UNIVERSITÀ DEGLI STUDI DI TRIESTE

Dipartimento Universitario Clinico di Scienze mediche, chirurgiche e della salute

Laurea Magistrale in Medicina e Chirurgia

Cost-effectiveness of the italian screening protocol for international adoptees

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Laureando
Sebastiano Genna

Relatore
Prof. Egidio Barbi

Anno Accademico 2017/2018

"There are times when the adoption process is exhausting and painful and makes you want to scream. But, I am told, so does childbirth."

- Scott Simon, journalist and radio broadcaster

Abstract (Italian)

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Abstract

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Acknowledgements

To my friends *I Cazzilli*: Fede, Lorenz, Grismina and Ste, for always being worthy of being the family I chose for myself and for looking out for me day after day.

To Emme, for growing from my sweetheart to the woman of my life.

To Carol, the closest tea-brewing sister I could hope for. I'm proud of you.

To my Mom, for teaching me, among another thousand things, her own personal special way of calling somewhere *"home"*.

To my Dad, for always trying to be the man he ought to be.

To the rest of my strange, enlarged family, for always supporting me in every possible way.

To Luca, my tireless desk-mate, who never called himself out of an all-nighter.

To Valentina, who helped me stand in times when I couldn't stand for myself.

To prof. Barbi and prof. Ventura, for remembering me that medicine can be how i dreamed it.

And lastly, to myself, for always believing that, even when your heart's lost all its hope, after dawn there will be sunshine.

Contents

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Abbreviations

CFD	**C**omputational **F**luid **D**ynamics
VR	**V**irtual **R**eality
AIRC	**A**erospace **I**ntegration **R**esearch **C**entre
SATM	**S**chool of **A**erospace, **T**echnology and **M**anufacturing
HMD	**H**ead **M**ounted **D**isplay
API	**A**pplication **P**rogramming **I**nterface
OS	**O**perating **S**ystem
VRTK	**V**irtual **R**eality **T**ool**K**it
GUI	**G**raphical **U**ser **I**nterface
OOP	**O**bject **O**riented **P**rogramming
OOD	**O**bject **O**riented **D**esign
UI	**U**ser **I**nterface
TCP	**T**ransfer **C**ommunication **P**rotocol
RAM	**R**andom **A**ccess **M**emory
XML	E**x**tensible **M**arkup **L**anguage
UML	**U**nified **M**odeling **L**anguage

Chapter 1

Introduction

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1.1 Objectives

Being a rather open-ended project, i.e. a project in which there is no strict and well-defined set of software requirement specifications, the objectives of the development have been purposefully kept wide and general, as to reflect the idea that the project could follow an exploratory approach.

Nonetheless, there are still some guidelines that have been followed from the beginning to the end of the project:

- The project shall result in a working prototype of a Virtual Reality application.
- The application shall allow the handling of CFD data; in particular, it shall provide:
  - visualization of the data,
  - interaction with the data,
  - some basic forms of manipulation of the data.
- The application shall allow the import of data from ParaView.

- The application shall run compatibly at least on Windows (version 7 or greater), and optionally on Linux.
- The application shall support a HTC Vive kit.
- The code should be designed to be maintainable, flexible and expandable.
- The application should be easy to use, being it aimed at CFD scientists with little to no prior VR experience.

In Section 1.2 these objectives will be discussed in light of the work done.

1.2 Project Management

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1.2.1 Time management

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1.2.2 Versioning and productivity tools

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1.2.2.1 Github

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1.2.2.2 Waffle

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Chapter 2

Materials and Methods

2.1 Literature Review

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2.2 Technologies Used

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2.2.1 ParaView and VTK

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2.2.1.1 Virtual Reality Capabilities in ParaView

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2.2.2 Unity

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2.2.2.1 Object behaviors in Unity

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2.2.2.2 Virtual Reality Capabilities in Unity

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2.2.3 ParaUnity

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Chapter 3

Results

3.1 Introduction

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3.1.1 Why Unity?

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3.2 Application Architecture

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3.2.1 Environment

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Chapter 4

Conclusions

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4.1 Final system architecture

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4.2 Objectives achieved

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4.3 Future work

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Chapter 5

How to Do

This is all I know on LaTex up to now.

5.1 Including Sections and Subsections

This is my first section.

5.1.1 I like myself

I'm nice.

5.1.2 but I'm weird

but fun.

5.1.2.1 LOST OF FUN!

Writing writing and writing.

5.1.2.2 I'm calm and shit

I write stuff in subsubsections.

And lastly this is new and amazing PARAGRAPH: You can write whatever you want and it's pretty cool and new. I still like subsubsections more.

5.2 Including references and citations

This is pretty simple to cite: developed as open-source C++ software by Rudolf Biczok [23]. We'll learn more about this as we go.

5.2.1 Referencing images and tables!

So you can see figure 5.1 at page **??**. AMAZING
OR you can also see the table 5.1 at page 18!

5.2.2 Referencing chapters and subchapters

You can also ref chapters, as Chapter Results 3.

5.2.3 Using footnotes

Let's try this out.[1] And another one to see if it is progressive and shit.[2]

I'll try now to "place them manually". This is were the sign is.[3]
Somewhere else in the text. I insert what it contains.

[1] This is my first footnote.
[2] CAREFUL! Don't leave any spaces before the command or they will be rendered.
[3] This is my footnote!

5.3 Including quotes

This is how a quote looks.

> From an evolutionary perspective, virtual reality is seen as a way to overcome limitations of standard human-computer interfaces; from a revolutionary perspective, virtual reality technology opens the door to new types of applications that exploit the possibilities offered by presence simulation.

And also in text quotes: "[by] immersing the user in the solution, virtual reality reveals the spatially complex structures in computational science in a way that makes them easy to understand and study".

And dots...

5.4 Including code

The following code is written by Lorenzo:

```
public void ToggleShow(bool show) {
  // Hide all walls
  foreach (GameObject wall in walls)
    wall.SetActive(show);

  // Set default material to floor
  floor.SetMaterial(show);
}
```

5.5 Formatting Text

This is BOLD *This is ITALIC* This is SANS SERIF `This is TRUE TYPE`

In this sentence this is tiny. this whole sence is tiny.

I go back to normal.

Then I can go for large, or Large, or Larger, or Huge and even HUGE.

5.6 Including bulleted list

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- The first item of your list
- The second item of your list
- The third item of your list

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1. The first item of your list
2. The second item of your list
3. The third item of your list

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a) The first item of your list

b) The second item of your list

c) The third item of your list

5.7 Including Figures

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5.8 Including Tables

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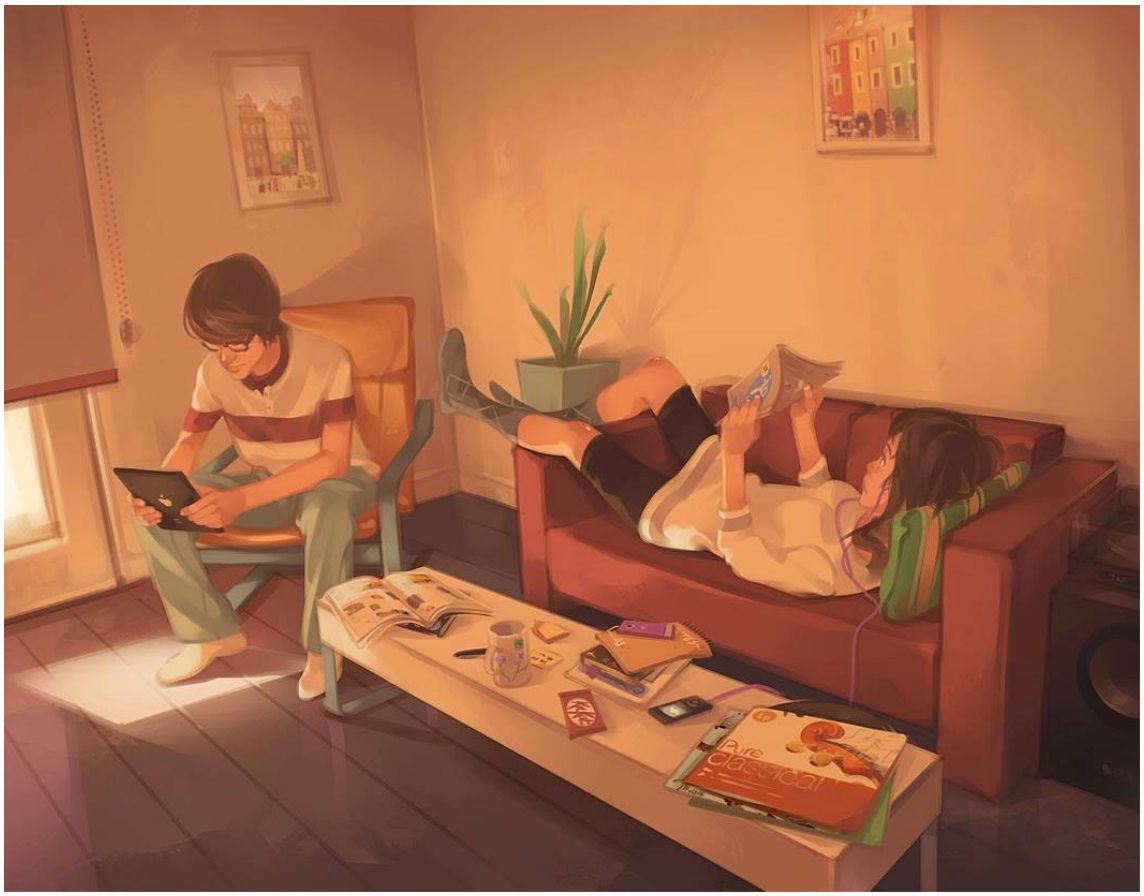

FIGURE 5.1: Living room as I imagine it

Source: Photo courtesy of HTC

Day	Max Temp	Min Temp
Mon	20	13
Tue	22	14
Wed	23	12
Thurs	25	13
Fri	18	7
Sat	15	13
Sun	20	13

(A) First Week

Day	Max Temp	Min Temp
Mon	17	11
Tue	16	10
Wed	14	8
Thurs	12	5
Fri	15	7
Sat	16	12
Sun	15	9

(B) Second Week

TABLE 5.1: Max and min temps recorded in the first two weeks of July

ParaView			
VTK			
OpenGL	**MPI**	**OpenVR**	**Etc.**

TABLE 5.2: ParaView-VTK Architecture (simplified)

Appendix A

Setup Instructions

This appendix provides the instructions to setup, install and run the software system described in this thesis. They refer to a machine with VR-ready hardware running Windows 10.

A.1 Building ParaView and ParaUnity

This section provides the instructions for building a working copy of ParaView with the ParaUnity plug-in. It is a simplified and adapted version of the *readme* file of the official ParaUnity repository [23].

A.1.1 Prerequisites

- CMake 3.8.1
- Visual Studio 2015 x64 Community Edition

A.1.2 Obtain the source code

To obtain a patched, pre-prepared version of the source code for Qt, ParaView and ParaUnity, clone the repository available at `https://github.com/vrcranfield/paraviewunity`. Unless specified otherwise, all the following instructions refer to the files contained in this repository.

A.1.3 Compile Qt

The files in `Qt4.8.6` are a patched version of Qt that allows compilation with Visual Studio 2015 x64.

In order to build it do the following:

1. Move the content of `Qt4.8.6` in `C:\Qt\4.8.6`
2. Open the `VS2015 x64 Native Tools Command Prompt` from Start.
3. cd `C:\Qt\4.8.6`
4. `./configure.exe -make nmake -platform win32-msvc2015 -prefix C:\Qt\4.8.6 -opensource -confirm-license -nomake examples -nomake tests -nomake demos -debug-and-release`
5. `nmake`
6. `nmake install`
7. Add `C:\Qt\4.8.6\bin` to the Path environment variable.

A.1.4 Compile ParaView

The files in `ParaView-v.5.2.0` consist in the official source code of ParaView.

In order to build it do the following:

1. Open CMake and set source in `ParaView-v5.2.0` and build in `ParaView-v5.2.0\build`
2. Configure with "Visual Studio 14 2015 Win64" as a generator.
3. Check that `PARAVIEW_QT_VERSION` is `4` and that `QT_QMAKE_EXECUTABLE` points to `C:\Qt\4.8.6\bin\qmake.exe`. If necessary, configure again.
4. Generate.
5. Open with VS2015.
6. Build solution.

A.1.5 Compile ParaUnity

The files in `ParaUnity` are the developed and improved version of the official ParaUnity plugin, as described in Chapter **??**.

In order to build ParaUnity do the following:

1. Open a terminal in `\ParaUnity\Unity3DPlugin`
2. `mkdir build`
3. `cd build`
4. `cmake -G "Visual Studio 14 2015 Win64" -DParaView_DIR="<PARAVIEW_DIR>\build" ..`
5. Open `\ParaUnity\Unity3DPlugin\build\Project.sln` in Visual Studio
6. Right click on the project `Unity3D`, go to `C/C++ > Additional Include Directories` and add `\verC:\Qt\4.8.6\include\QtNetwork`
7. Build.
8. You now have some files (most importantly a `Unity3D.dll` file) in `\build\Debug`. Remember their location.

A.1.6 Loading the plug-in in ParaView

To load the plug-in in ParaView, do the following:

1. Open ParaView 5.2.0 (from `paraview.exe` in the `\build\bin\Debug` folder, or from Visual Studio).
2. Go to `Tools > Manage Plugins`, click `Load New` and locate `Unity3D.dll`
3. Open the dropdown entry from Unity3D and select `Auto Load`.

A.2 Building the Unity Application

This section provides the instruction for obtaining and building a working copy of the Unity Application described in Chapter **??**.

A.2.1 Prerequisites

- Unity 5.6.1f1

A.2.2 Obtain the source code

To obtain the source code of the Unity Application, clone the repository available at `https://github.com/vrcranfield/UnityApplication`. Unless specified otherwise, all the following instructions refer to the files contained in this repository.

A.2.3 Compile the application

In order to build the Unity Application do the following:

1. Open the root directory of the project in the Unity editor.

2. `File > Build Settings`
3. Uncheck all scenes apart form the `Main` scene.
4. Set `Target Platform` as `Windows` and `Architecture` as `x86_64`.
5. Click build.
6. Choose the same location as the `Unity3D.dll` (see previous section).
7. Save the file as `unity_player.exe`

A.2.4 Exporting an object from ParaView to Unity

To test if the system is working correctly, do the following:

1. Load any file in ParaView (e.g. a simple sphere)
2. Click the button with the Unity logo and the `P`
3. You should see your Unity scene with the ParaView object in the middle.

Appendix B

Code of the Unity Application

In this section the code of the scripts of the Unity Application is provided. The appendix is divided in sections, each containing the source code of one class, in alphabetical order.

B.1 AnimationManager

Stuff maybe goes here?

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