

**Department of Computer Science**

**BSc (Hons) Business Computing (with Option if appropriate)**

**BSc (Hons) Computer Science (with Option if appropriate)**

Academic Year 2016 - 2017

The concise and insightful title for the project to which this dissertation pertains

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A report submitted in partial fulfillment of the requirements for the degree of

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# Abstract

This document is a template for the dissertation. It includes some guidance to help you write about your project. Use the styles that have been setup (Heading 1, Heading 2, Appendix 1, Appendix 2). If you do this, the table of contents can be automatically generated.

You are very welcome to adjust the styles, and change the template to suit your work. You can have different can have different headings, chapters, titles and structure

The abstract should contain a high level description of the project. You should cover:

* Overview of the Problem
* Approach
* Summary of the contribution and outcomes

Try to keep the abstract short, and certainly not more than about 300 words.

# Acknowledgements

This page is where you have the opportunity to give thanks to anyone, or anything that inspired or helped you with your project.

I certify that the work presented in the dissertation is my own unless referenced.

Signature \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Date \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Total Words: 2005

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# Introduction

Provide a brief introduction to your project, providing some background which allows you to clearly present the problem that you are seeking to address in your dissertation. This section should prepare the reader for the Aims and Objectives which come next.

You may draw on some of your background study as evidence, but you should leave the full background discussion to chapter 2.

I have titled each chapter with a generic heading, but you might want to tailor them to your specific dissertation.

Student often find science related topics boring or overwhelming due to difficulty or number of sources of information. This often means that less students or people are less likely to pursue scientific careers or simply choose to stay away from the subjects entirely.

In the modern day, the gaming community is massive, and gaming is being integrated everywhere. By utilizing this audience, a possible way of addressing this problem is to turn science topics into game levels where the user learns through playing, which in turn would allow the user to learn without thinking they are studying.

A study by (Bejjanki et al., 2014), found that students who played action video games had better “templates” for the tasks at hand compared with student who did not. They were able to “Build and finetune templates quicker and did so on the fly.”

The researchers also found that the improved performance is a lasting effect.   
They also mentioned that it might not have to be an action game, but “They may need to be fast paced, and require the player to divide his or her attention and make predictions at different time scales.”

This is what has led me to choose to develop an educational platformer game.

## Aims and Objectives

Here you should clearly define the overarching aim for your project. Usually, for a final year project, you will have a single aim.

You should then list, the necessary and complete set of objectives that you will need to achieve in order to satisfy the aim:

1. Undertake a relevant background study to identify existing work in the area, and to identify appropriate techniques which can be adopted to produce a solution in this project.
2. Identify an approach which, when executed, will give rise to results from which rigorous conclusions can be drawn.
3. Design and implement some software, or undertake a simulation, or business modelling exercise, or conduct some other kind of appropriate activity which will give rise to the results desired.
4. Tailor the generic objectives to make them relevant for your specific project. Generic aims and objectives will lead to low-grading, generic project.
5. Evaluate the results using an appropriate framework, or set of success criteria which are clearly related to the problem and stated aim.

This project will work on a solution to a lack of interest in science and difficulties in learning by people. The aim is to create a game that takes away the “work” mindset while learning and replaces it with fun to reach a wider audience. The game will also need to be somewhat fast paced and have multiple elements the player needs to focus on.

The objectives that will fulfil the aim are as follows:

* Research how other games, that have the aim to teach, approach making the game intriguing and learn how they make the levels challenging and rewarding.
* Identify a methodology for how the research will be carried out and mention the evaluation process.
* Start implementing a prototype and design the learning aspects of the project.
* Fully implement the game using Unity
* Evaluate the game with online surveys with participants from different educational backgrounds and interests.
* Test the game to ensure it works correctly and smoothly.

## Project Approach

Describe how the project will be undertaken. Remember that the way in which you conduct your project will dictate the nature of the results that you produce, and the corresponding conclusions you can draw from them. This is why it is important that your reader understands how you are going about your project from an early stage, so they can understand how to interpret your results.

First, I will research how other learning-based games implement fun and learning without taking away from either. This will be used to help me design the levels and tailor the difficulties to ensure the game is successful in “fun learning”. I will also be researching the topics that I will add to ensure what I aim to teach in the game is factually correct. Learning the Unity software will also be part of the early stages.

Towards the middle of the researching stage I will start implementing a prototype and progress it alongside me learning Unity.

**At the end of the implementation I will thoroughly test the game** using multiple test cases and methods. The tests will focus on different aspects of the game. For example, efficiency of the game and playability.



## Dissertation Outline

Traditionally, dissertations tend to contain a description of each chapter:

Chapter 2, discusses the background for my project, and identifies some key techniques that can be adopted during the development of the proposed solution. Chapter 3 explains how the project will be undertaken . . . etc, etc.

This approach is acceptable, however it can make quite bland reading. You might like to consider drawing a flow-chart of your project, showing how information such as background data, questionnaire data, results of studies, running computer programs, or undertaking user studies act as input to, or output from your chapters. You can also indicate how each chapter relates to your objectives. This kind of diagram can help to add clarity for your reader, and can help you to get your head round the structure of your project.

|  |  |
| --- | --- |
| Chapter | Description |
| 1 Introduction | Describes the problem this project is going to attempt to solve. Will include the approach to the project and the aims/objectives. |
| 2 Background | This chapter will go through all the research that I have carried out. This will include the topics that the game will tackle, the application that will be used in the project and other games that try to solve a similar problem. This will also determine my approach and techniques during the development of the project. |
| 3 Approach/Methodology | This will describe how I will carry out my project in order to meet the aims and objectives. This chapter will also include the prototype method used for creating the game and how/ when it will be a finished game. |
| 4 What I did p1 – Design | This will show how the game will be structured, language and application used. Prototypes for the GUI and levels will also be introduced using a drawing application. |
| 5 What I did p2 – Implementation | This chapter will cover the implementation of the project. This will examine the different aspects of the system including how the system is coded and the connections between components. It will also discuss how the education aspects are added to the game. |
| 6 Evaluation | This will start the evaluation for the system, in terms of both performance and how effective learning through this game is. |
| 7 Conclusion | This section wraps up the project and will see how well the game meets the aims and objectives. I will also discuss ways in which the platform can be expanded and improved. |

## Project Monitoring

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Dec** | **Jan (1/2)** | **Jan (2/2)** | **Feb (1/2)** | **Feb (2/2)** | **Mar (1/2)** | **Mar (2/2)** |
| Introduction |  |  |  |  |  |  |  |
| Background Research |  |  |  |  |  |  |  |
| Methodology |  |  |  |  |  |  |  |
| Design |  |  |  |  |  |  |  |
| Implementation  (paper proto) |  |  |  |  |  |  |  |
| Implementation  (Unity) |  |  |  |  |  |  |  |
| Testing |  |  |  |  |  |  |  |
| Evaluation |  |  |  |  |  |  |  |
| Conclusion |  |  |  |  |  |  |  |

# Background

In the background, you will produce a critical summary of your background literature. Please do not just describe the background material that you find, reference, by reference. Once you have absorbed your background material, try and write about your problem, describing any conflicting schools of thought, existing solutions, shortcomings of existing approaches, etc., and reference your sources accordingly. Let your writing be supported by your literature. Do not let the literature guide the structure of your writing.

When you make references, please use the Harvard Style. You will find a guide to referencing at the Brunel Library (2013). You may find it useful to use a citation manager such as RefWorks which can be accessed from the library website. Whatever you do, please make sure that you record your references as you go along. Do not try to assemble your references at the end.

## Introduction

* Describe what this chapter will include

This chapter will include research on the benefits of educational games with examples of previously done educational games. It will also include the scientific topics that the game will tackle with a brief scientific explanation of them and when they are typically taught in terms of level of education.   
The chapter will also include various game creation software that have been considered for the project and why I have chosen one over the others.

## Scientific Topics

* Energy production (Nuclear Reactor, Geothermal)
* Briefly describe the science of the topics
* State what level of education introduces you to these topics and to what depth.

The first topic that the game will tackle is to do with energy and how its produced. Within this topic, nuclear reactors and geothermal will be covered.

### Nuclear Reactors

Nuclear reactors consist of:

* Nuclear fuel/Fuel rods that are usually a uranium or plutonium isotope
* A Moderator (Graphite core) that slows neutrons down
* Control rods used to control the speed of reaction
* A coolant which heats up due to the reactions which then boils to drive the turbines
* A concrete shield to protect people from radioactive exposure.

Add to references (<https://www.bbc.com/bitesize/guides/zyqnrwx/revision/2>)

### Geothermal Energy

Geothermal energy uses hot water and steam from deep underground.   
It can be used in volcanic areas where the rocks warm up water which then rises to the surface as hot water and steam, where it can then be used to spin turbines.

It can also used in areas where the rocks are hot, but no water rises. This can be done by pumping cold water down to the hot rocks which is then heated by them and returns to the surface as hot water and steam.   
This can also be used as a heating source for homes.

Add to references (https://www.bbc.com/bitesize/guides/zsmpk7h/revision/3)

## Educational Games

* Explain why educational games help and are useful
* https://journals.plos.org/plosone/article/file?id=10.1371/journal.pone.0156389&type=printable (test to see if test scores improve)
* Show proof?

## Other Educational Games

* Show other games that are educational
  + Lumosity
  + Duolingo
* Explore how they were successful or where they could improve

### Lumosity

This is an app that claims to improve memory, attention, problem solving and speed of processing. It uses a number of minigames that focus on each aspect above. However, there is no medical evidence to support claims that memory training improves cognitive function.

### Duolingo

Duolingo focus’ on language learning and has several languages on the platform from Japanese to Italian. It teaches the language through a series of minigames. An example of one of the games is where a character is shown, and the sound is makes plays at the same time. Shortly after you are then told to recall what character represents the sound of what was just played.

One of its weaknesses was that there was no human interaction to which the learning can be tailored to the student.

//possibly add “https://misfitvillage.itch.io/theoreum”

## Unity

* Explain why I chose unity
  + Includes physics engine
  + Has plenty of support as it is widely used
* Explain the features of the software
  + Built in physics engine
  + 2D and 3D model creator and editor
  + Supports multiple languages, chosen c#

One of the reasons I chose unity is because of the included physics engine. This makes coding the movement of the player and objects much easier so that I am able to focus on other aspects of the game, such as interactions between the player and in game objects.   
Another reason is that the software is widely used which will give me a vast knowledge base. This will help me with whatever issues I encounter.

One of the features of unity is its inbuilt 2D and 3D model creator/editor which will increase the fluidity of making the game as I won’t have to keep switching applications.

It also supports multiple languages which means more people can use it. The language I have chosen is C#.

## Other Applications for Game Creation

* Monogame, why I chose not to use it
  + Not used frequently, so not much support if needed
  + No physics engine, makes natural movement difficult to code
* Unreal Engine, why I chose not to use it

### Monogame

One of the other applications I considered was Monogame. This is purely code based which makes means you need to create your own physics in game which can be very time consuming and prone to bugs/errors. This also means movement will be much harder to perfect and animations will be rather difficult.

It also doesn’t have much of a user base which means limited support is available if a problem is encountered.

### Unreal Engine

This was the biggest contender to Unity as they both have many similarities. The main reason that I went against this is because I have some previous experience with Unity and very limited experience with Unreal.

## Tables

If you use tables in your dissertation, please label them with a caption, so they are included in the automatic list of tables.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | **Impact** | | |
|  |  | 1 | 2 | 3 |
| **Likelihood** | 1 | 1 | 2 | 3 |
| 2 | 2 | 4 | 6 |
| 3 | 3 | 6 | 9 |

Table 1 - A risk analysis table

## Figures

Similarly, if you use tables in your dissertation, please label them with a caption, so they are included in the automatic list of tables.

Process Overview Diagram.pdf

Figure 1 - A generic model of the Final Year Project

# Approach or Methodology

In research circles, this chapter would often be called the methodology. Basically, it is the chapter in which you describe how you are going to go about your project in order to achieve your Aims and Objectives. Are you going to gather requirements in a certain way, build some software, and measure the results of experiments? Are you going to develop simulation models which you will test with a set of expert users, or compare to existing data sets? Will you produce a mock-up of a system and test it with a number of users to ensure that the results are statistically significant.

Whatever you do that is relevant for your project, you need to convince your reader that the approach you are taking will give rise to a set of results that are unbiased, and from which you can draw objective conclusions.

## Introduction

This section will include the way I’ve decided to go about this project to ensure objectives are met.

It will include my research approach which talk about how the data is gathered and where it will be used to meet the objectives.

It will also include the software development approach that will be used during this project.

## Research Approach

The way I’m going to approach researching about this project will expand on section 2 and explore deeper into the topics. I will use different sources to develop a break down of the information and place it in a format that can work for a game.

### Gathering of Data

I will look at physics books, journals and websites to create fact files and then section the information to fit in different aspects of the game. I will also explore what aspects of the topics to introduce first to the user to help with understanding the topic. For example, introducing the concept of needing protection before interacting with radioactive substances.

## Software Development Approach

I will go about developing the software through a RAD - Rapid Application Development, where I will develop a prototype and continually evolve the prototype until it is a shippable solution.

I will start by setting requirements and adjust them as I go along. Then I will proceed to developing the paper prototypes of the levels which I can then start rapidly programming once they are complete.

The paper prototypes will include the layout of the initial levels and where each aspect of the topics will reside in the level. For example, where will the fuel for the reactor be and how can it be obtained; How will this progress to the next stage of the level.

Using the paper prototype, I will develop the level in Unity starting with the layout of the level and then progressing to the mechanics of the game.

# What you did Part One - Design

These middle chapters are the places for you to write what you have done in more detail. This might mean the design, implement, test elements of a software project. It might mean the model, evaluate re-model phases of some kind of business modeling or simulation modeling project. It might be the data capture, requirements gathering, system design and mock-up test stages of an IS project trying to evaluate the feasibility of a software system to solve a particular problem.

You need to divide the material up amongst these middle chapters in a way that will make sense to your reader.

## Introduction

This chapter will showcase the programming language that will be used and how the project will be tested. It will also provide the paper prototypes as well as the information that has been broken down.

## Software Design

## Software Implementation

**Programming language**

The language that I’m most familiar with is Java and recently C#. Therefore, both of these languages are the ones that I considered for this project. I not only want to be able to work with a language that I’m comfortable with, but also a language that suits the needs for game to be successful. When testing or playing a game, you would want the performance of the game to be as sturdy and responsive as possible; and when coming to which language can meet that requirement, C# delivers more. While developing the game, I want the coding of the game to be as smooth as possible and C# has events built in which makes creating interactions between object in the game much simpler to implement.

Java is more resource hungry than C# when it comes to game development which also shows a benefit to using C#. Using C#, I can also use an existing game engine (Unity) to develop the game rather than having to develop my own which will be very difficult both considering the number of developers and time frame.

I could have chosen C++ but as with Java, I would have to develop my own engine and I have little experience with the language.

## Level Design

The way I am going about designing the level is based off of (<http://devmag.org.za/2011/07/04/how-to-design-levels-for-a-platformer/>) – add to references.

It will follow this task list:

* Choose a visual theme
* Create a list of objects and actions
* Design paper prototype of layout
* Design items
* Add detail to paper prototype
* Develop the level in unity
* Test/ Play level
* Finalize/ Decorate the level

### Choose visual theme

The visual them will be decided based on the topic the level is being designed for. The first level being based on nuclear power will suggest the theme being a power plant.

### Create a list of objects and actions

The list will entail all interactions I want the player to experience including what items they encounter and what is needed for the player to progress.

For example, find hazard suit, pick up first fuel rod, etc.

### Design paper prototype of layout

This task requires the layout of the level to be drawn on paper. This will not include any items or interactions, just the path of which I want the player to follow.

### Design items

Here is where I will design the items that will be used in the game. This will include all objects that the player will interact will.

### Add detail to paper prototype

This is where the paper prototype will be used as reference to draw a more detailed prototype where the items that were deigned previously are added.

### Develop level in Unity

Here is where the paper prototype will be used to develop the prototype level in Unity.

### Test/ Play level

This task is where the level is played and evaluated to determine if it is fun and the time it takes to complete. The level will continually be updated until I am happy with the outcome of the level.

### Finalize/ Decorate level

Once I am happy with the level, I will then add details to the map and any audio that is relevant. This can include music and sound effects.

## Test Driven Development

(<https://blogs.unity3d.com/2018/11/02/testing-test-driven-development-with-the-unity-test-runner/>) – add to references

Test Driven Development (TDD) is the practice of writing automated tests for a piece of code before writing the code itself (Sophia Clarke, 2018).

TDD typically follows these steps:

* Determine what the code will do
* Write a test that checks the code does its job
* Run the test; test should fail since code hasn’t been written yet
* Write code
* Rerun test; test should pass

One of the reasons this is done is because when tests are written after the code, developers may favor writing tests designed to pass. However, writing a failing test before you ensure that the code must work before passing the test.

# What you did Part Two - Implementation

We are following a seven chapter model, which gives you a couple of chapters in the middle for the “What you did” part, but if you really think it is better to have eight chapters, that is fine too. If you go for many fewer than seven, you have probably missed something, and if you have many more than seven, you may be going a bit fine-grained.

# Evaluation

This is where you will present your results and provide an evaluation of your solution against the problem. Try and structure your results in a meaningful way. Try and help the reader. Do not just take some numbers, load them into a statistics package such as SPSS and then present every statistical analysis technique in the known world. Use appropriate methods for analysing, presenting and summarising your data.

# Conclusions

This is where you draw your final conclusions. You have presented your findings or data, now summarise how you have met each objective, and draw a conclusion as to whether you have met your overall aim. You should provide some justification for this. There are three possibilities here:

1. You have completely met your aim, and solved your problem (unlikely)
2. Your results show that your solution does not solve the problem at all (unlikely)
3. You conclude that your solution addresses your problem to some extent, but that there are weaknesses in the approach in other regards (most likely)

In each case, you will have produced a valid result, and each of these is equally valuable when it comes to grading your work.

What is less valuable is drawing the conclusion that you have solved all the problems with only weak justification.

## Future Work

You should find that when you reach the end of your project, it will be defined more by what you haven’t had time to do, than what you have managed to do. If you engage properly with the process, you will continually raise questions, and spin-off projects which it would be interesting to explore, but which you simply did not have time to pursue while focusing on the primary aim of your FYP. This is your place to write about these areas as inspiration for future students.

# References

Brunel University Library (2013) *Harvard Referencing Guide.* Available at: http://www.brunel.ac.uk/\_\_data/assets/pdf\_file/0020/161471/Harvard-Guide.pdf (Accessed: 18 November 2013)

### BEJJANKI, V. R., ZHANG, R., LI, R., POUGET, A., GREEN, C. S., LU, Z. AND BAVELIER, D.

#### Action video game play facilitates the development of better perceptual templates

**In-text:**(Bejjanki et al., 2014)

**Your Bibliography:**Bejjanki, V., Zhang, R., Li, R., Pouget, A., Green, C., Lu, Z. and Bavelier, D. (2014). *Action video game play facilitates the development of better perceptual templates*.

Personal Reflection

This compulsory appendix should contain a personal reflection on your project. It should contain two sections:

Reflection on Project

In this section, you should reflect on the project you have undertaken, and consider, with you specific knowledge of the topic area, studies that you undertook, and problems you encountered, how you might have undertaken it differently.

Personal Reflection

In this section, you should consider more personally how you might have worked differently to deliver an improved project if you had your time again.

Appendices

More relevant material

The remaining appendices can contain relevant material which is not essential to be included in the main body of the dissertation, but which may be useful to support your dissertation.

* Examples of relevant material might include:
* Example questionnaires
* More detailed designs
* Relevant results which didn’t fit in the main body

Examples of material that should not go into an appendix:

* A dump of all your code
* Transcripts of all your interviews

Remember, that the appendices should be there in case the reader wants to refer to them. They will not be read as part of the dissertation story, so do not just use them to put essential material because you ran out of room. Also, do not be tempted to pad out your dissertation to the full 60 pages just by adding lots of unnecessary material to the appendices.

Any supplementary materials can be uploaded electronically with your submission.