AUTISTICALLY GIFTED

Capstone Project Final Report

Yasmine LAASSILA

Supervised by:
Dr. Bouchaib Falah

Spring 2017
I confirm that I have in fact respected the standard ethics of the design and development process. I have made sure to guarantee the “safety of the public to be paramount and [have] addressed this in the presented design wherever may be applicable” as specified in the requirements of this class.

AUTISTICALLY GIFTED

Capstone Final Report

Approved by the Supervisor:

Dr. Bouchaib Falah
Acknowledgements:

First of all, I would like to express my sincerest gratitude to my supervisor Dr. Bouchaib Falah for his constant feedback, support and help throughout all the phases of this project.

Second, I would also like to thank Dr. Aure Veyssiere and Dr. Maurice Frank Venables who helped me gather the information I need about Autism and get the professional input and requirements from another doctor who is specialized in children psychology in Morocco, Dr. Meryem Tahiri, who explained to me what I should do exactly.

I would also like to thank my friend Zahia Rochdi for her valuable advice and testing of the product from a customer point of view.

I want to take this opportunity to express my deepest gratitude and sincerest thanks to all the members of the community of Al Akhawayn University, especially the faculty members, who prepared me to make and have my own projects and taught me how to manage them from A to Z!

Finally, I would like to express a shy thank you to my family, friends and fellow Akhawayn students who supported me and helped me throughout my journey of 4 years in this university.
# Table of contents

Acknowledgements .................................................................................................................. 2  
Abstract .................................................................................................................................. 6  
1. Introduction ............................................................................................................................. 7  
2. STEEPLE ANALYSIS ............................................................................................................. 8  
   2.1 Societal factors: ................................................................................................................. 8  
      2.1.1 Demography: .............................................................................................................. 8  
      2.1.2 Health consciousness: ............................................................................................... 8  
   2.2 Technological: .................................................................................................................... 9  
      2.2.1 Factors ....................................................................................................................... 9  
      2.2.2 Effects ...................................................................................................................... 9  
   2.3 Environmental: .................................................................................................................. 9  
      2.3.1 Factors: .................................................................................................................... 9  
      2.3.2 Effects: .................................................................................................................... 10  
   2.4 Economic: .......................................................................................................................... 10  
      2.4.1 Factors: ..................................................................................................................... 10  
      2.4.2 Effects: ..................................................................................................................... 10  
   2.5 Political: ............................................................................................................................ 10  
      2.5.1 Factors: ..................................................................................................................... 10  
      2.5.2 Effects: ..................................................................................................................... 11  
   2.6 Legal: ................................................................................................................................ 11  
   2.7 Ethical factors: ................................................................................................................... 11  
3. Methodology and development process .............................................................................. 12  
   3.1 Specification: ..................................................................................................................... 12  
      3.1.1 Feasibility Study: ....................................................................................................... 13
Table of figures

Activity diagram for the categorization/emotion recognition game ........................................... 19
Activity diagram for the visual discrimination/emotion recognition game: ............................. 20
ERD for game 3 ............................................................................................................................ 21
Class diagram for the 3rd game .................................................................................................. 21
Screenshot of the different scripts written for the project: .................................................... 23
Snippets of some of the scripts: ............................................................................................... 23
Abstract

The main purpose behind my capstone project is to develop a game that will help autistic children by teaching them some basic life skills that they usually struggle with, in a fun and an entertaining way.

This project, named Autistically Gifted, aims to improve the social behavior and interactions of autistic children focusing on three main areas of their problems: Emotion recognition, categorization and visual discrimination. Thus, the game will include a different set of scenes, each targeting a different issue of those mentioned above.

The game is meant to be played by an autistic child; however, it could be played by young kids or toddlers who don’t have issues as well in order to improve their reactions and enhance them. Either way, the game is designed in a way that requires the child to have a supervisor or companion around to help them.

The player is supposed to select the scene that they want to play in and will accordingly get the tasks that they’re supposed to accomplish to finish that level.
1. Introduction

The goal of this capstone project is both educational and entertaining. It aims the help of autistic children through a game that will improve some of their life skills in a fun and a kid-friendly way.

Research on the way autistic children behave, their attention span, and things they find attractive will be of huge interest to this project and it has been studied in order to be used in the game. For example, because it has been proved by a study and a project conducted at the Vanderbilt University that an autistic child reacts better and pays attention more to a robot, the main character of the game is a robot. [1]

The game is composed of different scenes. Each scene focuses on different issue but deals with more than just one of the 3 issues. For example, the first game deals directly with categorization while also involving emotion recognition. It is set as the first requirement for finishing the game. The player will have to categorize a set of pictures of facial expressions into the four main different emotion categories: happy, sad, angry and surprised. The second game is based on a typical memory card game. After having been able to recognize the emotions in the first game, now our player is required to remember the different pictures of the faces while making sure to not confuse the pictures of the same faces but with different facial expressions, hence, this game focuses on visual discrimination. Finally, the last game, consisting of three levels, introduces our player as a 2D robot plat-former who has to go through simple missions following a specific scenario, each of a different emotion. This last game focuses on emotion recognition only and uses characteristics specifically chosen for autistic children: A robot as the main player since autistic kids react better to robots on screens, and pieces from an autism music therapy session as audio [2].

Because of the nature of this project and its main clients, images and sounds will be an important feature to grab the attention of the children.

The user will be greeted with a homepage containing a small menu prompting them to pick what they want to do.
2. STEEPLE ANALYSIS

This game is a first finished draft of a product that can be extended to cover more issues instead of just the three that I have chosen to focus on. It can also become a platform of educational games aiming the help of children in need in general and not just autistic children. For example, the platform could contain a second set of games for dyslexic children to help them with writing and reading and so, keep them from being behind in class and their studies as it is usually the case.

To learn as much as I can about the project’s external factors, I need to do a STEEPLE analysis to know how these different factors impact my project:

2.1 Societal factors:

These factors, according to a definition found on pestleanalysis.com, they “involve the cultural and demographic aspects of the external macro-environment” [3]. Here are the ones I found for my project:

2.1.1 Demography:

According to the World Health Organization’s report of 2016, 1 in every 160 children has an autism spectrum disorder [4]. And this number covers only the cases that have been diagnosed. This means that autism is a relevant issue that requires all the attention it can get and so, my project is demographically justified.

2.1.2 Health consciousness:

This project does indeed target a specific segment of society that has a mental health difficulty. This means that it should not be based on any assumptions or unjustified innovations that may affect the health of the clients negatively. So, all my requirements and specifications were gathered from a professional children psychologist, Dr. Meryem Tahiri. In addition to that, I used studies conducted by several universities in the US and the UK to support my approaches.
2.2 Technological:

2.2.1 Factors:

Based on the same website mentioned above, these factors concern the “technological barriers to enter” society and markets. Here are the technological factors considered for this project: [3]

Resources: Thanks to the constant progress in technology, most the tools that I wanted and needed to make this project were available to me:

- Online 2D game development class
- C# tutorials
- Unity5.5
- Android Studio

Publication: In order to publish the product on Google Play for example, a small lifetime fee is required. [5] Using Play-store merchant accounts

2.2.2 Effects:

Unfortunately, when it comes to innovation, only a few people involve or consider people with special needs and this covers the technology field as well. There are thousands of games and game applications available online but only a few numbered ones are developed for customers with special needs. My project is inspired by normal games but recreated them in a new way adapted specifically for autistic children, making this its technological added value.

2.3 Environmental:

2.3.1 Factors:

Based on the same website mentioned above, the purpose of the study of these factors is to assess the impact of my project on the environment.

Natural resources: Water, wind, soil and food:
They are unexploited, unused and irrelevant to my project and its scope.
Pollution: My product is a software product. It cannot be affected by external pollution.
2.3.2 Effects:

As mentioned in the introduction above, current solutions for the improvement of social and communication skills of autistic children are based on traditional interactions in therapy centers using boards, papers, and cards. My product groups all these components digitally, reducing the requirements for paper, chalk, etc and their effects on nature and the environment.

2.4 Economic:

2.4.1 Factors:

Based on the same website mentioned above, these factors are those that affect the potential customers’ purchasing power. Here are the economic factors:

Currently, the solutions offered are black boards and sets of cards and old-fashioned verbal games in special autism centers. My solution will be available on mobile phones for free, making it easily reachable, accessible and used. According to [6], a huge number of people around the world own/use phones (+1.8 billion), and so, access to the application should not be a problem.

2.4.2 Effects:

Although my games could replace the traditional therapy sessions done for autistic children, they will not cut down any job opportunities in that segment since, and as I have mentioned earlier, my project requires a supervisor with the child to help him/her through the game tasks. So it should not impact the economy negatively.

2.5 Political:

2.5.1 Factors:

Based on the same website mentioned above, these factors include the government regulations and legal issues that might impact my product:

Employment laws:
No employees are needed, so this section does not, in any way, affect my game.

Trade restrictions and political stability:
Both factors do not present a problem for the development, publication and use of my game.

2.5.2 Effects:

My project has no political implication.

2.6 Legal:

Based on the same website mentioned above, these factors deal with legal complications. I need to constantly check the new legal requirements to ensure the compliance of my product. Factors considered:

Legal restraints:

No law or regulation was limiting my project was found.

Health and safety of employees:

As said above, no employees are needed, so this does not even count as a factor.

Health and safety of users:

As explained in the social factors, this has been taken into consideration, as everything was done under the supervision of a children psychologist and with the support of several credible studies.

2.7 Ethical factors:

Based on the same website mentioned above, these factors are the social values that govern the business behavior. They are the foundation of what is right and what is wrong. Here are the factors considered:

Originality:

The game is the result of my idea and was not copied off anybody else’s.

Citation:

All the studies and entities used for the development of this product are cited and given their due credit.

My product respects ethics and was conducted in a very careful manner to not cross any line.
3. Methodology and development process

A software in general is a program or set of programs with their associated documentation including requirements, design models and user manuals. In order to develop my software for specific customers: autistic children of ages in between 4 and 12, I had to learn about autism, autism therapy, contact specialists in the field and get familiar with game development as well as special children needs.

As far as the methodology used goes, I have used a systematic approach to my work, using all the appropriate tools and techniques, [7] that I have learned throughout my software engineering class, in order to solve and reach my goal.

Since my project required an incremental process and a fast delivery, the development process followed is a RAD process: Rapid Software Development, especially Agile Methods and specifically talking about Extreme programming. I have chosen this method because it allowed me to work in small increments with minimal planning, which was perfect for my deliverable schedules. In addition to that, it allowed late software changes even in requirements, which was the case for my project throughout the entire semester. This allowed to constantly change my code based on my changing requirements. Among the main agile techniques adapted, I can mention: Test driven development and code refactoring.

My project followed these four steps of the software engineering process:

- Specification
- Development: Design and Implementation
- Validation
- Evolution

3.1 Specification:

Through a detailed feasibility study and requirement specification, the functionalities, services and constraints of the project were gathered and analyzed. This first step of the software process consisted of interviews with Dr. Mariem Tahiri, who, after having received my proposal for the project and the idea, got back to me with an approval and the set of requirements that I could cover.
3.1.1 Feasibility Study:

Fortunately, my project did not have any constraints in terms of what technologies I should use. Other than the technical health requirements that I had to respect, the development and technology sections of the project were all up to me and I had the freedom to choose the environments, platforms and languages I wanted to work with.

3.1.2 Technology used:

Microsoft Visual Studio:

I chose to work with this IDE (Integrated development environment) because of its solution-diversity. It can be used for the development of web and mobile apps, as well as web services. In addition to that, I have used it in other classes before which made me very familiar and comfortable with it.

Unity:

I chose to use this game engine because this was my first time developing a game and based on a research I’ve done at the beginning of the semester, through which I contacted several game developers and bloggers via game forums in order to know which game engine is best for a beginner. Furthermore, what made me insist on using this engine was the fact that it is a cross-platform game engine. This means that it covers Windows, Linux, Android, Max…

C#:

For the scripting of the games, I have used the scripting language c#. This languages, according to Microsoft’s website [8] “it was designed for the purpose of building applications, it is simple, powerful and object oriented.” Besides, it is supported by Unity game engine. This means that, in order to attach scripts to my gameObjects, I needed to use C#.

Android Studio:

This is the official IDE for the Android platform.
3.1.3 Schedule

<table>
<thead>
<tr>
<th>Weeks</th>
<th>Tasks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Project selection</td>
</tr>
<tr>
<td>2</td>
<td>Initial specification</td>
</tr>
<tr>
<td>3</td>
<td>Requirements + feasibility study</td>
</tr>
<tr>
<td>4,5,6,7,8</td>
<td>Design &amp; implementation of the first 2 games + the interim report</td>
</tr>
<tr>
<td>9,10,11</td>
<td>Implementation of the last game</td>
</tr>
<tr>
<td>12</td>
<td>Improvements and testing</td>
</tr>
<tr>
<td>13,14,15</td>
<td>Final report, presentation + the modified report</td>
</tr>
</tbody>
</table>

3.1.4 Requirements elicitation and analysis:

In order to elicit and set the requirements, both functional and non functional, I had to conduct a study regarding the topic that I am targeting and to contact different people that could be helpful. Relevant information was indeed collected from the university’s counselors and a child psychologist from Casa Blanca.

a- Requirements specification:

This step completes the previous one. The collected requirements were classified into the following main categories:

b- Functional Requirements:

In general, the functional requirements are the requirements that make the functionalities that the game is expected to provide and how it is supposed to react to specific inputs.

1. Access the first main menu

<table>
<thead>
<tr>
<th>The requirement</th>
<th>The player shall have access to the main menu</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input</td>
<td>Click on the icon of the app/software</td>
</tr>
<tr>
<td>Output</td>
<td>Menu displayed</td>
</tr>
</tbody>
</table>
Picking the setting

<table>
<thead>
<tr>
<th>The requirement</th>
<th>The player shall choose the option he/she wants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input</td>
<td>Click on the option wanted</td>
</tr>
<tr>
<td>Output</td>
<td>Redirection to the appropriate option</td>
</tr>
</tbody>
</table>

If the option picked is Play:

<table>
<thead>
<tr>
<th>The requirement</th>
<th>The player shall be able to play the 1st game</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input</td>
<td>Click on play</td>
</tr>
<tr>
<td>Output</td>
<td>Scene of game 1 is displayed</td>
</tr>
</tbody>
</table>

Dragging a picture:

<table>
<thead>
<tr>
<th>The requirement</th>
<th>The player shall be able to drag a picture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input</td>
<td>Click on a picture</td>
</tr>
<tr>
<td>Output</td>
<td>The picture is dragged</td>
</tr>
</tbody>
</table>

Zooming the picture

<table>
<thead>
<tr>
<th>The requirement</th>
<th>The player shall be able to zoom the picture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input</td>
<td>Drag the pic away from its frame</td>
</tr>
<tr>
<td>Output</td>
<td>Original size of the pic: zoomed</td>
</tr>
</tbody>
</table>

Dropping the picture:

<table>
<thead>
<tr>
<th>The requirement</th>
<th>The player shall be able to drop the picture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input</td>
<td>Let go of the picture</td>
</tr>
<tr>
<td>Output</td>
<td>Picture dropped into selected slot</td>
</tr>
</tbody>
</table>
### Ability to go back/next

**The requirement**
The player should be able to move from a scene to another, unless the scene targeted depends on the current scene. (ex: game 3)

**Input**
Click on next/ previous

**Output**
Next or previous scene is displayed

### Playing the 2nd game

**The requirement**
The player shall be able to play the 2nd game

**Input**
Clicking on the turned picture frames to match the pictures

**Output**
If matched, the pictures stay flipped, if not, they go back to their original state.

### Playing the last game

**The requirement**
The player shall be able to play the 3rd game

**Input**
The following keys: left/right/up/down/space/P/S

**Output**
Movement of the player: running, jumping, attacking, shooting candy, sliding, skipping text

### Exiting the game

**The requirement**
At all times, the player should be able to quit the game mode

**Input**
The escape key

**Output**
Closing the game
If the option picked is Settings:

<table>
<thead>
<tr>
<th>The requirement</th>
<th>The player shall be able to access the controls of the game</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input</td>
<td>Click on Settings</td>
</tr>
<tr>
<td>Output</td>
<td>Settings scene is opened</td>
</tr>
</tbody>
</table>

Change audio settings:

<table>
<thead>
<tr>
<th>The requirement</th>
<th>The player shall be able to mute/play audio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input</td>
<td>Click on audio/mute</td>
</tr>
<tr>
<td>Output</td>
<td>Audio starts/audio stops</td>
</tr>
</tbody>
</table>

c- Non-Functional Requirements:

The Non-functional requirements focus more on the constraints of the product. Here are some of the non functional requirements considered for this project:

Product requirement:

**Efficiency requirement:**

The response time of my game to the player’s actions should be quick.

**Space requirement:**

The game shall not occupy more than 20K ko.

**Usability requirement:**

Not only should the application have a user friendly interface, but it should have autistic and child appropriate characteristics: The colors used, the size of the font, the use of images, the music used, the weapons used: candy and lollipops instead of bullets and knives.

**Reliability requirement:**
The functionalities/user requirements specified above should work as specified and so be reliable.

**Portability:**

The software should be compatible with Windows and Android. For this purpose, a set of buttons were added to the interface to allow the user to play the 3rd game on a mobile phone since it requires different keys as input: (S, P, Jump, Slide, Attack, Shoot, Run).

**Organizational requirement:**

**Delivery requirement:**

The Autistically Gifted application shall be finished by the end of April.

**Development requirement:**

The games will be scripted using C#.

**External requirements:**

**Ethical requirements:**

The application shall respect all ethical standards and regulations of both game and app development, as well as the special requirements of its customer segment.

**Requirements validation:**

This will be checked throughout the different steps of the development of the game to make sure that it conforms to the requirements.

**3.2 Design and implementation:**

Having a clear idea of the problem that I am targeting with this system, this step of the software engineering process allowed me to plan my solution, design it and implement it.

**3.2.1 Software Design:**

For this software, I have chosen to follow the agile method because it works with incremental deliverables, which is also, the nature of the submission of this project. Each
step/increment goes to its own software lifecycle to make sure that it conforms to the requirements at all time and that it works fine. This way, the testing is made easier and the final testing will cost less time. In addition to that, this method allowed and will allow me to make any changes needed and extensions.

**Diagrams Used:** Activity and ERD.

1st game:

*Activity diagram for the categorization/emotion recognition game*
I used an ERD to represent the structure of my 3rd game:

- First of all, the logical structure of the 3rd game’s entities is based on inheritance of the entities: Player and Enemy from Character as shown in figure. The use of inheritance here was used to better manage the Player and enemy classes since they are very similar and related. The details of the Enemy will be shown below in figure, separately since it has a lot of additional different features/functionalities.
ERD for game 3

Class diagram for the 3rd game

Enemy:
This diagram explains how the enemy goes from a state to another: Attacking state depending on the range (distance between him and the player), idle state (not moving/resting), patrol state (walking left and right between two specified points until it targets the player then it follows it).

For the enemy, I chose to use an interface. Since C# does not support multiple inheritance, I tried to group objects’ behaviors under one interface. For the IEnemyState interface, there are four different classes that implement it. I used this feature for maintainability and component-based programming.
3.2.2 Software implementation:

In this step, the system structure is translated into an executable program. The programming language used to develop the system is #C. #C scripts are allowed to be attached to game Objects on Unity 5.5, as long as these scripts derive from the base class that all Unity scripts derive from.

Unity as a game engine is a great tool since it has the drag-drop feature of assets (folders, pictures, material, prefabs,…). However, my games required more than just the simple drag and drop features, from allowing a coin to glow to allowing a character to move/attack. As a result, I coded about 30 different C# scripts.
Screenshot of the different scripts written for the project:

Dropdown.cs
EnemySight.cs
Inventory.cs
login.cs
register.cs
IgnoreCollision.cs
MeleeState.cs
movingPlatform.cs
PatrolState.cs
Player.cs
RangeState.cs
SwordCollider.cs
trigger.cs
LandBehavior.cs
SideBehavior.cs
Bullet.cs
Camera.cs
Character.cs
Enemy.cs
GameManager.cs
IdleState.cs
EnemyState.cs
AnimatedDialog.cs
AttacksBehavior.cs
Bar.cs
DamageBehavior.cs
DeathBehavior.cs
GlareBehavior.cs
JumpBehavior.cs
Knife.cs

Snippets of some of the scripts:

Code snippet of the Player script covering 3 of its functions:

Flipping the player, handling the input of the customer, handling the movement of the player.
private void HandleMovement(float horizontal)
{
    if (MyRigidbody.velocity.y < 0)
        myAnimator.SetBool("land", true);
    if (!Attack && !Slide && (OnGround || airControl))
    {
        MyRigidbody.velocity = new Vector2(horizontal * movementSpeed, MyRigidbody.velocity.y);
    }
    if (Jump && MyRigidbody.velocity.y == 0)
    {
        MyRigidbody.AddForce(new Vector2(0, jumpForce));
    }
    myAnimator.SetFloat("speed", Mathf.Abs(horizontal));
}

private void HandleInput()
{
    if (Input.GetKeyDown(KeyCode.Space))
        myAnimator.SetTrigger("Jump");
    if (Input.GetKeyDown(KeyCode.UpArrow))
        myAnimator.SetTrigger("attack");
    if (Input.GetKeyDown(KeyCode.DownArrow))
        myAnimator.SetTrigger("slide");
    if (Input.GetKeyDown(KeyCode.S))
        myAnimator.SetTrigger("shoot");
}

private void Flip(float horizontal)
{
    if (horizontal > 0 && !facingRight || horizontal < 0 && facingRight)
    {
        ChangeDirection();
    
}
Code snippet for playing dying and allowing the game to be played on a phone (Movement buttons implementation was required because my game uses several keys, so a simple screen touch wouldn’t be enough.)
4. Main interface:

This part deals with the main scene/menu. From this menu the player can start the 1st game and then move on to the other games. The last game contains 3 different levels covering 3 different and simple-child appropriate tasks.

4.1 Game one

This game deals with the first issue: Categorization. This means the struggle that autistic children find categorizing things. It indirectly targets Emotion recognition as well since the
pictures/items used in the panel to be dragged are pictures expressing different facial expressions while the categories are emotions. The task of this game is very simple and straightforward.

4.2 Game two

This game deals with the second issue which is Visual Discrimination. This means the ability to discriminate between similar items. For example, an autistic child may find trouble differentiating between a “d” and a “b.” Therefore, in this memory game, I have chosen to use pictures of the same faces, each having a different emotion. That way, not only would the game target emotion recognition once again, but it will also help with visual discrimination.

4.3 Game three

This game deals with the third and last issue which is Emotion Recognition. This refers to the challenges that an autistic child could face while communication with someone. They may not be able to recognize the emotion expressed on the face of their partner. Based on this, this game features 3 different levels, each with a different scenario/context based on one specific emotion. In addition to that, all the characteristics of the game, from scenes, themes, colors and sounds were chosen carefully to fit the customer segment and be child appropriate. Furthermore, this game uses a robot as a player and music-therapy pieces for autism as audio. This way, it is made even more appropriate for autistic children.

5. Difficulties encountered:

Time-cost for learning C# and 2D game development:

This was my first time developing a game. So, I had to learn and familiarize myself with Unity from scratch. Moreover, I have only used C# before for only one project about 3 semesters ago. So, I had to relearn that as well. I had to watch a series of online game development tutorials of about 40 videos, each lasting between 15 and 40 minutes long. Therefore, just the learning process of this project was time-costly.

Getting the assets:

A crucial characteristic of games is graphics. For this game, I needed a set of assets corresponding my ideas. Unfortunately, the sample assets that come with Unity are very basic and simple. I wanted something more complex. The kind of assets I found were available only
for money using an international visa card which I did not have. Consequently, and after about a week of resource location, I finally found a website featuring 2D game assets for download, both for free and for money, depending on the chosen sets. I have managed to find appropriate assets for free.

**The bugs:**

I have faced several bugs throughout the way. The few that I will mention are those that lasted the longest and so I still remember them. When I was developing the second game, I first had a set of 12 pictures. Then, when I modified it to 16 (for better display on the screen), I forgot to modify the corresponding for loop in its script, as a result, Unity started crashing. No errors were reported by Unity nor Visual Studio, the game ran normally, until the IDE crashed. I had to redo the game, and only then, while creating the scene for the second time and setting the images for my pictures, have I realized that the error was actually very simple and all I had to do was change a 5 to a 9. So I ended up with two versions of the same game.

The second bug that distressed me a lot occurred on the level of the last game. I wanted to create a health bar for my characters. First of all, I could not find cute-child appropriate and interface-friendly health bars in Unity’s asset store. I had to customize my own. Once I finished that part and created a health bar as a prefab (So I can use it on another project if I want to), I had to create a health bar script and attach it to my gameObject, in this case, the health bar prefab. Unfortunately, all the solutions I found in the documentation of Unity and Unity forums, as well as tutorials, suggested to use a runtime C# script. However, this type of script cannot be attached to gameObject on Unity. It took me about a week to find a better solution.

**Mistakes:**

While I was developing game 3, and before adding the enemy, I had a simple structure. So my games worked fine. When I added the enemy character, my 3rd game started taking a delay before running. To improve this, I deleted all the assets and scripts that I had saved under my project and was not using. Mistakenly, I also deleted the scenes (equivalent to a page for a game) for the 1st and 2nd games. 10 days later, I realized what I have done, and had to redo them from scratch. Also, I found a better way to remove the delay caused by the 3rd game. I created a Character script, and had my Player and Enemy inherit from it instead. Furthermore, I replaced
my old animation scripts (Jump, attack, etc), with animation behaviors implemented generically by Unity and then I customized them based on my needs.

6. Outcomes of the Capstone:

I loved the experience of working on an individual project while having the absolute freedom to apply what I have studied to whatever field I want and use the technologies I want instead of having to conform to the specifications of a particular professor or class. Because of that, I had the option to choose to develop games as a project. As a result, I learned how to use Unity and make a simple 2D plat-former game. In addition to that, it made me strengthen my C# skills, as well as it served as a totally different and new direction for me. In fact, throughout my four years here at AUI, I had different projects, and my goal was to learn something new from this experience. For example, my projects went from C programs solving specific problems (Introduction to programming/Data structures classes), to Java programs with a graphical user interface (Advanced programming class) to web and desktop applications connected to a database (Software Engineering 1 and database system classes), to implementing a part of a compiler (Languages & compilers class), to developing a mobile application (software engineering 2 class) And finally, and thanks to my capstone project, I had the opportunity to develop games as well!

7. Conclusion and future work:

The software that I have worked on complies to the requirements that Dr. Mariem Tahiri and I set at the beginning. It targets the three communication/behavior issues that we wanted to help with. Moreover, it can be extended to cover even more area issues. In fact, I could add a couple more games before creating a merchant android account to publish the game on the play store.
8. References


