

Development of a 3D application to
support Important Elements in First Aid
Techniques

MSc Multimedia: Final Project

*“The report is submitted in partial fulfilment of the requirements for
the M.Sc. degree in Multimedia at the University of Westminster.”*

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ABSTRACT

The purpose of this project is to create a prototype of an application that consists of 3D simulations to support First Aid techniques as required by St. John's Ambulance guidelines. It has been carried out not to replace the course itself but to demonstrate that with the use of this application, it will help the user have a better understanding of what has been taught but more importantly it will be a tool utilized at the user's desired speed. In addition to the application being used as the course is being taught, it could also be used as a refresher – for those who have already had the training in previous years.

CONTENTS

Acknowledgements.....	1
Abstract.....	2
1 Introduction	6
2 Methodology.....	8
2.1 Aims.....	8
2.2 Objectives.....	8
2.3 Project Methodology	9
2.3.1 Project lifecycle	9
2.3.2 Project Schedule	10
2.4 Target Market	11
2.4.1 The company.....	11
2.4.2 The Students	11
2.4.3 The Trainer	11
3 Literature review.....	12
3.1 St John’s Ambulance 3 Day First Aid at Work Course	12
3.2 Importance of Simulation	14
3.2.1 2D Vs 3D.....	14
3.3 Technology.....	15
3.3.1 Computer Hardware	15
3.3.2 Resolution	15
3.4 Software.....	16
3.4.1 Mixamo fuse.....	16
3.4.2 Autodesk Maya 2015	17
3.4.3 Unity 5.....	17
3.4.4 Programming language used	18
3.5 UCID techniques.....	19
4 Analysis	20

4.1	St John ambulance website	20
4.2	Existing products.....	21
4.2.1	Games/apps played and tested	21
4.2.2	British Red Cross first aid app	24
5	Design and Implementation.....	25
5.1	Idea conclusion	25
5.2	Paper Based Prototyping and Wireframes	25
5.3	Implementation	26
5.3.1	Creating the Characters	26
5.3.2	Facial Animations lip Syncing	27
5.3.3	Character Animation	29
5.3.4	Advanced animation in Unity 5.....	30
5.3.5	Login screen	33
5.3.6	Importing fonts	35
5.3.7	Images	36
5.3.8	Buttons and Navigation.....	36
5.3.9	Splash Screen	38
5.3.10	SQLite Database.....	38
5.3.11	Login Page and database	41
5.3.12	Saving User information.....	41
5.3.13	Singleton	42
5.3.14	Player Preference.....	42
5.3.15	Developing the Introductory Video	43
5.3.16	Importing Video into Unity	48
5.3.17	Simulations.....	52
5.3.18	Sound Editing	53
5.3.19	Problems Encountered.....	53
6	Testing.....	57
6.1	Black Box Testing	57
6.2	User testing.....	57
6.3	Questionnaires.....	58
6.3.1	Paper Based Design Questionnaire.....	58

6.3.2	First Aid Application	58
6.4	Interviews.....	59
6.5	Observations	59
6.6	Further development.....	59
7	Conclusion.....	60
8	References	62
9	Bibliography	69
10	Appendix	70

1 INTRODUCTION

The inspiration for this project came from the completion of a first-aid at work three-day training course. Due to the lack of 3D content that was available for such an incredible course it was the ideal subject area to pursue for developing a 3D application to enhance the learning experience.

At the end of each day the trainer will give out paper based worksheet from which they will test the knowledge of the trainees. This project will look into developing a 3D based interactive application to help the trainees retain what they have learnt and test their knowledge on what they were taught on the course. The main purpose of the application will be to enhance the learning experience by moving away from paper based worksheets and using fun alternative means of learning and testing knowledge of the trainees.

The secondary purpose of the application is to test the knowledge of the user once they have completed the course. The test function should allow the user to answer questions based on what they were taught on the course and if the user receives good results they will be rewarded by adding their name and score to a Top 10 leaderboard. However, if the user makes a mistake they should be rectified as this is also part of the learning process.

In producing this prototype multiple 3D authoring tools such as Mixamo Fuse (modeling 3D characters), Autodesk Maya (3D animation software) and Unity 5(Game Engine) is used along with C#, an object oriented programming language and SQLite Database. 2D authoring tools are also used to produce 2D graphics, illustrations and designs to enhance visuals, the user interface and interactions with application.

This project will also look into fundamental concepts of 3D environments, **User Centre Interface Design (UCID)** and project management techniques to enhance and understand the software developed.

2 METHODOLOGY

2.1 AIMS

The project aims is to develop a 3D application to help enhance the learning process for students on the first aid at work three-day course.

The application should allow the users to understand the importance of first aid and raise their learning experience by adding simulations of real life scenarios and give solutions in resolving the threat.

The learning environment should be engaging, easy to use and help the user to retain and recall content that has been taught during the course.

2.2 OBJECTIVES

The primary deliverable will be the 3D simulation based application which will teach students how to provide first aid correctly.

The project will address the following:

- Explore and identify a detailed requirement of the 3D first Aid Application.
- Identify and incorporate first aid simulations based on technique that are taught on the first aid course.
- Design the main components, Interactions, feedback system of the software and how they will be used.
- Learn how to use the required authoring software for the development of the application.

- Develop the prototype software, database and incorporate the outlined functionality.
- Test and develop the application.

2.3 PROJECT METHODOLOGY

2.3.1 Project lifecycle

This project will be using a **Game Development Life Cycle (GDLC)** although there are many variations of this lifecycle [1] However, Ramadan and Widyani were able to identify the flaws with most of them and proposed a logical structure. This proposed life cycle is very thorough and appears to contain less margin for making mistakes whilst developing the game. It contains six development phases. The production cycle consists of Pre production, Production and testing.[1] This lifecycle resembles the **Rapid Application Development (RAD)** lifecycle however the proposed GDLC is better suited for the development of this application.

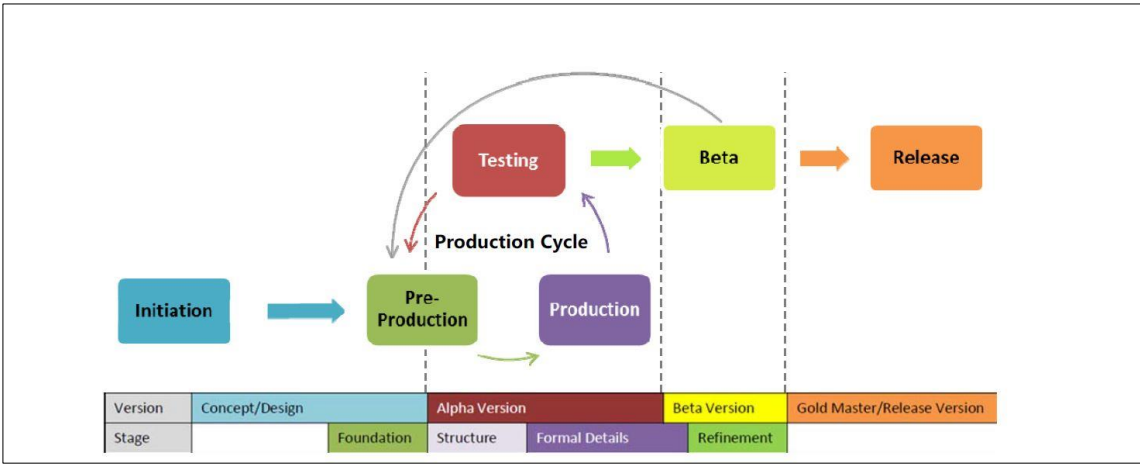


Fig.1 The Proposed Game Development Life Cycle[1]

2.3.2 Project Schedule

This Project schedule on the following page (fig 2) is produced using the proposed GDLC. The project productions is based on multiple tests and refinements which should greatly improve the final prototype. The report will be written whilst the project progresses. This will initially be in an electronic diary format and later be added to the report where applicable.

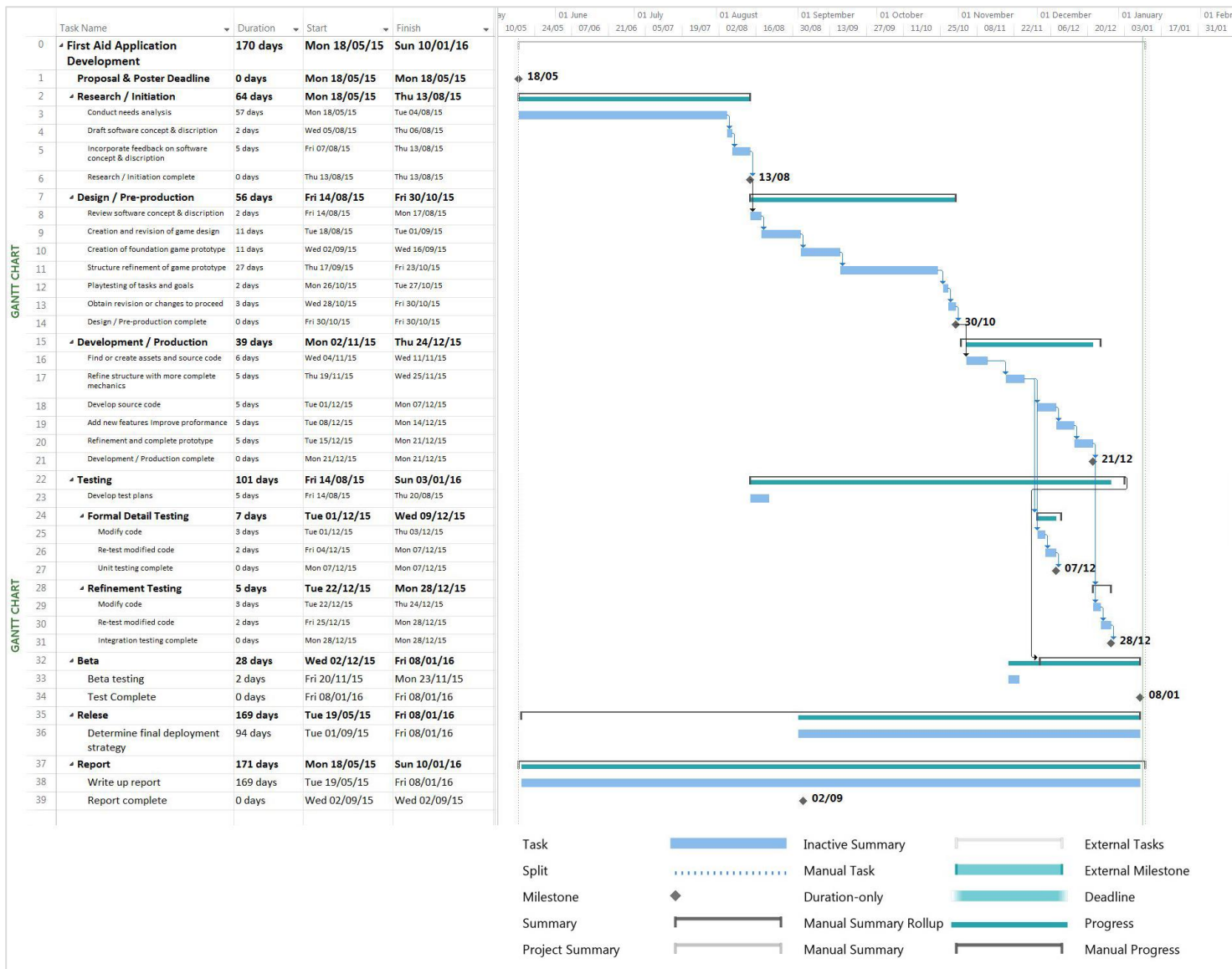


Fig.2 Revised Project Schedule in the form of a Gant Chart.

2.4 TARGET MARKET

2.4.1 The company

The 3 Day First Aid at work course application will be designed for St John Ambulance as the course is originally delivered by them.^[2] This makes them the ideal candidate to represent the prototype as one of their software. This prototype is designed to be used whilst on the course.

2.4.2 The Students

The Target audience will be a variety of working individuals who volunteer to participate on the course or were requested to attend by their employers as a legal requirement to accommodate their health and safety responsibilities.^[3] Individuals who are to complete the course will vary (male/female/elderly/youth) so it is important to keep the application simple, user friendly and comprehensible. It must not be too busy in terms of aesthetics but it should always reflect St. John's Ambulance look and feel that has been established.

The students attending the course should have a basic command of the English language (defined as Level 2)^[3]. The participant will not require knowledge of medical terms although it can prove to be useful. A basic level of IT knowledge will be required to interact with the application.

2.4.3 The Trainer

Throughout the course students are continuously observed by the trainer. Students are given worksheets and assessments to complete [2]. The Trainer is required to then Mark the written assessments and give student feedback. This software will try to eliminate the paper based written assessments by adding a fun interactive software to complete the assessment process.

This application should alleviate pressure from the trainers when proceeding to the written assessment phase of the training sessions. It will help support the staff by giving them access to the results making it time efficient rather than having a high quantity of paper work. They can refer to the application as a helpful tool to assist students who would like to see a demonstration of a certain procedure taught on the course. This can be established via the helpful 3D simulation.

3 LITERATURE REVIEW

3.1 ST JOHN'S AMBULANCE 3 DAY FIRST AID AT WORK COURSE

The description of the course is as stated: "The first aid at work training course provides the comprehensive set of practical skills needed by first aiders at work. Giving both the ability and knowledge to deal with first aid emergencies. It meets the standards required to help comply with Health and Safety (First aid) regulations." ^[2] To become a certified first aider on the course students are observed by the Trainer and are given paper based assessments which must be completed successfully. Once certified the qualification will be valid for three years and to requalify students will need to attend a requalification course 2 months before the qualification expires ^[2]

Within the duration of the 3 Day first aid at work course 22 modules of the following course activities ^[4] will be covered. This should be the basis of the 3D simulations and techniques to help support victims or casualties during these conditions.

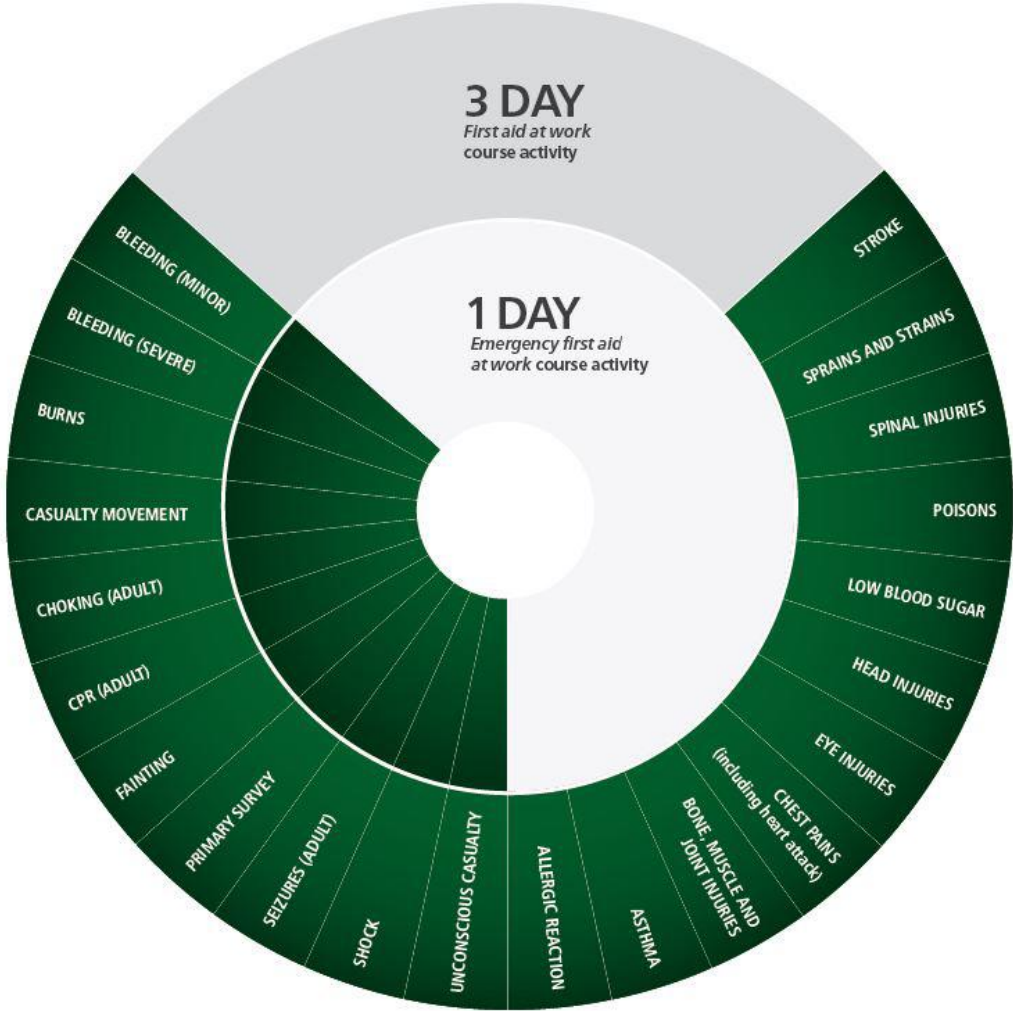


Fig.3 Course activities^[4]

3.2 IMPORTANCE OF SIMULATION

Animated Simulations are widely being used in learning application software. It helps to take real world scenarios and simulate related emotions and interactions, engaging students with the experience otherwise missed alternative media, for example driving theory test includes interactive videos and simulations.

3.2.1 2D Vs 3D

JW Rice, conveyed that “three-dimensional graphics with multiple views increase cognitive viability because complex three-dimensional VR affords users additional opportunities for cognitive processing”.^[5]

Dalgarno and Lee asserted that 3D simulations provide enhanced spatial knowledge representation, engages users to experience based learning therefore it leads to improved motivation; effective and collaborative learning compared to 2D simulations.^[6]

However Whitton disregarded this by suggesting that there is little evidence that this benefits learning, and in fact it might be a distraction or lead to cognitive overload.^[7]

After researching multiple papers and books with regards to how immersive 3D environments help with knowledge acquisition and skill transfer it was identified that the argument still stands which does not provide sufficient evidence to prove this case.^{[5][6][7]}

3.3 TECHNOLOGY

The current standards of computer technology is advancing rapidly and the hardware is at a relatively high standard where computers are able to play high resolution online games and HD videos smoothly without interruptions. This means that mid-range 3D games with low resolution textures and polygon count should run smoothly on a decent standard computer.

3.3.1 Computer Hardware

On the other hand, to develop such an application, a more capable computer is required. The minimum requirement for this project will be:

Operating system:	Microsoft Windows 7
CPU:	64-bit Intel or AMD multi-core processor
Graphics Card:	BLACK DD RADEON R9 290X 1050M 4GB D5 DP HDMI 2XDVI (or similar)
RAM:	8GB
Disc Space:	Enough to install the software use the project assets 200GB
Pointing Device:	Three-buttons mouse

3.3.2 Resolution

Although current standards are high statics show ^[8] that the most common screen resolution currently used is 1366x 768. Conversely, 1920x 1080 is a higher resolution and is better suited for desktop computing as the ratio between these resolution are the same is better to develop the application the for higher resolutions and if required it can still be played on the smaller screen and still look good.

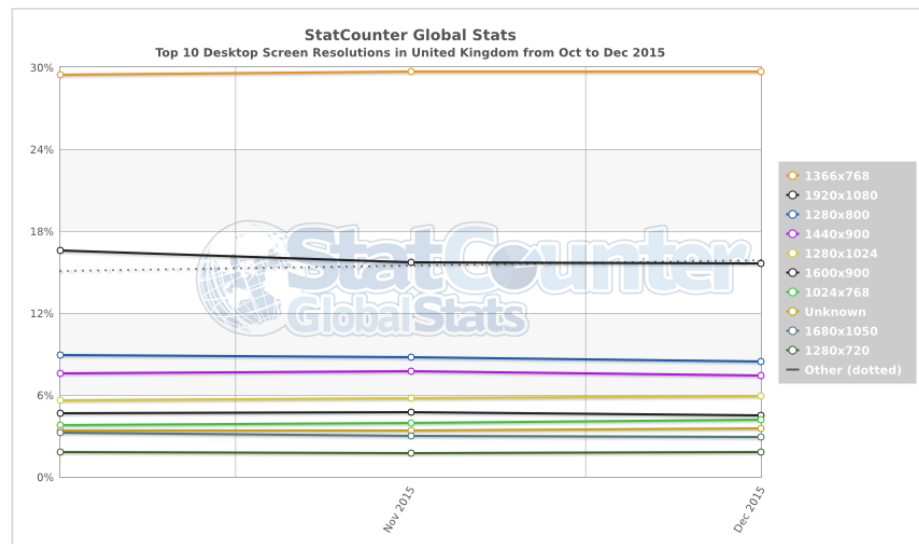


Fig.4 Top 10 Desktop Screen Resolutions in the UK over the past 3 months [8]

3.4 SOFTWARE

There was a lack of prior background knowledge of the following software applications until this project. However, during the phase of the project a lot of knowledge was acquired regarding the software used in developing the application.

3.4.1 Mixamo fuse

Mixamo fuse is a software package that enabled users to create customised 3D characters and Auto rig them using an online application. These characters can be used in Unity games as an FBX file. [9]

Whilst working on the Unity project it was identified that creating customised 3D models and characters for the application was not as easy as it seems. After searching through the asset store that was available in Unity, it was very hard to find a free humanoid a male and female character that looked realistic and did not really have a very high polygon count [10] which increases the file size.

Mixamo offers content online which makes it easier for clients to learn how to use their package. [11]

3.4.2 Autodesk Maya 2015

Unity is a game development engine and not a 3D modelling package so when creating characters and animating them research had to be done in finding best possible solution for the development of this project. The two main applications used were Blender ^[12] and Maya ^[13] however, Maya was the most popular 3D modelling software of choice to be used alongside unity. Both of these products were available for student to use for free. The preferred choice after the initial research was to use Maya as this is a professional software used within the industry and allows for much more flexibility and support.

The Maya environment took a while to get used to and like any advanced software; the learning process is a continuous cycle on the other hand, a lot of material on how to use the application was found within books and online support that's available ^[14]. Maya 2016 was also installed as it was the newer version but had issues with the Auto rig plugin from Mixamo so Maya 2015 was used instead.

3.4.3 Unity 5

Unity was the game engine software of choice for the development of this project. The reason for choosing Unity 5 was due to popular demand and recommendations taken from peers who have worked in game development and project supervisor. Furthermore, research were undertaken to validate and understand more about the product and why it was ideal for this project. Some of the points being, it was free, it offers Multi-platform support, it has an Asset store and it was fairly easy to learn due to the vast support available from developers and

students alike^[15]. Hopefully with the 5th iteration of the software it should be less buggy and filled with all the features necessary for this project.

The Unity 5 environment took time to understand how it worked. However, after a few weeks of working within the environment, things started to gel and the learning experience was fun and a lot easier. Helpful tutorials and content was available online on the unity website ^[16], Lynda.com ^[18] and other forms.

3.4.4 Programming language used

For this project the chosen programming language was used C# (pronounced as C sharp). This object oriented programming language was fairly similar to the actionScript3.0 programming that was taught on the ECMM701 Multimedia scripting for interactivity module [link lecture notes]. The programming languages that are available for unity 5 is C# and JavaScript, however due to its popular use in unity the documentation for C# used In Unity 5 will be a lot easier to find and develop as it's the most commonly used amongst unity users^[18].

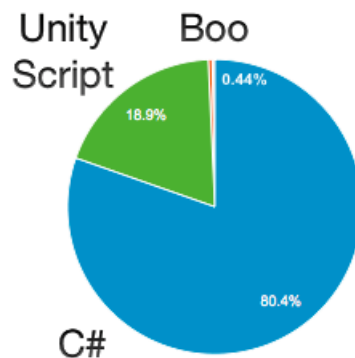


Fig.5 Demographics of programming language used Sep 2014^[18]

Due to lack of use, support for the Boo programming language has been discontinued within Unity 5. However, projects containing Boo will still work the option to “Create Boo Script” has been removed from the menu.^[18]

3.5 UCID TECHNIQUES

User Centered interface design (UCID) is an important aspect to this project as it will be used to help support the users interaction with the software. A well developed software using UCID principles will allow the user to easily use the application and be more engaged with the system. The user should be able to look at the software and know what they are expected to do and what they are not. When developing the software, is it important to know who the users will be and what tasks they will be required to perform with the application.

Thus it is crucial to develop a system image by which they can develop a good mental model. The strategies for good mental model will be used. This includes providing visibility which incorporates clear actions that the user can take options and states. Mapping it so that the user will know how to navigate with what they intend to do and executing the operation they want to perform. The system should give the user ample feedback so that they know where they are and comprehend what is occurring or what has happened. For example these can be sound, visual or text based feedback. The concepts of the design must be clean and concise using metaphors, objects and actions^[19] The use of familiar but new metaphors which will need to be used as the application will closely align with the first aid course and recognition from memory should be made easy and possible. Effort will be made to apply cued recall elements to help process and engage the user interface and the learning phase of the application through feedback elements.^[20]

The developing system will follow set colour guidelines consisting of contrasting colours to help with perception ^[21] to help support users with colour blindness or visual difficulties. This will not be a problem as St John Ambulance follows a good brand guideline and colour scheme.^[22]

The software will be designed to be very minimal so that learning to use the application and the user interface will be like learning from analogy or previously used systems or taught elements.^[23]

4 ANALYSIS

4.1 ST JOHN AMBULANCE WEBSITE

The St John Ambulance website provided a lot of resources required for the project including the copy for the simulations ^[24]. They also provide users with online video guides to perform first Aid. These videos prove useful in the production of creating animation for the characters.

The website also contains the St Johns Brand Guidelines ^[22]. This will support the production of the application as guideline were available for what the application should look like to resemble the rest of their brand identity. The website also helped understand more about who they are and the language used.

4.2 EXISTING PRODUCTS

4.2.1 Games/apps played and tested

To develop the software it is necessary to undergo thorough research and test applications and games that were already created. This will identify new features that are available and the current standards used by developers within the 3D gaming Industry^[25]^[26] and St John's Ambulance(SJA)^[27]^[28]^[29].

4.2.1.1 *Rescue Run*

Rescue Run^[27] is a 2D Flash based game available to play on the St John Ambulance site. The game was a single player platform runner game. It had a male character that was making his way to the cinema, and on his journey he had to assist passing pedestrians who were involved in accidents or required first-aid support. The aim of the game was to help the pedestrians and make it to the cinema on time. A timer is set on the top left of the screen next to the sound and music buttons. Two bars are present on the display one being the 'Goodwill' earned and the other calculating the 'Lateness'. 'Goodwill' is earned by being able to provide first-aid within a short span of time and scoring points performing the tasks correctly. The other bar increases if the player starts to run late for the cinema time at the end of each level 'goodwill' is deducted to compensate for the time that the player was late and if not enough goodwill remains the player cannot proceed to the next level. This game is about fighting against time and providing first aid effectively.

The Rescue run game had a small amount of First Aid scenarios such as severe bleeding, choking, broken bone, chest pain and CPR. Although the game was not a good tool to use to learn first aid as it did not include all the details involved when providing first aid. It also had to

be played very quickly as there is a timer which runs quickly. This does not give the player much time to read carefully and learn the processes in detail during the learning phase of the game. No audio voice overs were provided which would have helped. However, learning to play the game was easy as they followed some good user interface structure and gave the user plenty of visuals and highlighted the instructions to read from.

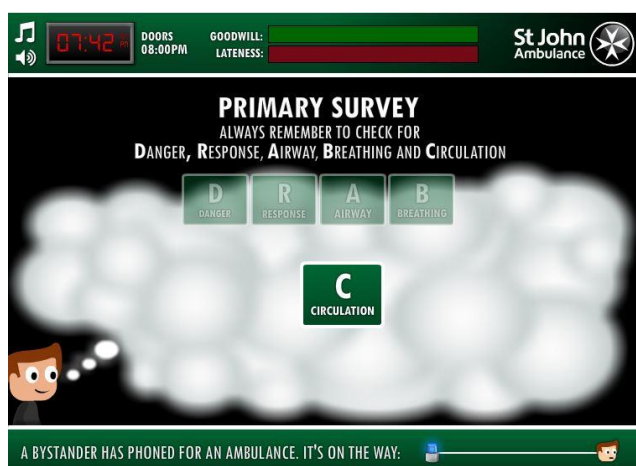


Fig.6 Teaching the Primary Survey^[27]

The primary survey was emphasised during the gameplay by adding it to every scenario as this will help identify any life threatening dangers that may be involved when assisting a casualty. However it did not teach how to perform the primary survey which is also very important i.e. how to check the circulation of your casualty as you can see in the example above.

This game is assumed for someone who has already taken the course or someone using the game leisurely and is interested in gaining an insight into providing first aid.

4.2.1.2 St John's Ambulance First Aid Advice App

The First aid advice app is available for Android™, BlackBerry® and iPhone® mobile device users. [28] The function of this app is to give easy to follow advice on a range of first aid scenarios. This software is perfect for quick access to first aid advice. It is not text heavy and follows simple navigation systems which initially follows a linear system in each category of advice. However, hyperlinks are also added to some advice keywords, which allows navigation to other sections if more information is required regarding something that may be relevant or another treatment that should follow.

The limitation of the software is that you need to know what you are looking for to be able to treat. This could be even more confusing if the casualty is unconscious and you do not know what to do because there is no visible category to treat somebody who is unconscious or what to do with in that state of emergency.

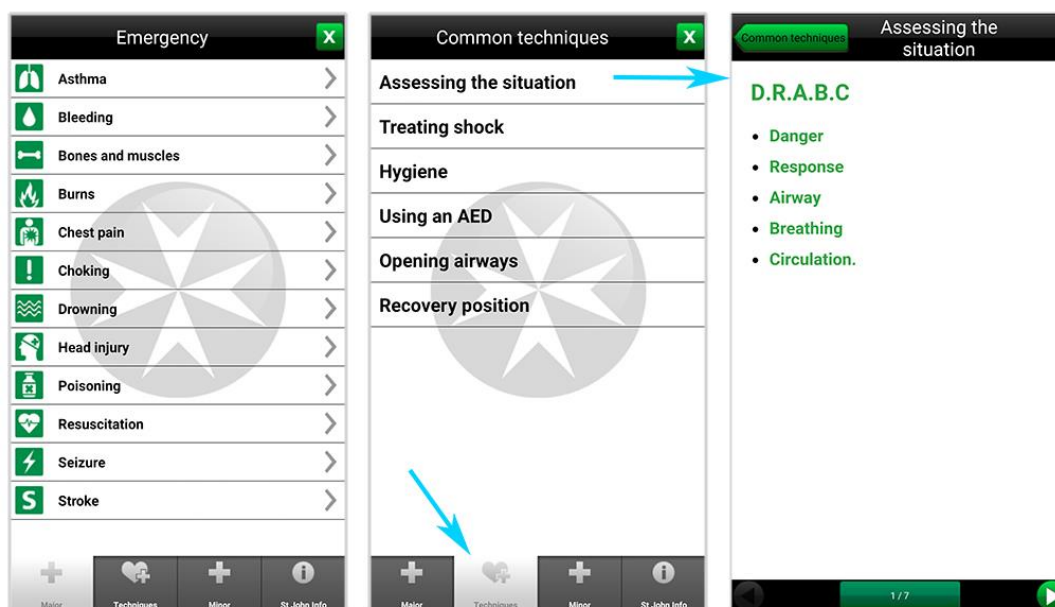


Fig.7 Limitation of App finding support for someone who is unconscious^[28]

However if the users has time to play with the app and navigate through all the links. They will eventually discover a button name 'techniques' at the bottom and another menu option with another link to 'assessing the situation' and then discover the 'D.R.A.B.C' technique. However, this can be farfetched for someone who is new to the app. It is still unclear when this technique is applied within the app even after finding it. This issue is a common when reducing information and simplifying first-aid techniques.

The second limitation is that the application lacks audio and illustrations on how to apply these techniques. This may also be due to keeping their application small so that more users will be likely to install and keep it.

The third limitation to this application is that due to its simplicity, the techniques do not come with reasoning to why the individual should follow the instructions. Why it will be beneficial for the individual in need. This is also something that is important and should not be disregarded.

4.2.2 British Red Cross first aid app

The British Red Cross is another charity organisation who carters for first aid courses. They have also developed an interactive first aid mobile application ^[29] to give first aid advice and teach first aid.

This application has added online features that allow the user to see video and 2D Gif Animations. The design of the application is comprehensive and has a well-developed list of first aid and emergency scenarios. It also included three variations of unconscious casualties as a subject heading. The app also contains question and answers to all the scenarios. There were virtually no flaws with this application other than the fact that it will require an internet connection to download most of the content.

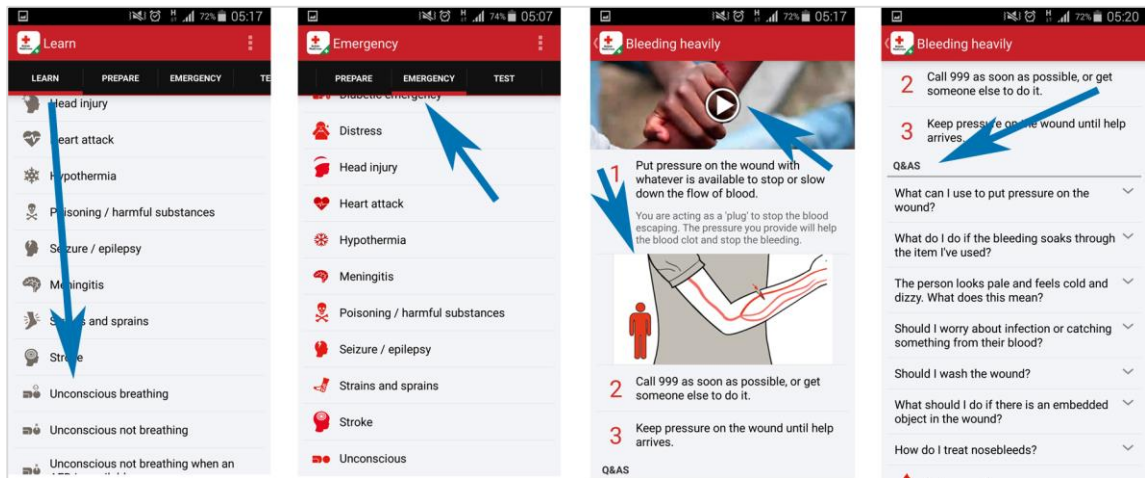


Fig.8 First aid App to Illustrate some of its comprehensive features [29]

5 DESIGN AND IMPLEMENTATION

5.1 IDEA CONCLUSION

Through experience and extensive research, it has been decided that the application prototype is to take the informative approach in guiding the user through the 3D simulations that will be created in Maya and Unity. As well as being visually helpful, sound will also be integrated to be helpful to those who may need it. A personalized theme is also considered to reflect the user's progress throughout the course and in addition, a scoring system with a leaderboard is introduced which will push the user to acquire all information needed to gain a higher test score.

5.2 PAPER BASED PROTOTYPING AND WIREFRAMES

Prototyping ideas onto paper is very important as it helps the chances of catching design faults at an earlier stage. These paper based designs were then shown to test subjects for verification and then the production of computer generated wireframes began. These wire frames wire

were also in a continuous cycle of refinement and things were constantly changed through developer and user testing to make sure the application is refined and of an excellent standard.

Please find Storyboards and wireframes in the Appendix

5.3 IMPLEMENTATION

5.3.1 Creating the Characters

Mixamo Fuse^[9] was used to develop and create the game characters for the simulation. The application was downloaded from the Mixamo site and installed locally. Then using their online tutorials the characters mesh were developed.

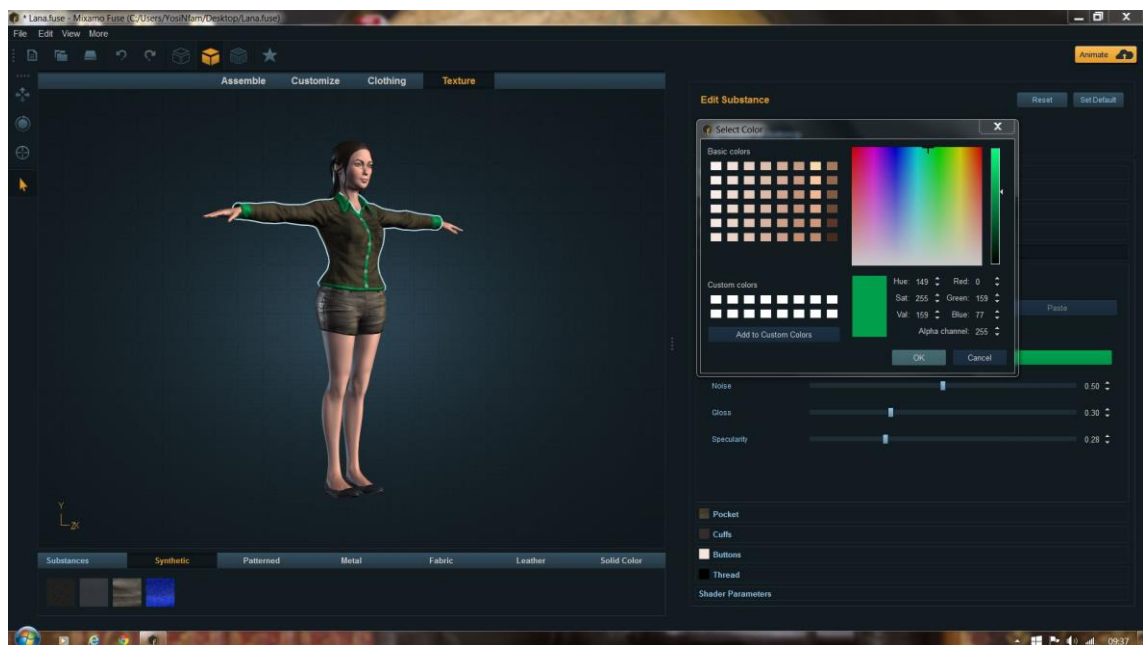


Fig.9 Character assembly, design and development Lana

The colours chosen were adapted to represent the colour scheme within the application by following the St John Ambulance colour scheme Guidelines.

Once the characters were produced to a beautiful standard they were ready for the Auto Rigging processes ^[30]. This process will automatically apply a skeleton to the character mesh

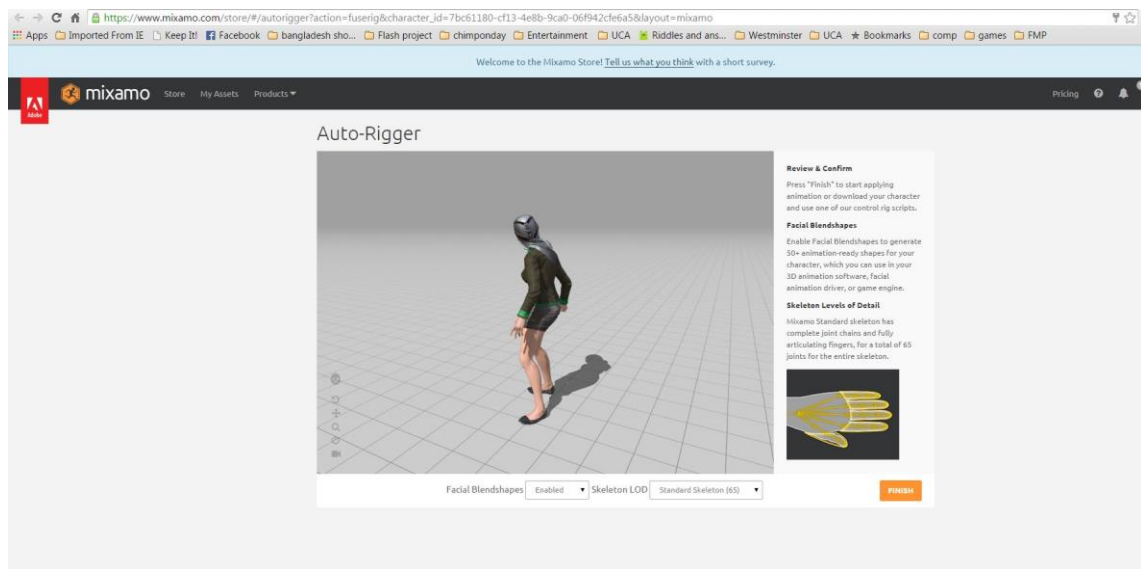


Fig.10 Mixamo Online Auto-Rigger^[30]

Once the characters have been uploaded to the Auto-Rigger online they are ready to be downloaded in the FBX file format in Unity 5 or Autodesk Maya 2015. These Mixamo provides standard locomotion (Animated movement) which can be used in both Unity and Maya however they do not come with any First Aid procedure locomotion which meant that the characters animations would need to be created in Maya before importing them into Unity. Tutorials were available online on the Mixamo site on how best to produce the animations and then bring them into Unity. Mixamo also provides Control Rig Script for the characters to be used in Maya.

5.3.2 Facial Animations lip Syncing

Although the auto rig script also comes with facial blend shape editors they did not work correctly when exported to unity with blend shape animations even when trying to follow instructions received from the Mixamo team.

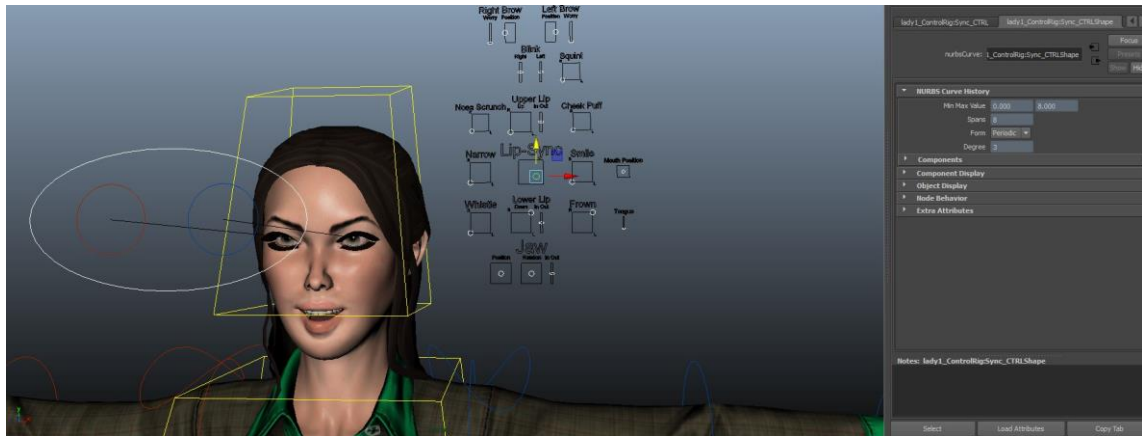


Fig.11 Lip sync editing in Maya

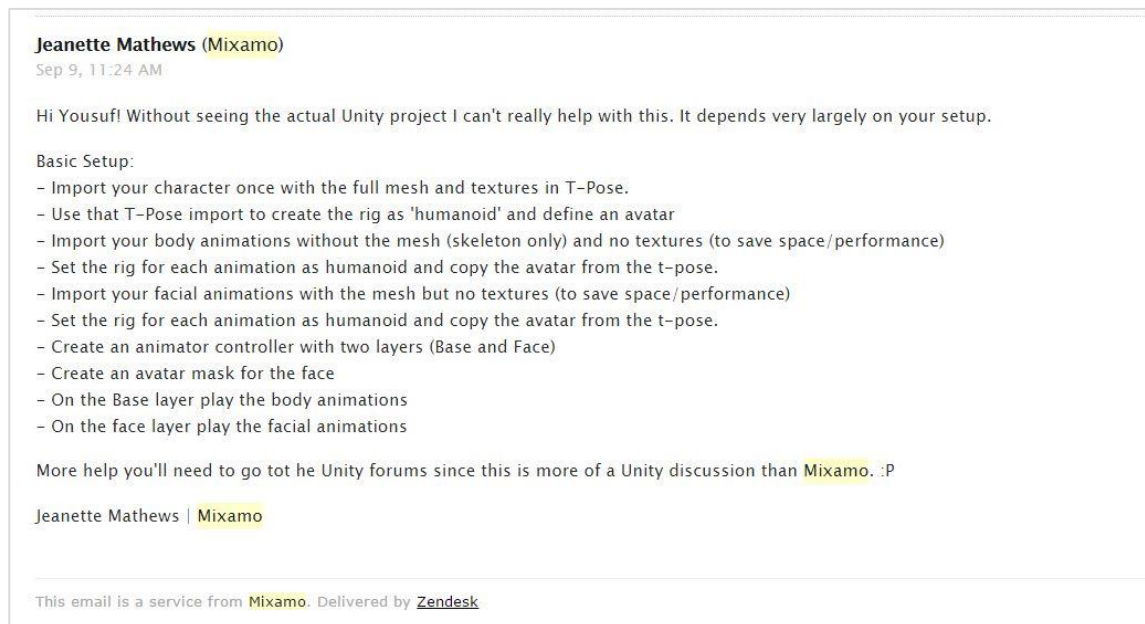


Fig.12 Jeanette Mathews Email from Mixamo

Face Plus was an easier solution to lip syncing in Unity however the plugin only worked with Unity Pro versions 4.2x - 4.8x. This Unity Plugin allows users to use the computers webcam to create facial animations then transfer it on the imported characters in Unity. [31]

Due to the timeframe of this project after browsing and testing through a verity of tutorials online and not finding any successful solution the pursuit of trying to make the characters movie their lips in Unity had to be forfeited.

5.3.3 Character Animation

The character animations were developed in Maya using key frame animations for each of the moving body parts. Some of the animations required a more intricate touch such as the tapping of the shoulders when checking for response. The Maya Graph Editor was used to edit the curves by creating flat tangents ease out the animation in order for the timing to be more accurate.^[32]

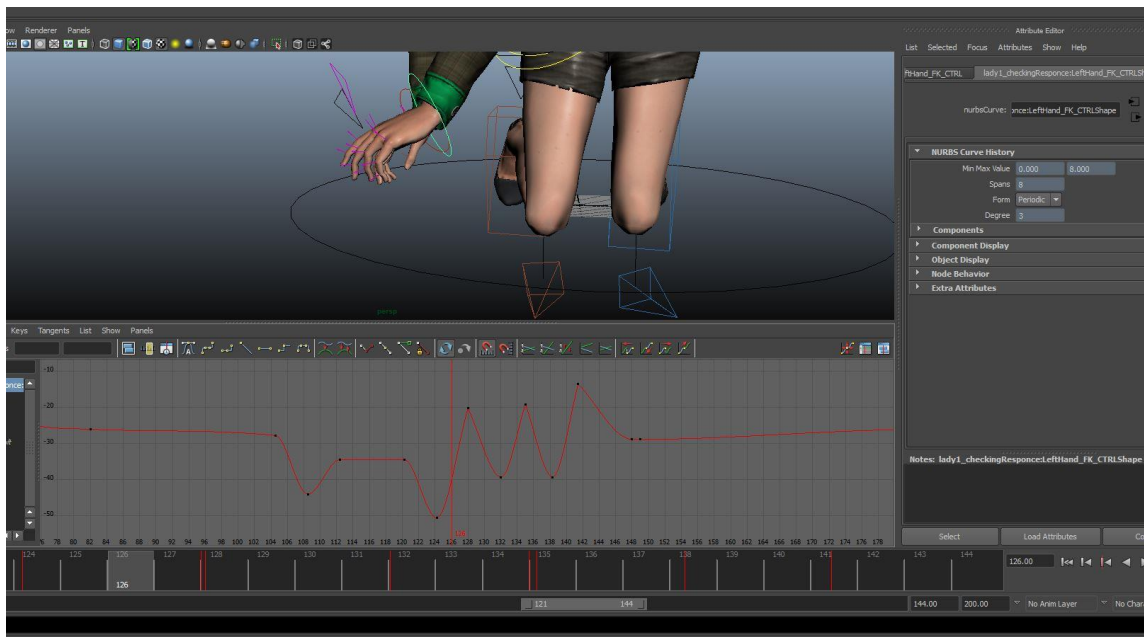


Fig.13 Graph editor in Maya 2015

5.3.4 Advanced animation in Unity 5

Once the character animations were created in Maya they were imported into Unity and the character animation process began. The skeleton animations were placed within the Project folder>Assets>characters>Lana>Animations and the original Maximo T-pose FBX file was imported into the Lana folder this will be the main avatar. The Main avatar was placed into the scene and then placed into a unity empty GameObject the Animator controller was copied from the Avatar and was applied to the GameObject using the inspector. A character controller was also added to the GameObject to allow for collision detection so that game physic can be applied to the character and they would not walk through walls or fall through the floor. Both the character and the GameObject would need to be Origin X=0,Y=0,Z=0 so that the character is within the center of the gameObject and lines up correctly. The height and radius of the container GameObject will need to be adjusted to fit the character. To create a prefab of the character it was dragged into the project folder and it was ready to be used in any Scene.^[33]

The Animator controller and the C# Control script were used to create to import and used the Animations. Two parameter in the Animator controller was created one being a float variable and the other being an Integer. The Integer variable current action is used to create the following Sub-State Machine to allow the next and previous buttons to call the function which will check the current actions and navigate the path accordingly.

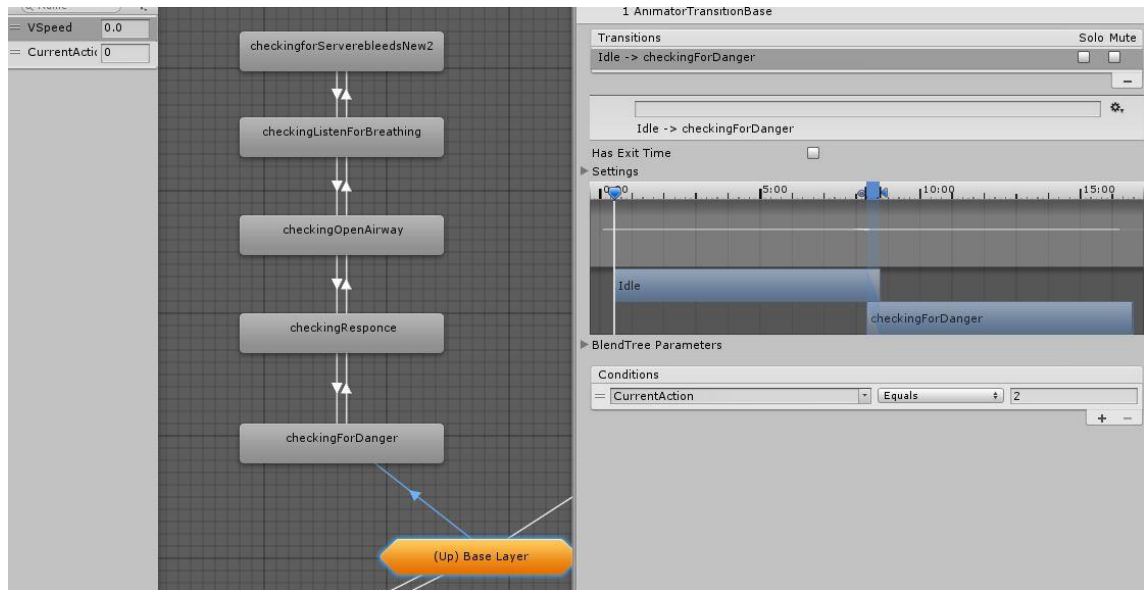


Fig.14.1 Sub-State Machine With animations and conditions.


```

70 public void NextPress()
71 {
72     if (lanaAnimator.GetInteger ("CurrentAction") == 0) {
73         lanaAnimator.SetInteger ("CurrentAction", 2);
74     } else if (lanaAnimator.GetInteger ("CurrentAction") == 2) {
75         lanaAnimator.SetInteger ("CurrentAction", 0);
76     } else if (lanaAnimator.GetInteger ("CurrentAction") == 3) {
77         lanaAnimator.SetInteger ("CurrentAction", 0);
78     } else if (lanaAnimator.GetInteger ("CurrentAction") == 4) {
79         lanaAnimator.SetInteger ("CurrentAction", 2);
80     }
81     counter ++;
82     if (counter == 5)
83     {
84         //NextSimulationBtn.enabled = true;
85         NextBtn.enabled = false;
86     }
87     if (counter == 1)
88     {
89         PreviousBtn.enabled = true;
90     }
91 }
92
93
94 public void PreviousPress()
95 {
96     if (lanaAnimator.GetInteger ("CurrentAction") == 0){
97         lanaAnimator.SetInteger ("CurrentAction", 3);
98     } else if (lanaAnimator.GetInteger ("CurrentAction") == 2){
99         lanaAnimator.SetInteger ("CurrentAction", 4);
100    }
101    else if(lanaAnimator.GetInteger ("CurrentAction") == 4){
102        lanaAnimator.SetInteger ("CurrentAction", 3);
103    } else if (lanaAnimator.GetInteger ("CurrentAction") == 3){
104        lanaAnimator.SetInteger ("CurrentAction", 4);
105    }
106    counter --;
107    if (counter == 0)
108    {

```

Fig.14.2 Script to navigate the next and previous functions.

This code is very logical. But needs time to understand and develop, due to the complexity of the integer based navigational path. Each arrow in the sub-state machine will make the current action into a number so a mathematical path had to be created.

5.3.5 Login screen

First it was required to include text, Image, and vector files created in Illustrator so that the designs can be recreated in Unity 5.

The problem faced was Unity does not support vector files. This is a problem when working with the St Johns ambulance guidelines. More specifically, the chevrons that were developed contains diagonal lines which will look pixelated or blurred if they were to be converted to bit map graphics. To try and resolve this the first important issue was identified. What will be the screen resolution for the application?

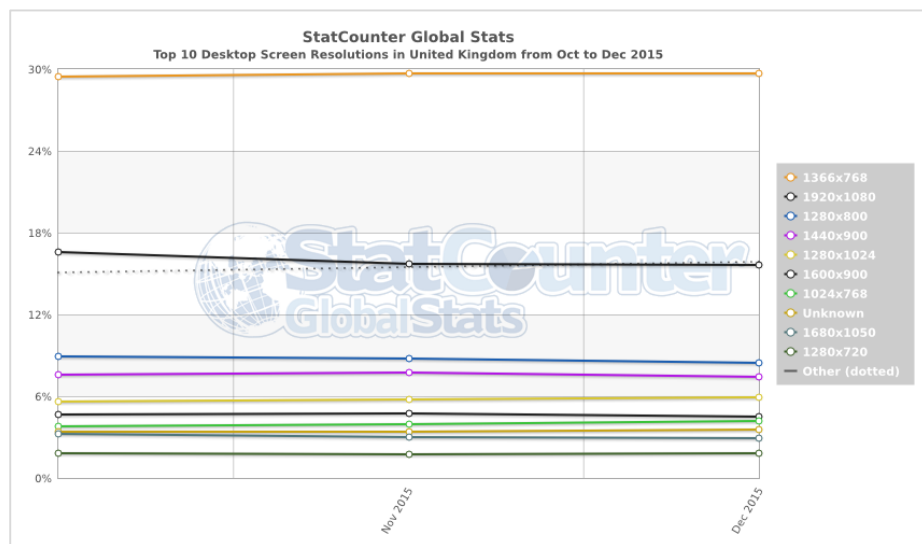


Fig.15 Top 10 Desktop Screen Resolutions in the UK over the past 3 months [8]

Looking at the stats it was identified that the most commonly used screen resolution is 1366x768 pixels [8] and the second most commonly used is 1920x1080p. This can however be argued that the data also includes laptops screen resolution as no other options were available to change the segmentation any further. Further research shows that the case in point is true[34] and since this application will be set up for a desktop computer the resolution should be set for the desktop monitors which is prominently 1080p. Hence it has been decided to

proceed the application for this resolution. However, alternative resolutions will also be supported and can be catered for on the application start-up.

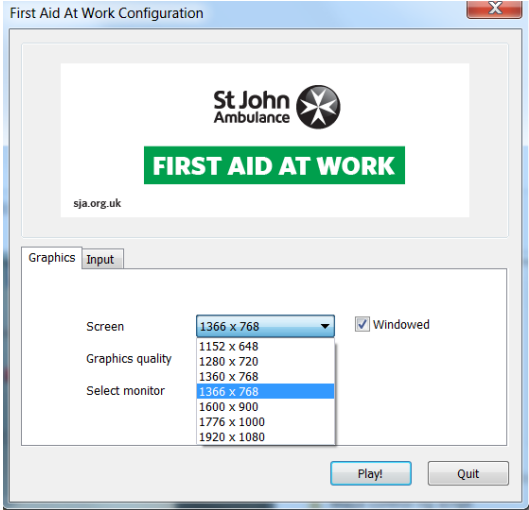


Fig.16 Optional screen Resolutions for 16:9

The aspect ratio of the project is now set to 16:9 which will keep the graphics it in its original ratio set for Full HD monitors and other resolutions within the same ratio. [14]

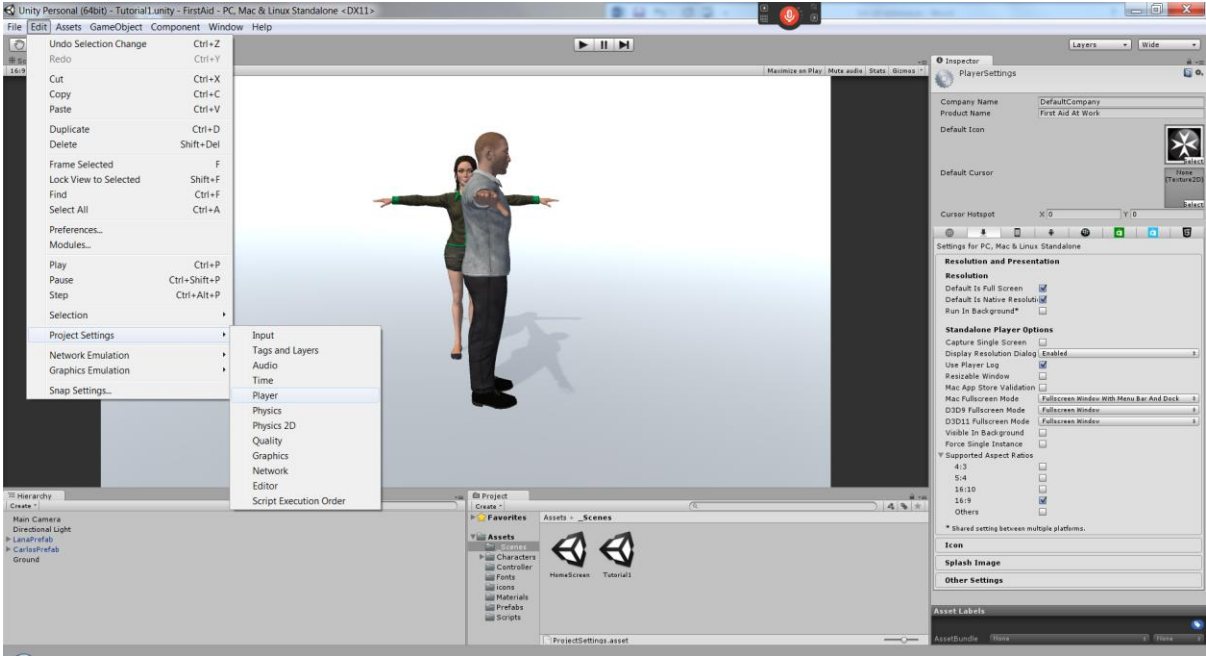


Fig.17 Project settings

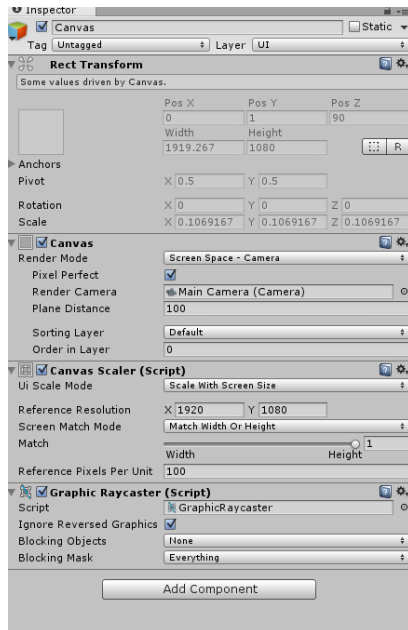


Fig.18 Canvas Scaler properties

The Canvas for the GUI resolution was set to 1920x1080p. It is the most ideal solution and should stop distortion and providing users with resolutions that will work better for visual aesthetics on Display resolutions higher than 1366x768.

Another option that will help aid with distortion of graphics is the Pixel perfect option and UI Scale mode set to Scale with screen size option will greatly help text from pixelating or becoming blurred. This is especially helpful if the screen resolutions were ever changed.[35]

5.3.6 Importing fonts

Instructions to import fonts into the project was straightforward. Any true font files are accepted by Unity ^[14]. The brand guideline for St Ambulance provides the names of all the free fonts they use ^[22]. These following fonts were installed on the computer to use with the application Whitney Semibold ^[36], Whitney Book, ^[36] , Whitney Black ^[36].

5.3.7 Images

Importing Images into unity was not very convenient as unity automatically sized them to the power of 2 for example 2, 4, 8, 16, 32, 64, 128, 256, 512, 1024 or 2048 pixels.

The solution to this was to import them using these numbers or going into the texture properties and selecting 'advance' option the changing the 'Non power of 2' to 'None' and turning off this feature.^[17]

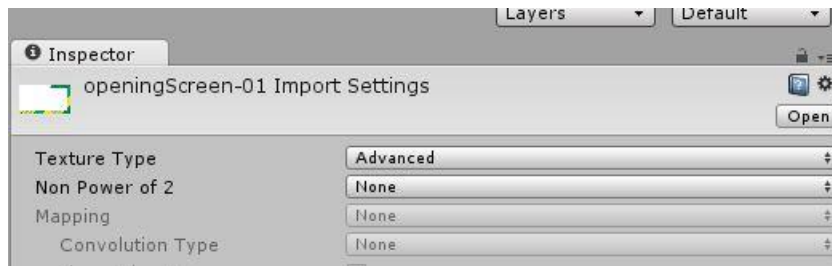


Fig.19 Inspector Settings Power

5.3.8 Buttons and Navigation

The UI Button function is very advanced and contains so many useful functions.^[37]

The method that was implemented was taken from various inputs. However, the functioning of the buttons and how they were able to open and close the exit menu were taught by Xenosmash Games^[38]. The concept of applying C# script to a canvas and buttons then selecting the function to call from the script was amazing, although it did take it bit of time to get used to. Once this technique was understood the concept for all the other pages started to gel.

Please read the comments in the 'signInPage' script to further understand the code.

This code was applied to the Canvas the user should see first in the Scene. Not that it recognised the Naming convention and applied spaced for easy readability. Here all the variables that were called for in code must be linked manually. Such as the other Canvas and buttons. A canvas is like a container for User Interface Elements. That is why it was ideal to use them as pages or screens of an application. As you may have predicted this list can become quite big, however the convenience of this kind of workflow is that if they object name has been changed in the project this list will also be updated with new name so the code would not have to change.

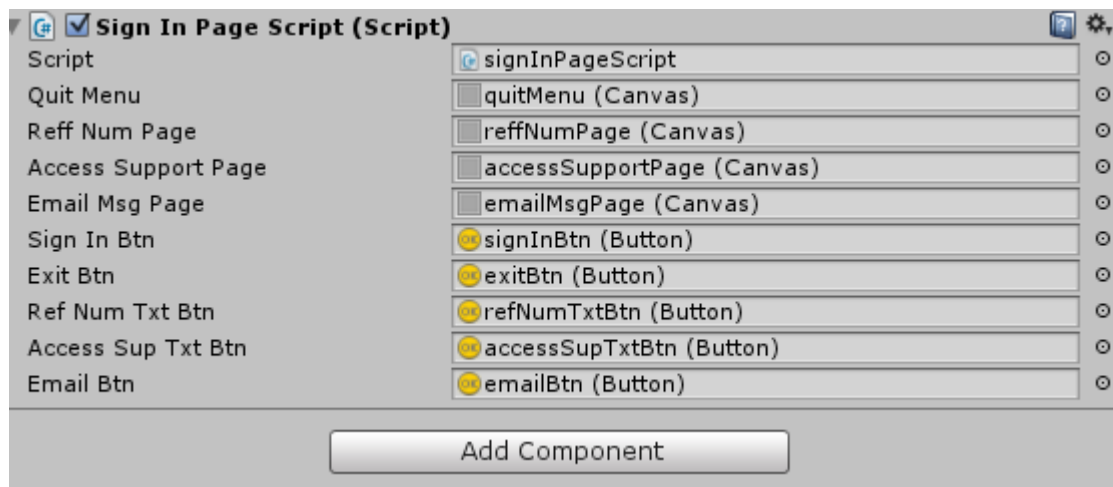


Fig.20.1 Sign In page Script attached to a Canvas

For each of the buttons the main canvas had to be attached to the 'on click () event' and the function that the button would call would be selected from drop-down list on the right.

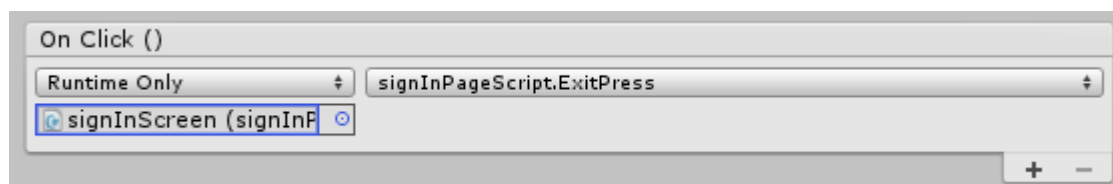


Fig.20.2 Button Property calling function from code

5.3.9 Splash Screen

The Splash based loading screen was created using an alpha animation created within Unity using the Animator within unity for the logo to change alpha transparency over time which was following their application guidelines ^[39]. To enhance the wait time a customized loading bar was also created this is generally a rule of thumb that applications of this size should contain loading screens if the user must wait for a page to load.^[40]

5.3.10 SQLite Database

Using a database to store user information and score will be a necessary task. In this project a few things will be stored in a database table. This includes the booking reference number, first name, last name, date of birth, email, completion percentage and the test score.

The code and tools used to generate the score pages and setting up the database was learnt and adapted from these tutorials, which was quite elaborate and the best amongst many found online. ^[41]

Getting the tools setup

The tutorial provided a link to download the 64bit 'SQLite3.dll' plugin file ^[42] for the 64bit version of Unity being used.

Two other files were required from the Unity program files 'System.Data.dll' and 'Mono.Data.Sqlite.dll'. These three files were then imported into the unit project as plugins ^[41]

A Mozilla Firefox version of SQLite Manager found in the add-ons tool was required to create, test and manage the database initially. It was also helpful in pretesting the SQL commands and view the contents of the database table.

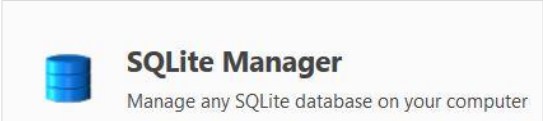


Fig.21 SQLite Manager used

The Table was created using the following setting on the table creation wizard. The date of birth/'dob' was set as a Text data type so that it can be inserted into the database using any possible format DDMMYYYY which is to be used as a security question on the login page.

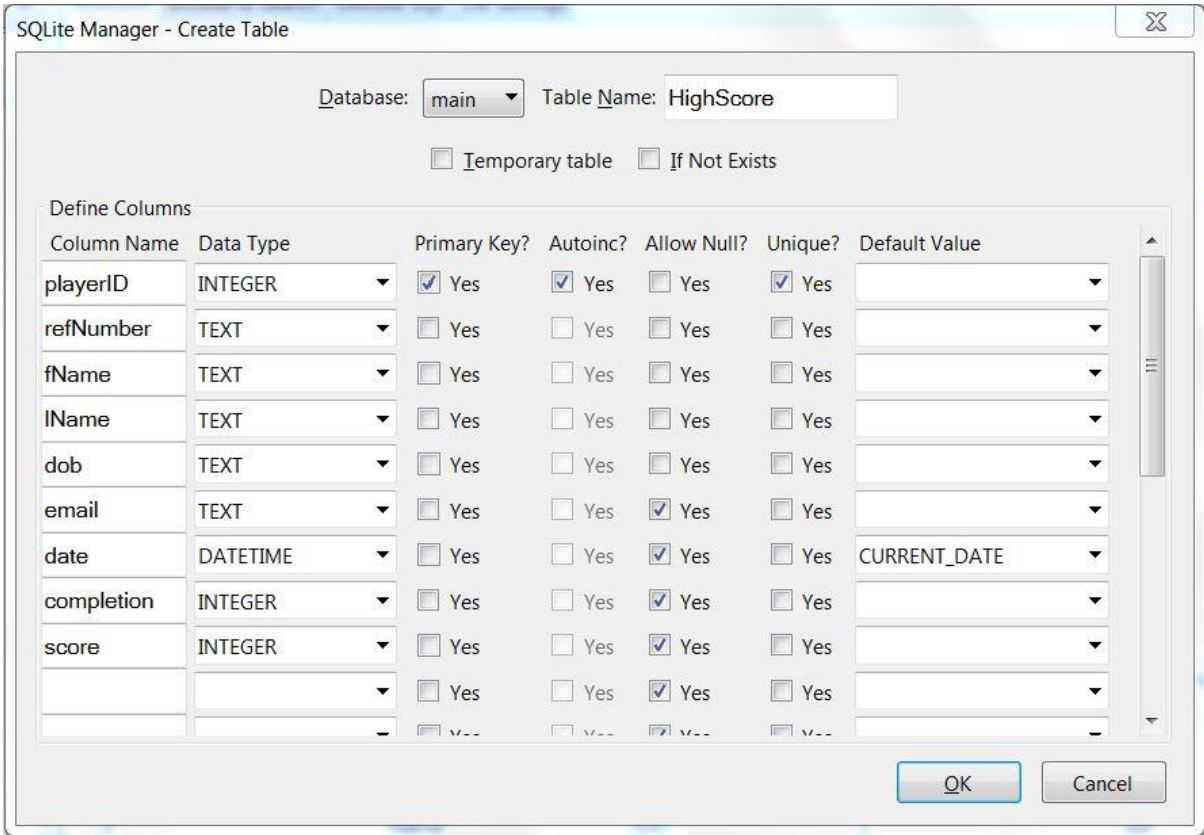


Fig.22.1 Creation of the Database table

The following code will be copied into notepad++ so that it can be used within the she C# code as new database file will need to be created on each deployment of the software. This will be initially created when the game opens for the first time.

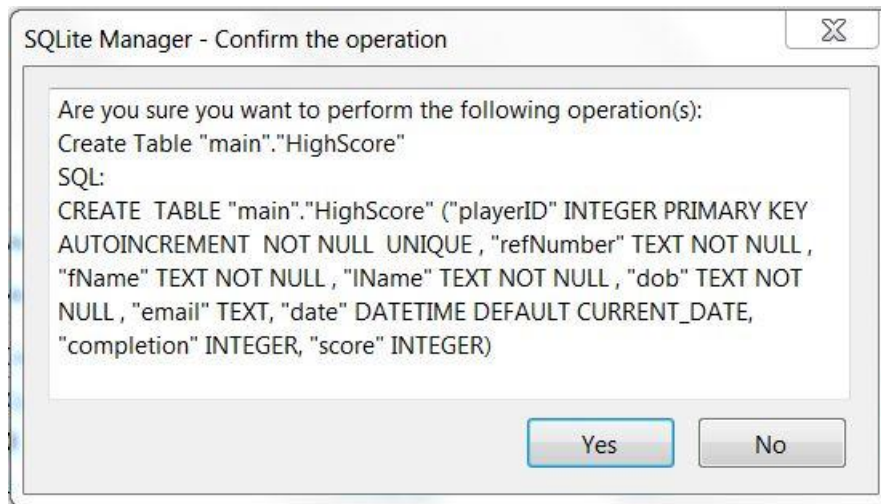


Fig.22.2 Code generated for the table.

All the SQL queries were tested in the manager then copied into the code and adapted for C#.

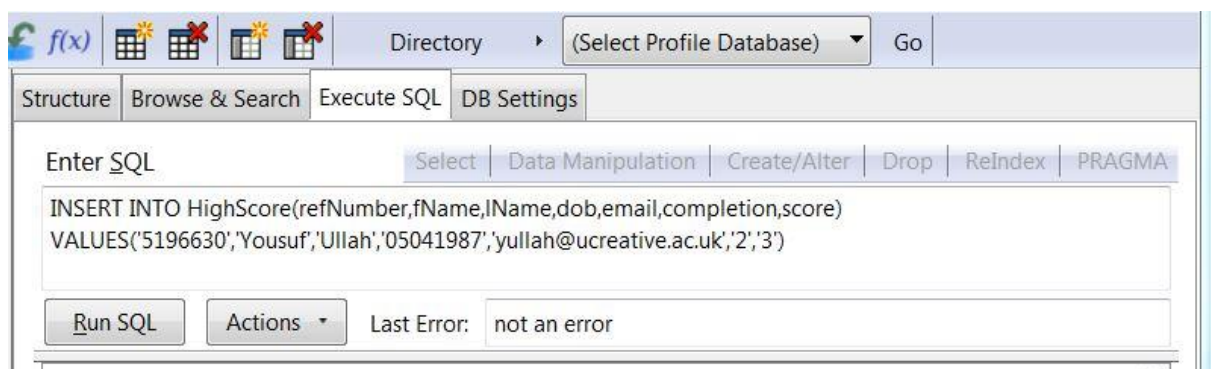


Fig.23 Testing of SQL queries in the manager

In this project there are a few C# files that access the database to collect data and write to the database table. Two main files are the 'databaseManager' which manages the High Score

leader board and the other is the 'loginManager' which manages the login function and the home screen welcome message. It also contains a variable to collect the UserID which will collect the user primary key from the database table so that it can later be used to save the users test score and progress percentage.

5.3.11 Login Page and database

To make the login page functional and work correctly with the database the code to create it was both programming knowledge gained and the tutorial below. Although, the tutorial was created for a different software all together the C# code and SQL query commands were useful. ^[43] The C# code was adapted to find a matching reference number and the user date of birth entered into the 'InputFields'. These details were pre populated into the SQLite database using the SQLite manager. Once the user information is successfully found in the Reader the user Name and Primary Key would be stored and used for the session that they are logged into the system.

5.3.12 Saving User information

Generic variables does not save the login information or data when moving from one scene to another. If the login information cannot be contained then when saving the user Test score, progression or even adding a customised welcome message will be impossible unless everything is done within one scene. This is not a good idea as if everything loads within one scene the file size of that scene will be very large and this will increase loading time and lag the application severely.

5.3.13 Singleton

A few methods were found on how to save data so that it can be transferred to other scenes the most common of all was creating to create a Singleton Class.

“A design pattern that's not specific to Unity but is still very useful in the context of games is the singleton pattern. A singleton is a class that can only have one instance at any given time, and it can be accessed from any other class. Singletons are often used to store a game state, or for manager classes, such as a class that manages all the user interface or plays all of the audio for the game. The singleton is a powerful design pattern that is relatively easy to implement.”^[44]

However the problem faced with using a singleton class was that it did not store the Text or String data type as “a generic list can be made to hold game objects or transforms or integers, depending on the type you specify when you create the list.” ^[44] The Singleton pattern was trial and tested in this project for a long period of time so an alternative solution had to be identified.

5.3.14 Player Preference

The second method identified was to store the data in player preference which is stored locally and can be accessed at any given time from any scene. Please see comments in the ‘loginManager’ C# code file with regards to how the data was stored and collected in the ‘public string inGameUserName;’ the code was adapted from this online tutorial Unity Scripting

Tutorial 5 – Saving/Using data between levels^[45] and the Unity script reference page Player Prefs^[46]

Most of the C# code have been commented on so that it is easy to understand. The code will be printed and attached at the end of the document as there is a lot of code that was used to build the application most of which were adapted from video tutorials with a mix of past and present knowledge such as Scripting for interactivity lectures and notes.

This section of the project was difficult due to the amount of knowledge that is required but, the understanding gained from the scripting for interactivity module^[47] made it easier to comprehend how to operate SQLite Database using C# object oriented programming language. However, a lot was learnt and it was valuable to know how to adapt and acquire new knowledge from courses available online.^[48]

5.3.15 Developing the Introductory Video

As this is a multimedia project it is important to demonstrate the use of rich media such as audio, image and video. Since a video editing module had been undertaken in the first year of this course it is only natural to add the video to demonstrate some of the skills acquired. This video will be implemented on the home screen once the user logs in to the application. This will also enhance the application by adding a human touch to it.

The introductory video will introduce the course that the user has logged into and what the application is about. It will tell the user of the importance of undergoing such a life changing course. It will also tell the user of what they should do next and point them to some of the

main functions, such as, where to find the training simulations, when to take the test and added flavour of excitement by pointing to the top scores leader board.

In this section a description of the main tasks to create a video will be included.

Custom Video Studio

A custom studio was developed. There were four main lights, two ceiling lights, one standing lamp to remove background shadows, and one table lamp to balance the light from the opposite direction. A Canon DSLR model: EOS 700D shooting at 1080p to acquire the best possible resolution. A tripod video steady and not allow camera shake once shooting.

The subject in the video was yours truly. However; two extra crew was required one to keep the camera focused on the subject and record the video and the other to check the clothes being worn were okay and did not contain creases.



Fig.24 Camera Assistant (Fhatama Ullah)



Fig.25 Director (Ismail Ullah)

Video and Sound editing

Once the shoot was complete it was time to develop the video. This video should resemble St John ambulance video branding and style ^[49] as closely as possible. So it had been decided to edit and use part of this intro and outro clips. This was however not enough the video also required the background to be white. Adobe Premiere Pro CS6 was used to edit the video and apply effects such as keying.

To accomplish this background two keying effects ^[50] were used the first being the Eight-point Garbage Matte to crop the background extra walls that was not required and the second was to remove the background key colour and make adjustments accordingly. Conversely, an error occurred once rendered the Eight-point Garbage Matte did not work correctly and cropped the lower half of the body too. Thus instead the White background image and the crop tool was used to get rid of any access gradients. Keying should usually be done using a green screen, however a green screen was not available so alternative adjustments were made. Where the chosen background was a different colour to the costume and the subject. The list of settings below were adjusted to achieve the results seen. Colour balance was also used to enhance the

blue clothing and decrease the red mid tones but increase the red shadows bring life back skin tone.



Fig.26 Settings used to Key and crop the Background

Due to the 8GB RAM limitation of the computer this was exported and reimported into another project to add the intro, outro, video title, clipping and removing unwanted pause or error in speech using the razor tool. The crop tool was also used to edit the outro and intro sequence to apply the chevron effects best as possible. Steel titles were also used to add subtitles using the St John ambulance white on green background text. The size of the font was quite large so that it is readable even when viewed on a smaller resolution screen. The text were set to left adjustment to enhance faster readability by the viewers. Subtitle text was added just in case the user had hearing or listening difficulties.

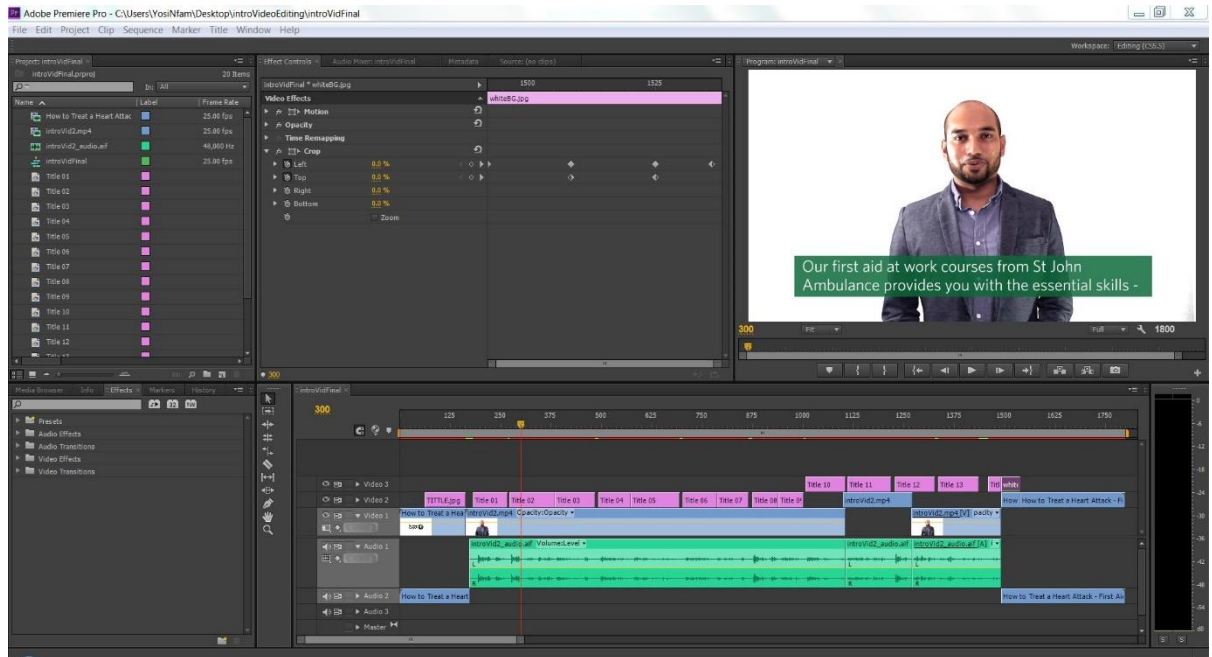


Fig.27 Further Video Editing in Premiere Pro

Audio Editing

The sound that was produced on the camera had noise interference as this was an entry-level DSLR camera with a low quality microphone. So it was required to remove the noise using Adobe Audition noise reduction effect by selecting an isolated area of the video clip with only the noise, capturing the noise Print then removing it from rest of the track.

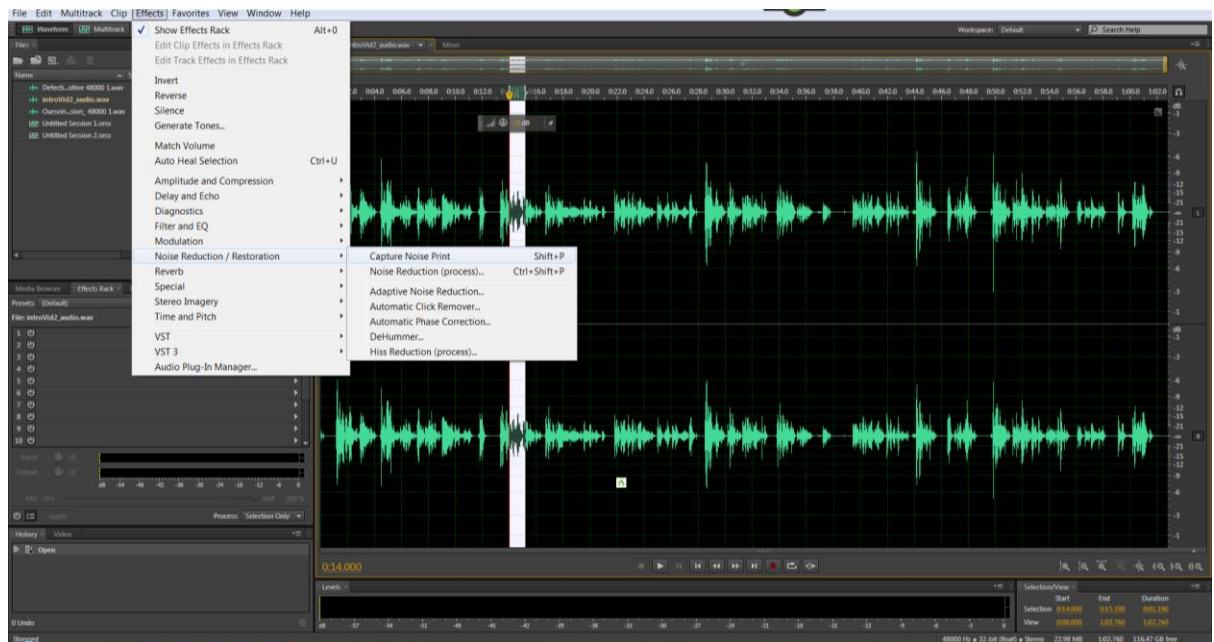


Fig.28 Noise Print being captured and edited

The volume of the vocals was also quite low the decibel (dB) of the track was increased accordingly and reimported into Adobe premiere pro and re-linked to the video clip. Other effects were tested such as Effect-Mastering and selecting the Make room for vocals. However the effect seems a little over the top with regards to auto tuning so was decide to keep it natural as possible and was not applied.

5.3.16 Importing Video into Unity

Importing videos into Unity is fairly effortless however making it work in Unity the way it was intended was not. The video was imported as a texture ^[51]. However a few things must be correct such as the format being used and it also requires Apple Quicktime to be installed on PCs [52]. This means that the file type being imported into the Unity project will have to be of

supported file types that the QuickTime installation can play which are usually of .mov, .mpg, .mpeg, .mp4, .avi and .asf file format.

However the .mp4 (using h264 compression) file that was imported only played audio and not the video. So the video was exported using the native .mov file format which then played the video file in Unity.

To play the video file in the scene it had to be applied to a Unity 'UI gameobject' such as the 'RawImage' container. A script was created 'playVideo.cs' which had to be applied to the container along with the Audio file which appears as a child element of the video.

```
10 //Declaration of variables
11 public MovieTexture movie;
12 private AudioSource audio;
13
14 public Text gui;
15 public Text videoPlayed;
16
17 // Use this for initialization
18 void Start () {
19     //this finds the RawImage gameobject that the code is applied to and applies the video to it.
20     GetComponent<RawImage>().texture = movie as MovieTexture;
21     //gets the AudioSource from the inspector panel and applies that to the audio
22     audio = GetComponent<AudioSource>();
23     audio.clip = movie.audioClip;
24     //Plays both the movie and the audio together
25     movie.Play();
26     audio.Play();
27     /*shows the total float duration of the video and sends it gui.txt
28     as texts which is attached to a text component on the canvas.
29     FormantTime is a called from below to converts the time into minutes and seconds*/
30     gui.text = FormatTime(movie.duration).ToString();
31
32 }
```

Fig.29 Script to play video when the page is loaded

The movie was applied to the movie field of the script this links the video from the Project attest to the 'VideoPlayerImg' ^[53]

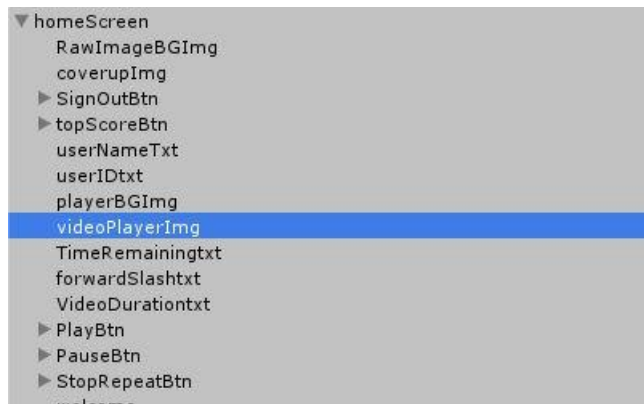


Fig.30 Unity VideoPlayerImg in the Unity Hierarchy

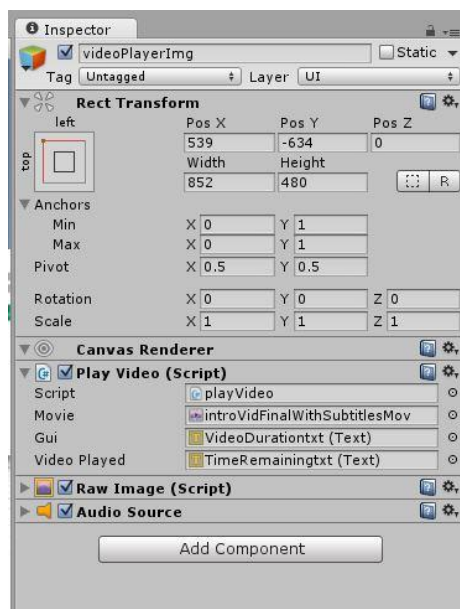


Fig.31 Unity Inspector window for the VideoPlayerImg component

A display timer was created for the intro video so that the user can see how long the video will last for before the clip ends. This duration was originally a float and was converted using the 'FormatTime' function to minutes and seconds. ^[54]

```
//this is more user friendly to read when were looking at time.  
//This convert the time to Minutes and Secounds with a colon in between, /60 converts it to minutes, %60 converts it to seconds  
private string FormatTime(float timeInSeconds)  
{  
    return string.Format("{0}:{1:00}", Mathf.FloorToInt(timeInSeconds/60), Mathf.FloorToInt(timeInSeconds % 60));  
}
```

Fig.32 Code to convert time to minutes and seconds

Unity does not give flexibility over the video Playback as does not give the time information of the video other the total duration. On the other hand, it does give more flexibility and functions over the sound files. The AudioSource.time functions was used in the Update state to call the current time of the Audio being played. The default code to Pause and Play the video was converted into functions outside the update state as code in the update function can be taxing to resources as it is called on every frame. Buttons were also a better way to let the user know these options were available to them which may also help users who will be reading the subtitles.

Issues Faced: Some colours of the video changed noticeably when it was imported into Unity. Unity covertrs all video files using Ogg Theora format ^[51]. This is noticeable due to the yellow colours in the chevrons changing into darker yellow tones.

The audio timer keeps resetting to 0:00 when the video is Paused and played again. A lot of searching, modifying and testing was done within the code. However no solution to this issue were found.

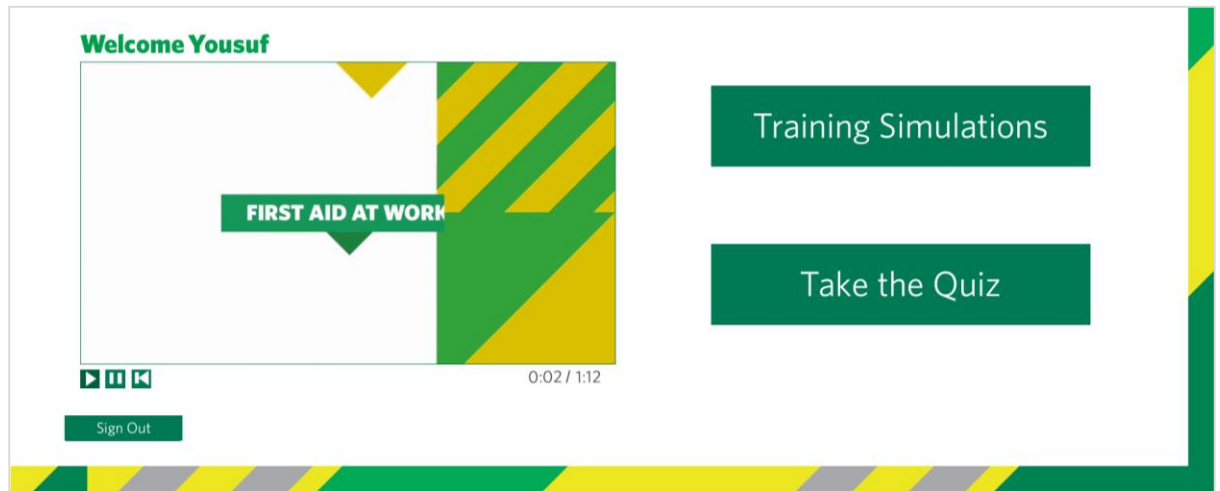


Fig.33 Colours in video reproduced incorrectly

5.3.17 Simulations

When creating the simulation in Unity. The FBX Skeleton animation files were imported from Maya with the skeletons using the Mixamo scripts. Then a using Mecanim Advanced Animation^[55] with sub state machines and modifying the script to make it toggle between animations it was possible to make the simulations come to life in Unity. Unity was a new system to learn and had many difficulties were faced when making the animations both in Maya and unity. They were all overcome and some good work was produced with the time limitations in place.

5.3.18 Sound Editing

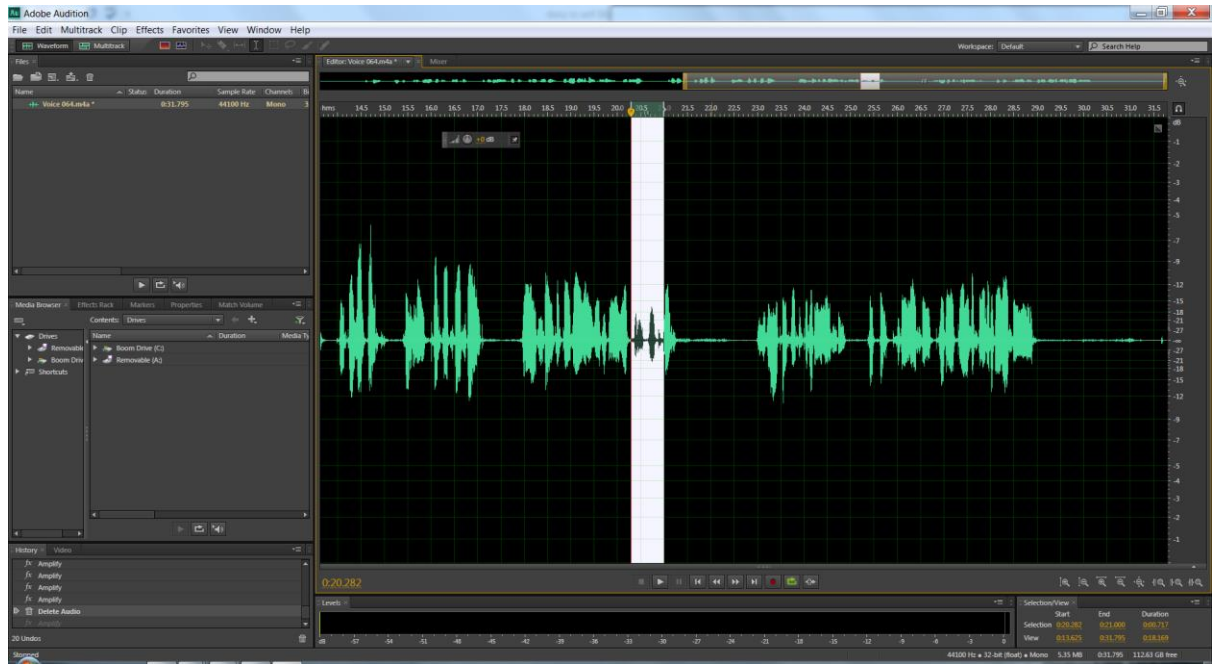


Fig.34 Sound Editing for Simulations

Adobe Audition was used to remove any long pause in the recording or where the voice drops off slightly. This could be an issue for users who suffer from loss of hearing. The vocals were made steady by increasing the volume using the waveform Decibel (db) was adjusted in the editor. Then the sound files were ladled carefully and inserted into the project.

5.3.19 Problems Encountered

5.3.19.1 Maya 2015 issues

Whilst working in Maya certain issues were becoming apparent.

The problem with Maya was that every time a new file with a model was created using a new name it remembered all the previous names and applied it to each of the node of my model.

This made the names of each of the nodes much longer than necessary. This may impact the size of the file and make it harder to read each of the selected joint nodes individually as shown below.

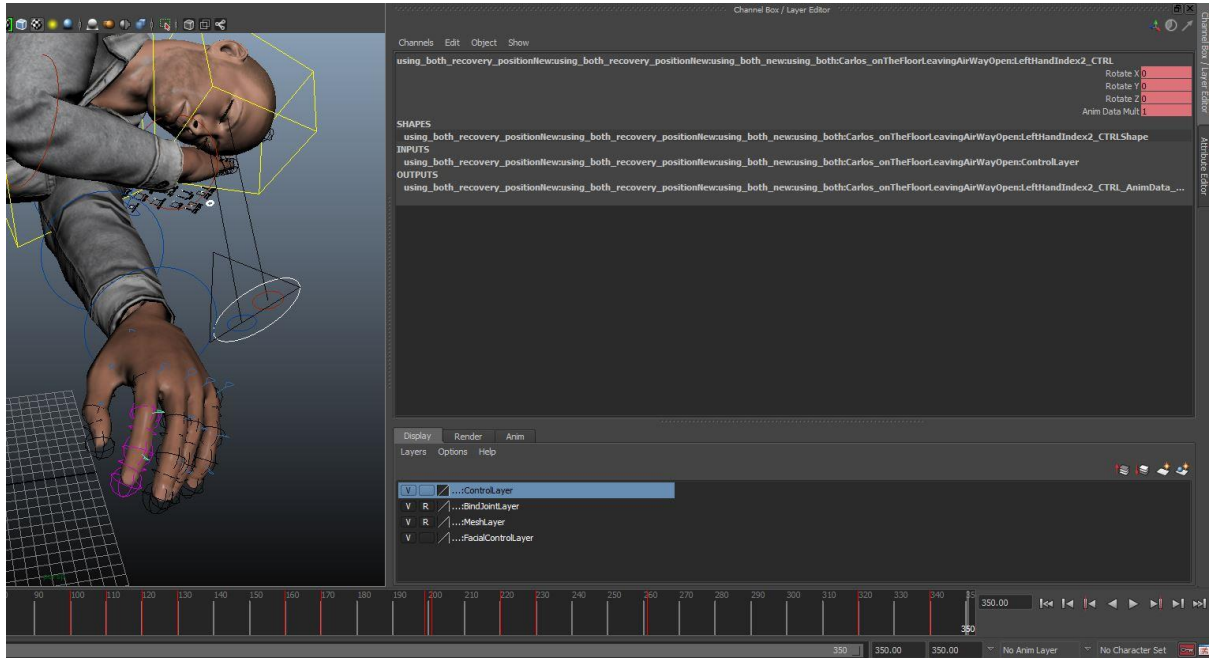


Fig.35 Namespace issue in Maya

5.3.19.2 Unity 5 issues

Generating each of the individual animation for each of the characters and importing them into unity from Maya was a difficult task. This was due to following tutorials that dictated each of the models would need to be animated individually in Maya then exported using the Mixamo script plugin. Working like this meant that characters interacting at the same time would be very difficult. If one of their animations move slightly faster than the other or placed incorrectly in the 3D environment the body parts of the models will impale or move into each other as shown below. This made the workflow a lot harder and more time-consuming as we would have to move back and forth between each of the applications.

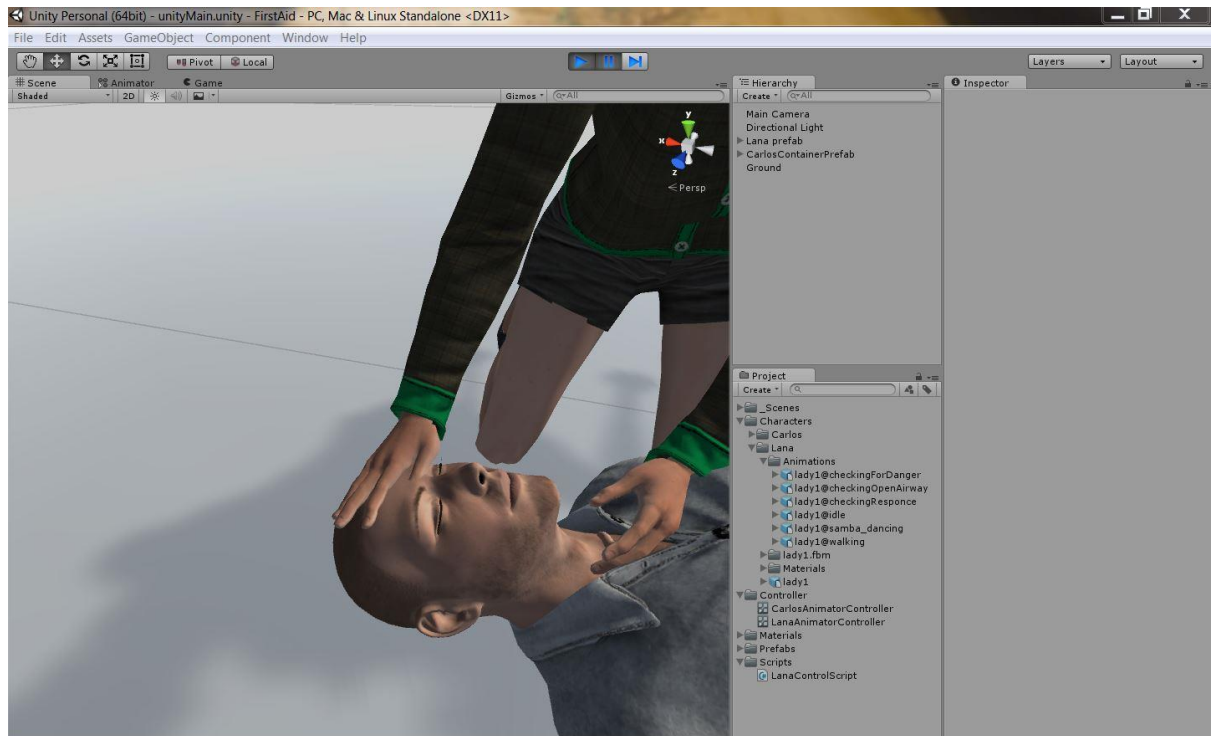


Fig 36 Impaling body parts within Unity.

Solution Used: The solution discovered to rectifying this issue was to Rig the Mixamo characters and save them as a Maya file. Then open one of the model files and import the other into the workspace this will open the other Rigged character and allow you to animate them in the Maya 3D environment at the same time. Save the file with two names for each of the characters and using the Mixamo script plug-in export the FBX skeleton files with the animations.

The solution also had issues where Maya applied Namespace and Prefixes to each of the characters and all their components. This would cause the following error.

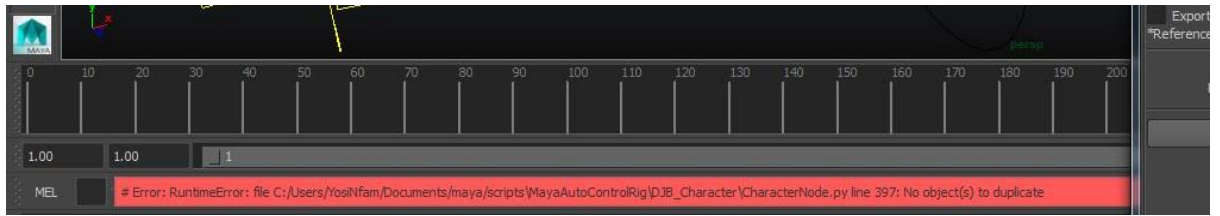


Fig 37 Error generated due to using two characters with the same names in a Maya scene.

After a lot of trial and errors to try and understand the issue a fix was identified online which would resolve the problems using the Window>GeneralEditor> NamespaceEditor and using the outliner window to delete the Prefix manually ^[56].

The namespace editor also allowed me to remove any unwanted components that belonged to the other character.

Although the solution above was troublesome at first it would save a lot of time to develop the animations for unity.

6 TESTING

6.1 BLACK BOX TESTING

During the development phase of this application, testing was a continuous cycle where each section of the code generated within Unity would be tested. The Debug.log function allowed the programmer to check and identify if certain parts of the code were in working order.

```
if (count ==1)
{
    // Using the debug log helps to identify any issues eariler in the code
    Debug.Log (" Welcome " + inGameUserName + inGameUserID);
    //welcome home Screen
    //homeScreen.enabled = true;
    Application.LoadLevel (2);
}
if (count > 1)
{
    Debug.Log (" Duplicate username and Password created");
}
if (count < 1)
{
    //Debug.Log (" The username and Password is not correct");
    WrongLoginPopUp.enabled = true;
}
```

Fig 38 Debug login manager script

6.2 USER TESTING

During this project life cycle user testing was carried out in three phases first tests were completed once the initial paper based designs were developed. The second user testing was carried out when the wire frames were developed, lastly the third testing phase were undergone once the software had been prepared.

After the first test results

6.3 QUESTIONNAIRES

6.3.1 Paper Based Design Questionnaire

From the paper based questionnaires, majority of the feedback was positive. However some important constructive feedback were also received. Some individuals did not find the paper based design easy to understand and read as it was not clear enough due to the lack of colour therefore, they were unable to identify with the user interface. However other results has shown that users were able to identify in a positive manner with all the questions asked this could be due to familiarity with similar systems. Majority of the users found that the pages followed a consistency due to the design and layout.

6.3.2 3D First Aid Application

The 3D First Aid Application received more positive feedback as users found the application easy to use, the colours coordinated with St John ambulance guidelines. The end users also liked the fact that the application had 3D simulations, sound and audio engaging them. They expressed that the personalised welcome made them feel as though the application was tailored for them.

Test users have stated that they would like more interactions including further 3D simulations where possible.

6.4 INTERVIEWS

Louise bailey: (Work colleague)

Louise was asked what her thoughts were with regards to the development of a first aid application to enhance the learning of first aid at work 3D application. She was very pleased to hear the concept as this “would help greatly as a refresher tool” which would probably help many other too. However this tool may not be suitable for the Training Centre as they don’t currently have many computers.

6.5 OBSERVATIONS

The application was tested on peers who did not have prior experience in first aid and has not completed the course to assess the ease of use of the application and how fast it was to understand. It results showed that the users found the application easy to pick up and pleasant feedback was given regarding the aesthetics and the format of the application.

Praise was given in relation to the 3D simulations as it was mentioned that “this will greatly help in understanding as the right environment is not always caught when producing animations in 2D”. The sound aided significantly in producing a better application and overall, a professional feel was sought after.

6.6 FURTHER DEVELOPMENT

As with any project, there is always room for further development.

Creating a functional email page by linking the project online and developing the project so that it adapts well with different resolutions. This can be done by creating most of the text and

graphical elements within the Unity engine using multiple 2D game objects however this may increase the size of the project and produce lag in the application.

Completing the test page so that it is fully functional add an administrative page for the trainers to segment and evaluate the results. This will help improve identify areas of improvement and help them identify areas of learning that may need more support from the staff.

Inserting interface functions for visual Aid such as increasing font size, providing colour change options, although most of these adjustments can be made from the operating system settings it adds to the user experience to have them included or available to the user.

More enhanced simulations and fun test scenarios and questions. Nevertheless due to time restraints on the course test questions should be limited.

7 CONCLUSION

Learning styles and requirements were identified and applied to the 3D software. Whilst creating the software knowledge gained from the multimedia MSc course was adapted and used in developing a 3D based software which allowed users to learn how to provide first aid at work.

The prototype was developed to see if 3D-based learning environments were better to help support retention more than the standard 2D learning environments or work sheets. After researching work that was done in the past ^{[5],[6][7]} and looking at the test results from the test

subjects. The results showed that there was a learning process to be aware of while learning to use the programme. Were there help guides? Was it easy for them to navigate the system? Did they adapt to the application on their first attempt due to the ease of use and was the User interface recognisable and correctly labelled.

This software was built on the knowledge that this will not be a replacement in any way to the real training that takes place. However, it can be used as an alternative to the SJA paper based worksheets ^[57] that were given at the end of each day to test their knowledge.

Assuming that some of the users who attend the First aid training course may not be computer literates or dislike using computers should be provided the paper alternative. However this software was developed so that new users will find is easy to recap their training using the simulations and score a higher test result.

More standardised tests should be completed for such results to be valid.

Developing the prototype was a very enjoyable learning experience yet also a tedious task especially, when facing unknown errors within the software and trying to identify and find new solutions for them. Sometimes it was hard to identify if the problem was with the computer or its user. However, all the valuable lessons taught on the course once was priceless always make backup and test after every change made. If big changes to the interface designs were made then make sure to user test them to get a second opinion just in case the development has flaws.

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This was a research paper which observed some of the more common game development life cycle (GDLC) and highlight their strengths and weaknesses. The refined and presented a solution which seemed to have a better structure and attributes. This project will be using their lifecycle to put it to the test.

[2] St John Ambulance. (2015). First aid at work (3 day course).[online] Available from: <<http://www.sja.org.uk/sja/training-courses/first-aid-courses/first-aid-at-work.aspx>>

This site contains information regarding the first aid course on which I have attended. It also contains the contents of the course and what was taught in it.

[3] St John Ambulance. (2015). Calculate first aid and health and safety requirements. [Online] Available from: <<https://www.sja.org.uk/sja/training-courses/requirements-calculator.aspx>>

St John ambulance calculator to evaluate legal first aid and health and safety requirements within the work place.

[4] [St John Ambulance. (2013). First aid at work course comparison chart. [Online] Available from: <<http://www.sja.org.uk/sja/pdf/CourseComparisonChartv3.pdf>>]

Course comparison chart consisting of what is taught.

[5] Rice, J. W. (2007). Assessing Higher Order Thinking in Video Games. Journal Of Technology & Teacher Education, 15(1), 87-100. [online] Available from: <<http://search.ebscohost.com/login.aspx?direct=true&db=ehh&AN=22682353&site=ehost-live&scope=site>>

Rice developed a system in which game developers will be able to develop games for learning and enable users the ability to gain a higher level of thinking. Some portions of this research is disproved in other literature

[6] [[Dalgarno B, Lee M.(2010). What are the learning affordances of 3-D virtual environments?. British Journal of Educational Technology, 41(1), 10-32.[online]Available from:< <http://onlinelibrary.wiley.com/doi/10.1111/j.1467-8535.2009.01038.x/epdf> >

The Journal states that 3D increases motivation, engagement improved contextualisation of learning. The author also contends that further studies are important in 3D games and VLES

[7] Whitton N. (2014). Digital Games and Learning: Research and Theory. TJ International Ltd.

Cornwall

This book had a lot of extensive research in the field of Digital games and learning from them.

[8] StatCounter Global Stat.(2015). Top 10 Desktop Screen Resolutions in the UK.[online]
Available from: <<http://gs.statcounter.com/#desktop-resolution-GB-monthly-201510-201512>>

Top 10 Desktop Screen Resolutions in the UK screen resolutions which also contains laptops

[9] Mixamo.(2015). Mixamo Fuse.[online] Available from:< <https://www.mixamo.com/> >

This application was used in creating the 3D characters however since then Mixamo is now in partnership with Adobe.

[10] Unity Asset Store.(2015). Asset store Unity 3D. [online] Available from:
<<https://www.assetstore.unity3d.com/en/>>

This Asset store was looked at but no items were bought or used in this project.

[11] Mixamo.[2015].Maya: Auto-Control Rig Script.[online] Available from:
<<https://www.mixamo.com/scripts>>

Auto rig tutorial and knowledge base where information of how to use Mixamo is available

[12] Blender.(2015).Blender 2.76.[Online] Available from: <<https://www.blender.org/>>

Blender is an application to model and animate 3D characters. This application was not used in the project as Maya 2015 alternative was used.

[13] Autodesk Maya.Maya 2015 Education downloads.[online] Available from:<
<http://www.autodesk.com/education/free-software/maya> >

Maya 2015 was the software that was capable of supporting the Mixamo Auto rig plugin and was required to create the 3D Animations.

[14] Watkins A.(2011).Games with Unity and Maya- How to develop Fun and Marketable 3D games. Focal Press. Oxford. P.276,284, 290,310-311, 335, 358,505.

This book was helpful in finding instructions to use within the unity game engine however the code used in the book was Java script so that did not help much when coding the program

[15] unity.(2015).Unity5.[online] Available from:< <https://unity3d.com/5>>

The homepage to find information regarding unity5 and download the package.

[16] unity.(2015).Unity Tutorial.[online] Available from< <https://unity3d.com/learn/tutorials>>

Unity Tutorial site new developer or users to get started.

[17] Crespi A.(2015). Unity 5: 3D Essential Training.[online] Available from:<<http://www.lynda.com/Unity-tutorials/Unity-5-3D-Essential-Training/383666-2.html>>],

Unity 5 essential training tutorials was used to learn a lot of tools and techniques

[18] Aleksandr.(2014). Documentation, Unity Scripting Languages And You.[Online]Available From< [Http://Blogs.Unity3d.Com/2014/09/03/Documentation-Unity-Scripting-Languages-And-You/](http://Blogs.Unity3d.Com/2014/09/03/Documentation-Unity-Scripting-Languages-And-You/)>

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[19] Tejani A.(2010). ECMM702 User Centered Interface Design Introduction. UCID, University of Westminster, London

Lecture notes referring the UCID Introductory notes with regards to strategies to promote good mental models.

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Lecture notes referring the UCID Memory and cognition processes and best practice used.

[21] Tejani A.(2010). ECMM702 User Centered Interface Design Perception. UCID, University of Westminster, London

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[22] St John Ambulance.(2014).Identity Guidelines.[Online] Available from:<<http://my.sja.org.uk/Resource/pdf/St%20John%20Ambulance%20brand%20guidelines%20September%202014.pdf>>

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[23] Tejani A.(2010). ECMM702 User Centered Interface Design Skill Acquisition. UCID, University of Westminster, London

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The Primary Survey was used at one of the main animations as it was the first technique is used to Identify what has happened to a casualty.

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Game played and tested to identify what are the current standards for high-end 3D games

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Game played and tested to identify what are the current standards for high-end 3D games

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The 2D Flash based Game created for St John Ambulance evaluated and tested as part of the research

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<<https://www.sja.org.uk/sja/first-aid-advice/free-mobile-first-aid-app.aspx>>

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[29] British Red Cross.(2015). First aid by British Red Cross.[online] Available from:
<<http://www.redcross.org.uk/What-we-do/First-aid/Mobile-app>>

British Red Cross First Aid App for mobile phones was evaluated and tested as part of the research

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<https://www.mixamo.com/auto-rigger> >

This online API will auto rig the 3D fuse characters with a skeleton and make is animated and downloadable.

[31] Mixamo.(2015).Face Plus.[online] Available from< <https://www.mixamo.com/faceplus> >

This is an automated Plugin used with Unity and a digital camera to capture facial animations. Only available for pro versions of unit 4.2x - 4.8x

[32] Mr. H.(2012). Animation Principles In Maya - Timing and Spacing.[Online] Available from:
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This was a tutorial to aid in creating better timing animating 3D Maya.

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<http://blog.synopse.info/post/2013/03/23/Latest-version-of-sqlite3.dll-for-Windows-64-bit> >

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9 BIBLIOGRAPHY

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This book contains very useful information in developing games. It covers a lot, history of games, Staff involved and their roles to developing your own game. This book is aimed at beginners to advance game developers.

Miniclip SA. (2014). Plague Inc. [online] Available from:
<<http://www.miniclip.com/games/plague-inc/en/#t-sd>>

This game was researched as it is a bacteria emulator and the sole purpose was to kill the human race although the work was in the complete opposite to what I am trying to create it had a lot of features which can help in learning and transferable skills. The app is very impressive.

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Gee, J. P. (2003). What video games have to teach us about learning and literacy. Palgrave Macmillan. Hampshire

This book contained a lot of theory of how we can learn from games although some of them were very convincing there is no tests done in the field so the information cannot be used as facts.

Austin M, Crawford R, Armstrong VJ. (March 2011). First Aid Manual. 9th ed. Dorling Kindersley, London

This was a manual that was given to me after completing when I had attended the course.

10 APPENDIX

Storyboards

Questionnaires

Code