 3Ds Max will be presented.

Shake **(Apple, 2009)** is an industry standard compositing tool, allowing for advanced editing to be conducted. It offers a wide range of functionality including support for motion tracking data within the composition. While this is a very versatile software tool it is also exclusive to the Apple hardware platform, ergo causing it to be considerably expensive to implement.

3Ds Max **(Autodesk, 2009)** is a powerful tool used within both the film and games industry to produce an array of 3D assets from character models to building layouts. It also supports two main types of motion tracking technologies, motion capture animation, and camera matching. Motion capture animation as previously mentioned allows for the motion of a human, or other moving object to be captured and translated into motion data. This can then be applied to an animation ready model in order to allow for more realistic animations to be formed. Camera matching involves taking the motion tracking data from an edited piece of footage and translating into the X, Y and Z coordinates of the 3D environment. This then allows for the virtual environment to mimic the camera movements from the real footage, which can be especially useful when trying to create seamless transitions between real and virtual assets. The disadvantages however are that an understanding of the 3D modelling software and animation principles must exist in order to correctly animate models, another issue is that the software is relatively expensive.

After Effects is again a very powerful piece of software, allowing for the editing and composition of a wide range of assets. It allows for the tracking of objects using the landmark system in conjunction with masked footage to achieve this. This method of motion tracking is however manually achieved so can be less accurate than other software tools.

In summery motion tracking technologies have a wide range of useful application, within both research and entertainment. They allow for virtual assets to be added into a scene and realistic animations to be incorporated into 3D applications. Although the process involved can be expensive and time consuming it is worthwhile in many cases.

### **3. Composition and Post Production**

Composition is simply the process of compiling a range of media assets **Casares, J, et al, (2002)** images, audio, 3D models, etc into one space. The combination of assets and images (**Willis, P, 2007**), allows for a much more advanced edit to be produced. Post production is the process of editing footage after it has been captured, adding in special effects, filters, etc.

The process of post production necessitates that the required range of assets be gathered, and the planned editing applied within an editing program of the user's choice. Once completed the composition of results can begin, compiling them all together into the required format to produce the final edit. Post production and compositing allow for well developed and creative edits to be formed, however the major issue with this is the general expense and amount of experience required to successfully apply the required techniques.

However again the process of composition is constantly evolving, with the aim of making the overall editing process more user friendly, for example an automatic system is being created. This system automatically detects the file type of an asset and assigns it to a specific group, sorting assets onto a timeline and presenting the option to create chapters (**HUA, X, 2006**). Others are also trying to develop a more user friendly and easy to use real time composition system (**Arisona, M. S, 2006**)

There is also a range of software available for editing and compositing assets, two of which are the Adobe After Effects and Adobe Premier (**Premier Adobe, 2009d**), packages. Premier is useful for less visually epic productions allowing cutting and moving of footage and application of a range of filters. It is also useful for combining assets and editing basic audio settings for the final production. The software is relatively easy to use and offers a wide range of support in the form of tutorials, it is however an expensive software tool. After Effects presents a more in depth editing suite, allowing for the use of more advanced filters and effects, Chroma keying, etc. This software requires more advanced skills in order to use specific elements, however overall can be used to achieve some impressive results, it is again though very expensive so not viable for small scale productions.

In order to produce a good composition the creation of good quality and relevant assets is required. One example of the overall process involved in editing is in the production of “Dead Transmission” for the MTE3006 Assignment 2. This required the capturing of footage and audio assets, once this stage was completed the assets were imported and edited within both Premier and After Effects. Chroma key was applied to the footage to remove the background, and specific filters such as noise were added to make it feel more atmospheric. Once editing was completed the final composition was produced, visual and audio based assets were placed onto the time line, with images and 3D renders overlaid to add a sense of realism before producing the final render of the footage.

#### **4. Available Filters and Plug-ins**

A filter is a tool within a program that applies an effect to a file, in relation to multimedia this could be making footage black and white, or adding a film grain effect to it. While programs generally come with some native filters a large array of plug-ins tend to be available for many programs, both media based and not. A plug-in basically adds an additional element to a program. For example an Nvidia plug-in for Photoshop allows for the creation of basic Normal Maps for use within 3D modelling programs such as Autodesk Maya It is of course not possible to cover all available plug-ins within the scope of this report, as there are hundreds of plug-ins for dozens of programs, however three examples will be discussed further, Primatte, Colour Finesse and Cinoa 3D.

The Primatte Plug-in (**Onion, 2009**) for Adobe After Effects enables the complexity of the Chroma keying process to be reduced. It automatically produces mattes around an actor by selecting the background colour range and separating it. This could potentially increase the speed of post-production and allow for a much cleaner key to be produced.

The Color Finesse plug-in. (**Koppelman, C, 2006**) for Adobe After Effects presents an array of colour tweaking options. It allows for fine tuning of an images colour, which in turn allows for a more realistic looking final production. This offers further functionality to the inbuilt colour filters of After Effects, which gives the editor more power over the editing process.

Finally a look at Canoa 3D (**Canoa, 2009**) developed for Adobe Premier, this plug-in allows for simple 3D geometry to be placed within footage. It replaces the need to use an external 3D program such as 3Ds Max by allowing textures, lights, etc to be placed within premier. This is beneficial as it could reduce the cost of buying external programs and increase the compatibility of files allowing for a broader range of assets to be produced.

There are several issues that need to be taken into consideration when wishing to use a plug-in. Firstly they can be very costly, while more simple plug-ins are accessible to the general public, more advanced ones are generally to expensive. There are also system requirements to take into account, these are dependant on what the plug-in does as it may be found to be more demanding on the systems hardware than the original application, thus increasing cost. Next the actually software should be considered, it is no good buying a plug-in for Photoshop if you intend to use it in After Effects for example.

In summery filters and plug-ins enable a wide range of effects and features to be added to a production. While they are sometimes costly, they are beneficial to the quality of the final artefact, and can make the overall editing process much quicker.

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