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# None in Three: The Design and Development of a Violence Prevention Game for the Caribbean Region

David Smith

A thesis submitted to the University of Huddersfield in fulfilment of  
the requirements for the degree of Master of Arts by Research in  
Game Design

School of Art, Design and Architecture

University of Huddersfield

December 2017



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# Abstract

Approximately 1 in 3 women worldwide have experienced either physical and/or sexual intimate partner violence or non-partner sexual violence in their lifetime. The *None in Three* project aims to reduce violence against women through training of civil society organisations and public awareness. It also seeks to change attitudes of young people through the use of a prosocial game.

This thesis demonstrates techniques used to develop a violence prevention game. Emotional reporting interfaces and techniques were evaluated. Script writing was shared across a multidisciplinary team of experts in the Caribbean. A number of techniques were used to speed up development, including the use of Adobe Fuse and Mixamo's motion capture store allowing for the semi-automated creation of 3d characters. An event editor called Actus was developed, which allowed for a multiple-choice dialogue system to communicate a level's objects, saving event implementation time.

The *None in Three* Caribbean game's development lasted 18 months and resulted in a 3d point-and-click adventure game called *JESSE*. The game was rolled out in a trial in schools in Barbados and Grenada. Findings indicate that players become more familiar with an emotional self-reporting interface over time, and that children are more adept at identifying threatening behaviour and body language than other emotions. Players initially found the controls challenging, but usability greatly improved in the later, larger environments. The most effective learning appeared to come from the game's dialogue. Players seem to predict what will happen if they don't take action, and the majority of players choose to leave at the end. It is difficult to determine if this is due to information they learned during the game or prior knowledge. The *None in Three* project has announced a global expansion, with 5 further games being developed for different countries around the world.

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*More information about the None in Three Caribbean and Global projects, including the game titled None in Three – Jesse,*

*can be found at <http://noneinthree.hud.ac.uk/>*

# 1 – Introduction

Violence against women is a global issue affecting all demographics and cultures. Over a third of women have experienced either intimate partner violence and/or non-partner sexual violence (WHO, 2013). These issues can have huge social and economic costs, with Domestic and Sexual Violence accounting for as much as 0.5% of the GDP of Trinidad and Tobago (Theodore, Laptiste, La Foucade, Metivier, & Gittens-Baynes, 2008).

The *None in Three* project was created to tackle violence against women in the Caribbean and features a whole-of-society approach, developing training for health and social care professionals and workers in the legal system based upon qualitative research into the issues faced by women and the attitudes of both men and women towards violence. In addition to creating systemic change through training, the project also seeks to raise awareness of domestic violence issues and begin the process of changing attitudes towards violence among young people. In order to achieve this, the *None in Three* project has developed a serious gaming intervention for young people aged 9-18 with the goal of educating players about domestic violence and its impact on families and those around them. The game is also designed to encourage attitude change towards violence through educational role play.

This thesis will cover the background of educational and prosocial games and their merits. Afterwards, there will be an exploration of detailed research already undertaken by the *None in Three* project, along with how the findings of these studies have influenced the design of the game and its content. This will be followed by a look at a number of educational game design theories, identifying any approaches suitable to the game content based on the preliminary research. Afterwards, a look at Emotional measurement techniques will identify methods that can be built into the game. The thesis will then discuss practical development techniques and design considerations in order to ensure the effective creation of a contextually accurate prosocial game for the Caribbean region. A number of research methods will be identified and compared, which will determine the

best way to approach the data gathering process to determine the usability of the game and its systems.

This study is one of several related to the *None in Three* Caribbean project. Research scope has been limited to determining the usability of the game and its Emotional Intelligence reporting interface, as the success of the gaming intervention with regards to causing attitude change and violence prevention is being investigated by a separate work package of the project through means of a psychological survey.

Player data from the game will then be analysed and findings will be discussed. Alongside this will be a discussion of the most effective parts of the collaborative process involved in developing the game, and an explanation of challenges faced in the data gathering process.

## 2 – Literature Review

In this section, existing applications of serious and educational games will be explored. This is followed by a background in the domestic violence issues the game intends to raise awareness of, and the context of the *None in Three* project in more detail.

### 2.1 – Applications of Serious Games

Serious games have a wide range of purposes. In this section a number of Serious Games are identified with a variety of different goals.

#### 2.1.1 – Games for Wellbeing

Some games are designed to encourage people to improve their lives, whether as the primary goal of the product or as an indirect outcome of an entertainment game.

Fitness games, also known as Exergames, are games that are designed to improve the physical fitness of a player by having physical actions as part of the core gameplay loop. *Zombies, Run!* (Start, 2012) is an exergame for mobile devices. Players must run to generated locations within their local area, and sprint during intervals of gameplay to avoid zombies capturing them and ending their session. Throughout their run, players are rewarded with an audio narrative about the fictional post-apocalyptic world they are role-playing in.

Players are promised additional narrative if they continue to play the game, rewarding them for persistence in their exercise. This can in turn form a habit of returning to the game, where they might previously have given up on a traditional exercise programme. This behaviour was examined during a study of 40 participants (Cowdery, Majeske, Frank, & Brown, 2015), which found that a group exposed to the game intervention maintained an intrinsic motivation to engage with it over 12 weeks. The control group were given a non-exergame fitness tracking app instead. The overall activity of the control group declined, whereas the intervention group's activity was maintained. This

reveals that exergames have the potential to establish good fitness habits through the leveraging of engaging narrative content.

Games are not just created in an attempt to improve physical health. Some games are created to improve the cognitive function of players. This is considered to be especially important for the elderly, as cognitive functionality has been found to worsen with age (EL, 2007). A controlled trial of elderly people playing the game Brain Age for 5 weeks found that short-term training through video games resulted in the improvement of executive functions and processing speeds in the elderly (Nouchi et al., 2012). Although trials like this indicate improvements in brain health and some cognitive function, there is limited evidence that these games improve the daily cognitive abilities of older people (Health, 2017).

#### 2.1.2 – Games for Learning

Games can be used as learning experiences in a wide variety of ways. Some games are designed entirely to educate players, whereas others may educate indirectly.

Many entertainment games encourage tangential learning through historical and geographical accuracy. Games set in real-world locations can allow players to develop a sense of familiarity with their real-world counterparts. Watch Dogs 2 (Ubisoft, 2016) is set in San Francisco, with a large number of the streets and landmarks in the game being identical to reality, as demonstrated by a comparison article (Hollister, 2016). Although most games in the entertainment space stray from realism in favour of other design goals, players that learn the layout of the streets in Watch Dogs 2 also learn some of the layout of real-world San Francisco.

Sometimes entertainment games find serious applications as a byproduct of the original design intent. Minecraft (Persson, 2011) is an open-world sandbox survival game containing systems that are abstractions of real-world scientific and natural concepts. An article covered the usage of Minecraft by 8 and 9-year-old girls (Dezuanni, O'Mara, & Beavis, 2015), with one girl stating that the fictional substance Redstone is 'kind of like electricity in Minecraft'. The girl goes on to explain more

about Redstone theory, understanding that her knowledge of the system is transferrable to electric circuitry as well.

Some commercial games provide challenge in a way that causes players to practice skills that will assist them in their day-to-day lives. The developers of the popular 90's light-gun game 'The House of the Dead 2' decided to release a modified version of the game (Brew, 2017), which replaced the light-gun with a QWERTY keyboard instead. In order to make progress, players must type word prompts quickly and correctly into the game to kill the zombies that approach the player. To complete the game, players will practice typing quickly, and learn the spelling of words they may not be familiar with.

Simulation games aim to recreate certain jobs or physical actions from reality, with a focus on realism. Simulations are often created not as games, but for industries as training tools. One popular type of simulator used for entertainment purposes is the Flight Simulator, as pilot lessons are expensive and players may be located very far from an airfield. Well-developed simulations can have educational value, which translates into skills usable in real life. Users of desktop flight simulator software have later taken flight lessons and found they were familiar with some of the processes involved with flying a plane (Sparks, 2012).

### 2.1.3 – Games for Advertising

Games for advertising are often referred to as 'Advergames', and are developed primarily to encourage audience participation with a product, or to raise awareness of a brand or cause.

Audi are using VR during the sale process by including a digital showroom at each physical showroom (World, 2017). Through working with Newcastle-based company ZeroLight, dealership visitors can customize car specifications and walk around them, instead of relying only on the cars currently in the physical showroom.

In addition to commercial uses, Advergaming can also be used as part of a non-profit organisation's marketing and awareness strategy. The *Jennifer Ann Crecente Memorial Group, Inc* is a philanthropic organisation dedicated to raising awareness of teen dating violence (Group, 2009). In order to raise awareness of its core messages, it has created a program called Gaming Against Violence. This program encourages the development of games that teach players how to recognise abusive dating relationships and promote attitude change. In order to make these games approachable to young people, it focuses on the development of games that do not feature violence directly. By sharing their messages using educational games, they make awareness of teen dating violence more accessible to young people.

## 2.2 – Prosocial games

Bespoke games built to deal with social issues are small in number when compared with the wider entertainment games market. In particular, games dealing with sensitive topics, such as child neglect and unhealthy relationship behaviour do not often reach a wide audience. In this section a number of purpose-built prosocial games are discussed that have similar intended outcomes to the *None in Three* game, along with a group of entertainment games with prosocial messaging.

Rosie 2 (Reeves, Drew, Shemmings, & Ferguson, 2015) is a 2D child protection simulation created by the University of Kent, designed to assist health visitors and social workers with recognising the signs of child neglect. Rosie 2 is structured into multiple scenes, with players engaging in conversations with the family members and children related to the case. Players can make choices throughout these conversations to ask important questions to build up a more complete picture of the situation. Players can flag objects in the background of scenes as cause for concern, along with any information that is given to them by the characters. These flags are then checked at the end of the game, and the player is told which of these they were correct to flag, providing constructive feedback on the player's own choices.



Honeymoon (Lara, 2016) is a 2D Visual Novel created for a competition by the Jennifer Ann's Group, designed to raise awareness of unhealthy relationship aspects, such as controlling behaviour. The game features multiple conversation choices and decisions on how players present themselves in the game. Players can choose to play as either a boy or a girl, and they begin a relationship with another character. Through dialogue, it is apparent that the player's character is becoming a victim of controlling behaviour. The other characters in the game provide different perspectives on the situation, allowing the player to understand not just how the unhealthy relationship behaviours affect the player, but everyone around them as well.

Some entertainment games are built around prosocial themes. Ether One (W. P. Games, 2014) covers a person's mental decline due to Dementia not just as part of its narrative, but also through its gameplay systems. Many items in the game world can be picked up and stored in the player's inventory, which manifests as a room filled with bookshelves. As players don't know which items will be useful, they begin to hoard simple objects, such as cups and plates on the inventory shelves. Later, it is revealed through narrative that the player character has been moving objects around in the care home and placing them in nonsensical locations. Through their actions, players are unintentionally mirroring the behaviour of some dementia sufferers, raising awareness of the symptoms of dementia (Hamilton, Fay, & Rockwood, 2009).

Papo & Yo (Inc., 2012) is a PlayStation 3 game in which the player must solve puzzles alongside their monster companion, who becomes violent if he is exposed to poisoned frogs. This behaviour change upon exposure to a poisonous substance is a direct allegory for the alcoholism of the player-character's abusive father, and this is revealed in the closing moments of the game, as the imagery used in the game switches with that of the player-character's reality.

Papers, Please (Pope, 2013) is a game about border control. Assuming the role of an immigration inspector, players must identify the correct documentation, letting only those legally allowed to enter the fictional Arstotzka past the check-point. However, players can choose to

sympathise with the situations of individual characters and let them through at the risk of the own family's safety. Due to the nature of these gameplay systems, *Papers, Please* raises awareness of how borders can separate families, and presents players with the choice between doing their job well, and doing what they may believe to be morally right.

## 2.3 – Prosocial gameplay elements in entertainment games

Although games built to deal with social issues are focused solely on prosocial gameplay and narrative, prosocial elements are also found in mass-market games.

Many games include elements of teamwork and cooperative play, which is required to complete the game or make progress. In *Portal 2* (Corporation, 2011), players must work together in order to solve puzzles. Some of these puzzles require specific timing of each player's actions, which requires players to communicate effectively with each other.

Other games allow multiple players to work together to reduce the difficulty of a game's challenges. In *Left 4 Dead* (Corporation, 2008), players can use their own medical supplies to heal other characters and rescue them. Although the survival of the entire team is not required to complete a level, keeping additional characters alive makes the game more manageable.

A significant number of games provide opportunities for the player to help characters within them. Often this is through helping questgivers with their troubles by accepting and completing their quests. Some games take the theme of helping characters and embed it further into the gameplay. *BioShock* (I. Games, 2007) features defenceless characters known as 'little sisters'. If the player encounters one, they have the choice to rescue or harvest them. Harvesting kills the little sister, but provides greater rewards for the player. In offering this choice, *BioShock* asks a moral question – does the player kill an innocent character to become more powerful and wealthy, or do they rescue them for lesser rewards?

Another method through which games can encourage prosocial play is by defining consequences for player behaviour in interaction with other characters. The Walking Dead (T. Games, 2012) game series does this by providing each game character with a memory of the player's actions. This can cause players to be more considerate with their actions than they might be in games without such consequences.

The common thread throughout most prosocial elements in entertainment games, is that they provide players with further advantages if players use their systems with positive intent. This can lead to players taking prosocial actions in order to fulfil selfish strategies.

Although players may be undertaking prosocial actions for personal gain, the positive feedback provided by prosocial elements can have an effect on the attitudes of players. A paper revealed that change in video-game use from violent to prosocial significantly affected change in helping, and that this relationship was mediated by change in empathy (Prot et al., 2014). This is in essence a reversal of the relationship between games that provide positive feedback to violent behaviour and a player's aggression levels.

## 2.4 – None in Three project background

The None in Three project has a wider scope than the creation of a serious game. In this section the None in Three project's goals and reasons for creation are explained more thoroughly, along with the ways other Work Packages integrate with the serious game's development.

### 2.4.1 – Context of the None in Three project

*None in Three* is a European Commission funded project, taking a whole-of-society, public health approach to preventing domestic and sexual violence in the Caribbean. The project targets not only victims and perpetrators, but children, young people, adults and agencies across wider society. Part of this project includes the development of a serious gaming intervention (Work Package 2), aimed at facilitating behavioural change, along with building empathy capacity among its player base.

The project is named from a commonly quoted statistic from the World Health Organisation:

*“...about 1 in 3 (35%) women worldwide have experienced either physical and/or sexual intimate partner violence or non-partner sexual violence in their lifetime.”*

*(Organisation, 2017)*

The project is split into multiple work packages, with each one delivering a different goal. The bulk of the project research was undertaken by Work Package 3 (Quantitative Research) and Work Package 4 (Qualitative Research) in both Barbados and Grenada. The findings from these studies that are relevant to the game’s development are explored below.

#### 2.4.2 – A Social Context on Gender-based Violence in the Caribbean

Some of the focus areas for the game and the project as a whole were determined by existing research undertaken by project stakeholders, along with research from previous years.

In a 2008/9 national survey carried out by the Caribbean Development Research Services (CADRES), 86% of DV cases were found to be perpetrated by men (Services, 2009). For the period 2000-2007, the data revealed 21% of homicides against women were the result of DV in Barbados. In Grenada there is also strong evidence of DV. In a report by the Caribbean Development bank and the Ministry of Social Development and Housing in Grenada, 22% of all murders in Grenada during a 7-year period from 2005 were due to DV (BANK, 2014). The cost of Domestic Violence and Sexual Violence (DV-SV) in the Caribbean is very high, and accounts for as much as 0.5% of the GDP of Trinidad and Tobago, according to an estimation (Theodore et al., 2008), revealing not just social but economic benefits to raising awareness of DV and running prevention programs.

#### 2.4.3 – How the Qualitative Research outcomes influence the game’s direction

The Qualitative Research team undertook a qualitative interview-based study into women in vulnerable circumstances, such as pregnancy and disability, and also men & youth. The study had 109 participants (49 women and 60 men) between April and July 2016 from Barbados and Grenada.

This research culminated in a publication called ‘Twenty-One Lessons for Preventing Domestic Violence in the Caribbean’ (Jones et al., 2017). The actionable suggestions from this report help to inform which topics to tackle with the game, and are covered here.

One of the key findings of the research was the lack of public awareness of the different forms of domestic abuse other than physical (Jones et al., 2017). Some of the other forms of domestic abuse include psychological abuse, social abuse and financial abuse (Kaur & Garg, 2008). Although the aim of the game is to cover the physical forms of DV, the game will include information on other forms of abuse, such as financial and psychological abuse, to broaden the definition of abusive behaviour that young people use in discussions.

Another finding in the research indicated that it is not enough to identify the impact of violence against women, but also that the impact on ‘secondary’ victims must be considered (Jones et al., 2017). Secondary victims are those who witness violence, but are not the direct victim. This is typically the children or young people with a familial connection to a domestic violence incident. Behaviour changes in secondary victims can often be overlooked while social workers and health care professionals engage with the main victim. The game will be designed to show the impact of the violence on the victim’s child by having the child as a playable character, and exploring changes in this character’s behaviour through the perspective of other characters, such as a school teacher.

The research indicated patterns in the behaviour in later life of children who witness violence in the home, based upon their gender. Girls were more likely to become victims of domestic violence themselves, whereas boys who witnessed their fathers and other males committing acts of violence against their mothers had an increased risk of becoming perpetrators themselves (Jones et al., 2017). The intergenerational abuse pattern will be addressed by explaining through the abuser’s backstory that his father used to beat his mother, and that he has normalised this behaviour and doesn’t see any other way to behave.

The Qualitative publication discovered interesting evidence on how pregnancy can have an impact on domestic abuse. In some cases domestic violence increased during pregnancy, with only one reported case of it lessening (Jones et al., 2017). To explore this within the context of the game, the victim character will be pregnant with the abuser's baby, and ends up hospitalized with injuries caused by the abuser. The perspective of a nurse character can then be used to educate players about the dangers of physical abuse during pregnancy to both mother and child.

The research indicated how some coping methods can help victims manage day-to-day with their abuse, but how this can then set an unfortunate example to young people. Complicity in the abuse can end up teaching children that they have to put up with violence themselves (Jones et al., 2017). In order to address complicity, the game will contain a conversation where the victim is asked why she continues to stay in a relationship with the abuser. Her reasons will then be challenged by another character, in the hopes that she leaves her abuser, which will then provide an example to young people playing the game that they don't have to put up with violence.

The ways in which alcohol can contribute to domestic violence were also explored. Alcohol misuse can increase emotional insecurities and undermine emotional self-regulation (Jones et al., 2017). Alcohol is defined as a potential trigger for outbursts of domestic violence, but it is by itself not the cause. This will be addressed in the game by having the abusive character attack the victim after a period of drinking. Dialogue will also be included mentioning how the abuser has not always been drinking when undertaking abusive behaviour. This will serve the dual purpose of demonstrating alcohol as a trigger, but not the cause.

The research also identified multiple ways in which the cultural attitudes of men towards women need to change in order to reduce domestic violence against women. The research calls for a greater awareness of forms of masculinity that are not built around violence, domination and submission of women (Jones et al., 2017). Due to the importance of this recommendation, every male character in the game other than the abuser will be a positive role model, not subscribing to

violence. This is further elaborated on in lesson 18 of the publication, which explains that all men need to lead by example, and educational programmes need to be created that challenge the notion of the tough, aggressive male (Jones et al., 2017). In order to present more positive role models to young people, the other men in the game will come from different socioeconomic backgrounds and age groups, and have a variety of different relationships with the abuser and other characters in the game. By portraying these positive male characters speaking out against violence as a form of conflict resolution, young people playing the game will be able to visualise less aggressive adult role models and learn from their example.

#### 2.4.4 – How the Quantitative Research outcomes influence the game's direction

The Quantitative Research team undertook a psychopathic survey with young people in Barbados and Grenada in order to identify personality traits and previous exposure to violence (Boduszek et al., 2017). This research will be used to inform other themes to tackle with the game in addition to the findings provided by the qualitative study above.

The survey found that a third of children in Barbados and Grenada observed non-interpersonal violence, defined as violence directed against property, was perpetrated by someone in their family (Boduszek et al., 2017). As this is a common occurrence in violent behaviour in these countries, this will be demonstrated in the opening scenes of the game, where the first hint of aggression will be the abuser deliberately breaking something in the environment.

One of the most damning figures in the report is one that indicates the scale of secondary victims in the Caribbean region. Just under a fifth of children in Barbados and a quarter of children in Grenada were exposed to a serious violent threat made by another family member that was directed towards their mother or their siblings (Boduszek et al., 2017). With almost a fifth of all children in both countries of the study exposed to threats of violence against members of their family, the importance of the creation of a serious gaming intervention that identifies these issues and attempts to provide information about what secondary victims can do to help is revealed.

## 2.5 – Educational game theory

As games have become used more as educational tools, there have been multiple studies into how best to apply them as effective self-learning experiences.

The amount of learning a student is capable of achieving alone versus what they can accomplish with assistance is known as the zone of proximal development (ZPD) (Sampayo-Vargas, Cope, He, & Byrne, 2013). This is used in the Scaffolding learning theory, which tailors teaching to within a student's own personal ZPD. Scaffolding theory involves providing learning activities that are just beyond the current level of what they can achieve by building on prior knowledge.

Maintaining a balance between challenge and skill in order to maintain focus and engagement is explained in Mihaly Csikszentmihalyi's theory of Flow (Csikszentmihalyi, 1990). If a challenge is too difficult, players may not complete it and enter a state of anxiety. If a challenge is too simple, players with more experience or greater skill at playing may enter a state of boredom.

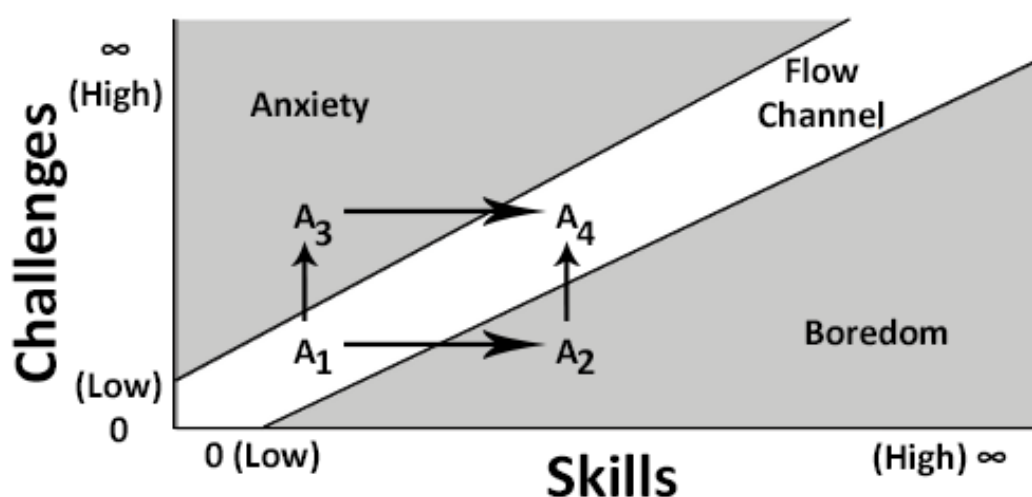


Figure 1 - Mihaly Csikszentmihalyi's model of Flow. Adapted from Csikszentmihalyi 1990

Reaching the balance of 'Flow' requires identification of a player's current skills and understanding, and only presenting them with challenges that fall just inside and just outside their existing skillset. Scaffolding can be applied to educational games by using adaptive difficulty, adjusting the challenges so that they are just beyond the player's current level of skill and



understanding. When combined with activities just inside their capabilities, educational games should be capable of inducing a Flow state in players.

Adaptive difficulty can be useful when scaffolding a self-learning experience. However, the studies involving adaptive difficulty tend to focus on hard skills, such as learning a language. The *None in Three* game intends to educate players about interpersonal skills through role play, and as a result it is considered more important to structure the game in such a way that everyone is capable of completing it. Because of this, the game will be designed heavily around narrative content, with the rewards of finding out what happens next to the characters in the game, instead of using adaptive difficulty to maintain engagement with challenges.

Role Play has been used as an effective tool in a number of different educational environments, including social studies (M. Garvey & K. Garvey, 1967). A journal article by Ronald Morris explains the ways that drama and role play allow students to connect with the lesson content:

*“Students feel empathy regarding events in the past when they act out the situation, and make connections between the character they play and real situations.” (Morris, 2003)*

As games allow players to take control of and assume the role of the characters within them, game players in a character-based game such as the *None in Three* game experience role-playing within the story and gameplay contexts provided.

In order for a student’s learning to be developed, feedback must be provided to students. A number of digital role-playing games rely on formative feedback, which can be defined as the following:

*“Information communicated to the learner that is intended to modify the learner’s thinking or behaviour for the purpose of improving learning.” (Shute, 2008)*

This feedback can be provided in the form of reflective prompts at the end of a learning activity. The use of self-reflective feedback prompts is already used in some prosocial games, such as Honeymoon, which asks players rhetorical questions about the behaviour of its characters and the actions the players have taken.

## 3 – Design Methodology

This section explores the various methodologies and approaches that could be taken to meet the project aim, which is to design a prosocial game aimed at young people based upon existing research literature. Various development methodologies will be examined from across traditional game development, software development, and serious games built by academic teams.

### 3.1 – Project aim

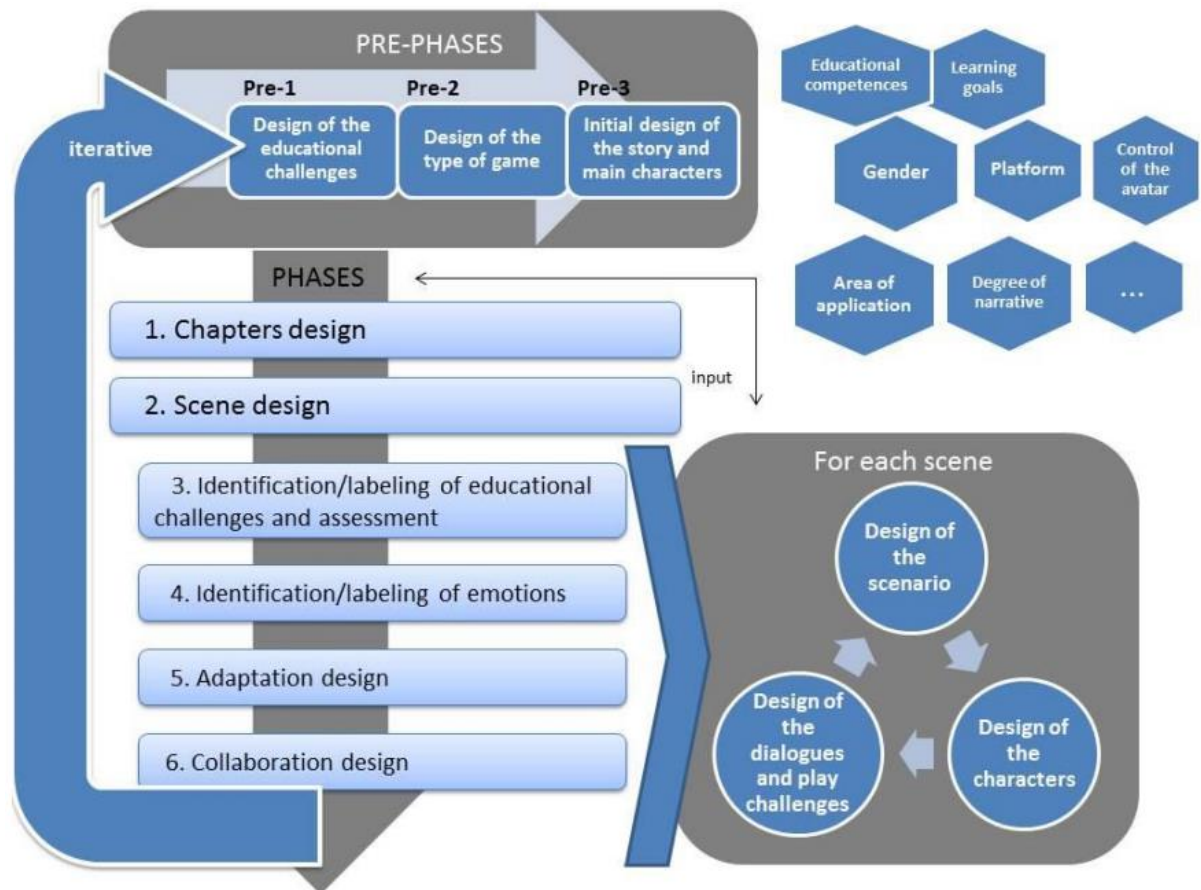
The aim of this project is to develop a serious gaming intervention aimed at young people that is intended to cause behaviour change and educate young people about the impact of domestic violence on everyone involved with it.

### 3.2 – Design methodologies of serious games

A number of design methodologies have been created for a variety of serious and educational games. These will be explored to note their suitability to the *None in Three* game's development.

#### 3.2.1 – Design methodology for educational games based on graphical notations

In the paper 'Design methodology for educational games based on graphical notations', Prieto et al identify a need for a design methodology that is suitable both for game developers, and for non-technical members of a multidisciplinary team (de Lope, López Arcos, Medina-Medina, Paderewski, & Gutiérrez-Vela, 2017). This is also a requirement of the *None in Three* game, due to the collaboration with experts in the Caribbean and in social work.



**Figure 2 - Methodology based on interactive screenplay**

This methodology focuses on an iterative process, beginning with the design of the educational challenges in Pre-1. This requires the learning outcomes to be identified first, which is a very practical approach when developing games for education. Pre-2 uses the educational challenges to inform the most suitable elements of gameplay. Pre-3 then uses the gameplay and learning goals to come up with the overarching story and characters that will be used to frame the educational challenges.

When these elements have been established, the game is designed on a structural level, into chapters and scenes. For each scene, the dialogue and play challenges are considered inside the context of the scenario, and the design of the characters. The entire design process is iterated on until the multidisciplinary team is happy with the balance between educational outcomes, gameplay and content.

### 3.2.2 – Design methodology of learning mechanisms in Serious Games

In an article called ‘A New Methodology of Design and Development of Serious Games’, Barbosa et al identify a methodology that is structured around multiple levels containing problems that the player must demonstrate learning to solve, as a gameplay-based manifestation of problem-based learning (Barbosa et al., 2014). The learning mechanisms are demonstrated in the diagram below.

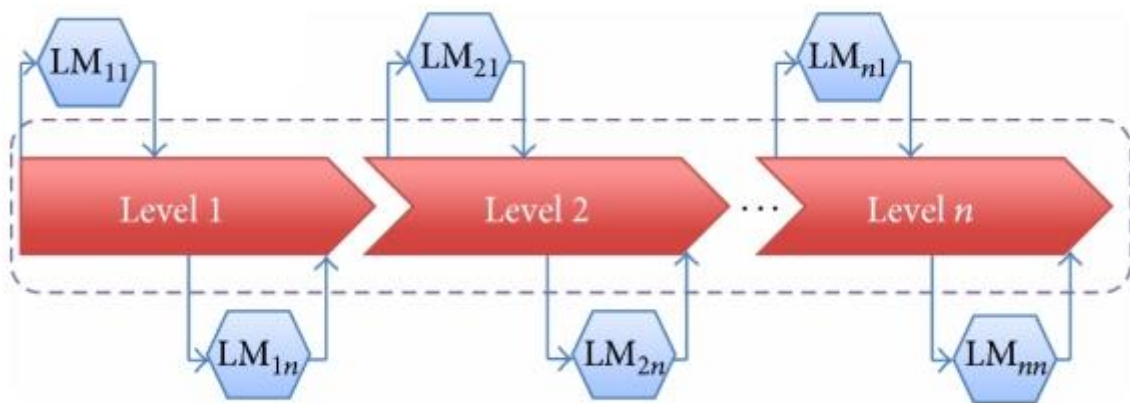


Figure 3 - Problem-based learning game methodology

These learning mechanisms are included alongside the main game, and the player must gather resources from inside the main quests in order to access the learning mechanisms to then progress through the game. Learning mechanisms suggested by the paper include quizzes, puzzles and mini-games. By separating the learning mechanisms from the game, the game’s design can be more focused towards entertainment.

### 3.3 – Design methodologies of traditional games and software

Traditional entertainment games and software releases have used a variety of development methodologies over the past few decades. These will be examined to identify potential methods through which to approach the development of the *None in Three* game.

#### 3.3.1 – Waterfall Model

The Waterfall model has been used in software development in some form since the 1950’s, with Herbert D. Benington describing a linear process moving through several different phases of

software development (Benington, 1983). Later, Winston W. Royce would go on to define the Waterfall model with 7 implementation steps (Royce, 1987). These 7 steps were drawn in a linear fashion, with developers completing one step at a time as they go.

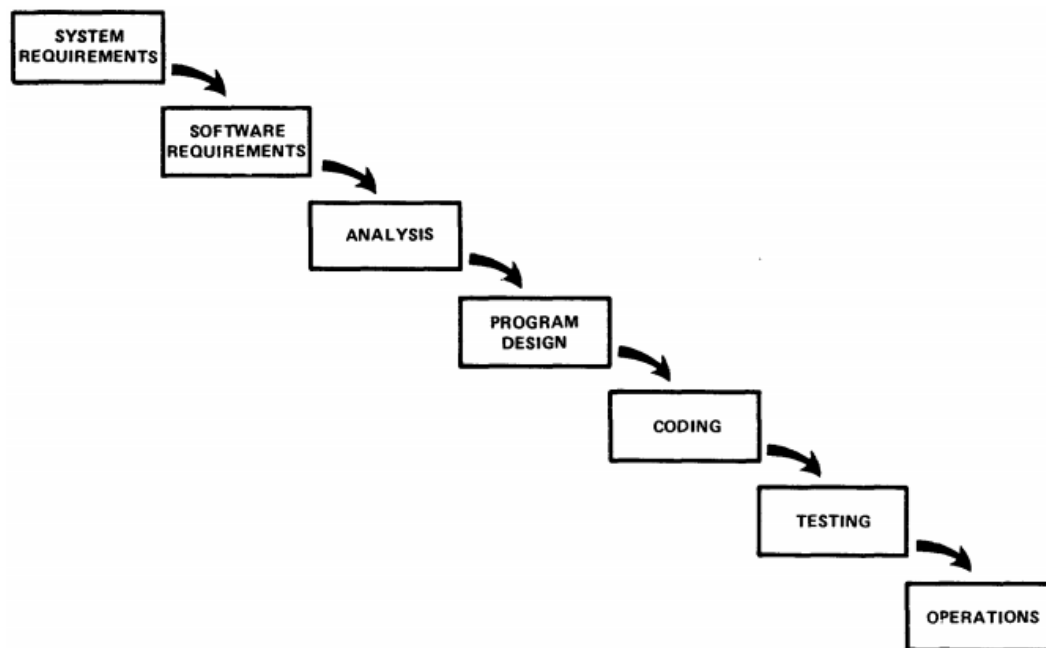


Figure 4 - The waterfall model

The Waterfall model is advantageous to large scale software development projects, where a thorough understanding of the requirements of users is important in order to minimise mistakes and reduce wasted development time. By designing the software completely in advance, developers can ensure it is as accurate to user needs as possible before the testing phase.

This development methodology is appropriate for large-scale organisations where the user needs of the end product can be clearly identified in advance. By organising production phases to match the waterfall model, companies can plan how to spend large budgets in detail in order to keep shareholders informed. Typical implementations of the waterfall model are often rigid, with little in the way of iteration once the design is in place. This in itself is a misinterpretation of Royce's paper, which recommends that each phase should contain an iteration loop, where successes and failures are iterated upon. Royce also mentions that the waterfall model should not be used without a prior state of prototyping and initial design.

The waterfall method is considered somewhat outdated and a poor fit for a variety of more modern software and game development practices. At the time it was created, computer software took a lot longer to develop, due to a combination of less powerful development machines and less powerful target hardware. Since the 1970's, Moore's Law has indicated that transistor counts for a given processor size would double approximately every 2 years, although this rate is slowing (Simonite, 2016). As a result of this improvement in processing power, development and iteration speeds of software and games have increased, which reduces some of the risk involved with a more flexible methodology.

With the *None in Three* game, the usability and appropriateness of gameplay features cannot be determined in advance, and so using a development methodology as rigid as the waterfall model will not be an effective way to create the game.

### 3.3.2 – Prototyping

Prototyping methodology is more flexible than the Waterfall model, with less focus on gathering a complete set of user requirements at the very beginning of the project, and more focus on achieving a workable product based around some of the known requirements. This is beneficial where user requirements are not clear.

Some prototyping methods intend for a 'throw-away prototype' to be constructed. This is a prototype built very quickly to determine if user requirements are met by the features implemented. Such prototypes lack the quality required to extend or maintain them, and are wasteful to produce. For larger organisations who can absorb the cost, this may be a good solution for when requirements are not known, but they need to be understood as quickly as possible before a move into full production. For the *None in Three* game, with a strict timescale and a limited budget, creating a prototype that will not be iterated on long-term is a cost that cannot be afforded.

In other prototyping methodologies, the prototype is kept and built upon constantly with any new requirements discovered during the process. This is a more sustainable approach as feedback on the initial prototype can then be worked on immediately.

### 3.3.3 – Design Science

Design Science was a term coined by R. Buckminster Fuller in the 1950's, and referred to the creation of physical artefacts that would solve problems faced by humanity, thus causing people to adjust their behaviour to employ the new artefact (Fuller & Kuromiya, 1992). In this way it could be interpreted that a game which is intended to educate and cause attitude change through interaction is itself an artefact matching Fuller's description, as students playing an interactive game may be considered preferential to learning about social issues in a passive manner.

Although Design Science has been used to generate research artefacts since the 50's, a common Design Science Methodology framework was lacking, with each researcher using their own interpretation of Design Science. However, in 2007, an attempt was made to create a formalised framework (Peppers, Tuunanen, Rothenberger, & Chatterjee, 2007). The authors identified 6 common phases of design science – Problem Identification and Motivation, Objective of the Solution, Design and Development, Demonstration, Evaluation, Communication, and Contribution. These phases are similar in nature to the waterfall model of development, with clear pre-production, production and operational phases. However, there is a greater focus on gathering research findings and reflecting on them after the final product is rolled out.

Design Science can be applicable to any project where a significant amount of research is undertaken at the beginning of the project, followed by the development and testing of a research artefact. As a result, Design Science is very suitable to the *None in Three* game's development process. However, the Design and Development phase itself contains no fixed methodology, with the framework only explaining that in this phase, the artefact is created. There is no distinction



between a linear or prototyping process. As a result, it would be possible to embed either development methodology into the Design Science process.

### 3.4 – Chosen design methodology

The design methodology for the *None in Three* game has to be suitable for a very small development team, allow for design changes to be made based upon feedback, and allow for collaboration with non-technical project partners at multiple points in the development cycle.

As the game itself is an artefact based upon a research process, the Design Science methodology is the most suited to the game's development. Due to the multiple level structure intended for the game, levels will be prototyped one at a time, with the core mechanics and features iterated upon. Each level will then be referred to the *None in Three* team for provisional feedback. This prototype will not be a throwaway prototype, and instead will be iterated on until it meets the requirements and design goals set forward by the project and research.

Another design constraint is that the dialogue must be finalised before any voice recording can take place, as it is impractical to re-record dialogue towards the end of the project, due to voice actors being potentially unavailable. To ensure this is avoided, the levels will have their themes and characters designed in advance, but their layouts, gameplay features and dialogue will be iterated upon until the level is determined to meet its learning goals. Only when each level is finalised in design will the dialogue be sent off for recording.

#### 3.4.1 – How Design Science will be used for the game's design and development

As mentioned earlier, there are 6 defined activities in the Design Science process. The first of these is *Problem identification and motivation*. This has already been accomplished through the literature review, which explained the rationale behind the project.

The second activity is *objective definition*. The project aim was defined earlier at the beginning of the Design Methodology overview. In addition, as part of the literature review, existing

research undertaken by the *None in Three* project was explored, which identified key lessons that would be embedded into the game.

Activity 3 is *Design and development*. There is some flexibility with regards to how this can be approached. First, the overall story, learning and design goals of each level will be designed. This is similar to the approach put forward in the Serious Games methodology by Prieto. After each level is playable start to finish, the next one will be prototyped. When all the levels have been prototyped, the dialogue can be finalised and sent for recording. During this time, each level will be brought up to a final visual standard, with any found bugs and further playability issues resolved through further playtesting.

The next activity is *Demonstration*. This involves demonstrating the use of the artefact to achieve the aim set out previously. In order to do this, the game is going to be played by participants in the *None in Three* study in Barbados and Grenada. The exact nature of this will be identified in a Research Methodology process.

*Evaluation* involves the observation and measurement of the effectiveness of the artefact. The game will include an automatic data-gathering system to identify player behaviour during the game trial.

The final activity is *Communication*. This involves the use of an empirical research process to structure and communicate the research problem, artefact solution and its effectiveness to others. This is achieved through the structure of this thesis.

### 3.5 – Research and data gathering methodologies

This section covers the search for a suitable research methodology in order to gather appropriate data from the *None in Three* game trials. First, research questions will be developed that will turn the aim of the project into a number of focusable areas of study. A number of research

methodologies will be explored with the goal of identifying the best methods through which to gather data to answer the research questions.

### 3.5.1 – Scope of the study

As another Work Package (WP3) exists to measure the effectiveness of the game in terms of attitude change, this study will instead focus on other ways in which the game may have been effective. This will include an exploration of the effectiveness of the Emotional Intelligence Dial, the usability of the game's controls and mechanics, and what lessons players learned from the game's content.

### 3.5.2 – Research Questions

In order to measure the success of this project, the following research questions will be explored:

- 1) Does the emotional awareness of players of a prosocial game change and improve over the duration of gameplay?
- 2) Are the game mechanics and features designed for this serious game usable and understandable by young people?
- 3) Are the messages and lessons of the game understood by players?

### 3.5.3 – Quantitative Methodologies

Qualitative Methodologies involve the gathering of numerical data. This type of data is best suited to answering research questions where an objective answer is expected. For example, a research question could be 'Which of these levels has the most player retention', and to answer this question, the *None in Three* game could track the amount of time players spent in each level, and compare the averages.

Quantitative data is most suited to studies with a large number of participants, as it is quicker and simpler to gather than Qualitative data. Quantitative data sets can also be represented simply in a graphical form, making them an effective tool at communicating the outcomes of research to others.

Multiple methods of gathering quantitative data exist. Participants could have to fill in a self-completion questionnaire, with the answers being fixed, numerical, or short enough to classify in a straightforward way. Another method is to run a structured interview, where each participant is asked questions in an identical manner, and with each question having fixed answers. Additionally, a structured observation of participant behaviour could take place, through which researchers are looking for specific measurable elements.

As the game will be played by hundreds of students in Barbados and Grenada, it would be challenging to ask researchers to observe the behaviour of each participant individually. Instead, observation shall be built into the game itself.

#### 3.5.4 – Qualitative Methodologies

Qualitative Methodologies involve the gathering of subjective data, where a single numeric response is not expected. Because answers from participants can be anything, they are often difficult and time-consuming to quantify. As a result, qualitative data is more suited to smaller studies; where there is enough time to examine it. Although tools such as *NVivo* (International, 2017) exist to structure and analyse large qualitative data sets, these software suites can be expensive and also require additional training.

Researchers can use in-depth interviews to identify qualitative responses from a participant. These interviews may have an initial set of question prompts, but the responses may encourage new ideas for questions to ask, and ways to interpret the results.

Where there is more than one participant, a Focus Group may be used instead. Again, there may be some initial focus, and the interviewer may refocus participants if they stray too far from the topic, but the responses will be open-ended. Focus Groups can be an effective way of generating discussion, where one participant's responses may encourage another to respond. However, it is also possible for some members of a Focus Group to talk over and prevent others from providing their input. To avoid this, interviewers should encourage all participants to provide a response.

### 3.5.5 – Restrictions on the Qualitative data gathering of the study

Due to the nature of the project, and the inability of the researcher to be present in Barbados and Grenada during the study, only quantitative game data will be gathered from sessions of the gaming intervention taking place in the Caribbean. Any qualitative interviews undertaken might have prompted additional discussion and self-reflection beyond the prompting built into the game, and could therefore have influenced the results of Work Package 3's Quantitative study, which has its own research methodology and must take precedence.

It is for these reasons that Qualitative interviews and usability studies cannot be gathered from participants in Barbados and Grenada, and that the focus of the research data is not on the success of the violence prevention aspects of the game, as this is the goal of Work Package 3's psychological surveys.

Although this restriction on qualitative data gathering will significantly reduce the amount of data gathered as part of the study and reduce the depth of the study, qualitative data can be used from alternative participants to provide context to the quantitative data gathered from the Caribbean participants.

### 3.5.6 – Mixed Methodology

Mixed methodologies combine both Qualitative and Quantitative data gathering techniques. Where quantitative data can provide a broad statistical picture, qualitative data allows researchers to gather a more experiential take on a participant's involvement in a study. Where qualitative data can identify a participant's own subjective view of their experiences, quantitative data can objectively identify physical responses. This is beneficial as it allows researchers to combine the various strengths of both forms, while also mitigating the weaknesses. More time is required to collect and compare two different types of data, but it can provide greater perspective than using just one type.

### 3.5.7 – Chosen Research Methods

In order to answer the three research questions above, a combination of both qualitative and quantitative methodologies will be used. Data from participants in Barbados and Grenada will be purely quantitative in nature, with additional qualitative data being gathered from non-Caribbean participants. As part of the quantitative data set, an attempt will be made to measure the emotional intelligence of participants. This method will be determined through research into emotional measurement tools.

## 4 – Emotional Intelligence theory and player empathy

The goal of the *None in Three* game is to facilitate behaviour change and build empathy capacity and non-adversarial conflict resolution skills for different users among children and young people. As a result, it is essential that the game is capable of gathering data that can be used to identify an increase in empathy. Empathy can be defined as *“the capacity to share and understand another’s state of mind or emotion.”* (Ioannidou & Konstantikaki, 2008)

Emotional Intelligence (EI) contains multiple elements, including empathy, which makes it a useful model through which to identify what types of gameplay data will allow for empathetic changes to be noticed. This section contains research into existing theory on EI, player empathy and how emotional traits can be measured, with a focus on game-time measurements.

### 4.1 – Emotional Intelligence theory

The expression Emotional Intelligence was introduced by Salovey and Mayer in the 1990 article of the same name.

*“We define emotional intelligence as the subset of social intelligence that involves the ability to monitor one’s own and others’ feelings and emotions, to discriminate among them and to use this information to guide one’s thinking and actions.” (Peter & John, 1990)*

Daniel Goleman’s model of emotional intelligence in his 1998 book, ‘Working with Emotional Intelligence’ later refined this initial definition into a more detailed framework. Goleman defined his model with five elements: Self-awareness, Motivation, Self-regulation, empathy, and adeptness in relationships (Goleman, 1998).

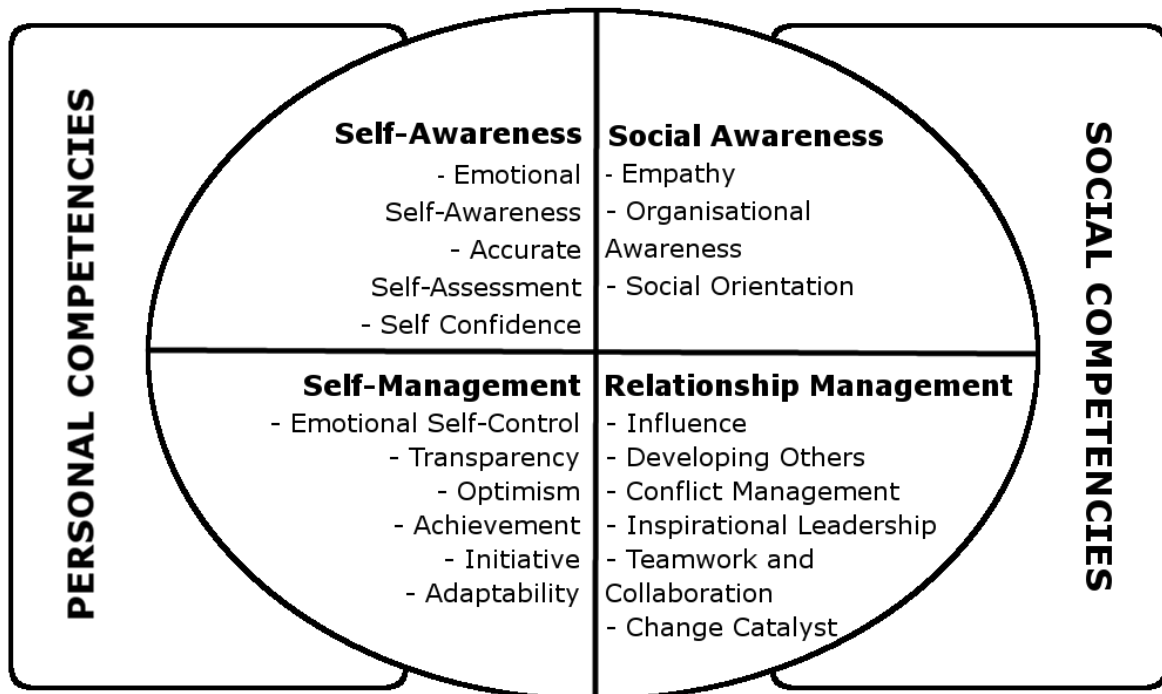


Figure 5 - Emotional Intelligence illustration

The various elements of each competency relevant to the *None in Three* game will be examined below.

#### 4.1.1 – Personal Competencies

Self-Awareness is how aware a person is of their own emotional state. This goes hand in hand with the personal competency of accurate self-assessment. It is not enough for a person to know they are feeling strong emotions, if they aren't able to identify which emotions it is that they are feeling, along with the reasons why.

Self-Management primarily involves a person taking control of their emotional state. Examples of this can involve calming techniques, coping strategies and therapy. It also refers to how adaptable a person can be to changing situations. In the *None in Three* game players will encounter an abusive character with little self-control, who believes he is losing control over the changes in his life. Self-management of emotions is often lacking in perpetrators of domestic violence, who cannot control strong feelings such as anger, and act abusively towards their victims. Throughout the course of the game this character will be presented with better ways of dealing with his anger, including going to an anger management class.



#### 4.1.2 – Social Competencies

The remaining two categories are social competencies, which revolve around recognising and managing the emotions of others (Goleman, 1998). Social Awareness identifies empathy as a key skill. To this end, the *None in Three* game will provide many different perspectives on how its characters might be feeling by using the other characters as emotional lenses.

The final category is Relationship management. Of particular relevance to the *None in Three* game is the key skill Conflict management. In order to teach this to players, characters in the game will explain that certain interactions are not found in a healthy relationship, and suggest better approaches to dealing with conflict.

### 4.2 – Emotional measurement techniques

There are multiple ways to measure a player's emotional state. One of the most common methods is to request players to reflect upon their experiences after playing a game. Due to the subjective nature of emotional experience, data gathering of this sort is often of a qualitative nature, and is accomplished through surveys, focus groups or interviews. The disadvantage is that players may not be able to recall how they felt at the time. In order to avoid this problem, the game will attempt to measure a player's emotional state during gameplay.

#### 4.2.1 – Physiological techniques

Measuring a player's physiological responses can determine how their body is responding to the situations in the game. Cardiovascular signals can be measured with heart rate monitors to determine patterns mapped to emotional profiles (Kassam & Mendes, 2013). Electrodermal activity can be measured by applying a low-constant voltage to the skin. As a participant's skin secretes sweat, the skin conductance causes a change in electrical activity, which can be used to identify stressful situations (Fowles et al., 1981). Physiological measurements remove the need for a

subjective report from the participant, avoiding bias they may have with regards to awareness of their own emotional state.

In order to analyse emotional responses to Rosie 2, the development team used a face tracking monitor to determine the facial expressions used by players. With this data they could analyse which in-game events were causing changes in a player's emotional state.

Although many physiological response measurements are non-invasive (Andreassi, 2013), gathering data in this manner is a challenge due to the requirements of additional sensors and hardware. Given that the intended audience of this game is young people in schools in the Caribbean, it would be impractical to send sensors on a large scale to the region, potentially further disrupting the curriculum by spending time setting up these systems of measurement. Furthermore, the conditions of measuring this data can themselves have an impact on a player's emotional state (Kassam & Mendes, 2013). Because of this, non-physiological methods of measurement during gameplay will be utilised.

#### 4.2.2 – Non-physiological techniques

Players can use real-time self-reporting systems built into games to identify their emotions. A systematic review of literature on self-reporting interfaces discovered 26 different named self-reporting interfaces between them (Fuentes et al., 2016). Of particular note is a self-reporting interface called AffectButton, which allows users to select a facial expression using a single mouse click (Broekens & Brinkman, 2013). The resulting output is a three-dimensional value representing the player's pleasure, arousal and dominance. These values can then reveal the emotion the player was attempting to express.

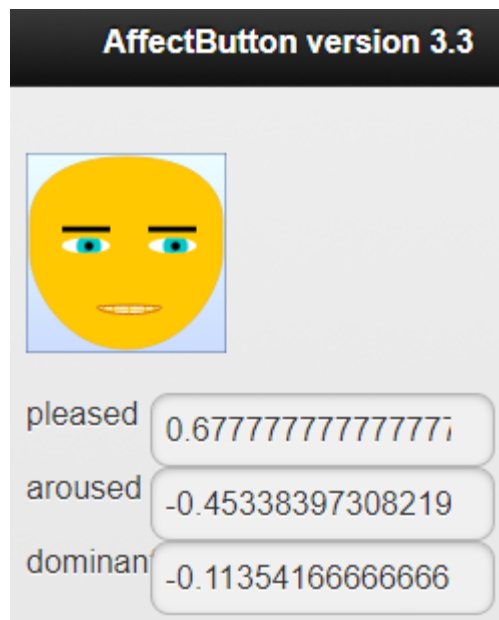


Figure 6 - AffectButton example

Another method the game can use to gather data about a player's emotional intelligence is through the use of metrics. At moments in the game where the player has a choice to make, we can record the decision that a player took. The decisions players make over their time with the game can then be tracked, and the data can then be used to determine if there are any changes in their behaviour.

### 4.3 – Designing the Emotional Intelligence Dial

The *None in Three* game will feature a single-click emotional self-reporting system based around design principles similar to AffectButton. As AffectButton is only available in Java, Python, HTML5 and Android (Broekens, 2017), it would take more time to port AffectButton to a game engine than to develop a new solution. In addition, although AffectButton is simple to use with its one-click system, the face can be ambiguous, and this could cause confusion to younger people using it.

In an attempt to remove ambiguity, it was decided to have clearly defined emoticon faces, which young people who use computers and messaging services are already familiar with. Players must then select one of these emotions in order to identify how they are feeling.

The emotions for the Dial were chosen based upon some of the basic emotion types put forward by Paul Ekman in his theory of six basic human emotions that are universally recognisable

(Ekman, 1992). The 6 emotions referred to are happiness, sadness, fear, anger, surprise and disgust. As the emotional intelligence dial is intended to be simple, some of these emotions were removed, leaving happiness (smiley face), sadness (crying face), and fear (sideways glance face). For situations where the player is not feeling strongly about any of those three emotions, there is also a 'neutral' face.



**Figure 7 - Prototype Emotional Intelligence Dial**

The EI Dial will be triggered during certain events on screen where the emotional tone of a scene has shifted. This will then prompt players to identify the emotion they are feeling and report it with a single click. Due to the speed at which players can decide an emotion and return to the action, this is an option for emotional self-reporting that is not too intrusive.

## 5 – Design and Development of the None in Three game

In this section an overview of the design and development of the None in Three game is provided. Throughout development of the game it was decided that the final title shall be None in Three – Jesse. This will be referred to as *JESSE* for the rest of the thesis.

### 5.1 – Designing an educational game for a wide audience

Although the *None in Three* project is taking a whole-of-society approach to violence against women, the game will be designed for young people in schools in Barbados and Grenada, with an age range of 9 – 17. In order to design a game for a wide age range such as this, some considerations need to be taken into account before anything else.

#### 5.1.1 – Content suitable for young people

Due to the theme of the game being domestic violence, there has to be a balance between portraying the impact of violence, including the triggers leading up to it, and showing the violence itself to young people. Acts of physical violence in the game take place ‘off-camera’ with no visual element. At most, the use of audio cues and subtitles will be enough to give a vague, non-descriptive idea to players what is happening off-screen. Players will be able to see the aftermath, but there will be no blood present in the moment, just animations indicating injury.

#### 5.1.2 – Input and skill considerations

With the age range including primary school students, it’s important to consider that many of these children may have very little game-playing experience. Therefore controls should be kept as simple as possible, with a limited number of buttons and interactions to remember. To keep inputs simple, all controls will be on the mouse, with users only needing to focus on what they want to interact with, and less on what button to press.

To accommodate all types of player, there will be no failure states in the game, and no challenges based around player skill. The game will be a purely role-playing experience, with a variety of types of objective to undertake.

### 5.1.3 – Curriculum and trial demands

As the game will be rolled out in schools, it is important that the game is structured to be flexible enough to fit in around the demands of the existing curriculum in these schools. For this reason, the game will be broken up into several playable 10 – 20 minute chunks, with each playable chunk featuring a new scenario in a level. A lesson plan will then be provided by the main None in Three project to guide discussion before and after play.

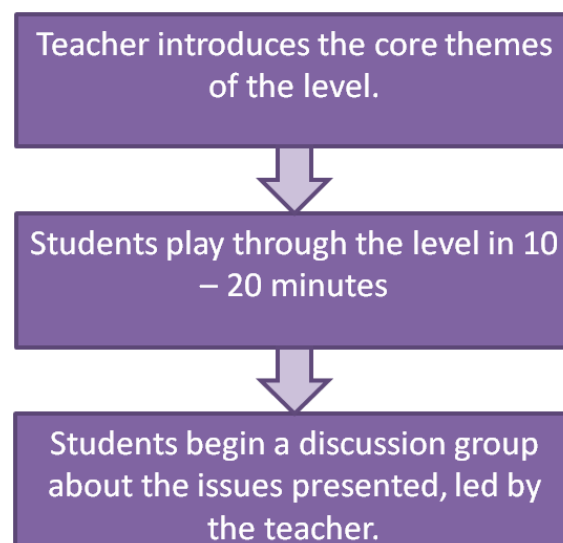


Figure 8 - Lesson Plan Structure per level

## 5.2 – Developing games with a Caribbean context

This section contains a variety of methods used to design a game appropriate for its Caribbean player base.

### 5.2.1 – Collaboration with regional experts

Many members of the None in Three project are very familiar with Caribbean culture. Their support was requested when writing the key lessons for the game to teach, and for the writing of the game's

dialogue. This allowed for a Caribbean context to be applied to the game's characters, environments and dialogue.

### 5.2.2 – Research Trip

During the None in Three conference in Barbados in August 2016, there was an opportunity to undertake a preliminary research trip to Barbados and Grenada. This provided an opportunity to take photographic reference of relevant environments and people. On the trip images were sought of the interiors of houses, due to the challenges faced by using traditional online search methods to find such images. Running an image search online for 'House Interior Barbados' results in holiday home websites using Search Engine Optimisation techniques to boost their rankings, leaving the results flooded by images of homes that do not represent the experiences of the majority of people in Barbados and Grenada, as shown in the figure below.

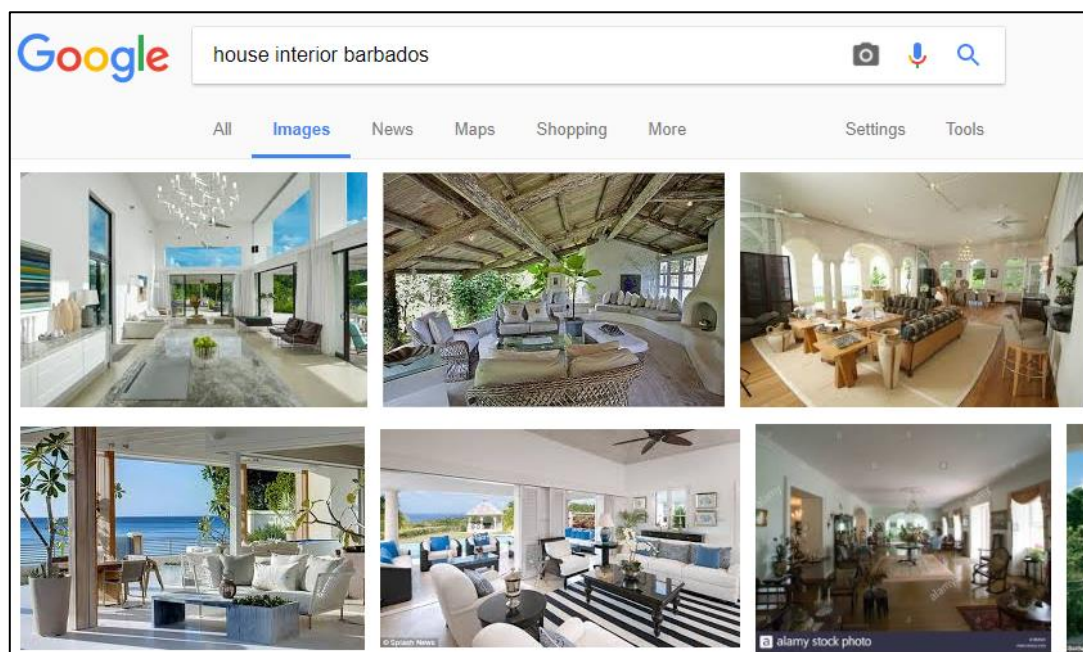
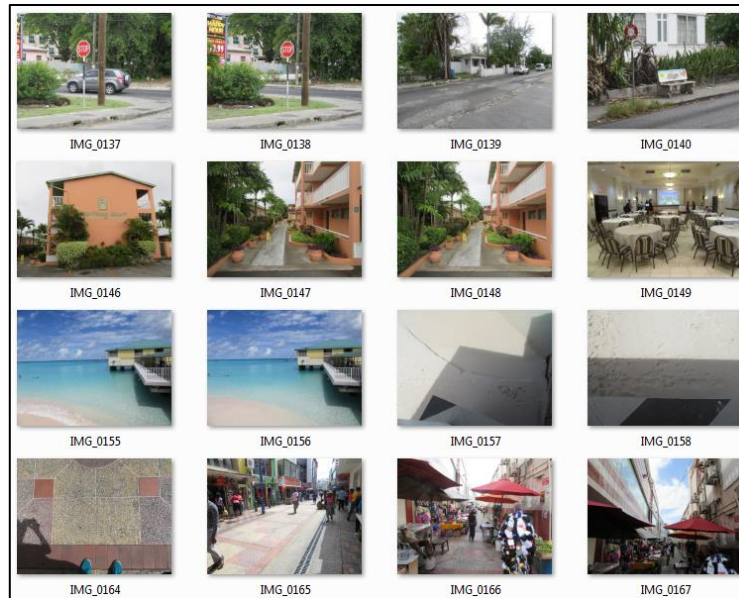


Figure 9 - Google Image Search results

A variety of indoor and outdoor photographs were taken, and later used to influence the visual design of each level.



**Figure 10 - Photographic reference**

In particular, the indoor photos were used to decorate the first level, as shown in the figure below, with floor tiling, bedding colours, type of wood used for furniture all being selected from these photographs.



**Figure 11 - Comparison of photographic reference and Level 1**

The research trip also involved meeting with 4 young people's groups in Barbados and Grenada aged between 10 and 18, and learning about their experiences first-hand. A short and informal focus group session was run with each group, along with a small prototype of the first Level, set inside someone's home.

While viewing the demo, a group of girls from Grenada mentioned that they don't have the space for a dining table, and that some of them had toilets housed outside the main building. In cases like these, it can become difficult to maintain accuracy and playability. There were multiple comments



on the size of the house, and how it appeared large. However, it is very difficult for players to navigate in a closed environment like this one, and so the size of the house is likely to remain the same size, or even increase slightly to allow players to more easily navigate the space.

Boys from Barbados provided an insight into what they believe an image of masculinity looks like to them. Boys in Barbados gave a definition of masculinity. *'If you get hit, hit them back. Do for do. Look after your family. Work hard and be trustworthy.'* There was a mixture of positive and negative traits mentioned, and so it is important to provide positive male role models as characters in the game to raise awareness of more positive forms of masculinity.

Young people from both countries and genders stated that they would like to see local food dishes represented in the game, such as Cou Cou and Flying Fish. These models will be created to ground the game further in Caribbean context. Young people also mentioned that they would like to explore outside the house and play outside in the game. Later levels will be designed around more open and outdoor environments to address this desire.

To give the young people groups a sense of ownership over the game, they voted on a name for the main child character. As a group they decided on Jesse.

### 5.2.3 – Additional research

In addition to the gathered reference imagery, time was spent gathering reference images, places and names from online news websites based in Barbados and Grenada. A table of names was created from these news websites. Names were then picked randomly using the first name from one person and the last name from another, enabling culturally relevant character names to be generated with ease.

In addition to names and images, the colloquial phrase 'coconut don' grow 'pon pumpkin vine' was also found on a Barbados news website. It is a similar phrase to 'the apple doesn't fall too far from the tree', and means that children behave in a similar way to their parents. This was deemed

relevant to the intergenerational cycle of abuse that the game intends to highlight, so it was added as a line of dialogue.

### 5.3 – Game Structure

*JESSE* is based around a fictional family story derived from original research conducted by the team and includes a variety of characters and themes. An important aspect of the game’s design has been socio-cultural sensitisation to Caribbean context, through consultation with groups of young people in Barbados and Grenada and continuous input from Caribbean experts. To further this, the character dialogue will be recorded with voice actors local to Barbados and Grenada, who volunteered to speak the parts.



**Figure 12 - Photographs of volunteer voice actors**

Each level is grounded in a Caribbean context, in terms of the environment and the activities undertaken. For example, in Level 4, players visit a Pool Hall, a popular Barbadian pastime. In Level 5, a roadside standpipe is visited, which is still a common sight for many in Grenada.

The game’s content is split into 5 levels. Each level takes place in a different environment, with the player taking control of a new character related to the story each time. By allowing players to experience the themes from the perspective of different characters, they will discover the ways domestic violence affects more than just the primary victim. A diagram showing the primary theme and learning objective of each level is shown below.

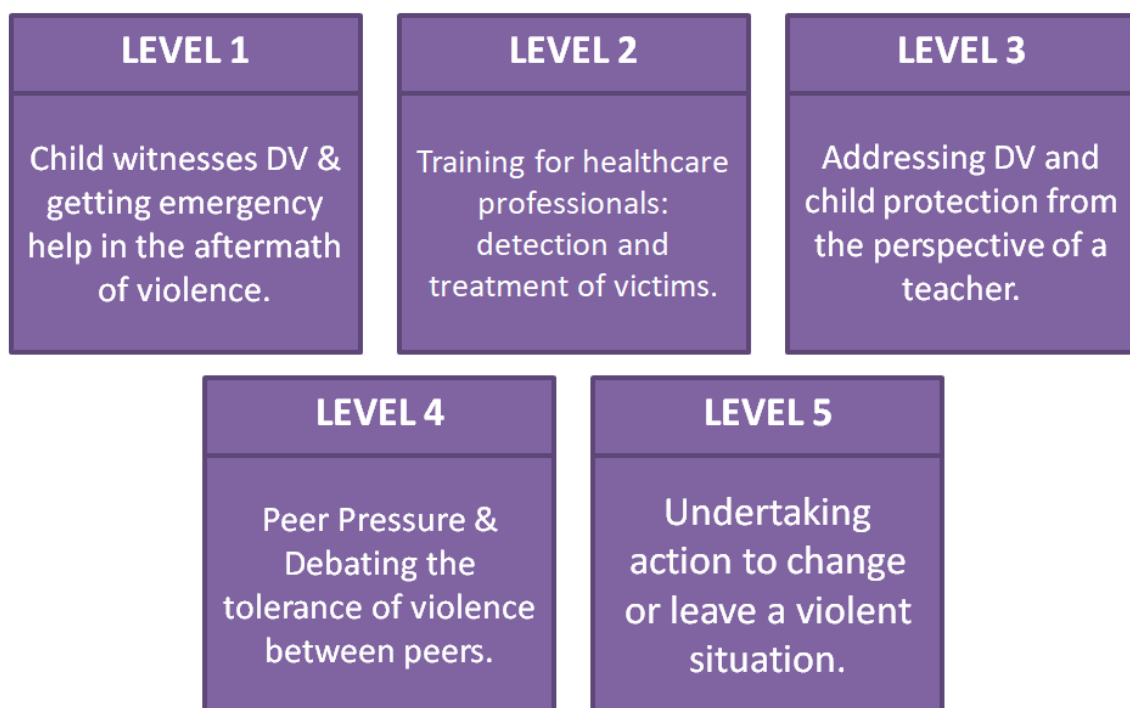


Figure 13 - The 5 level structure of the game

As a tool for use in education settings, breaking the game up into smaller sections allows for flexibility in the curriculum. Each level can have a lesson dedicated to its theme, and allowing a break between levels provides time for discussion and reflection.

#### 5.3.1 – Character Design

*JESSE* revolves around the story of three main characters, Diana (the victim), Rondell (the abuser), and Diana's son (Jesse), fathered by a previous partner.



**Figure 14 - Rondell, Jesse and Diana**

Diana is Jesse's mother, and is currently pregnant with Rondell's baby. Diana has recently lost her job, and as a result is now financially dependent on Rondell. Diana performs all household duties in the home. Diana feels torn between the happiness she experiences during the good times she shares with Rondell, and the times she feels trapped in her abusive relationship due to having Jesse and the unborn baby to support. Diana is concerned about the effects the violence may be having on her baby and is also worried about Jesse who seems to be becoming quite withdrawn.

Rondell is a telephone repairman renting a house in town. He is in a relationship with Diana. As the provider of the household, Rondell believes that Diana should perform all household duties and not contest him on anything. Rondell is quick to anger, especially after a drinking session, and lacks nonviolent conflict-resolution skills. He beats Diana when he believes she has made a mistake or he considers her to have stepped out of line.

Jesse is Diana's child from a previous relationship. Jesse has no memories of his Father. He was popular at his previous school and used to have several close friends. Jesse is often not a witness to the violent acts Rondell does, but he hears it taking place in the home. Jesse has very conflicting feelings towards Rondell. He is aware of what Rondell is doing to his Mother, and is

terrified that it will happen to him too, and the baby. At school he is becoming less cooperative during lessons.

Through playing as Jesse and through interactions with other characters, players will learn about the psychological effects of children being witness to parental acts of violence as 'secondary' victims, by seeing and understanding both internalising behaviours and externalising behaviours.

Supporting Characters were also created to provide different perspectives on the behaviour of Diana, Jesse and Rondell.

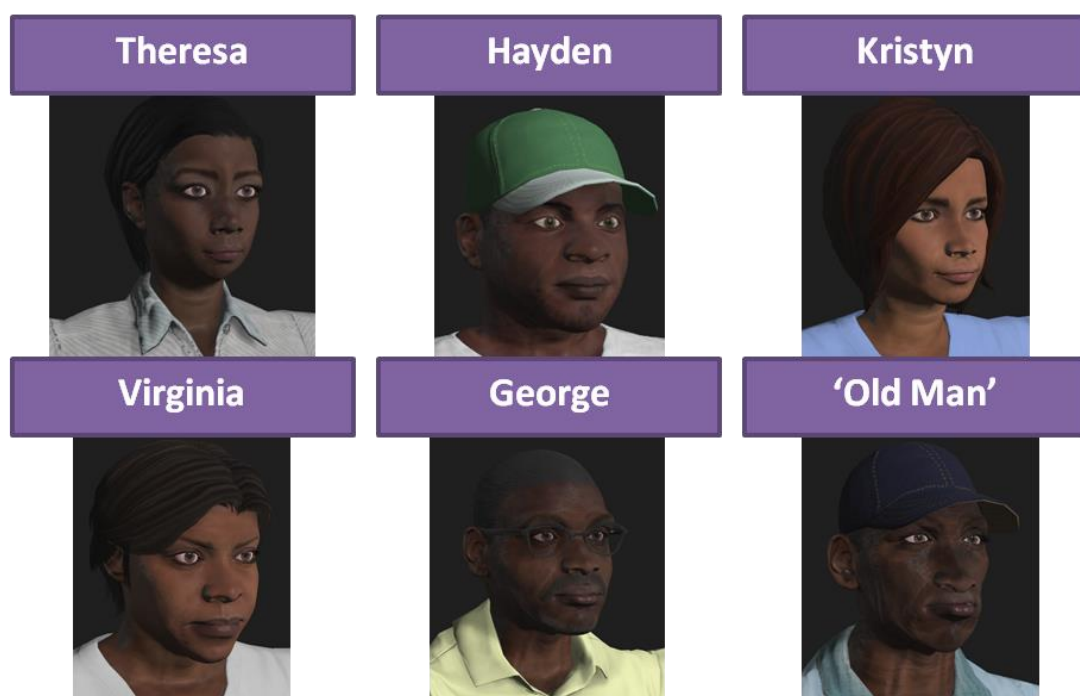


Figure 15 - Supporting Characters

Theresa is Diana's sister, who lives across town and is aware of Rondell's previous abusive behaviour. She encourages her sister to leave Rondell, but does not have room for her, Jesse and Jesse's dog Alvin to come and live with her at her place.

Hayden is Rondell's best friend, and is designed to provide a positive male role model that will not just disagree with Rondell's behaviour, but actively call him out for it. This allows players to examine ways to debate amongst peers.

Kristyn and Virginia are nurses at the hospital. Virginia is under a lot of pressure and does not have the patience to deal with Diana lying about her injuries to protect Rondell. As a foil to Virginia, Kristyn is much more open and patient.

Mr. George is Jesse's teacher at school. He is concerned about a recent decline in Jesse's behaviour and grades, and he calls him in to try to find out why. Mr. George is intended to highlight to players the way that any violent behaviour in the home can have an impact on children as well.

The Old Man is a character intended to summarise and challenge Rondell's attitudes one final time before Diana confronts him. He is intended to be a character that commands respect, and like Hayden, is designed to be a positive male role model.

### 5.3.2 – Summary of Level 1 - Homework

Level 1 is an introduction to the main characters involved, and begins on a typical evening. The main player character, Jesse, is playing at home. In this level, players are introduced to the conversation system. The victim, Diana, is introduced along with the perpetrator, Diana's partner Rondell. Players get the opportunity to explore the house and interact with objects while learning the movement system.



Figure 16 - Jesse in Level 1

Later, Rondell attacks Diana and players must help Jesse locate the ambulance number, which is the real-world number for their country. The level also references Rondell's drinking, which has been determined as a contributing factor to violence (Jones et al., 2017).

### 5.3.3 – Summary of Level 2 - Hospital

Level 2 takes place in hospital the next day. Players control a nurse who is tasked with looking after Diana. The situation is complicated by the fact that Diana is pregnant, thus introducing another victim of Rondell's violence into the mix. Diana's fear of Rondell is revealed, when she lies about how she received her injuries.



**Figure 17 - Theresa in Level 2**

Players will learn how to reassure a victim, what the impact of violence on an unborn child can be and how to provide the victim with the information they need to escape from the situation. This level is based around the preliminary research that revealed how Domestic Violence does not always stop during pregnancy, and an abuser's behaviour can actually worsen during this period (Jones et al., 2017).

### 5.3.4 – Summary of Level 3 - School

Level 3 takes place in Jesse's school. As Jesse's teacher (George), players must ask Jesse questions and attempt to discover why Jesse's behaviour and grades are suffering. Players will use a board game in order to get Jesse to engage with George's questions. This level is designed around the



actionable outcome of getting victims and secondary victims to open up about what is happening in the home (Jones et al., 2017). Levels 2 and 3 may also be used to provide training for professionals such as healthcare providers, nurses, social workers and teachers.

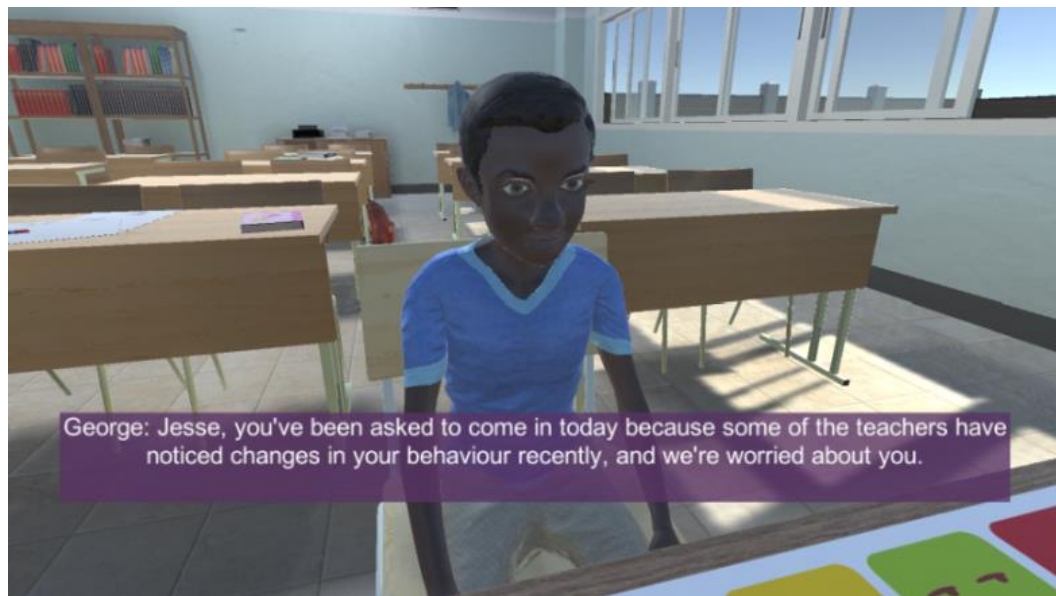


Figure 18 - Jesse in Level 3 with board game

#### 5.3.5 – Summary of Level 4 – Pool Hall

Level 4 features Rondell's best friend (Hayden), who goes to a pool hall to play pool with Rondell. Players can try to learn about Rondell's behaviour through questions between pool shots. This level draws from the research outcome that Men should be activists against DV - challenging negative gender attitudes and violent behaviours by other men. It is also revealed during this level that Rondell's father was violent towards Rondell's mother. This addresses research identifying DV as an inter-generational issue, with violence being perpetuated from parents to children (Jones et al., 2017).





**Figure 19 - Rondell in Level 4**

### 5.3.6 – Summary of Level 5 - Standpipe

Level 5 follows Rondell as he listens to advice from an Old Man. Later, players (playing as Diana) are given a choice to determine the outcome of the story, based upon the information and perspectives they have gathered from the characters in previous levels. The level explores how victims of DV can be conflicted in their emotions, both loving and hating the ‘harmer’, and also prepares players to handle conflict in relationships (Jones et al., 2017).



**Figure 20 - Rondell in Level 5 at the standpipe**

## 5.4 – Cost-saving techniques for game development

This section details a number of development techniques, tools and systems that were created or used to generate a 3d, fully-voiced point-and-click adventure game with animations and branching dialogue. The first decision that had to be made was which game engine technology to use. The two

primary choices were *Unity* (Technologies, 2015) and *Unreal Engine 4* (Sweeney, 2012). Information about computer infrastructure in schools suggested computer hardware was variable and in many cases, would not meet the requirements for *Unreal Engine*. It was decided to create the game with *Unity* for this reason.

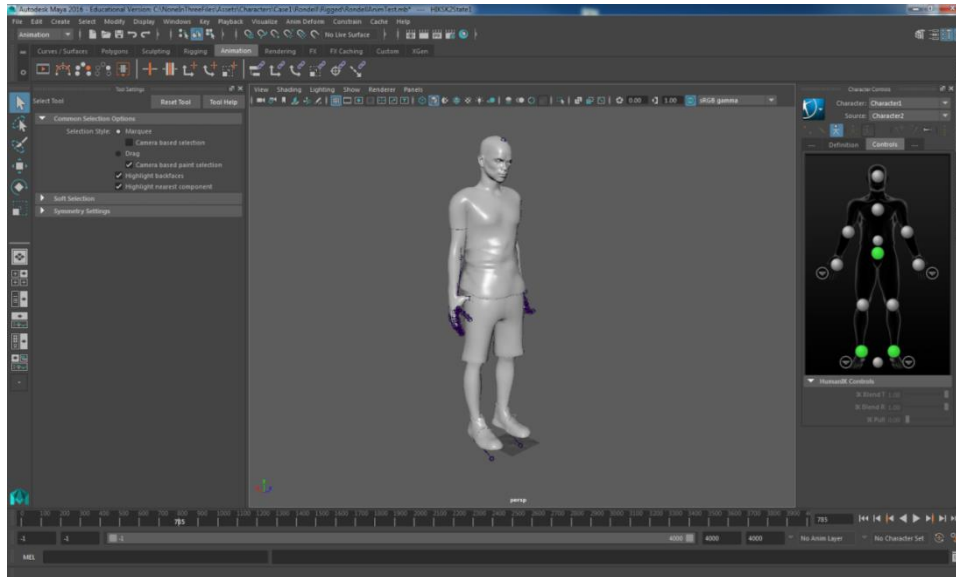
#### 5.4.1 – Characters and Animation

A significant amount of development time is required to manually create 3D game characters before they are ready to be animated, with rigging and skinning being time-consuming tasks. Fortunately, there have been several breakthroughs in the automation of these processes. *Adobe Fuse* (Mixamo, 2016) is a piece of character generation software that allows users to modify template characters until they have characters that fit their specifications. *Fuse* also contains a motion capture library, covering a large number of the animations players would expect to see in a humanoid game. This meant that time could be spent creating bespoke animations unique to the game.



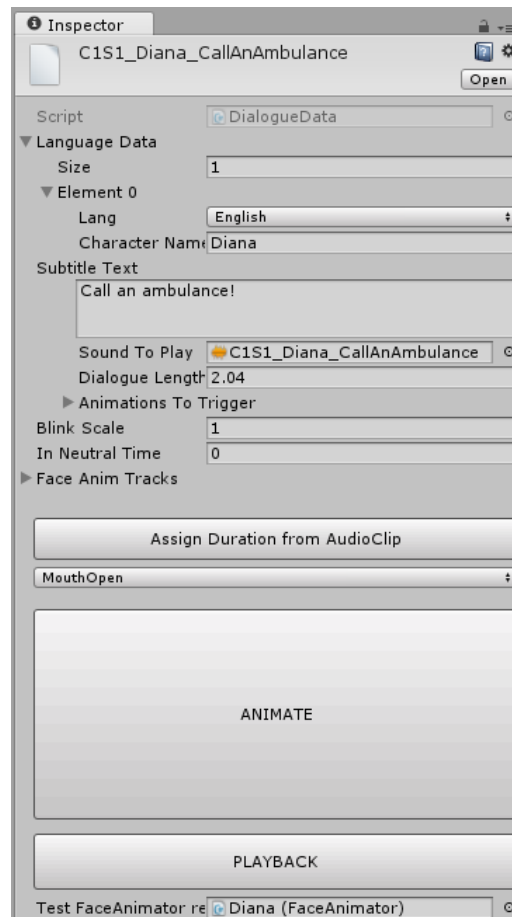
Figure 21 - Noitom Motion Capture suit

For bespoke animations where characters interacted with objects in the game environment, *Maya* was used for keyframed animation. For standalone, more natural motions, animations were created using motion capture. This was accomplished using a Noitom *Perception Neuron* suit (Noitom, 2015), a magnetic motion capture suit. This allowed for animation retargeting using *Maya* to match the *Fuse* skeleton through the use of custom python tools written specially for this project and the HumanIK tool in *Maya*. See Appendix 4 for further information.



**Figure 22 - Rondell with retargeted animations in Maya**

Fuse also generates facial blend shapes, allowing deformation of a characters face. This is used to further demonstrate how a character is feeling beyond their dialogue and motion. A tool was created to generate animation clips from mouse movements synced to voiced dialogue to speed up the implementation of facial animation.



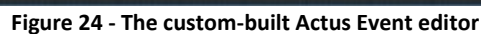
**Figure 23 - Custom Dialogue and Facial Animation Tool**

This approach to facial animation differs from other low-cost techniques, which often rely on static avatars or animated texture maps to move a mouth.

#### 5.4.2 – Pre-made Asset packs

Due to the scale of the project and the small development team, it was necessary to explore alternatives to authoring all game assets manually, as this would take time away from the development of the game's systems and interactions. It was decided that purchasing asset packs from the Unity Asset Store would reduce time spent on asset development. Some assets required optimisations, as materials used were expensive to render, and texture resolutions needed to be reduced for other assets. Even with these adjustments it was still quicker to purchase pre-made asset packs.

As conversations in the game can have multiple paths and prompts, an event editor called Actus was created to visualise branching dialogue and to provide a way to drive the logic tied to player interaction.



## 5.5 – Playtesting and Iteration

60

### 5.5.1 – Quest Line

Some players were struggling with finding their next objective. In order to deal with this, a compass button was added to the user interface.



Figure 25 - Quest Line example

If a player needs guidance, clicking this button will generate a purple line that players can follow to the next key objective.

### 5.5.2 – Quest Log

As there is more than one quest active at certain times during gameplay, players felt like they were missing out on exploring by sticking to the main quests.



Figure 26 - Quest Log example

To reveal more interactions to the player, a quest log was added to the user interface, which displays a todo list for players to consult if they want to explore more than just the critical path.



### 5.5.3 – Level 1 Layout changes and Tutorial Prompts

Players were struggling to learn camera controls during their first playthrough. With the size of Rondell's house feeling small, some players were unable to find Jesse's bedroom to make progress.

A solution to this was to add tutorial prompts to Level 1, explaining the controls in detail.

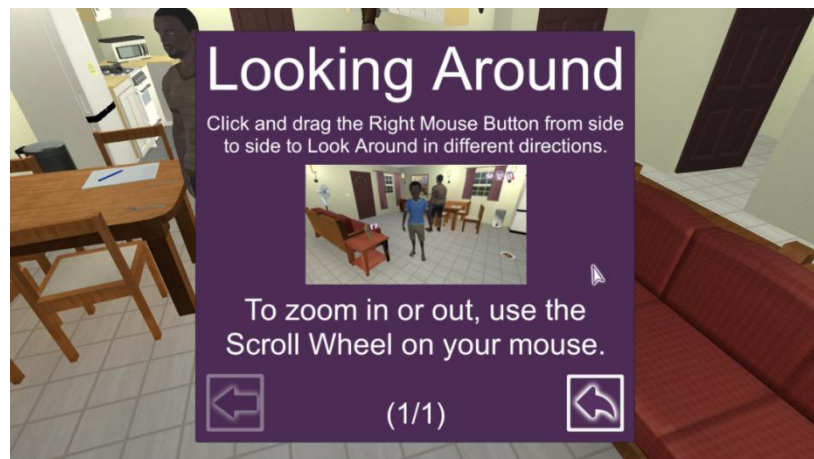


Figure 27 - Tutorial Prompt example

In addition, the wall behind the sofa was removed, making Jesse's bedroom more visible. The original wall position is highlighted in the image below. A sign was also added to the bedroom door.



Figure 28 - Removed wall from Level 1

### 5.5.4 – Emotional Intelligence Dial revisions

The emotional intelligence dial was initially designed to allow players to self-report their own emotional state at certain moments during gameplay. However, initial feedback indicated that it would be more effective to assess empathy by asking players to identify how the characters in the game were feeling at any given moment. By making some adjustments to the emotional intelligence

dial, it can be used for measuring empathetic response, by requesting players evaluate the emotional state of the characters in a game. This is done by changing the question mark icon on the Dial to an image of one of the characters in the level. Players must then think about how this character is feeling and respond accordingly.

In addition to making the EI Dial focus on a player's interpretation of how the characters in the game are feeling, the emotions themselves were revised. The emoticons were simplified to make them clearer to understand, and Neutral was replaced with anger, which more appropriately follows Ekman's 6 basic emotions (Ekman, 1992), along with further research on facial recognition that collapses these 6 emotions into 4:

*"Specifically, early facial expression signaling supports the discrimination of four categories, namely happy, sad, fear/surprise (i.e., fast-approaching danger) and disgust/anger (i.e., stationary danger), which are only later more finely discriminated as six emotion categories." (Jack, Garrod, & Schyns, 2014)*

In order to gather more detail from a player's emotional choice, a slider was added to the emotional intelligence dial. Players will hover over one of the emotions, which will then cause a slider to appear next to that emotion. Players must then drag this slider to the right, with a 'full' slider indicating that the character is feeling this emotion very strongly. Leaving the slider on the left side will indicate that they believe the character is not feeling this emotion very strongly. This mimics the behaviour of the 'neutral' emoticon of the prototype EI Dial. Players are given a grace period of approximately two seconds after an emotional choice is made to adjust how much to move the slider.





**Figure 29 - Revised Emotional Intelligence Dial**

To completely remove ambiguity regarding the emoticons themselves, hovering over each face also shows a small tooltip describing which emotion the face represents.

Playthroughs of the game in its early state indicated that players did not see the EI Dial appear on screen, as they were too focused on the middle of the screen, where any relevant action was happening. To draw attention to the dial without moving it to the centre of the screen and thus blocking the player's view of the moment, a camera fade was implemented, which fades out most of the main view, with the bright colours of the EI Dial overlaid to draw the player's attention.

The result of these changes is a single-click dial which allows players to quickly and unambiguously identify one of four basic initial emotions that are immediately recognisable across cultures, and then declare how much they believe a character is feeling this emotion.

#### 5.5.5 – Pool Difficulty adjustments

The playtesting session raised the issue of finding the Pool Game too long and too difficult. To address this, Rondell's aiming AI was improved, auto-aim was provided within 5 degrees to all player shots, and the pocket collision was made wider, making it simpler to pot balls. This can be seen in the screenshots below.

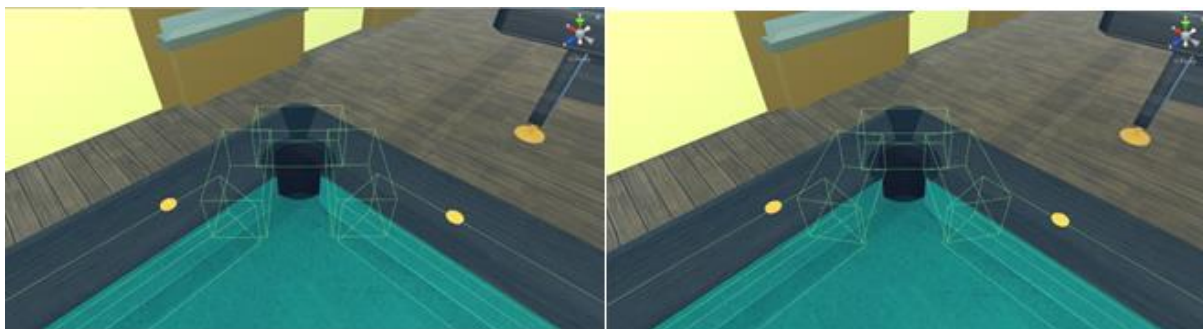


Figure 30 - Pool pocket collision before and after

## 6 – Development of data gathering process

With the game developed, the research questions will be explored in detail in order to determine the best way to apply the chosen research methodology during the game trial.

### 6.1 – Gathering data to answer Question 1

- 1) Does the emotional awareness of players of a prosocial game change and improve over the duration of gameplay?

Quantitative data will be used to identify changes in player's emotional awareness to provide an answer to question 1, through the generation of player data that will provide an image of player behaviour during their playthrough. This will include information provided by the emotional intelligence dial, along with the choices they made and actions completed during gameplay. When this data is looked at for a range of demographics (male/female, primary school/secondary school, country) trends can be identified in how their EI decisions changed over time.

#### 6.1.1 – Emotional Intelligence Dial quantitative data

For the first time the Emotional Intelligence Dial is used for each Emotional Intelligence event, the game will record quantitative data based upon the results. This data will include which EI event it was, the emotion chosen by the player, and the amount (between 1 and 100) the slider was dragged. This quantitative value represents how strongly participants believe the character related to the EI event is feeling a particular emotion. This data will also be timestamped so that EI events can be viewed chronologically.

EI responses provided on subsequent playthroughs will not be counted, as a clear image of what players experienced during their first playthrough of the game is prioritised, and the extra data would take longer to sort.

### 6.1.2 – Player choice Event Data

As the game has multiple endings and choices for participants to make, each event will be recorded with a timestamp for each user. Only the first occurrence of an event will be recorded for the same reason mentioned above about EI responses. Focus will be on the various ending decisions participants made.

## 6.2 – Gathering Data to answer Question 2

- 2) Are the game mechanics and features designed for this serious game usable and understandable by young people?

A combination of Qualitative and Quantitative data will be used to identify any issues in the game's design and usability. A questionnaire focused around the usability of the game will be developed, containing questions with a quantitatively measurable outcome. This can then be used 'at-a-glance' to determine players' ease of use. This questionnaire will also allow participants to elaborate further, with open-ended follow-up questions of a qualitative nature.

In addition to the above, the player data recorded by the game will also be used to generate timelines of player activity. If players found the game easy to use, they will move quickly from one event to the next. However, if there are large gaps between certain events on the timeline, and if this is common among a large group of players, then it will be apparent that certain activities and events in the game are difficult for players to undertake.

Looking at quantitative timeline data will also reduce the need to rely upon participants' recollection of what they found difficult, and identify where time is wasted during playthroughs of the game. Due to the nature of the game imposing on the time allocated for the curriculum in each school, it is important that players are not wasting time unnecessarily or with little benefit.

## 6.2.1 – Usability Questionnaire

Writing a usability questionnaire from scratch is unnecessary. Usability is considered a key principle by which to develop software, and so businesses have created usability questionnaires and studies which can be used as a starting point for this study.

The System Usability Scale (SUS) was created as a purely quantitative method of analysing a participant's subjective responses to the usability of a system (Brooke, 1995). Participants answer a 10-question multiple choice questionnaire, with questions ranging from how confident they felt using the system, to how easy it was to learn.

	Strongly disagree				Strongly agree
1. I think that I would like to use this system frequently	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1	2	3	4	5
2. I found the system unnecessarily complex	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1	2	3	4	5
3. I thought the system was easy to use	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1	2	3	4	5
4. I think that I would need the support of a technical person to be able to use this system	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1	2	3	4	5
5. I found the various functions in this system were well integrated	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1	2	3	4	5
6. I thought there was too much inconsistency in this system	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1	2	3	4	5
7. I would imagine that most people would learn to use this system very quickly	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1	2	3	4	5
8. I found the system very cumbersome to use	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1	2	3	4	5
9. I felt very confident using the system	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1	2	3	4	5
10. I needed to learn a lot of things before I could get going with this system	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1	2	3	4	5

Figure 31 - The System Usability Scale

SUS has a usability score which is calculated from the values chosen by participants, with 1 representing Strongly Disagree and 5 representing Strongly Agree. The scale of the final value is from 0 to 100, with 100 being a perfectly usable system. SUS is a popular method for determining the usability of a system, with more than 1300 articles and publications referencing it (Usability.gov, 2017). A final SUS scoring of 68 is considered the average.

Although SUS is considered an effective tool, the language used in the questions may be too complex or unknown to participants of a younger age. As a result, the questions will be modified slightly, with all references to 'system' being replaced with 'game', all references to 'use' with 'play', and words like 'inconsistency', 'cumbersome' and 'integrated' being replaced with simpler alternatives.

Below are the revised SUS questions, with more simplified language and the context shifted specifically to the game. In addition to these 10 changed questions, a qualitative prompt was added after Question 2 in the full study, in order to diagnose game elements considered unnecessary by players. This new question was open-ended, the exact text of which was 'If you agree, what parts are not needed?'

- I would like to play this game again.
- I found the game contained a lot of parts it didn't need.
- I thought the game was easy to play.
- I think that I would need the support of a technical person to be able to play this game.
- I found the various parts of the game were well connected.
- Parts of the game were different from each other in a way that made it difficult to play.
- I think that most people would learn to play this game very quickly.
- I found the game very awkward to play.
- I felt very confident playing the game.
- I needed to learn a lot of things before I could get going with this game.

With the modified question set and the addition of the qualitative question prompt, it is unlikely that the results of this study will be applicable to researchers attempting to measure the success of the SUS itself. It is also possible that the original language of the questions was important to the integrity of SUS scoring. However, the changes should make it easier for participants to understand the context of each question.

As the usability questionnaire will only be run with non-Caribbean participants, it is less likely there will be issues with the internet connection during the non-Caribbean part of the study. For ease of use, the questionnaire will be hosted online as a private Google Forms questionnaire. Google Forms will then export the data automatically into a suitable format for analysis, and also has the option to generate graphs from participant responses.

#### 6.2.2 – Timeline of Event Data

Key events in the game will reward the player with experience points in order to encourage progress. In addition to this, the game will record when players reach these important moments, which are all triggered by the player interacting with something in the game's environment. As part of this data gathering, a timestamp will be included along with each event. These events can then be placed into timelines, in order to identify player behaviour over time. Large gaps between events will indicate where players may be struggling to follow instructions or complete tasks assigned to them. This will then indicate any issues with usability on a more granular level than the questionnaire may reveal.

### 6.3 – Gathering data to answer Question 3

#### 3) Are the messages and lessons of the game understood by players?

Qualitative data will be used primarily to answer question 3, with a semi-structured interview containing questions asking participants about the lessons they learned from the game. Although from a single question it is unlikely that they will be able to recall everything that the game taught them, this will allow participants to explain exactly what they believe they learned from the game. In addition to this, some quantitative measurements will be added to the data gathering process, with a variable tied to how long players spend reading real-world information in the game.

### 6.3.1 – Semi-Structured Interview

A semi-structured interview will allow for researcher control over the initial research questions, but allow for the flexibility of participant input to shape the direction of inquiry. This will allow for a more insightful process than a rigid interview might provide.

Questions asked in the semi-structured interview are designed to gather more detailed responses of participant preferences than the usability questionnaire provides. The questions focus on the levels and characters participants enjoyed the most and least, with open-ended prompting allowing participants to elaborate on the specifics.

Due to time constraints, multiple participants may be interviewed at the same time. This will cause the Semi-Structured interview to take on the appearance of a Focus Group. However, in order to maximise responses to questions, each participant will be asked every initial question in the same manner. Additional questions may be fielded to individual participants based upon their responses.

### 6.3.2 – Time spent learning Tracker

A value embedded in the player data file will track how much time they spent looking at real-world information embedded into the game. There are two channels for this information. The first is through the Notebook in the corner of the screen. Players can click on this during most moments of gameplay and read factual information based upon the research literature that is relevant to the game.

In addition to this, players pick up a leaflet in Level 2 of the game which contains real-world organisation information. This information varies per country (Barbados and Grenada), and the tracker will increment each second as players are reading it. The total value of the tracker at the end of a player's intervention will be how many seconds they spent reading the notebook and the hospital leaflet.



## 7 – Evaluation

Evaluation of *JESSE* was performed in three countries – Barbados, Grenada, and the UK. Due to study constraints, participants in Barbados and Grenada followed one research protocol, and the UK participants followed another.

### 7.1 – Caribbean Protocol

Countries selected for participation in the main *JESSE* trial were Barbados and Grenada. This following explains the protocol developed for this country.

#### 7.1.1 – Selection

Participant institutions were identified by Work Package 3 before the game trial began, and were a combination of primary schools, secondary schools, and government education establishments. Within the schools, classes were selected at random to participate in either control groups or in the game study, with 100 participants for control and 100 participants for the game in each country. Consent was handled through a separate information and permission sheet by the main None in Three project team. All groups (control and game) were given the same pre-intervention questionnaire. This same questionnaire was then repeated at the end of the game trial, and at the same time for the control group.

The schools selected for this game trial will be a subset of the full game trial participants, as some schools, particularly in Grenada, started the trial later than their Barbados counterparts, and waiting for the results from those schools would have gone beyond the time allocated for the data analysis. For this reason a cut-off date for new data from the game trial of Friday 27<sup>th</sup> October was selected to provide enough time to gather the received data into an analysable form.

### 7.1.2 – Structure

The game trial is intended to be run over a week with each group, with a 1 hour session on each day of the school week, from Monday to Friday. Participants should play 1 level in 1 session, and in chronological order, starting with Level 1 on the Monday, and finishing with Level 5 on the Friday. Where students have missed a day of school due to illness or absence, they may be able to catch up and complete the missing level in the other sessions.

### 7.1.3 – Data gathering process

The data gathering for this study ‘piggybacks’ on the main *JESSE* trial by embedding player activity data recording and an emotional measurement tool into the game. As the research questions only relate to participants in the game trial who played the game, no data was captured from the control groups for this study.

An auto-emailing system gathers the four data files (PlayerData.txt, EventLog.txt, EILog.txt, SystemInformation.txt) from the computer a participant is using and attempts to email them to a data gathering email address at the point the ‘Quit Game’ button is clicked. In ideal conditions, this will be when a participant has finished their session for the day, and the auto-emailer would trigger 5 times per participant. In these conditions a complete picture of player data would be provided. However, to mitigate the risk that the auto-emailer will not send the files correctly, game trial facilitators will copy the files manually at the end of the intervention and send them via email to the same address.

## 7.2 – UK Protocol

The UK Protocol is designed to be completed in one session, as participant availability was less consistent due to no embedding into the curriculum of local schools. There are also additional Qualitative data gathering elements as part of this protocol.

### 7.2.1 – Selection

The selection process for the UK involved two groups – the first being adults with an interest in social work and game development, and the second being young people interested in playing the game. With no connections to local schools, young people were identified by asking colleagues and acquaintances if their children would be interested in participating. Participants under the age of 18 had to have additional signed parental permission to provide full informed consent.

Adults selected for the study were those who were familiar with social work, such as council social workers or university lecturers, or those familiar with games, learning and technology, such as learning technology advisors at university institutions. These people were selected to acquire feedback on the effectiveness of the game from the perspective of social work and game design.

Young people were selected based upon their availability and the permission of their parents. An attempt was made to identify young people across a spread of ages, so that the participants would be from primary school, high school and beyond.

### 7.2.2 – Structure

The content and themes of the game are explained to each participant through an information sheet. Then each participant is given a login code (between B901 and B999) which they will use to log into the game, and also to fill out the usability questionnaire. Each participant begins by playing through the game in its entirety in one sitting, from Level 1 through to the credits after Level 5. At this point they click the 'Quit Game' button, which records all of their data and attempts to send it to the auto-emailer.

### 7.2.3 – Data gathering process

The initial process is identical to the Caribbean protocol, except that participants play the entire game in one session instead of five, and they only close the game once they have finished it. After they have finished the game, the two protocols diverge. Next, each participant is directed to a

private online questionnaire hosted on Google Forms, where they answer 16 questions in order to establish the usability of the game. Finally, participants are run through a semi-structured interview of 11 core questions, designed to identify areas of the game they considered most and least enjoyable and effective.

Participants undertaking the semi-structured interview may do it in groups or alone. Where anyone under the age of 18 takes the interview, their parent or legally appointed guardian will also be present, but will not attempt to influence the questioning. This entire process is designed to fit inside 2 hours. Given the restriction of availability of UK participants, brief hints to participants on how to approach the next challenge in the game will be offered if a participant is struggling to make progress for more than a couple of minutes. Game facilitators in Barbados and Grenada will do the same.

## 7.3 – Caribbean Results

During the 5 weeks of data gathering, 8 schools across Barbados and Grenada sent data to the auto-emailer email address. This was a combination of manually and auto-emailed data. All data recorded as a unit of time was measured in seconds unless otherwise stated. As there were 100 intended game trial participants in Barbados and 100 in Grenada, the data gathered appears to represent 96% of all Barbados participants and 78% of all Grenada participants.

### 7.3.1 – Participant numbers per country and school

Category	Number of Participants
All Participants	174
Barbados Only	96
Grenada Only	78
<b>SCHOOLS</b>	
All Primary Schools	62
All Secondary Schools	112
Blackman and Gollop (Barbados, Primary)	25
Deighton Griffith (Barbados, Secondary)	25
Lawrence T Gay (Barbados, Primary)	23

Queens College (Barbados, Secondary)	23
Anglican (Grenada, Secondary)	28
Grenville (Grenada, Secondary)	17
Westmorland (Grenada, Primary)	14
Westmorland (Grenada, Secondary)	19

Class sizes were more consistent in Barbados, with Grenada's varying from almost 10 students smaller per class, to 3 students larger per class than Barbados.

### 7.3.2 – Level Completion Rates

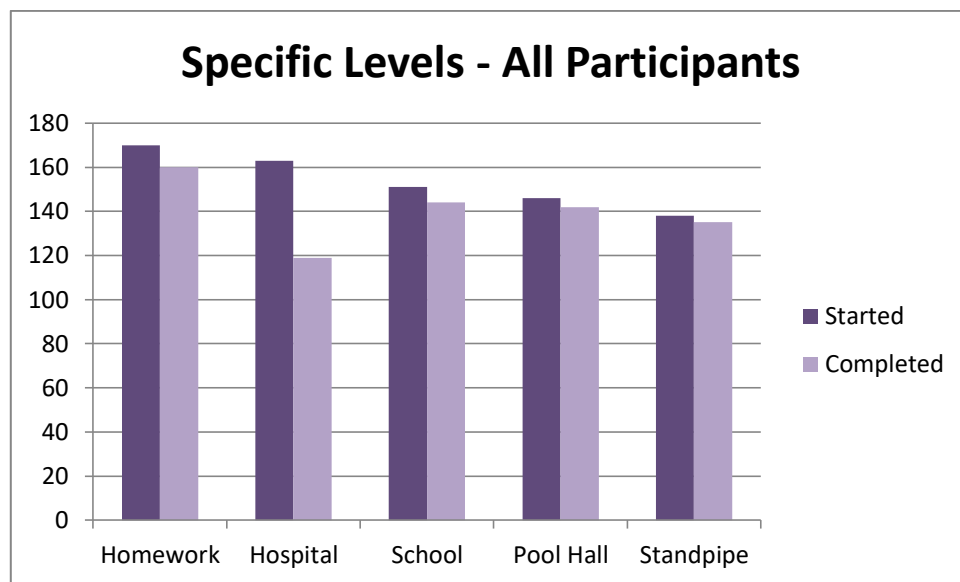


Figure 32 - Specific Levels Chart – All Participants

Completion rates are high across most levels that participants started, with retention from level start to level complete averaging at least 94% per level. The only exception to this is the hospital level, with a 73.01% retention level from level start to level completion.

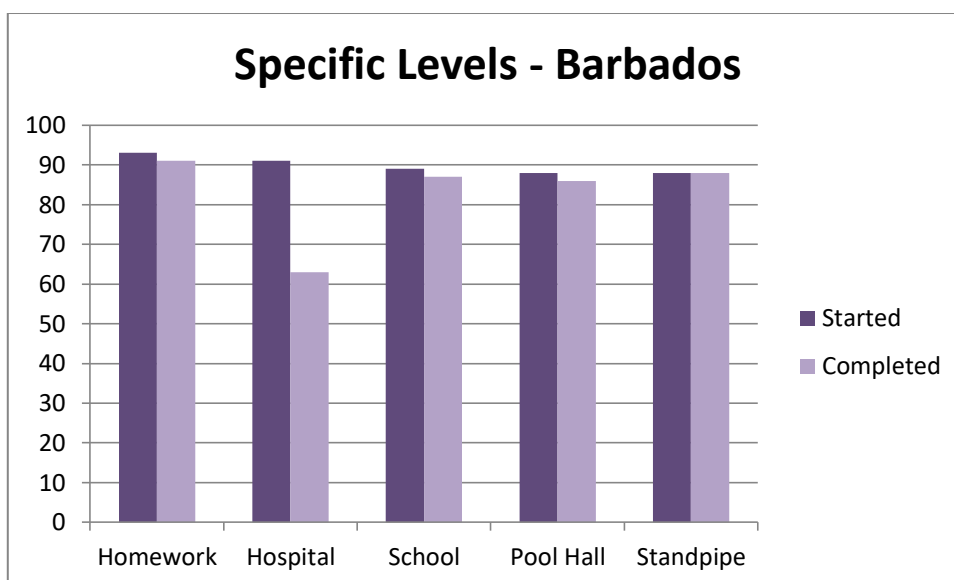


Figure 33 - Specific Levels Chart – Barbados

Barbados student retention was high across the entire intervention period, with all levels being started by at least 91% of all participants.

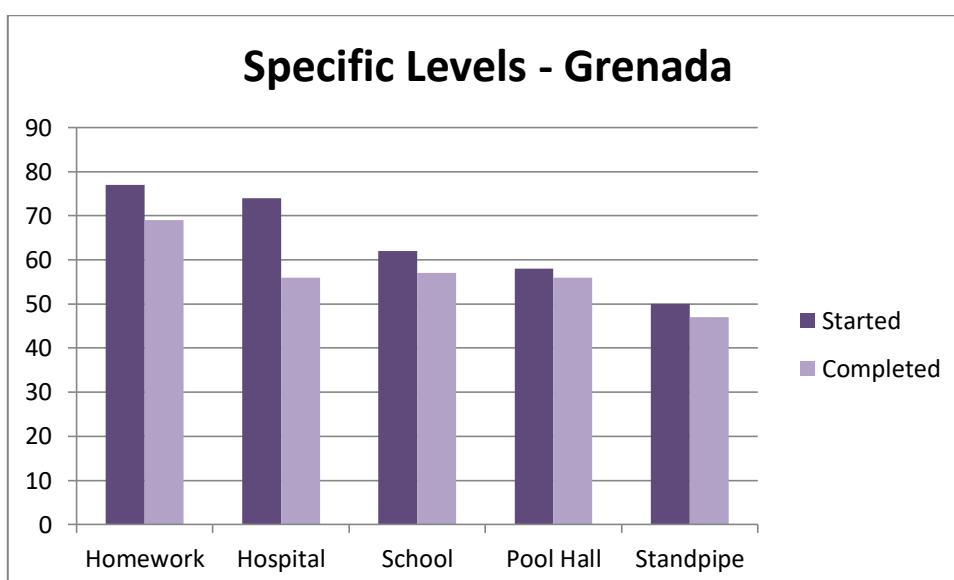


Figure 34 - Specific Levels Chart - Grenada

Grenada student retention was lower, with a noticeable drop in participants from 98.78% starting level 1 to just 64.10% starting level 5.

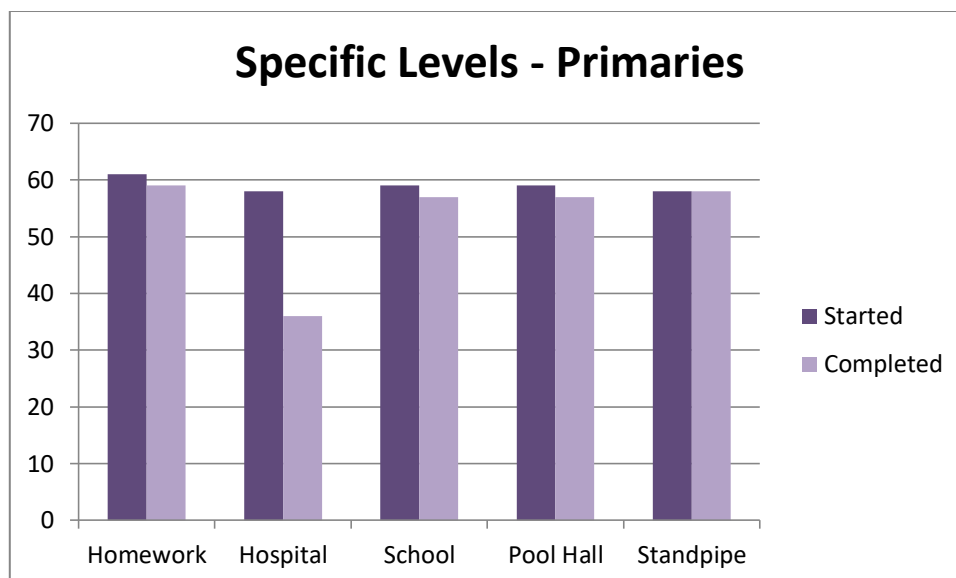


Figure 35 - Specific Levels Chart - Primaries

Primary Schools had strong player retention of at least 93% across all levels started. They also had the lowest percentage completions of the Hospital level at 62.07% of players who started that level.

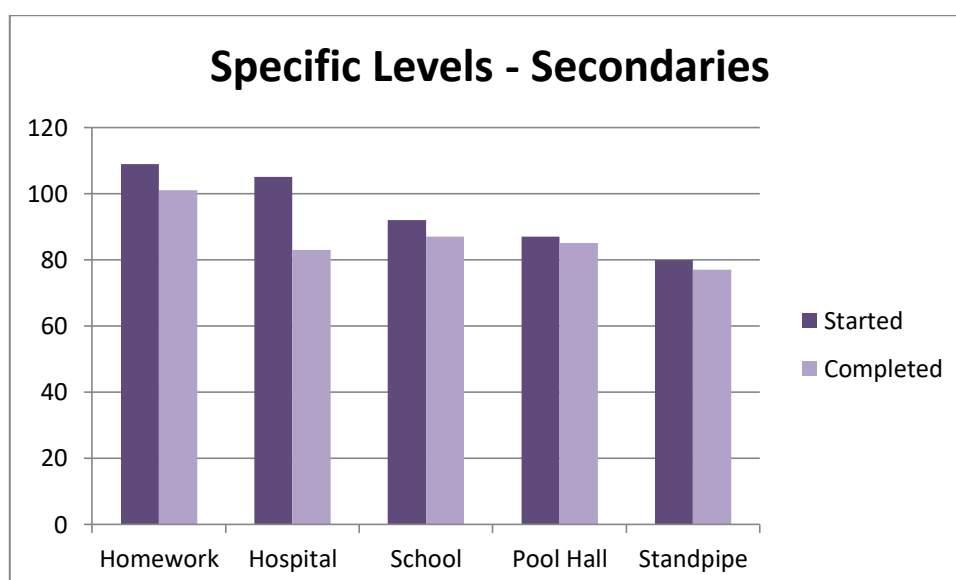


Figure 36 - Specific Levels Chart - Secondaries

Secondary Schools had weaker player retention, dropping from 97.32% starting the first Level on day one to 71.43% starting Level 5. However, they also fared better at completion of the Hospital Level when compared with the primary school participants, with a completion rate of 79.05% of those who started that level.

### 7.3.3 – Level Completion Times

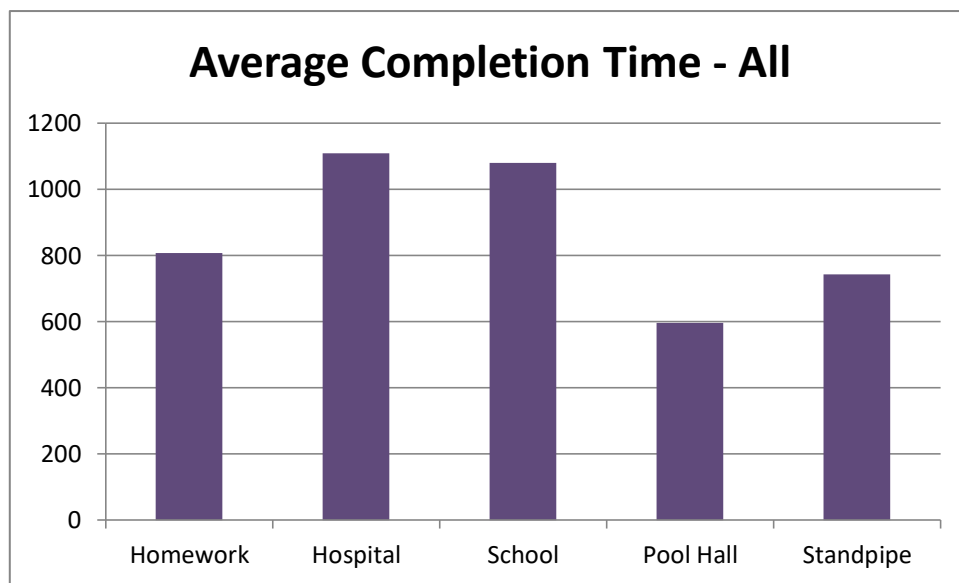


Figure 37 - Average completion time - All

On average, the Hospital Level took the longest to complete with an average of 1109 seconds, and Pool Hall was the quickest completion average with 600 seconds (10 minutes).

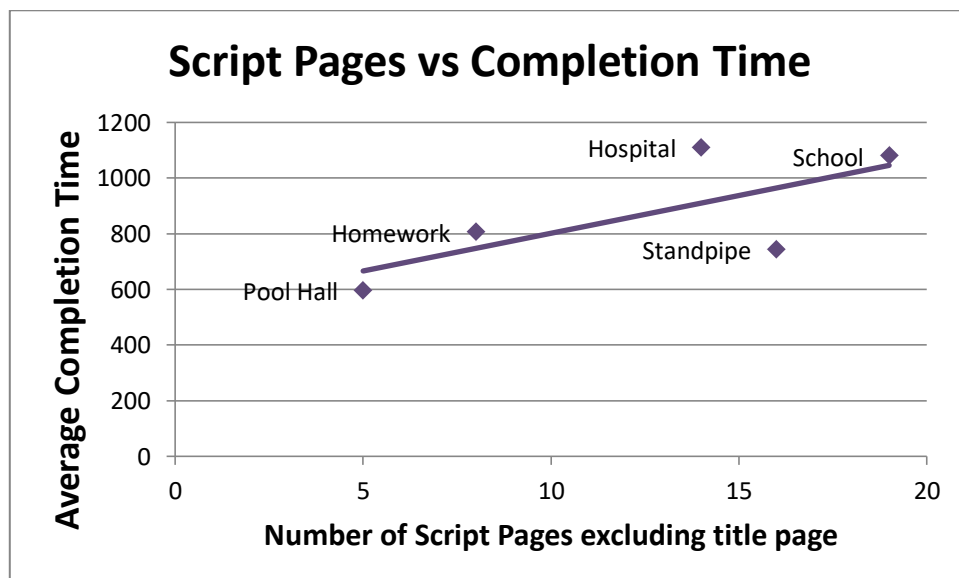


Figure 38 - Script Pages vs Completion Time

For comparison, the figure above has the number of pages of scripted dialogue for each level. A linear trend line has been added to demonstrate the relationship between length of scripted dialogue and average completion time of all participants.



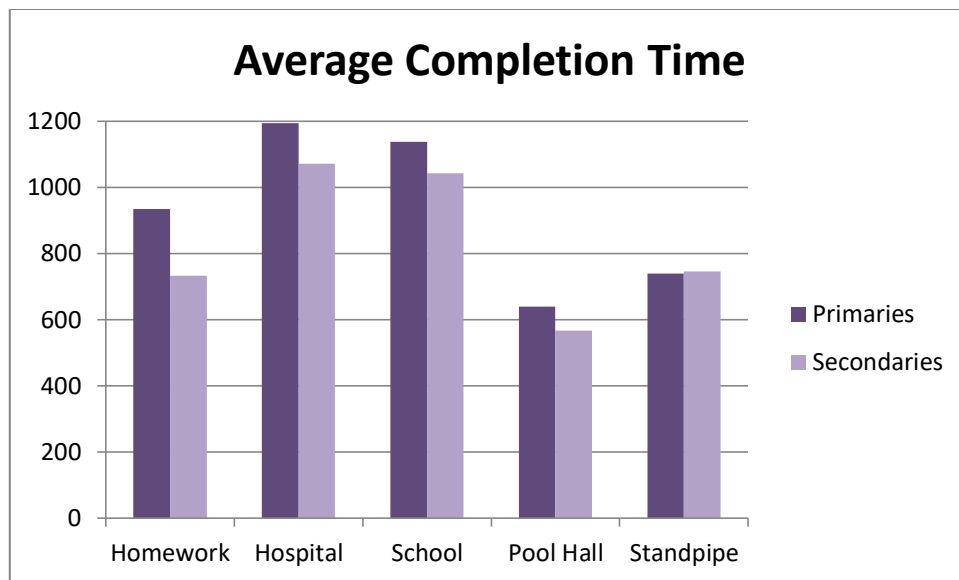


Figure 39 - Average Completion Time – Primaries and Secondaries

Level completion times were consistent across most groups, including comparing boys and girls and Barbados and Grenada. The only exception to this is Primary vs Secondary participants, with the first four levels taking between 9% and 27% longer to complete. The greatest difference in time was the Homework level, with Secondary school participants completing the level 27% faster. The Standpipe level average was within 6 seconds for both primaries and secondaries.

#### 7.3.4 – Time spent learning

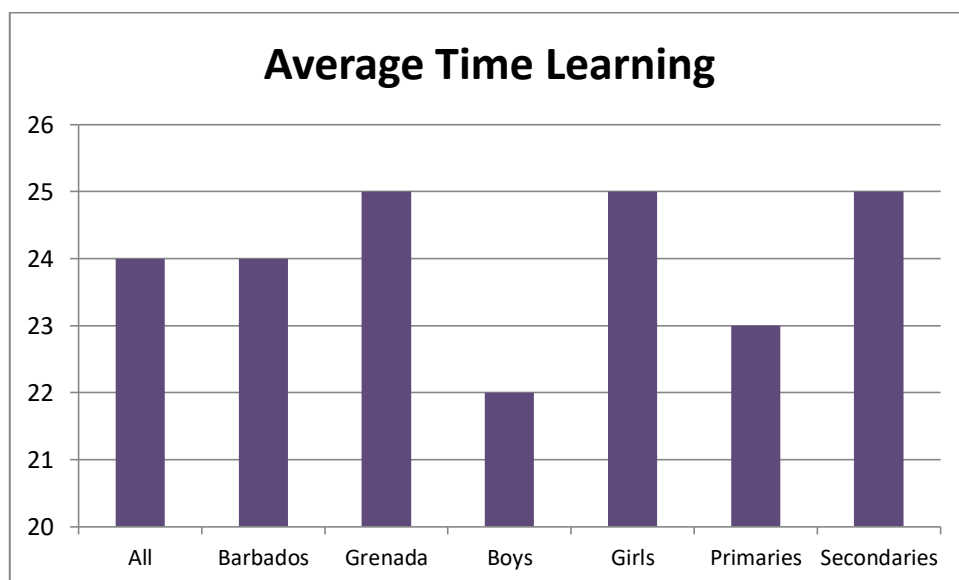
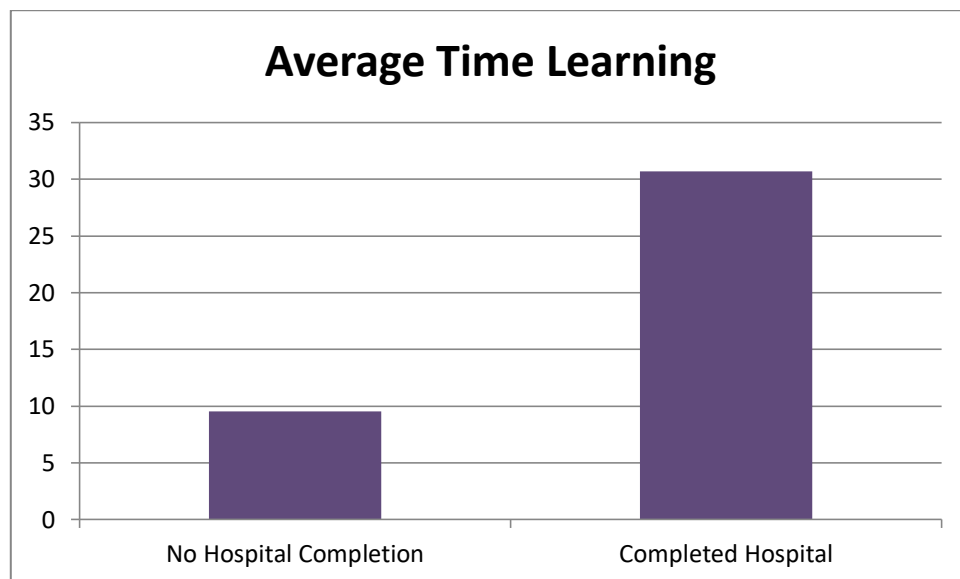


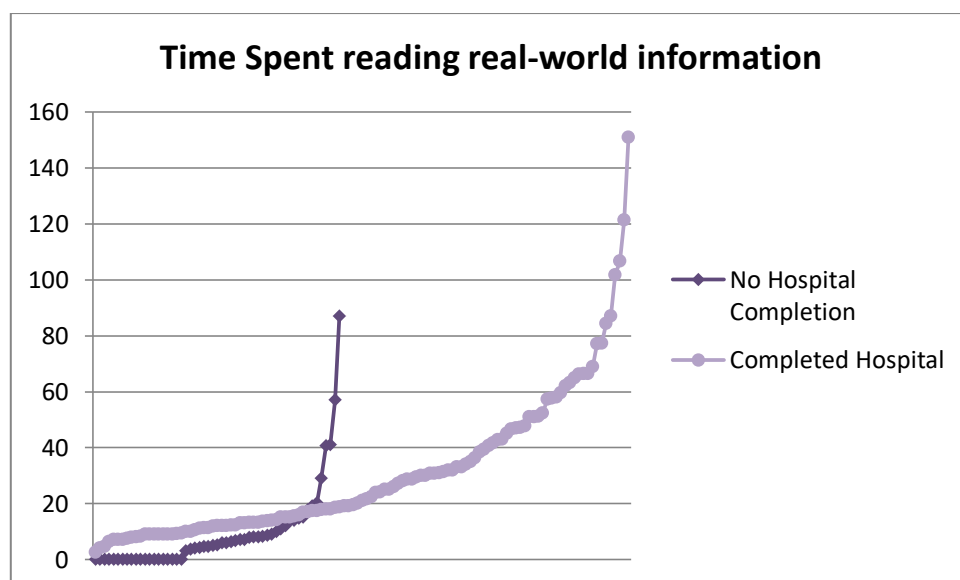
Figure 40 - Average Time Learning

Boys spent an average of 3 seconds less than girls reading real-world information, including notebook entries and the leaflets in the hospital level. Primary students spent 2 seconds less than Secondary students reading the same information.



**Figure 41 - Average Time Learning – Hospital vs Non-Hospital**

The biggest differences in average time spent reading the real-world information embedded into the game were in players who completed the hospital level and those that didn't. The difference between averages for these two groups was over 20 seconds.



**Figure 42 - Time Spent reading real-world information**

When these two groups are compared, a noticeable difference is 20 players that did not complete the hospital level had a learning time of 0 seconds, indicating that they never opened the notebook

during their playthrough. The steepness of the graph for a handful of participants indicates that those who did want to learn from the notebook did, but that many of them opened it once and never did again.

### 7.3.5 – Event Log Timelines

Timelines were generated to compare the times each event was triggered by participants.

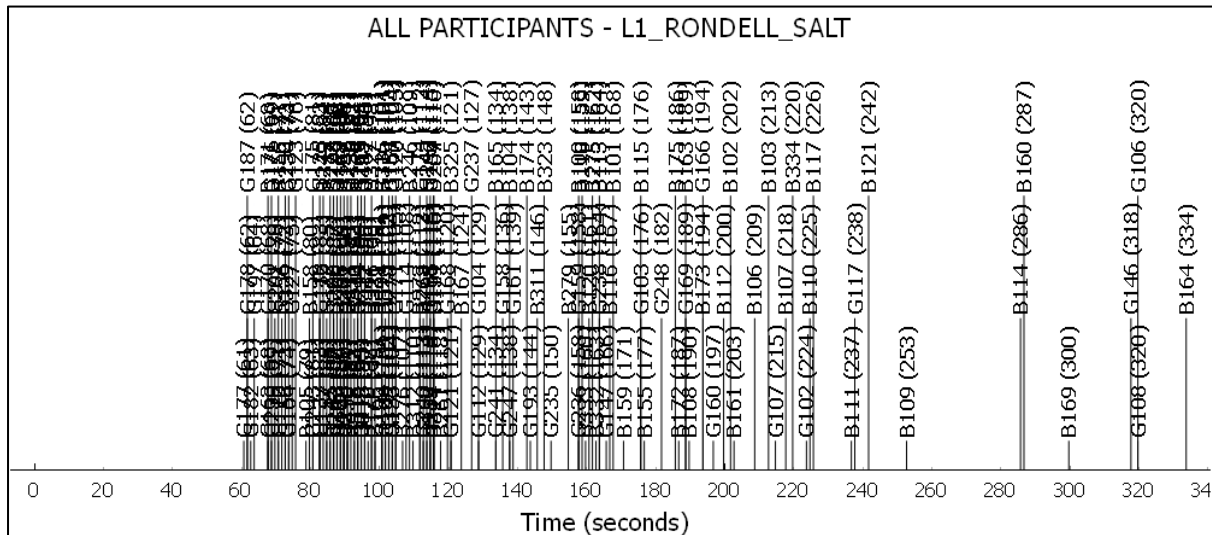


Figure 43 - All Participants Timeline – L1\_RONDELL\_SALT

Above is a timeline of the first measurable event in the game. Times are packed together for the majority of players. Those triggering the event later may have spent more time reading the tutorial prompts, or had to wait for other students to load the level before they were allowed to begin play.

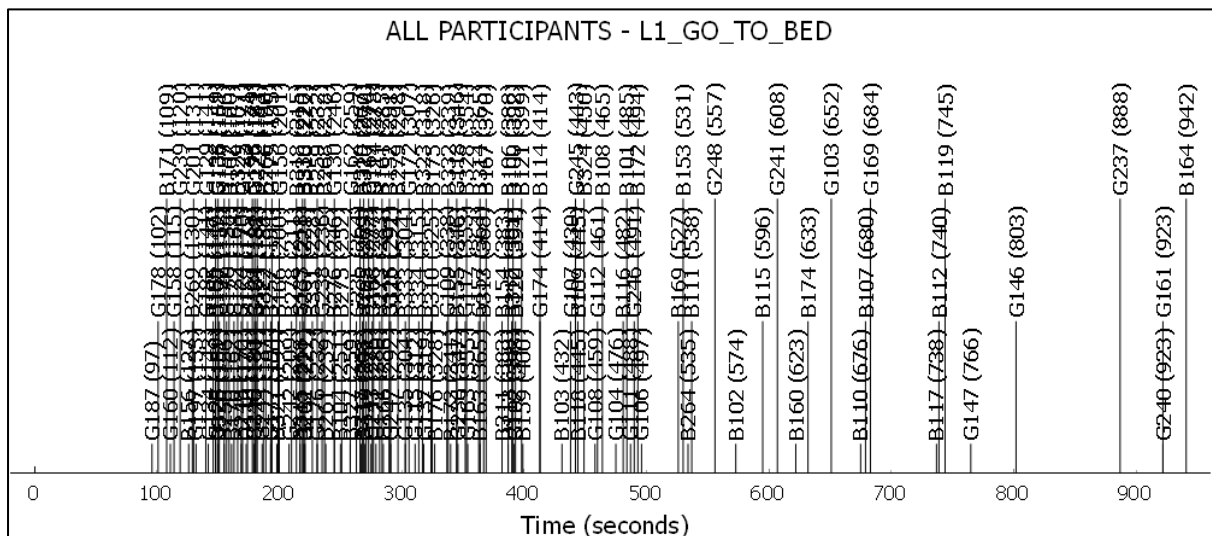
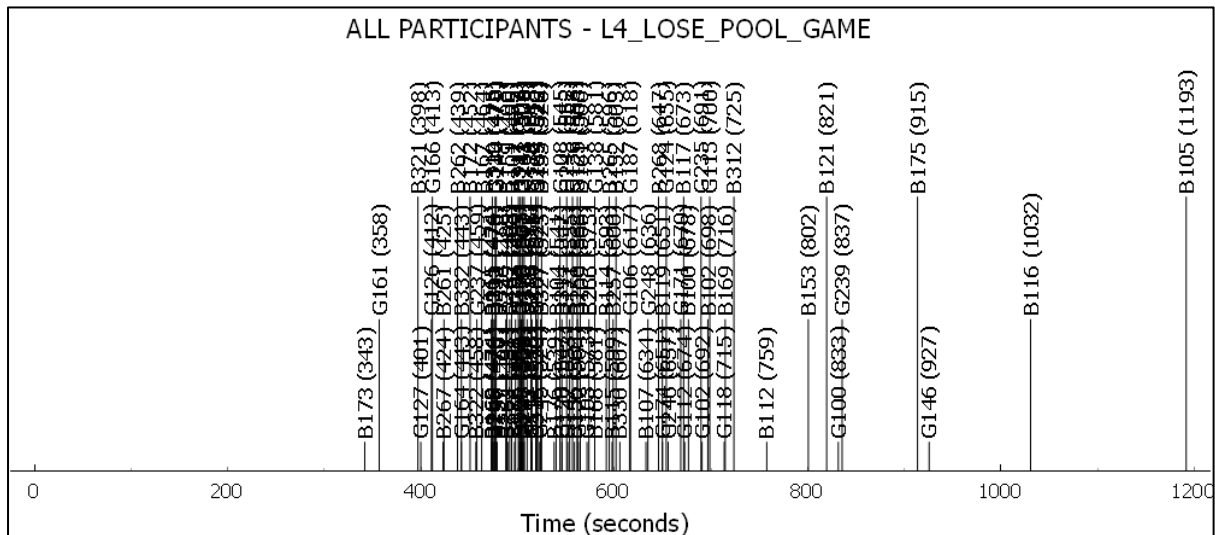
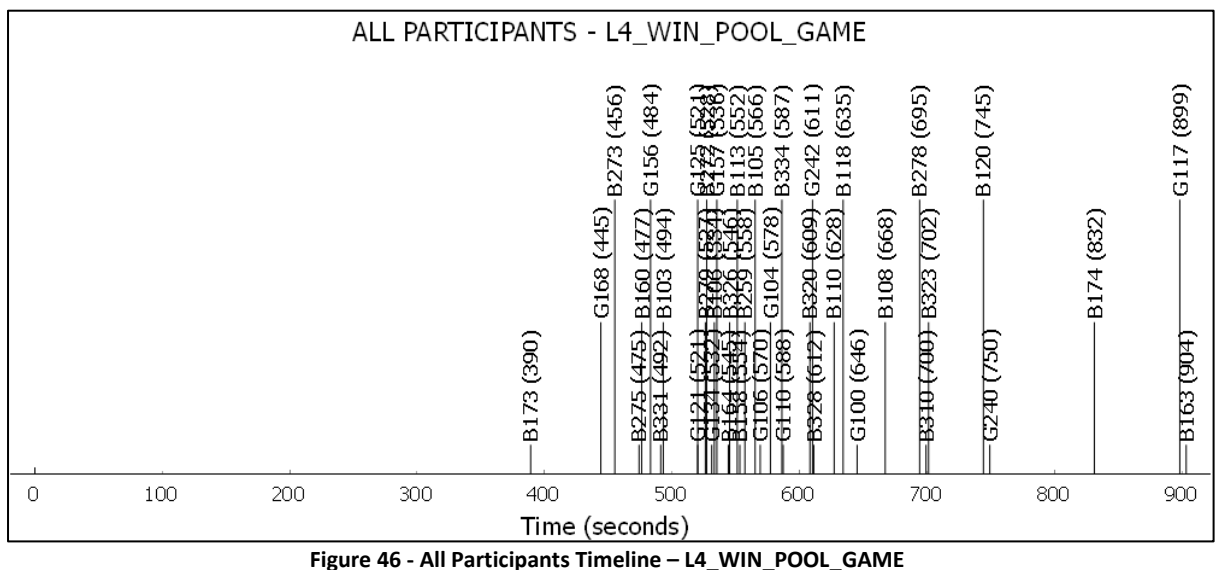


Figure 44 - All Participants Timeline – L1\_GO\_TO\_BED

The above figure shows one of the earliest mandatory event completions in Level 1. The participants are packed tightly together between 100 and 500 seconds, and then a spread opens up. The spread is similar to the previous timeline, but the time difference between these two events varies between 40 and 600 seconds. Players may be struggling to navigate the environment effectively, or exploring the starting location during this time.



Once players have begun the pool game, there is little time difference between them. Only players who explored prior to the pool game take longer.



When compared to winning the pool game, the main period for winning or losing happens at approximately the same time, between 400 and 900 seconds. Those that won the pool game did it

slightly faster, which could be an indication that they lost the pool game on the first attempt, and played the level again to secure a win.

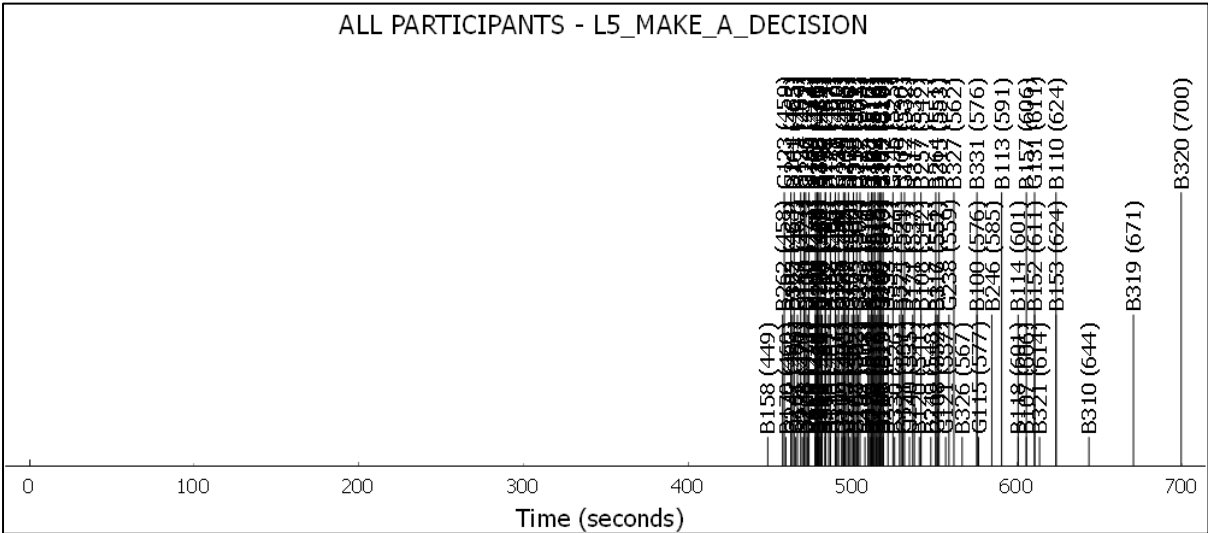


Figure 47 - All Participants Timeline – L5\_MAKE\_A\_DECISION

Having less interactive elements in some levels provided greater consistency in player times for mandatory events. In the timeline above, the majority of players make the final choice in the game within the same 120 second period.

7.3.6 – User Timelines

Timelines were generated for each user per level they played, so that their behaviour while playing a level could be examined.

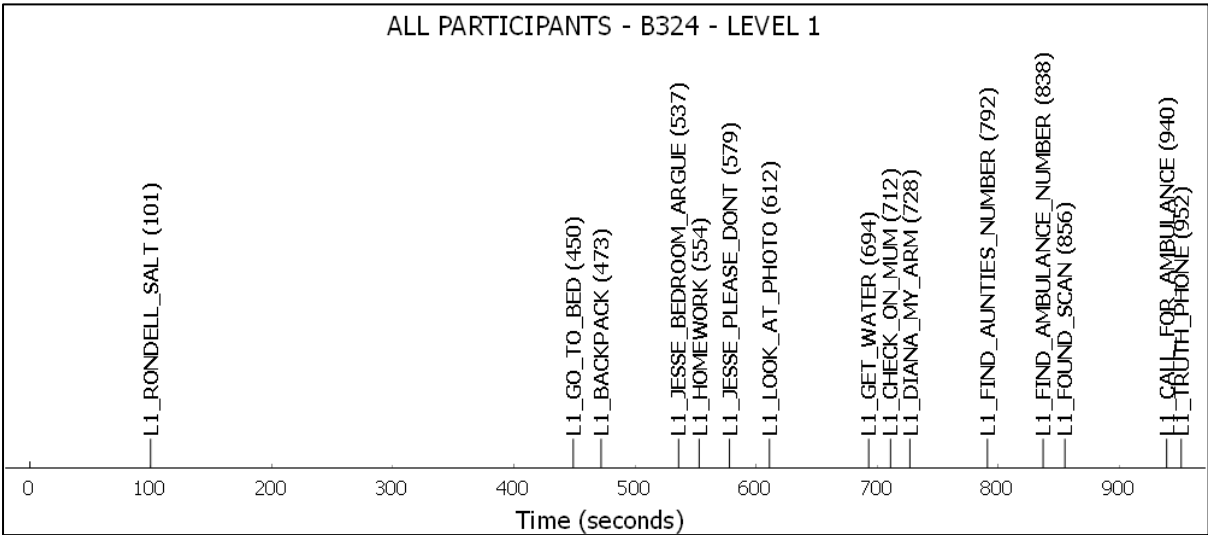


Figure 48 - Timeline – B324 – LEVEL 1

In the above timeline, a large gap exists between players being able to explore after L1\_RONDELL\_SALT and reaching the first main objective, L1\_GO\_TO\_BED. While some of this time can be explained as learning the controls, a time gap of almost 350 seconds indicates that this participant struggled to navigate the environment. There are numerous timelines with similar patterns to this one.

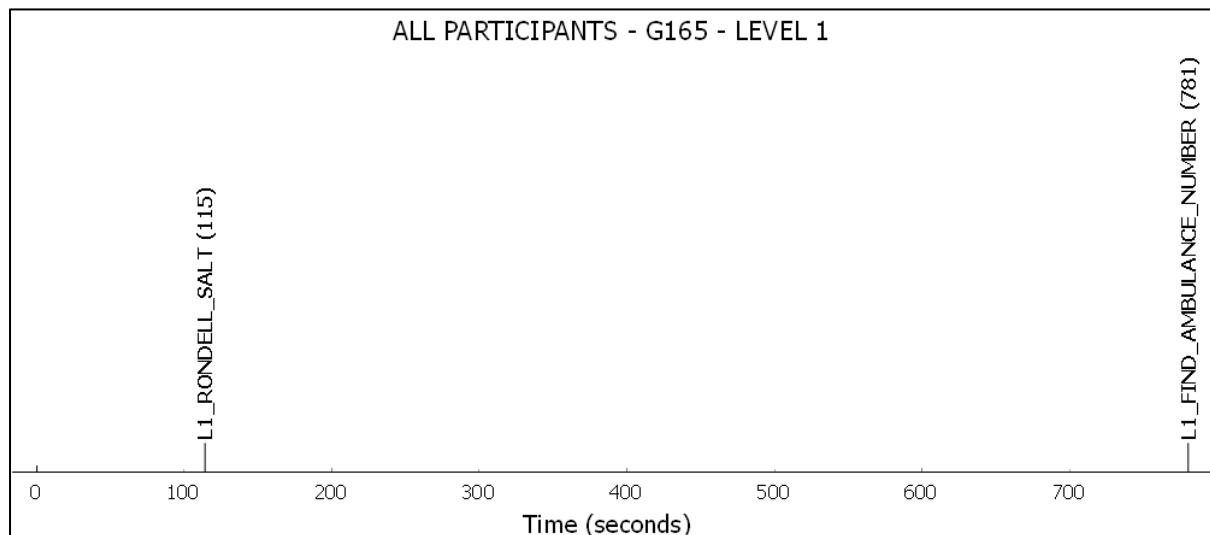


Figure 49 - Timeline – G165 – LEVEL 1

There are also instances of a participant's failure to progress through the level. This timeline shows that the player was exploring for over 10 minutes and failed to find Jesse's bedroom. This indicates that the player had trouble understanding the camera controls, as a camera rotation is needed in order to see Jesse's bedroom.

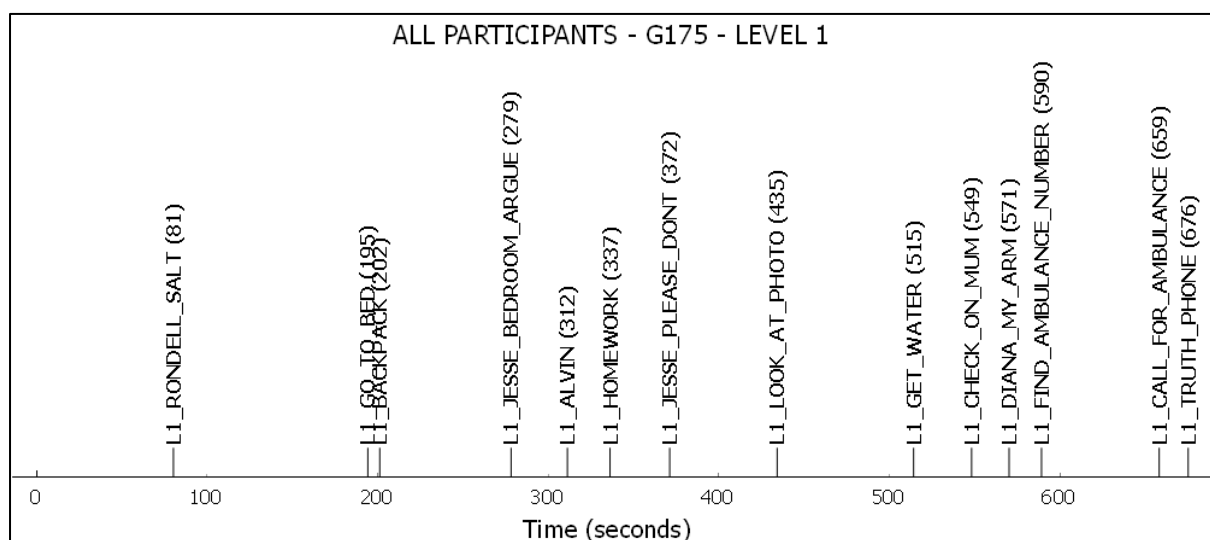


Figure 50 - Timeline – G175 – LEVEL 1

This timeline shows a more optimum playthrough, with the participant making progress at a consistent pace, and also encountering some of the non-mandatory events.

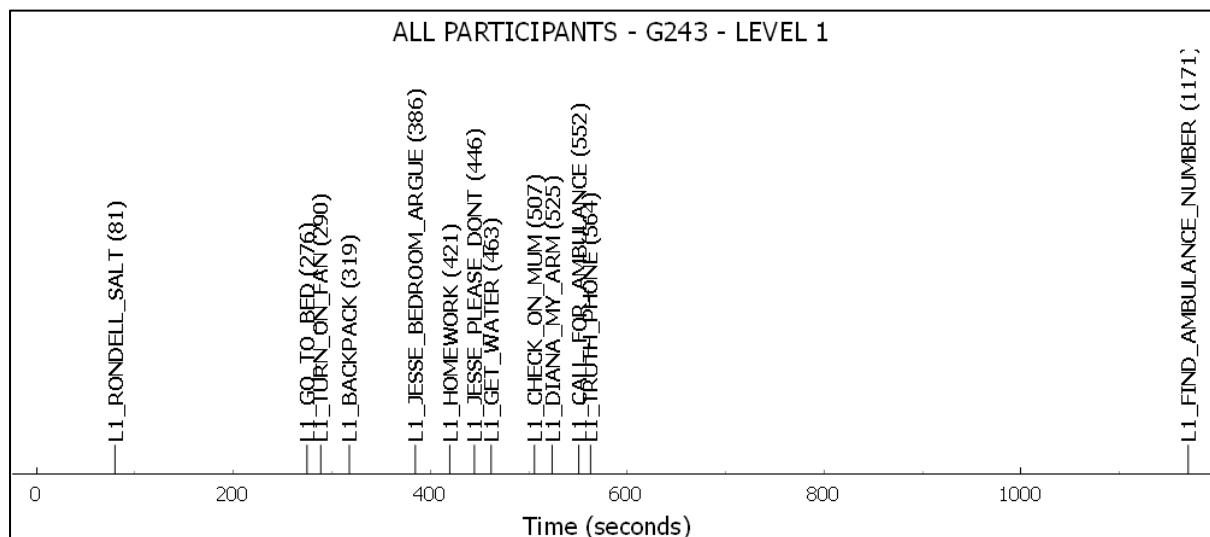


Figure 51 - Timeline – G243 – LEVEL 1

As events are only saved the first time a player triggers them, the L1\_FIND\_AMBULANCE\_NUMBER noted on the right of this timeline must be from an initial playthrough. This player then played through the level again with greater understanding, and completed it in a much faster time.

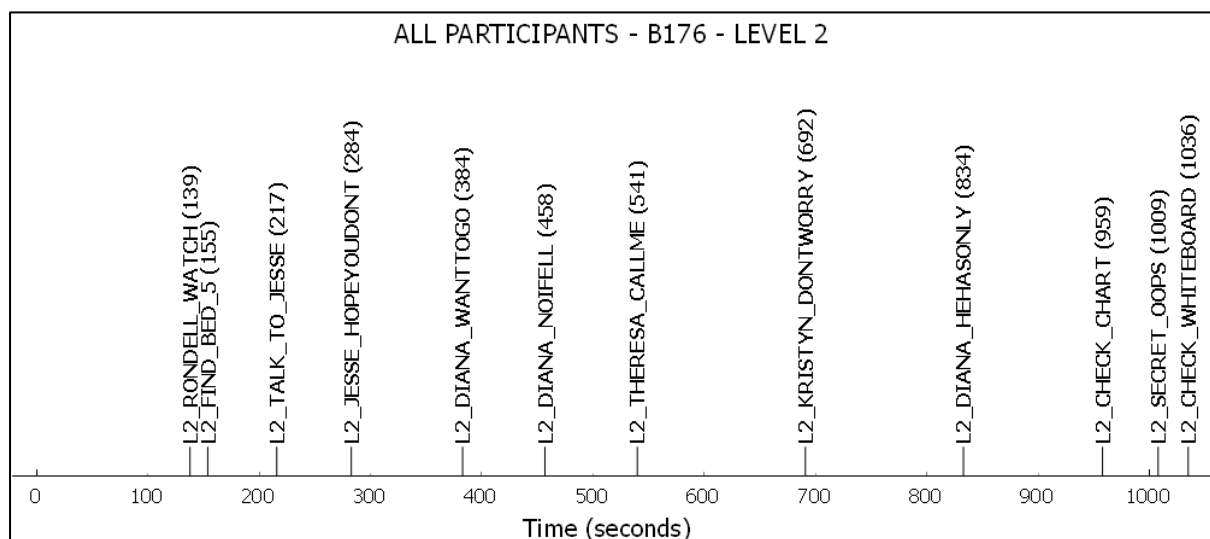


Figure 52 - Timeline – B176 – LEVEL 2

In the above timeline, the player reaches the end of the main dialogue around the bed in the Hospital level, but does not reach the next mandatory event, which is L2\_FIND\_LEAFLETS. There are a large number of graphs where L2\_DIANA\_HEHASONLY is the last listed mandatory event, which indicates a problem with progression towards the end of Level 2.

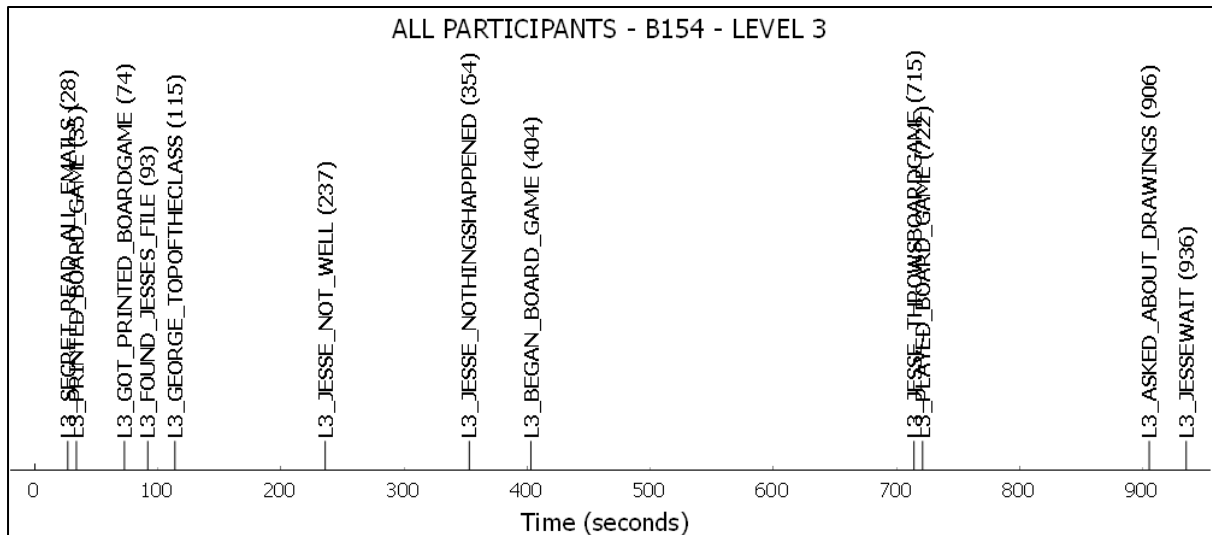


Figure 53 - Timeline – B154 – LEVEL 3

Timelines for Level 3 are largely similar across all participants, with the only deviation being how much time was spent exploring at the start of the level. Once L3\_FOUND\_JESSES\_FILE is triggered, players can no longer explore and the sequence is fixed.

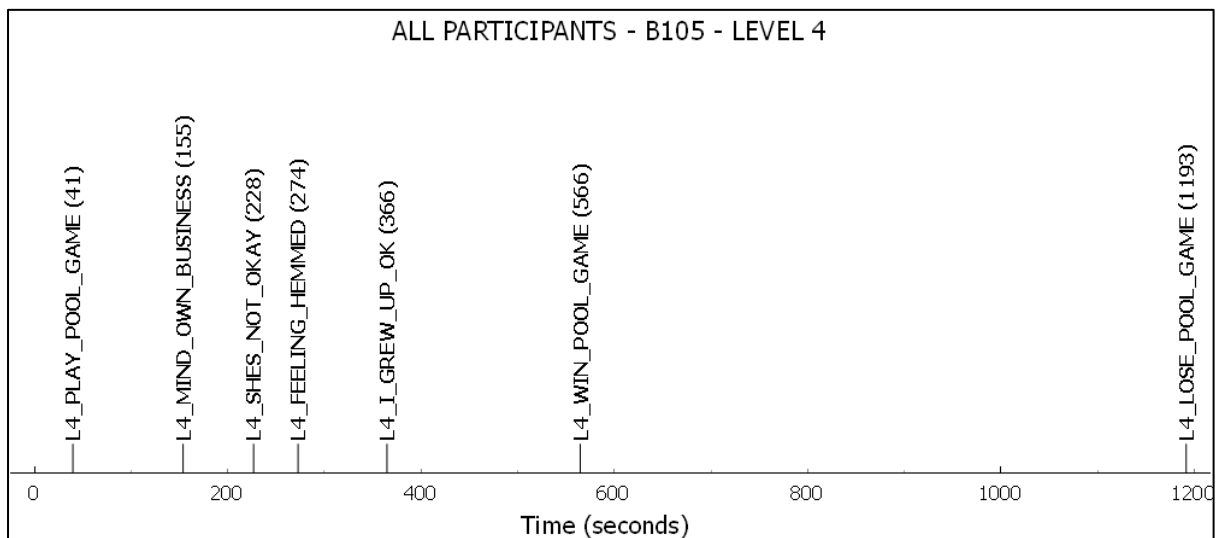


Figure 54 - Timeline – B105 – LEVEL 4

In this Level 4 timeline, the player lost the pool game in an earlier playthrough, and then replayed the level quicker in order to win the pool game.



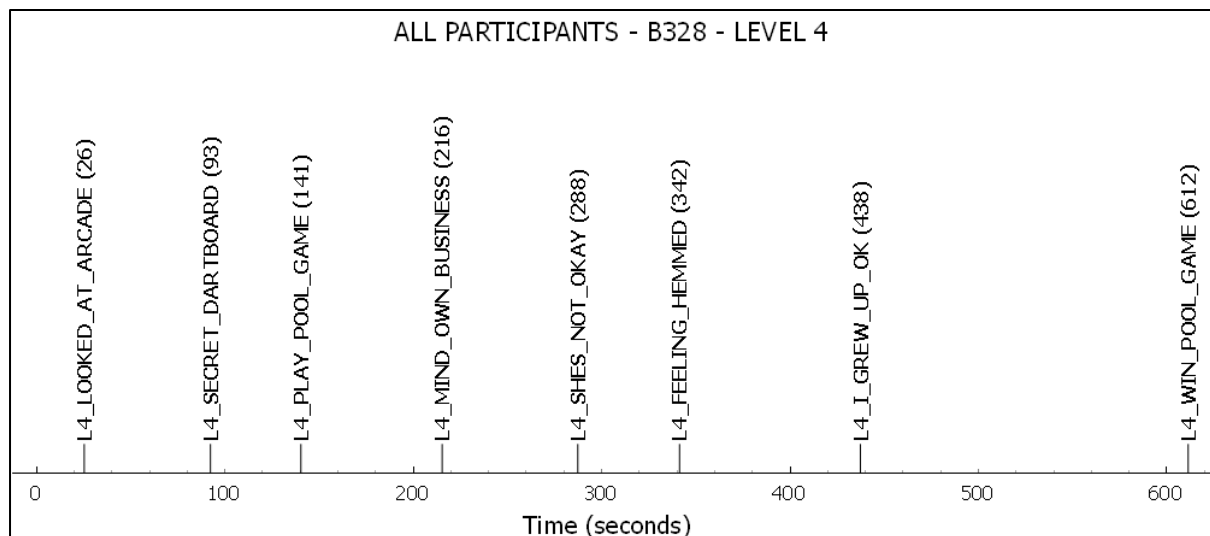


Figure 55 - Timeline – B328 – LEVEL 4

This timeline shows an optimal playthrough of Level 4, with B328 finding both secret items in the environment, playing the pool game and defeating Rondell.

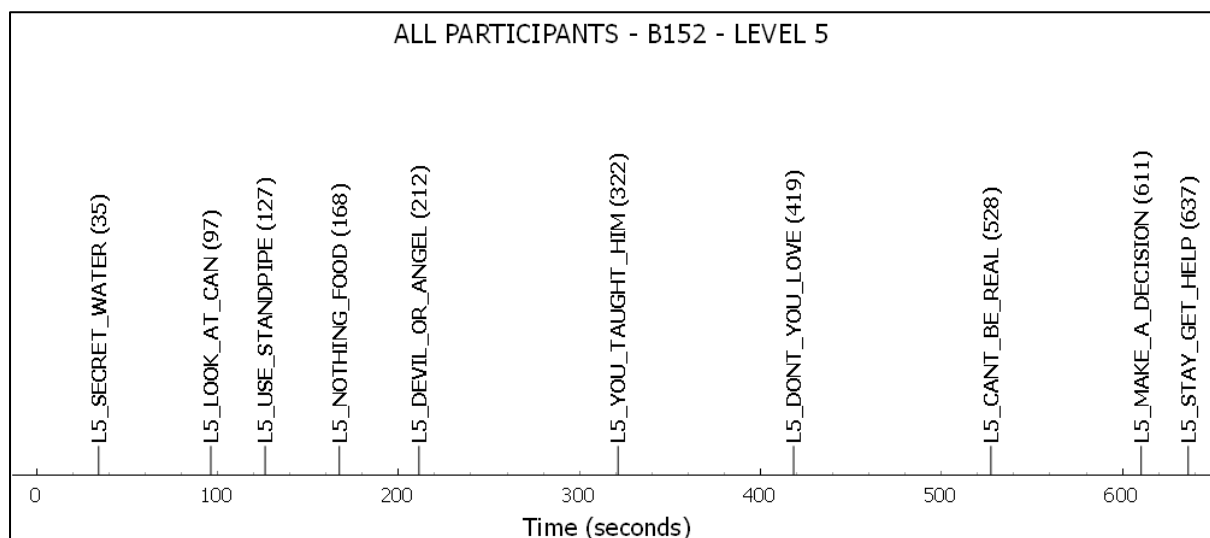


Figure 56 - Timeline – B152 – LEVEL 5

Level 5 contains a free exploration section with two hidden interactable objects at the start. Once L5\_USE\_STANDPIPE is triggered, the player is locked into a set of dialogues and cutscenes. In the timeline above, B152 found both interactable objects and then continued with the main objective. At the end of their playthrough, B152 has chosen the L5\_STAY\_GET\_HELP ending.

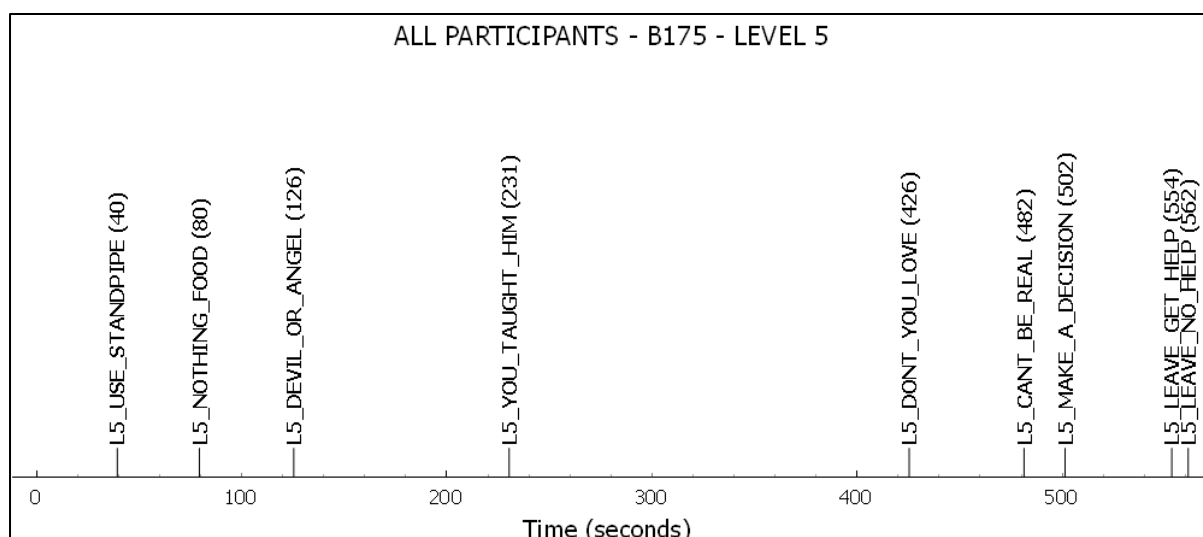


Figure 57 - Timeline – B175 – LEVEL 5

In the timeline above, two endings have been chosen. This indicates that the player was curious enough to replay the whole level in order to choose a different outcome.

### 7.3.7 – EI Log Choices

Emotional Intelligence dial graphs were generated from the EILog data recorded by the game.

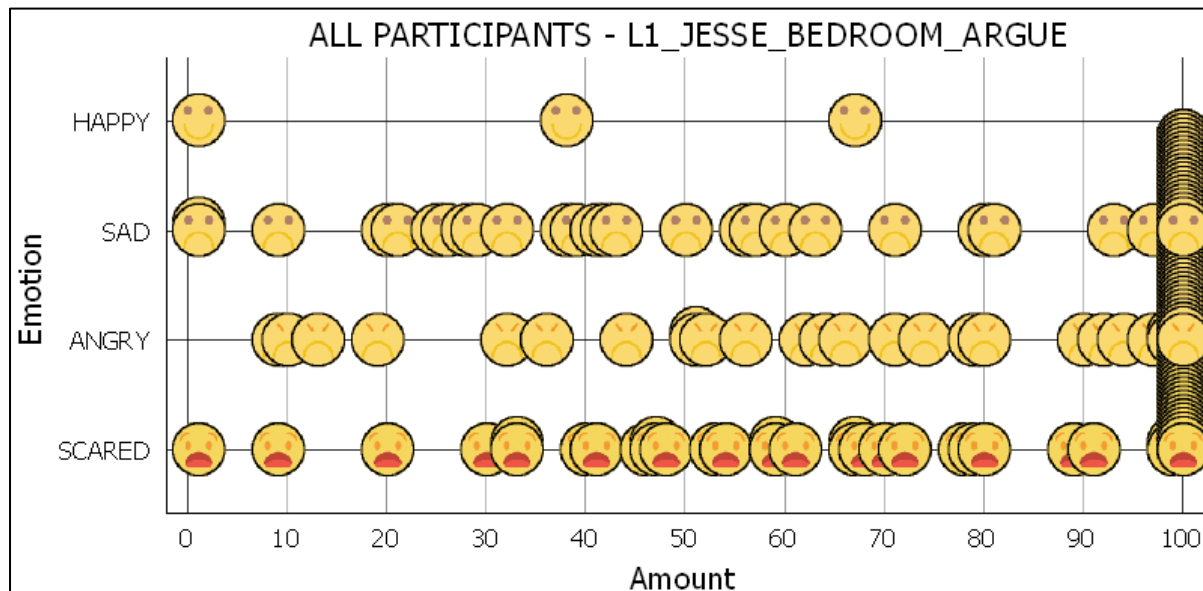


Figure 58 - EI Chart – L1\_JESSE\_BEDROOM ARGUE

In the above graph, opinion appears to be split equally across three emotions – Sad, Angry and Scared. There are also a couple of Happy responses. Given the context of Jesse overhearing an argument between his mother and her abuser, it is reasonable to think that Jesse is feeling Sad, Angry, or Scared in this situation. However, he is unlikely to be feeling Happy. Given the very small

number of responses for Happy, these are likely to be mistakes in using the EI Dial. This can be put down to a lack of experience with the EI Dial in the early parts of the game.

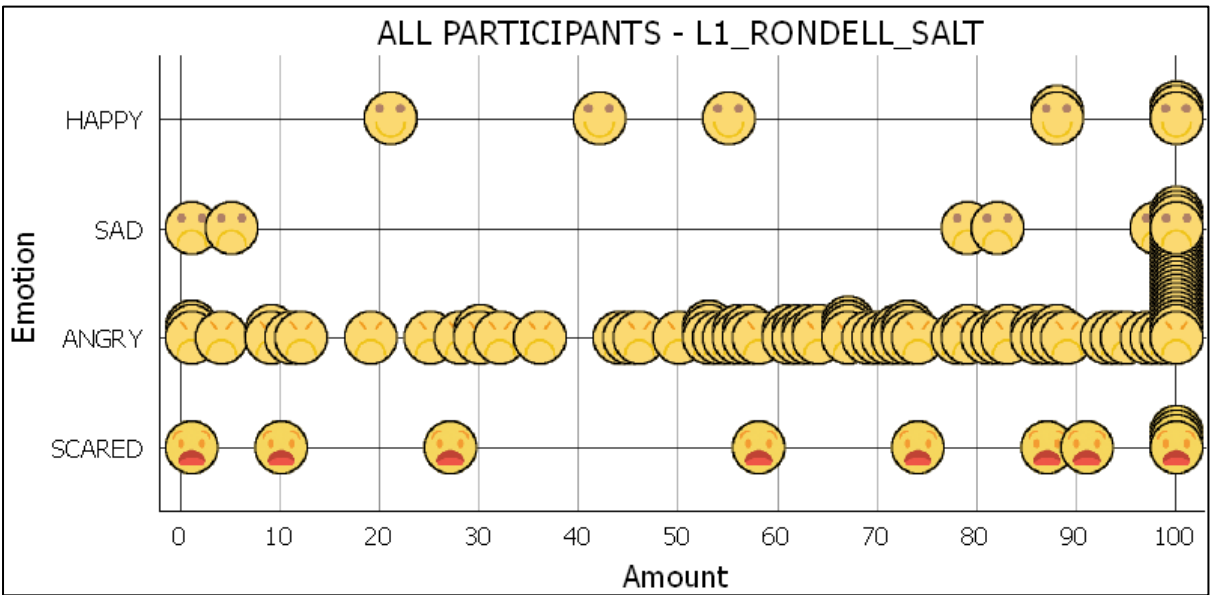


Figure 59 - EI Chart – L1\_RONDELL\_SALT

In the above graph, the vast majority of participants chose the Angry emotion. This is the expected choice, as Rondell has just smashed a plate in anger while shouting at Diana. Scared emotion choices could be players misreading the EI Dial as Diana, Jesse, or misinterpreting the EI dial as an indicator of their own emotions.

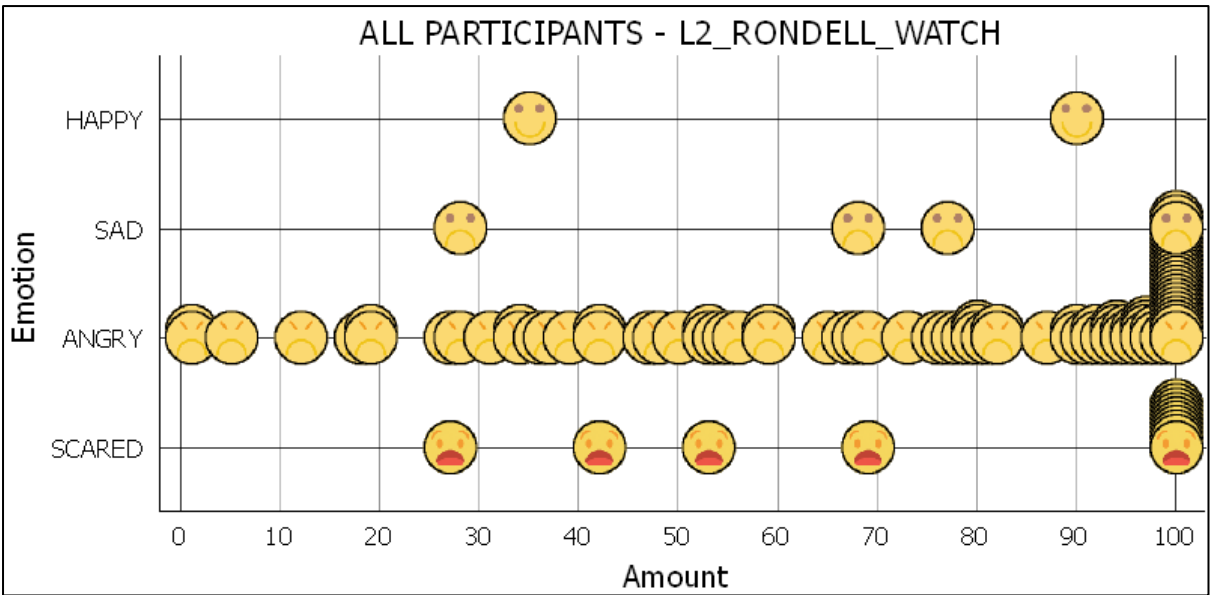


Figure 60 - EI Chart – L2\_RONDELL\_WATCH

Direct threats, such as Rondell’s threat to Theresa in Level 2’s L2\_RONDELL\_WATCH, are clearly understood as Rondell expressing anger by the majority of participants. Those that chose Scared were likely interpreting Rondell’s fear that his actions were about to be discovered by someone who may feel an urge to pass on this information to the police. Those choosing the Sad emotion could be identifying a measure of guilt in Rondell, that is masked by his threat.

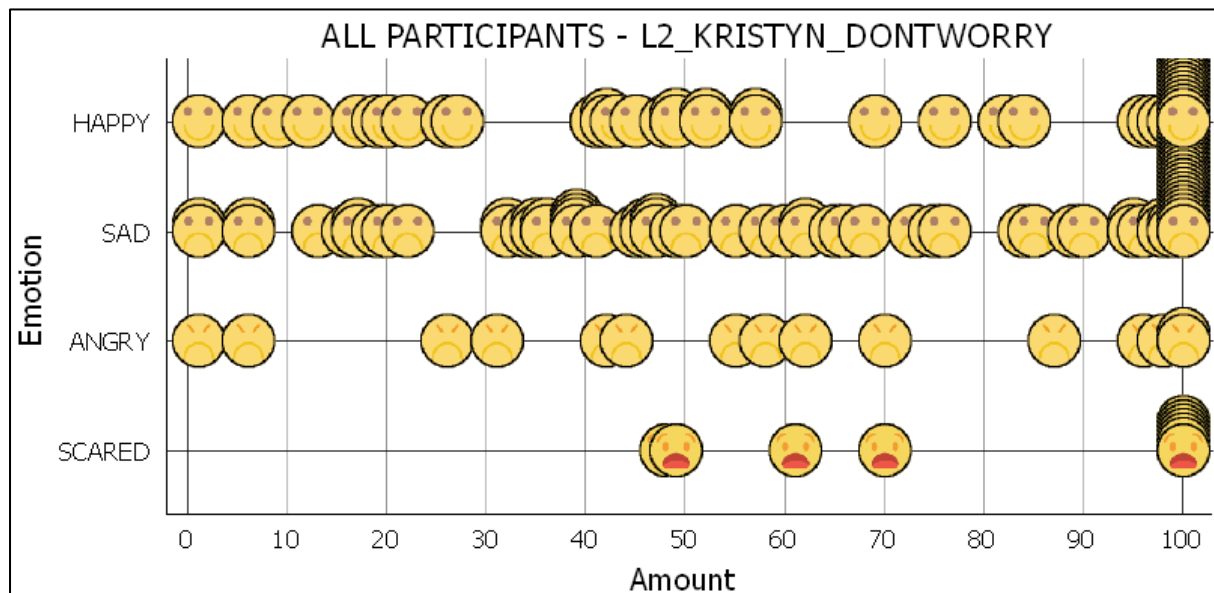


Figure 61 - EI Chart – L2\_KRISTYN\_DONTWORRY

For this EI Prompt, Kristyn’s positivity in the face of Diana’s sadness is noticed by some participants, with them choosing the Happy emotion to represent this. This is one of the few EI Dial moments where Happy is an expected outcome. Participants appear evenly split between Happy and Sad for this event, with the Sad emotion potentially being chosen due to Kristyn being nostalgic for a simpler time.

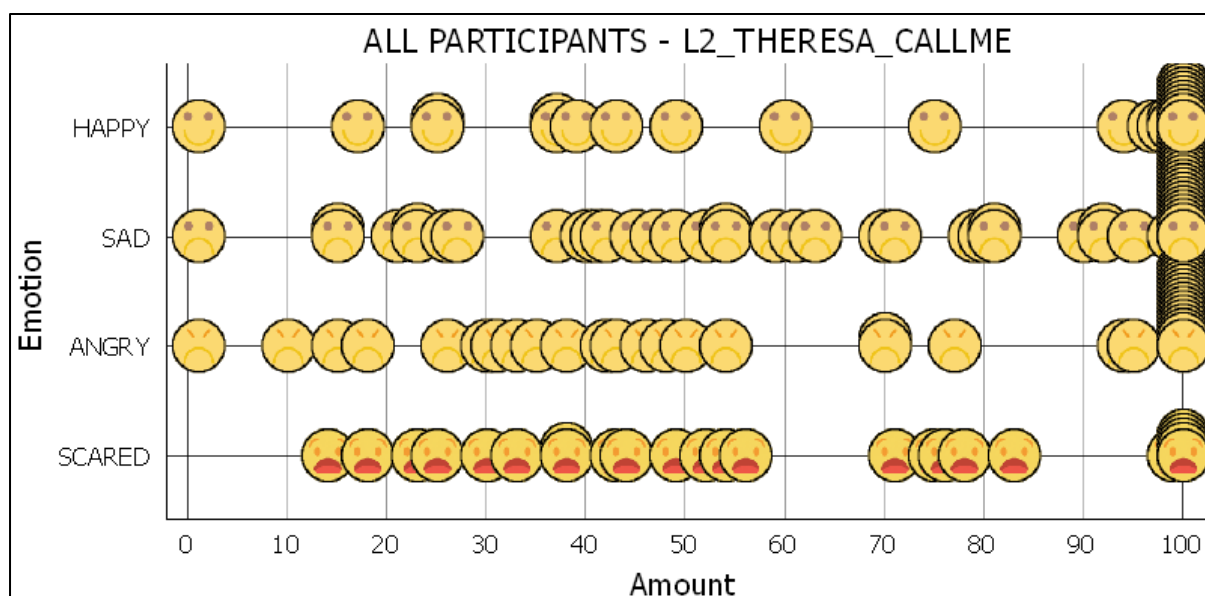


Figure 62 - EI Chart – L2\_THERESA\_CALLME

One of the most evenly split EI Dials was L2\_THERESA\_CALLME. This comes just after Theresa says goodbye to Diana. She is arguably feeling all of these emotions – she is pretending to be positive and Happy, she is Sad due to what Diana has experienced, she is Angry at Rondell for attacking Diana, and potentially at Diana for attempting to cover it up. She is also Scared of what Rondell might do next if Diana returns to his home. All of these are valid interpretations of Theresa’s emotional state, and so an even distribution across all four emotions is understandable.

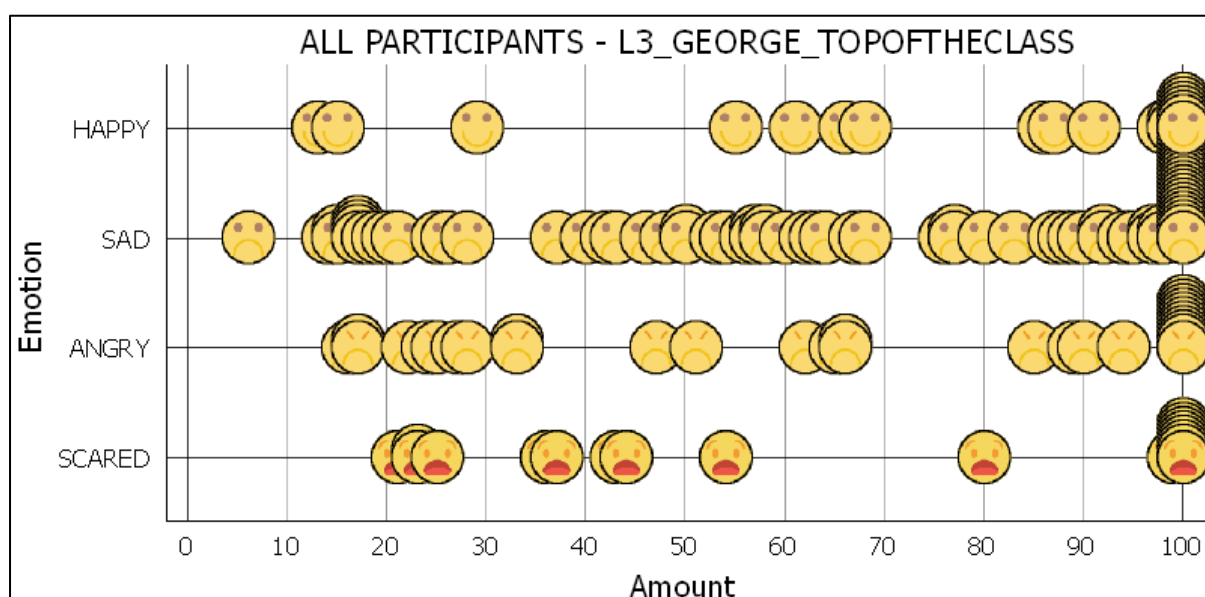


Figure 63 - EI Chart – L3\_GEORGE\_TOPOFTHEDCLASS

Ambiguous dialogue appears to drive mixed responses, as shown by this L3\_GEORGE\_TOPOFTHECLASS graph. The amount of angry responses here was unexpected, but could be attributed to the use of Corporal Punishment in schools in the region. In 2009, Corporal Punishment in schools was supported by 54% of people (Services, 2009). With students potentially being afraid of teachers inflicting corporal punishment, it is understandable that they would interpret an ambiguous statement from a teacher as anger. The scared responses could be participants interpreting George's surprise at Jesse's grades as alarm, and associating the Scared emotion with the feeling of being alarmed.

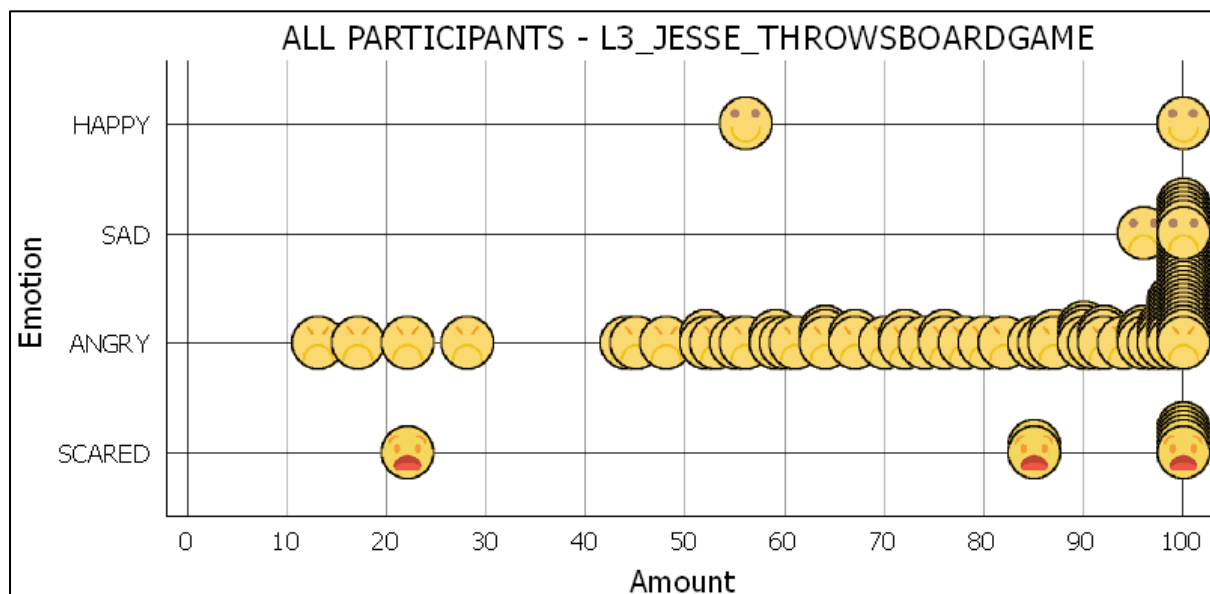


Figure 64 - EI Chart – L3\_JESSE\_THROWSBOARDGAME

Almost all participants chose Angry as Jesse's emotion in L3\_JESSE\_THROWSBOARDGAME. This again indicates that young people rely on body language heavily to interpret the emotional state of others.

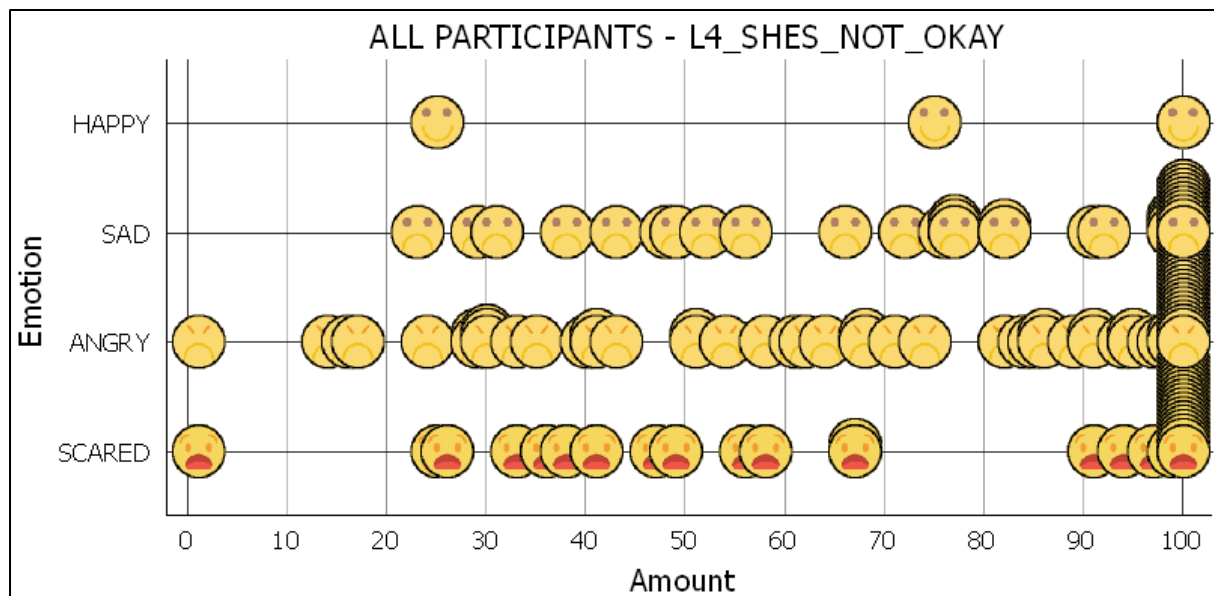


Figure 65 - EI Chart – L4\_SHES\_NOT\_OKAY

The EI Prompt L4\_SHES\_NOT\_OKAY is open to interpretation. Hayden may be Sad that Diana is in hospital, Angry at his friend for hurting Diana, and Scared for Diana’s wellbeing.

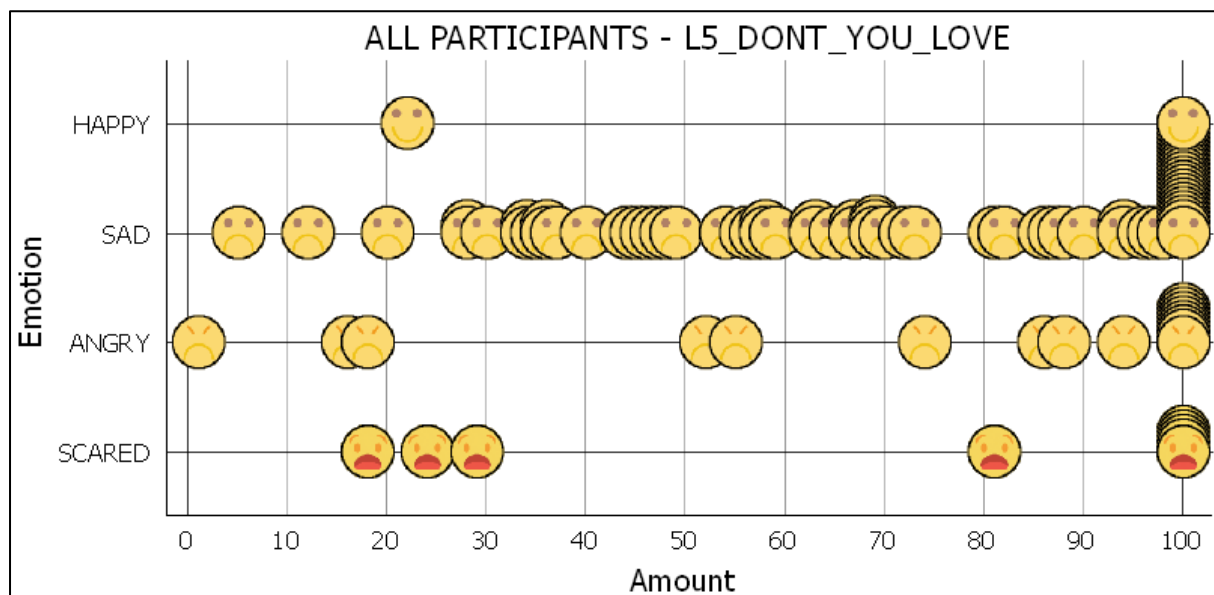


Figure 66 - EI Chart – L5\_DONT\_YOU\_LOVE

There was a wide consensus among participants that Diana’s questioning of if Rondell loves her was a Sad emotional expression.

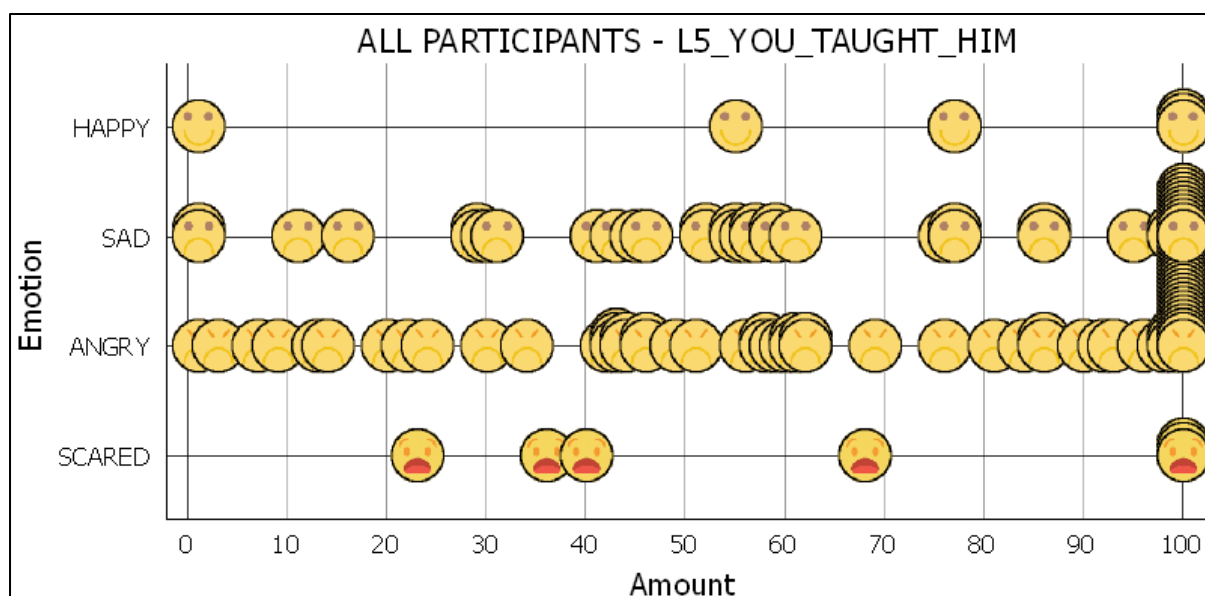


Figure 67 - EI Chart – L5\_YOU\_TAUGHT\_HIM

The Old Man points at Rondell and talks about how his future child will learn his behaviour from Rondell. The action itself could be considered aggressive, or Angry. It could also be interpreted as the old man being Sad that history may end up repeating itself.

### 7.3.8 – Ending choices

Ending choices were tallied from the Event logs. Only the first ending chosen by a participant was selected for each ending choice pie chart.

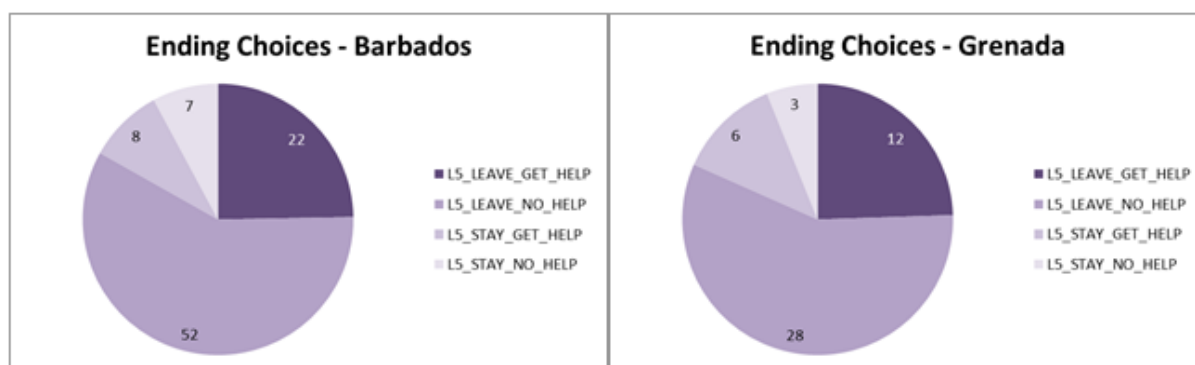


Figure 68 - Ending Choices Barbados and Grenada

There was little difference between Barbados and Grenada in terms of ending chosen. More than half of the participants in each country chose for Diana to leave Rondell, and not to encourage him to seek help. Although this is a positive outcome for Diana, it does not help Rondell in the long term.



Approximately a quarter of all participants chose to leave Rondell, but also to encourage him to seek help. This indicates that a large portion of the participants would rather have Diana and Jesse leave for their immediate safety, but also that they still want Rondell to be in his child’s life.

Less than a quarter of participants in both countries chose for Diana to stay. This indicates that participants understand the danger Diana is currently in by staying with Rondell, and would rather take action to remove her from the situation.

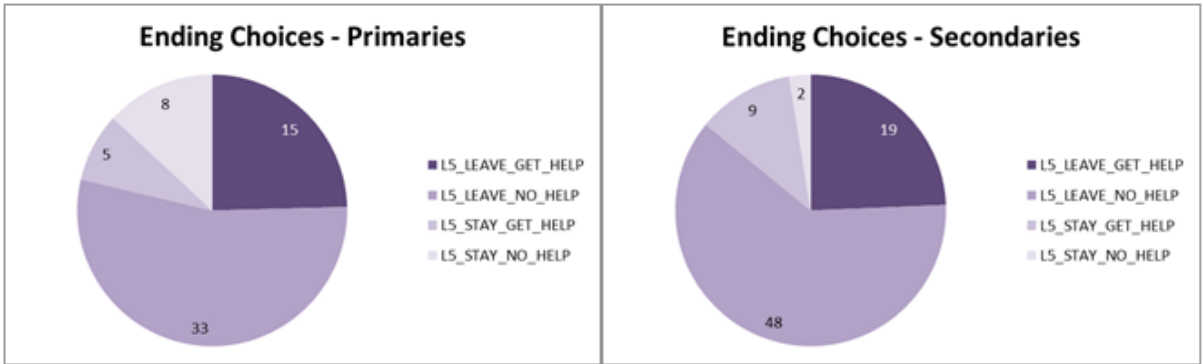


Figure 69 - Ending Choices Primaries and Secondarys

Differences between Primary and Secondary participants are quite noticeable. A greater number of secondary students decide to leave Rondell overall. What is more interesting is the smaller number of secondary school participants that decide to do nothing, and stay with Rondell, despite him not seeking help. This indicates that secondary school students are more aware of the potential danger Diana is in if Rondell doesn’t change. In contrast, a slightly larger portion of secondary school students were willing to stay with Rondell if he sought help.

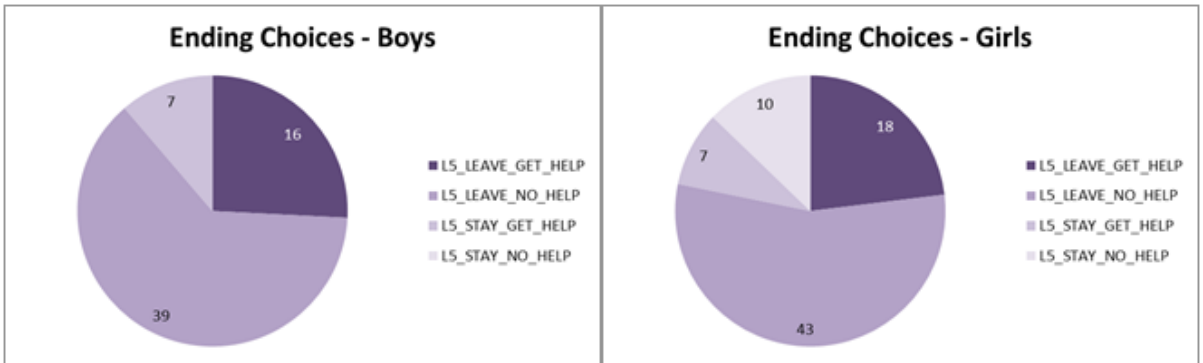


Figure 70 - Ending Choices Boys and Girls

None of the boys whose data was collected chose the L5\_STAY\_NO\_HELP option. In addition, a greater portion of them chose to leave Rondell when compared with the girls' data. This could be due to a number of cultural indicators, such as a greater concentration of Matrifocal families leading women to be more focused on maintaining a family unit (Massiah, 1983). Conversely, the difference in social image of parenting in the Caribbean indicates that men were forgiven for being poor fathers, but that women were given less tolerance for being considered poor mothers (Jones, 2013). This could mean a male participant was more likely to leave his family unit than a female participant was.

#### 7.3.9 – Multiple ending players

In total, 135 of 178 players completed Level 5. Of these 135 players, 4 went on to play Level 5 again to choose a different ending. Of these 4 players, 1 was a boy and 3 were girls. 3 players were in a primary school group and 1 was in a secondary school group. Although this is a very small sample, it appears that girls in primary school groups were more curious about the differences between the endings than boys and secondary school students overall. This could be down to secondary school students being able to imagine the other endings themselves without having to replay the game.

### 7.4 – UK Results

Across a period of approximately 4 weeks, participants were identified and approached across West Yorkshire. All those approached completed the entire trial.

#### 7.4.1 – Participant demographics

At the beginning of the session, each participant's education level was identified. For those over the age of 18, current profession was requested instead.

UniqueID	Gender	Age	Occupation / Education
B901	MALE	21	Game Design Placement Student (Educational games)
B902	FEMALE	42	Social Worker
B903	FEMALE	34	Social Worker

B904	MALE	33	Social Worker
B905	MALE	53	Learning Technology Advisor
B906	MALE	15	Secondary School Student
B907	FEMALE	17	College Student
B908	MALE	10	Primary School student
B909	MALE	11	Secondary School Student

#### 7.4.2 – Completion and level statistics

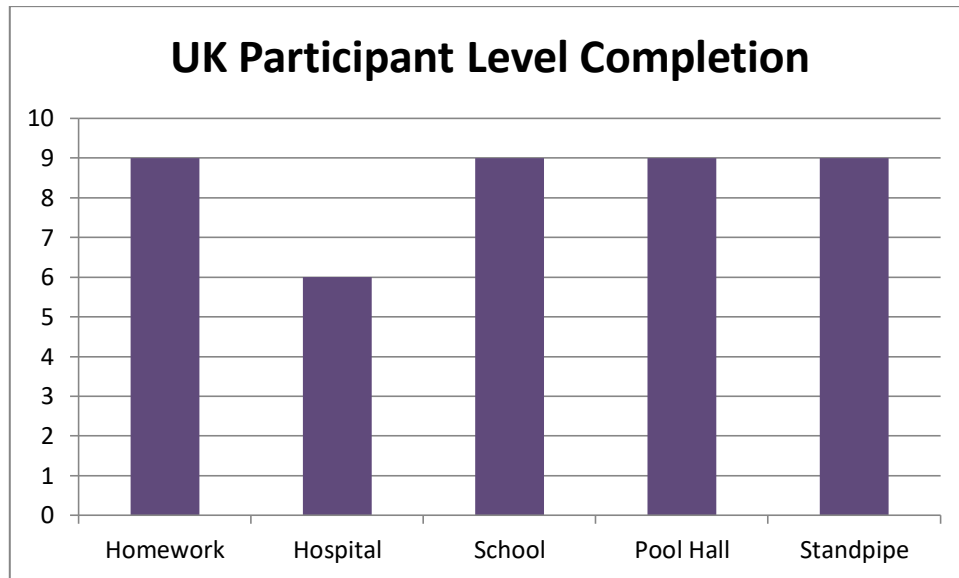


Figure 71 - UK Participant Level Completion

All 9 participants attempted each level, but due to a gameplay bug in the Hospital level, only 6 of the 9 participants were able to complete it.

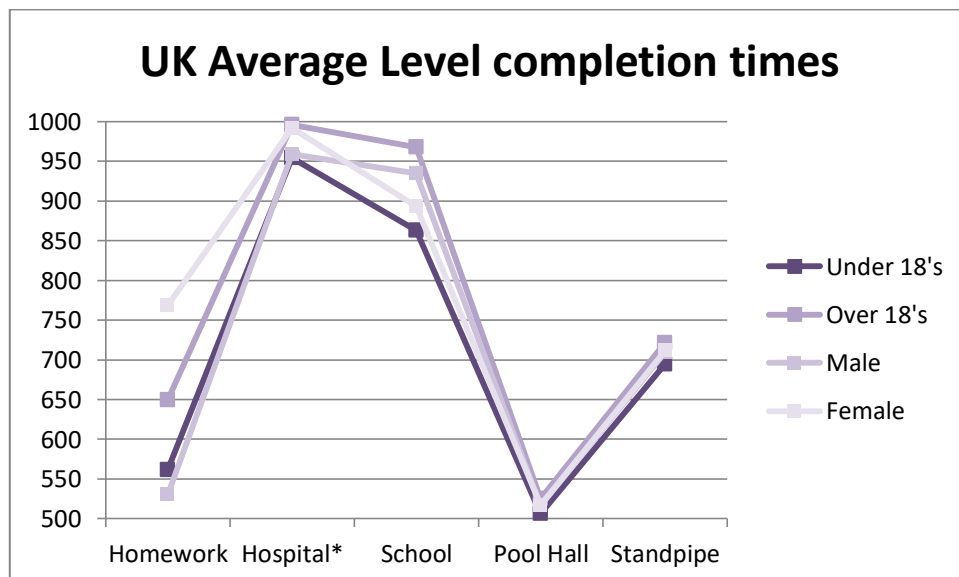


Figure 72 - UK Average Level completion times

A comparison of the average time to complete the level reveals that under-18 males were slightly quicker on average per level. Given the popularity of video games among young people in the UK, their greater experience with video games may explain the slight difference. Times for the Hospital level were only averaged from participants that completed it.

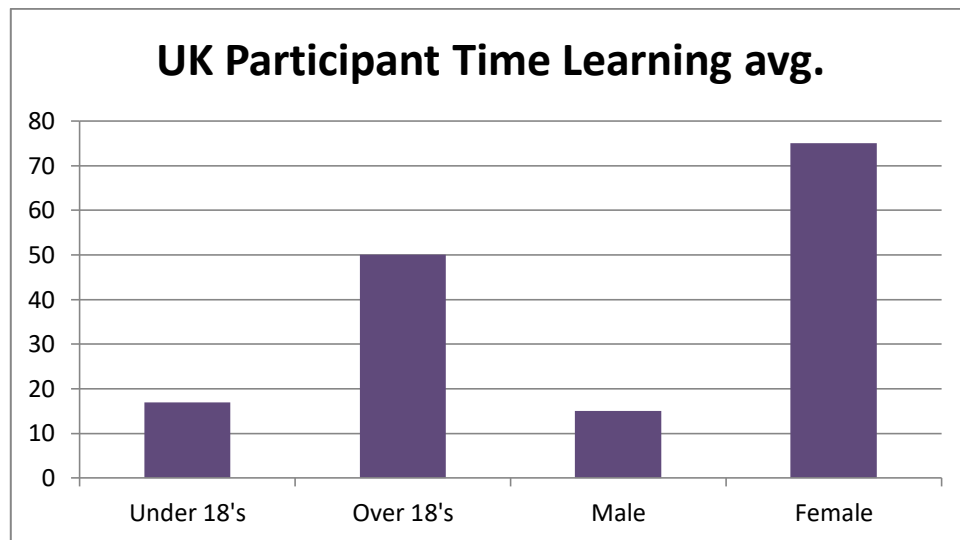


Figure 73 - UK Participant Time Learning Average

Adults are more willing to spend time reading the real-world information embedded in the game than young people. There is also a large difference between male and female times. The over-18 /under-18 split can be explained as the majority of the adults involved in the study were social workers, and so already had a vested interest in the real-world information.

#### 7.4.3 – Player Timelines

Timelines were generated per user for each level, and per individual event showing all user groups.

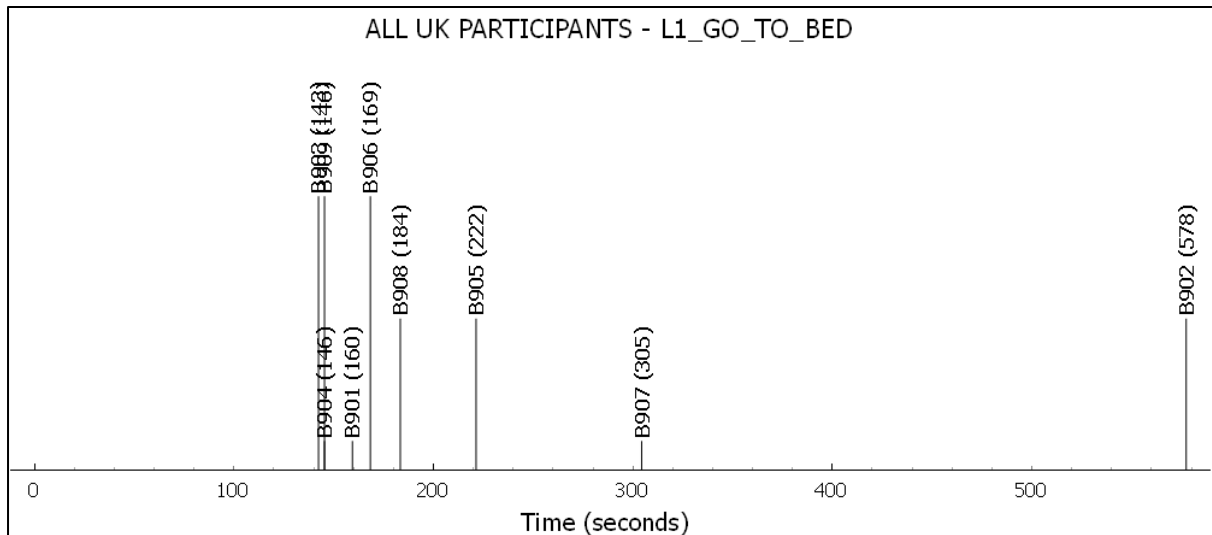


Figure 74 - UK Timeline - L1\_GO\_TO\_BED

In the above timeline, B902 took more than 250 seconds longer to reach Jesse's bedroom door than the next slowest player. This is likely due to confusion over the camera controls, and matches behaviour seen from Barbados and Grenada.

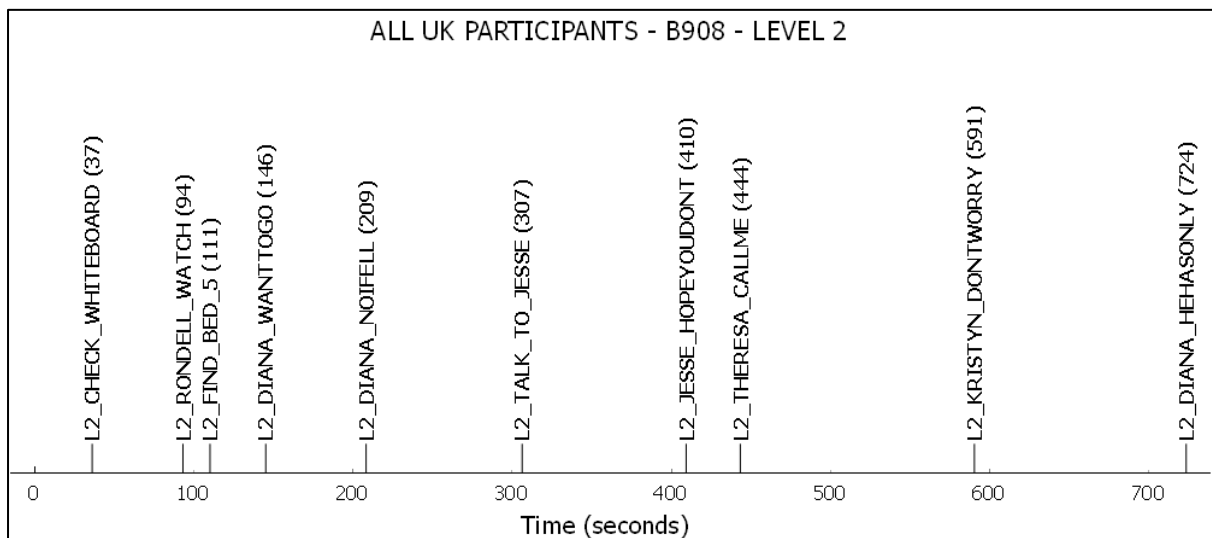


Figure 75 - UK Timeline - B908 - LEVEL 2

The above graph shows that B908 was unable to complete Level 2 sometime between L2\_DIANA\_HEHASONLY and the next mandatory event, which is L2\_FIND\_LEAFLETS. This indicates the gameplay bug occurs around this time.

#### 7.4.4 –Social Awareness

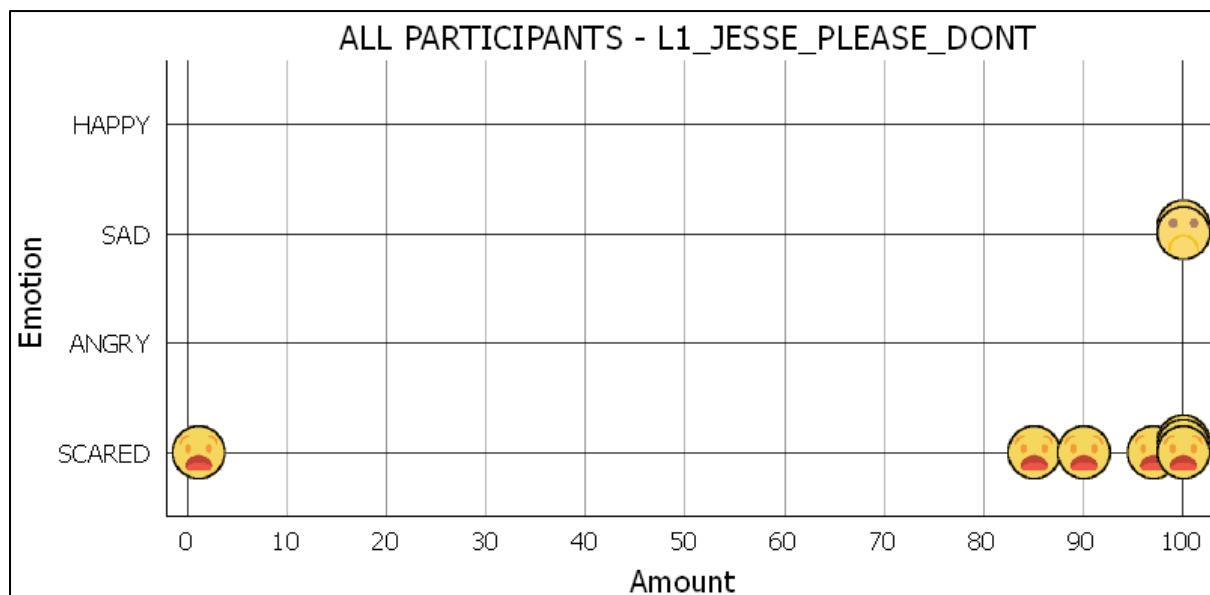


Figure 76 - UK EI Graph - L1\_JESSE\_PLEASE\_DONT

Early graphs in the trial do not have much range, with participants picking very high values.

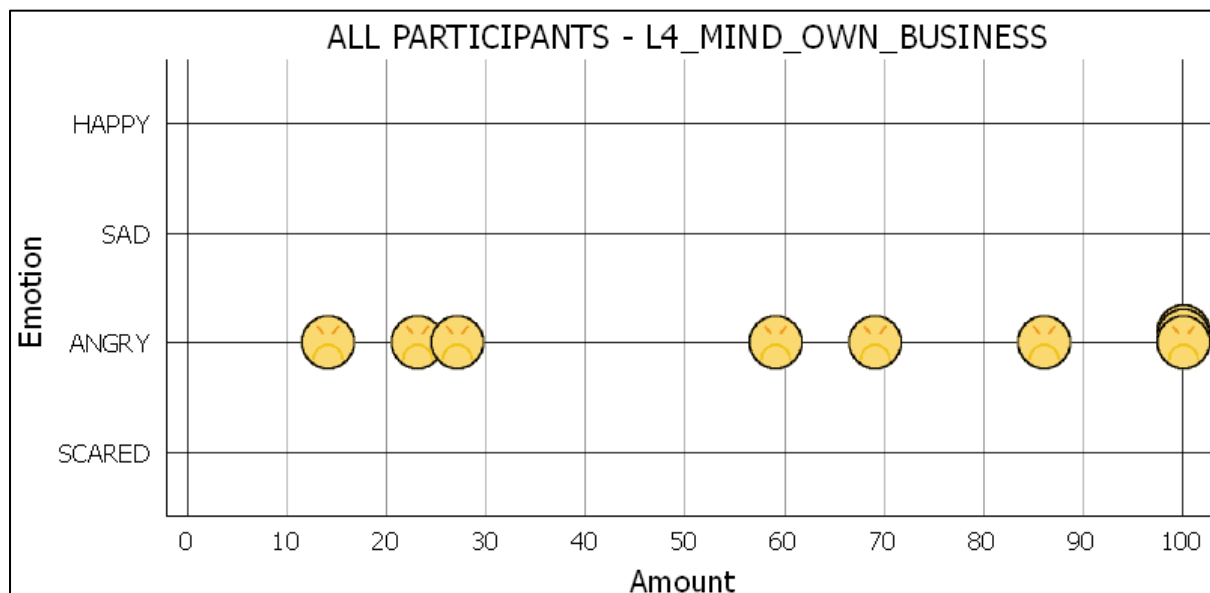


Figure 77 - UK EI Graph - L4\_MIND\_OWN\_BUSINESS

In later graphs, a much wider range of emotional intensity is reported. This could be due to participants paying more attention to the emotional state of the characters in the game over time. However, it could also be due to an increasing familiarity with the EI Dial itself. Another explanation is that L1\_JESSE\_PLEASE\_DONT is a high intensity emotion, whereas L4\_MIND\_OWN\_BUSINESS is a more subtle anger with less visible body language on screen.

#### 7.4.5 – Ending Choices

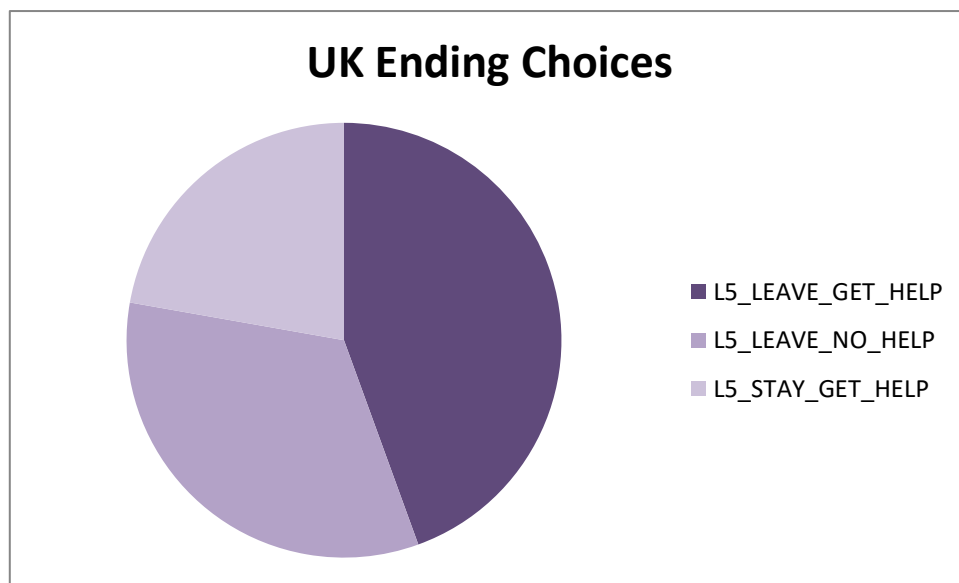


Figure 78 - UK Ending Choices

No participants in the UK chose L5\_STAY\_NO\_HELP. This decision is similar to the boys only ending chart from the Caribbean, but with greater support for encouraging Rondell to seek help. This might suggest that participants in the UK feel more empowered and in control of their own situations, as none of them elected for L5\_STAY\_NO\_HELP, in which the player makes no changes to the situation and this brings more peril.

#### 7.4.6 – Usability Survey results

All 9 participants undertook the usability survey immediately after playing.



Figure 79 - Usability Study graph – How many hours

Of the UK participants, a third did not play games, a third only played games for an hour a week, and the remaining third played between 2 and 10 hours of video games per week. This indicates that the UK participants are an even mix of non-gamers, and gamers with a mixture of available play time and experience.

The Standard Usability Scale score has been calculated following the calculations provided (Brooke, 1995). The final SUS Score, averaged across all participants was 73.6. This is above the average score of 68.

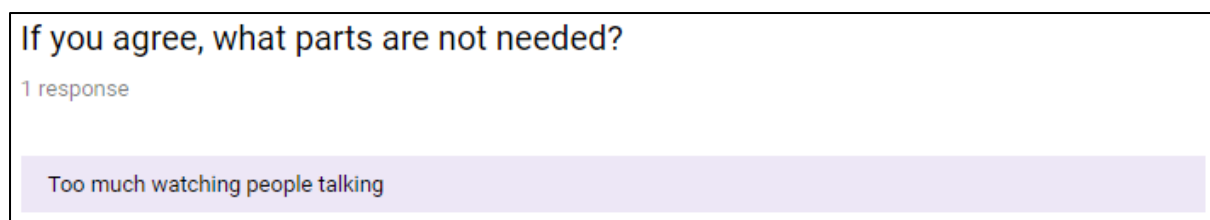


Figure 80 - Usability Study responses – Parts not needed

As shown above, one player complained about the lack of interaction. Some of the levels contained a large amount of dialogue between gameplay sections, and that caused frustration to this player.

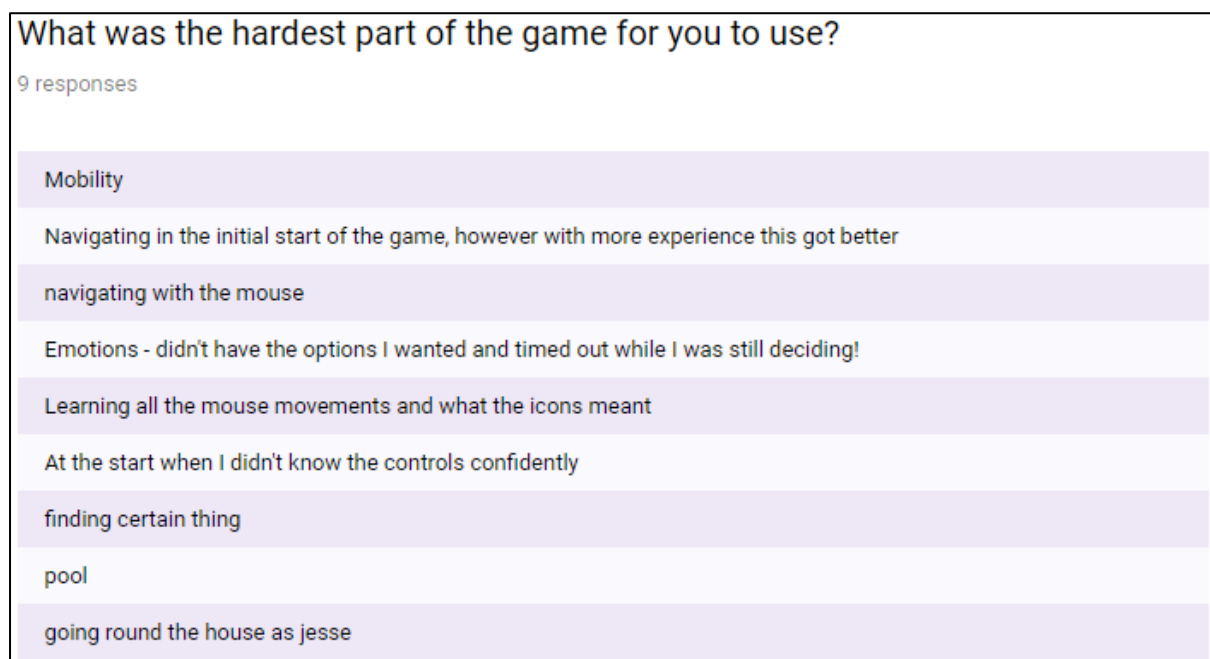
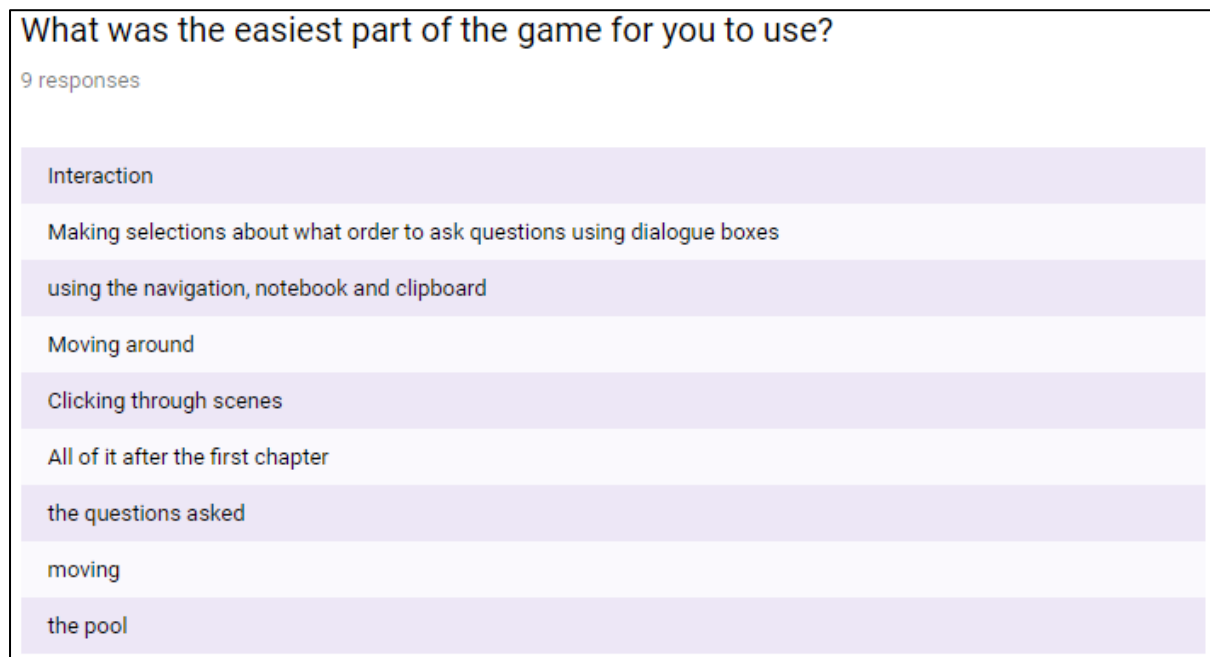


Figure 81 - Usability Study responses – hardest part

For the most difficult to use part of the game, most players answered mobility and controls. Players struggled to adapt to the mouse controls. This appeared to affect both children and adults equally.



One player struggled to find a 'certain thing'. This is likely to be the hospital leaflets in Level 2, as players were observed struggling with this. Another player found the pool game the hardest part to use.



**Figure 82 - Usability Study responses – easiest part**

Some of these answers appear contradictory to the previous question, however, they appear to be referring to movement in all Levels after Level 1. This indicates that Level 1 is challenging to navigate.

#### 7.4.7 – Semi-Structured Interview results

All participants took part in the semi-structured interview within a couple of minutes of completing the survey. 5 of the participants were in group sessions, and 4 were interviewed alone.

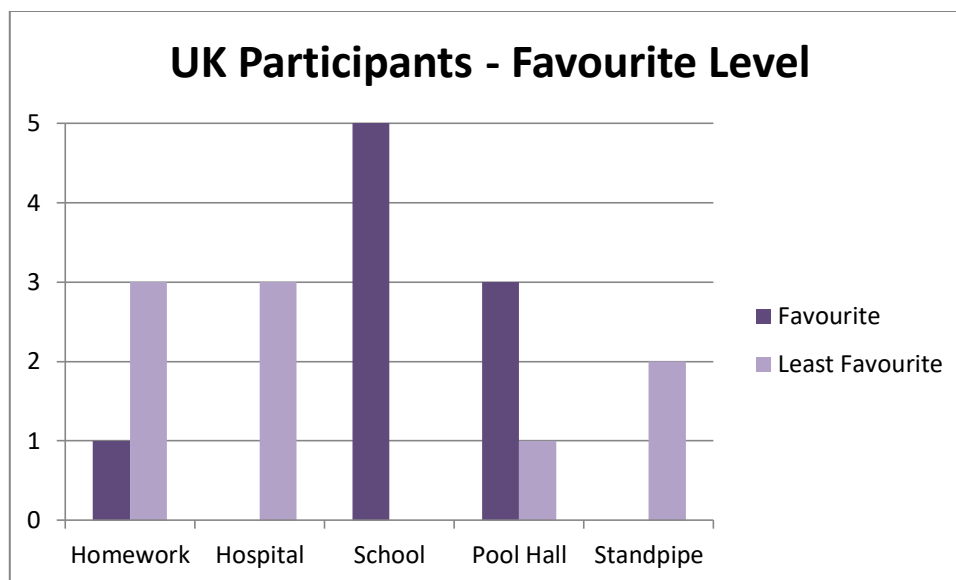


Figure 83 - UK Participants Favourite levels

The School level was the most commonly picked favourite level, closely followed by the Pool Hall. Mr. George as a character in the School, and the constant interaction in the Pool Hall were the main reasons provided. Homework and Hospital were the two least favourite levels, with control issues and excessive dialogue being their respective complaints.

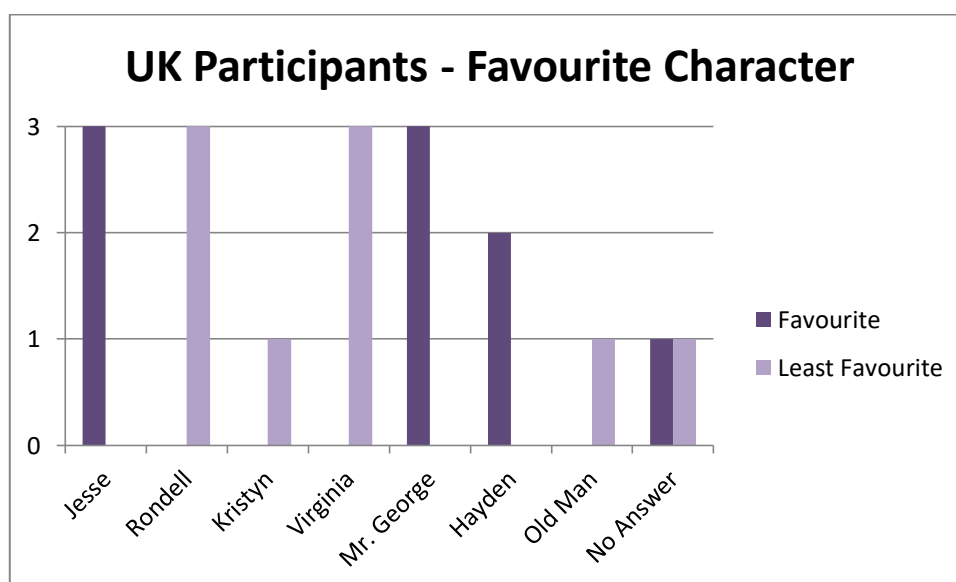


Figure 84 - UK Participants favourite characters

Jesse and Mr. George tied for favourite character, with Hayden missing out by one vote. Players appeared to empathise with Jesse the most, and Mr. George was seen as a very positive character. One participant declined to answer the question. Diana and Theresa received no votes for either favourite or least favourite character.

Participants commonly cited that they learned the least from Level 1. *'but obviously that's because it was the tutorial, I think you put more into showing how to play the game rather than just throwing lots of stuff at them straight away'*. Other participants elaborated and explained the controls were an issue. *'I think the first scene, but that's more because of the fact that I'm not very good with computer games. It felt quite clunky trying to get around it, so I think for me it was more that than anything else.'*

The issue most players had with Level 1 was rotating the camera to find Jesse's bedroom. *'I couldn't find Jesse's door! The very first task...I think I walked around about 3 times.'* This could be due to the unique control scheme of having the camera rotation controlled by the right mouse button.

Players also criticised Level 2's excessive dialogue. *'...it was a bit long-winded...it did feel as though it was just constant talking.'*

Participants believed that the lessons of the game were transferrable to any region. *'None of it felt culturally specific. You could've transposed the learning for anywhere...which is a good thing...yeah, apart from the numbers (real-world information).'*

Participants provided important feedback on the Emotional Intelligence Dial. *'I know I wasn't getting them right. It felt a bit clunky, because the scales of happy and sad were separate. The only two scales I used in the whole game were Sad and Angry. Oh actually I might have used the 'Scared' one. But I wanted one that said 'Frustrated', and I couldn't decide on which scale that would be. So I found myself messing about with them a bit, and then it timed out, so then it recorded something about my understanding of their emotional responses that just wasn't accurate at all.'*

Some participants confirmed that the game had taught them information about the issue of domestic violence. *'...Lashing out, and it hurting your family. Be it brother, sister, mother, father, cousin.'* Social workers playing through the game also provided feedback on the content. *'For various*

*professional reasons, I was quite well informed about it to start off with anyway. It just kind of helped confirm some of the knowledge about how people behave, why they behave that way, and the ways of intervening and dealing with people in that situation.'*

#### 7.4.8 – Additional player observations

- B901 was observed asking out loud 'Can you not pick two emotions at once?' with regards to the Emotional Intelligence Dial.
- B901, B904 and B908 encountered a gameplay bug close to the end of Level 2 where they clicked the bed 5 hospital curtain again, restarting a conversation that could not be continued. It was decided to explain the remaining 1 minute of the level to the participants that this happened to and move on to the next level.
- B902, B906 & B907 needed additional guidance on how to rotate the camera in Level 1.
- B902, B903 & B904 did not notice the back button while they were looking at some objects up close, and sat watching the screen for a while expecting something to happen.
- B903 commented 'I can't play pool in real life, never mind in a video game.'
- B906 encountered a gameplay bug in Level 1 where the game would not unlock the controls after interacting with the parent's bedroom door. The level was quickly restarted.
- B907 found that the quest line did not work all of the time, and was not able to find the Hospital leaflets in Level 2 independently because of this.

## 8 – Discussion

This section will discuss the various findings from the game trial, along with a look at the lessons learned during the design and development of *JESSE*.

### 8.1 – Findings

The following section contains a discussion of the findings from the game trial that relate to the research questions.

#### 8.1.1 – Player Awareness over time

As shown through the EI Graphs, there appears to be a trend of players becoming more uniform with their emotional choices towards the end of the game. However, this could be due to increasing familiarity with the Emotional Dial itself. Participants in the semi-structured interview stated that they struggled to use it correctly in the earlier few levels of the game, so any improvements in terms of accuracy of emotional choice could be down to participants becoming better at using the emotional intelligence dial.

Participants were most uniform in their choices when the character in question was threatening, shouting or using aggressive body language. During more ambiguous statements with less body language, the spread of emotional choices is much larger.

With each EI Dial choice being subjective, a lot of emotion choices can be explained as different interpretations of the same event. As such, it is difficult to compare EI data over time, as the events themselves vary widely in context.

Due to these findings, it cannot be said with any surety that the emotional awareness of players improves during a playthrough of *JESSE*.

### 8.1.2 – Usability and comprehensibility

Although it cannot be used to diagnose potential problems with the usability of the game, the Standard Usability Scale indicated that the game scored above the average of 68 with a score of 73.6. However, there are two reasons why it may have scored so highly. The first question asks whether participants would like to play this game again. Players of a game are more likely to want to play the game again due to entertainment value which a generic system lacks. Secondly, the phrasing of the questions was changed in order to make it more suitable for young people and contextually sensitive to a game, not a system. In doing so the meaning of the questions may have been shifted. Overall though, the SUS results are positive.

A significant number of participants found the mouse-based control scheme difficult to use, especially with regards to the camera. Once they learned the controls, they found the rest of the game very simple. However, this could be improved with a dedicated tutorial level, introducing the controls of the game.

### 8.1.3 – Encouraging learning

Real-world information was embedded into the game through a notebook, hospital leaflets and the ambulance number of Barbados and Grenada, dependant on the country the participant is in.

Level 1 teaches players the ambulance number, as they need it in order to call for help to complete the level. Level 2 embeds real-world organisation information into hospital leaflets. The time players spent reading the leaflets and looking at the notebook was tracked. Ultimately time spent reading this information was very low, with an average of 24 seconds per participant. Some players never opened the notebook at all. This indicates that for information to be embedded effectively into the game, it should be through a more mandatory process than the optional notebook. An end-of-level results screen with visually interesting slides containing the real-world information that players must read in order to continue would be a more direct alternative to the notebook.

Participants in the semi-structured interview claimed to have learned several factors about Domestic Violence, with the most common one that people remembered being the intergenerational cycle of violence. That participants remember this specific detail over the other lessons the game presents is possibly due to it being embedded in dialogue shared with multiple characters across multiple levels. The repetition of mandatory dialogue on the critical path of the game is more likely to be remembered by the player than optional text that does not have to be read.

Players also demonstrate awareness of the risks posed to Diana if she stays with Rondell, by overwhelmingly choosing endings where Diana leaves. Only a very small number of players chose the 'worst' ending, where Diana stays and Rondell doesn't get help. This could indicate that players have been listening to the other characters in the game, who voice their concerns about Rondell's potential future behaviour and Diana's safety, and they are applying that knowledge to the choice at the end. However, without a similar choice earlier in the game, it is difficult to identify whether this is due to prior knowledge, or players learning from the game.

## 8.2 – Game trial implementation challenges

During the implementation of the game trial in both the UK and the Caribbean, several challenges were faced in the data collection process.

### 8.2.1 – Data collection

Due to high activity detected on the email account used to upload Player Data from the Barbados test, the email account was suspended for a couple of days. As a result, the auto-emailing process did not work during the majority of the Barbados test and the emails containing gameplay data had to be sent by the game facilitators manually.

Adverse weather conditions in the Caribbean in the weeks leading up to the rollout of the game made internet connections unreliable, further impeding the auto-emailing of statistics.

The data collection process was slowed down due to students not using the same computer throughout their entire playthrough of the intervention – this made combining their data more complicated. Due to lack of guaranteed internet connection online profiles couldn't be used, so data had to be stitched together manually if a player played the same levels on different machines. To avoid this problem in future game trials, a fixed computer policy could be implemented, with students returning to the same computers for each day of the intervention.

#### 8.2.2 – Time constraints and differences in Protocol

The UK Game trial sample size was very small, due to only relying on researchers acquaintances. This reduces how well the results from the UK trial represent the population overall. In addition, differences in protocol between the Caribbean and UK portions of the study may have influenced Player behaviour during gameplay. Participants in the Caribbean played one level per day for a week, and it was a part of the curriculum, so they weren't rushed. This led to a slower exposure to the intervention. In contrast, the UK participants played all 5 levels in one sitting, with all participants completing the game in less than 90 minutes. This left less time for players to self-reflect upon the lessons of the game.

### 8.3 - Game Design

During the design of the game, multiple approaches had to be taken to ensure the game would be as suitable as possible.

#### 8.3.1 – Collaboration with regional experts

The None in Three project was multidisciplinary by design, and included social workers, game developers, and regional experts. In order to ensure the game was grounded in a Caribbean context, the writing of the game's story was done in collaboration with the regional experts based in the Caribbean.



This collaborative screenwriting process was done online using Google Docs. Each regional expert contributed sections of the script or suggested amendments. This also allowed us to determine what was and wasn't appropriate to show to children, with regards to acts of violence. Although the screenwriting was an effective method of developing the story, there were moments where colloquialisms were almost misinterpreted in the development process. In one situation, an expert had made reference to the Grenadian national dish 'Oil Down'. However, it had been split onto two lines, and was interpreted as 'you making oil, down there?' Fortunately the voice recording team were local to Barbados, and realised the original meaning of the line.

Some experts were only able to offer detailed feedback once the game was almost finished and it was impossible to change the dialogue at this point, as it had already been recorded. As dialogue is often implemented later into a game's development, a solution to this problem would be to enforce a table reading process. Each person involved in the writing of the game assumes a role from the script and entire levels are acted out online. By going through this process, experts would be able to notice any shortcomings in the script that a read-through may not identify.

### 8.3.2 – Using prototyping to adapt to feedback

With a prototype of the game built, a playtesting session was run with the project team in July. During this session multiple control and camera issues were identified. In an attempt to reduce these issues, the layout of the first Level was changed and tutorial pop-up screens were added. Although feedback from the game trial suggests that controls are still an issue, especially in Level 1, this prototyping phase followed by improvements allowed the mitigation of some of these issues.

### 8.3.3 – Design Oversights

In an attempt to reduce potential future work in porting the game to mobile devices, the game was designed entirely to be played on a mouse, so that clicks and drags could be loosely translated to touches and swipes. Unfortunately, a large number of participants found this control scheme

confusing and very difficult to learn. Once they completed Level 1, the levels were wider and players grew more confident in navigating.

However, another oversight of the control scheme was that some of the computers in the trial were actually laptops, and manipulating the game's drag controls using a touchpad is very complicated. One facilitator had to quickly acquire mice for the game to be played with properly.

One way to avoid this type of problem is to have an alternate control scheme set up, so that players unsatisfied with a unique control scheme can swap to a more conventional one.

## 8.4 – Development techniques

During the implementation of the game's design, a lot of development decisions had to be made based upon a limited amount of information.

### 8.4.1 – Technical limitations

Early in the project attempts were made to identify the specifications of the computers in the schools in Barbados and Grenada. Only a limited amount of information was received, with no detailed breakdowns of computer specifications, only vague lists of operating systems and the age of the computers. This meant that to some extent, the game was developed blindly.

To avoid these issues, it is suggested that educational game development teams reach out directly to the schools that are interested in running the game trial at the beginning of the game's development, so that the specifications can be determined in detail. Game engine and platform decisions can then be made based upon the available data. An alternative to this would be to develop an educational game purely for mobile devices.

### 8.4.2 – Pre-made assets

In order to fill the environments with assets related to each level, a decision was made to purchase assets from the Unity Asset Store. This was a very efficient use of budget, as time would then be

spent on the development of the levels and interactions themselves, instead of mostly on the visuals.

In addition to the Asset Store, a character generation tool was used to create ready-to-animate 3d characters based upon a set of adjustable parameters. These tools meant that time did not have to be spent manually creating character models.

#### 8.4.3 – Node-based logic graphs

With the game featuring conversational branches, quests and sequences triggered by interaction, it would have been time-consuming to iterate and modify game logic if it was written through code. To reduce iteration speed and to better visualise branching paths, a Node-based graph editor called Actus was developed to handle events, interactions and branching dialogue. This made the development of branching dialogue paths a lot simpler to manage, and dialogue could be swapped in using a custom file container.

#### 8.4.4 – Custom tools and scripts

Character facial animation would have been very time consuming to implement using a traditional timeline tool. Instead, a custom facial animation tool was developed, which synced mouse dragging to the dialogue audio. Designers can drag the mouse up and down to flap the mouth. After a couple of attempts at each line, this looks relatively convincing and can be done reasonably quickly.

To efficiently process motion captured animations, a set of python tools for Maya were created, allowing for almost instant retargeting of a motion capture skeleton onto the Fuse skeleton. This made motion capture viable for use in the project, and it was used to provide additional body language during certain scenes.

## 9 – Conclusion and Future Work

This thesis demonstrates techniques that can be used to develop violence prevention games. Emotional reporting interfaces and techniques were evaluated. Game design and script writing was shared across a multidisciplinary team of experts in social work and the Caribbean.

A number of cost-saving techniques were utilized, including the use of Adobe Fuse for the semi-automated creation of 3d characters. An event editor called Actus was developed, which also allowed for a multiple-choice dialogue system to communicate with the rest of a level's functionality, saving implementation time connecting objects and logic together.

The *None in Three* Caribbean game development project lasted 18 months and resulted in a 3d point-and-click adventure game called *JESSE*. The game was rolled out in a trial in schools in Barbados and Grenada, with additional qualitative testing done in the UK.

Findings indicate that players become more familiar with an emotional self-reporting interface over time, and that children are more adept at identifying threatening behaviour and body language than other emotions and behaviours in others. Players initially found it challenging to use the mouse-based controls, but usability greatly improved in the later, larger environments.

Only a small number of players read an optional notebook containing real-world information, with most of their learning coming from the game's dialogue. Players are able to predict what will happen to Diana if she stays, and the majority of players choose to leave at the end. It is difficult to determine if this is due to information they learned during the game or prior knowledge.

The *None in Three* project has announced a global expansion, with 5 games being developed for different countries around the world. Each will have a different theme, but all are aimed at reducing violence against women. The designs and techniques created, along with the findings discovered during the development of *JESSE* shall be built upon with the next 5 games.

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# Appendix 1 – Data Glossary

The following is an explanation of all data that was gathered from the *JESSE* trial in the Caribbean, along with the additional data that was gathered from non-Caribbean participants.

## A1.1 – All Participants

All participants in both the game trial in the Caribbean, and the additional participants gathered in the UK will play through the entirety of *JESSE*. During a playthrough, the game will gather data from both their playthrough and from the device they are playing the game on. All data captured by the game will be exported into comma-separated value text files for easy collection.

Facilitators in the Caribbean will follow a set of guidelines on how to collect the data from each computer at the end of the full intervention in order to ensure the data collected is as accurate and complete as possible. Participants in the UK will be accompanied by a researcher who will immediately gather the data upon completion.

### A1.1.1 – At-a-glance Player Data

The base Player Data will be recorded in a text file called `PlayerData.txt`. This file will contain each player's unique identifier, some basic demographic information, and statistics to identify a player's overall progress in the game. Whenever progress is saved, the game will check `PlayerData.txt` and overwrite the entry for this player. If there is no existing entry for this player, it is added on a new line. This data is intended to provide an at-a-glance look at player participation with the game.

Data Field	Explanation
USERID	The unique identifier of each participant in the study. For participants in Barbados and Grenada, they will be provided a code at the beginning of the survey by Work Package 3. The first letter indicates the country (B or G). For participants from the UK, the login range B900 – B999 has been allocated.
DATE	The date of the last time this participant's data was recorded in this file. Where participants play over multiple computers, this can be used to identify which levels were played on what day.
TIME	The last time this participant's data was recorded in this file.



COUNTRY	The country version of the game the participant played. This is automatically decided by the login code. A login code of Bxxx will set the game to show real Barbados organisations, and a login code of Gxxx will show real Grenada organisations.
AGE	The participant's age. This will be used to split by demographic.
GENDER	The participant's gender. This is limited to Male/Female/Other. This will be used to split by demographic.
SCHOOL	The participant's school. This will be used to split by demographic.
CURRENT_LEVEL	The player's current level when the game was last saved. This is calculated from the current experience points the player has. Maximum of 10.
CURRENT_EXP	The player's current experience points. Points are rewarded whenever a player completes an event. Points vary depending on the event, with more points given towards the end of the game. The experience points required to increase current level increase as level increases.
TOTAL_PLAYTIME	The total amount of time in seconds the player has spent with the game running on this computer.
BEGANLEVEL1	True/False flag for level beginning.
FINISHEDLEVEL1	True/False flag for level completion.
L1TIME	Total time spent in level in seconds.
BEGANLEVEL2	True/False flag for level beginning.
FINISHEDLEVEL2	True/False flag for level completion.
L2TIME	Total time spent in level in seconds.
BEGANLEVEL3	True/False flag for level beginning.
FINISHEDLEVEL3	True/False flag for level completion.
L3TIME	Total time spent in level in seconds.
BEGANLEVEL4	True/False flag for level beginning.
FINISHEDLEVEL4	True/False flag for level completion.
L4TIME	Total time spent in level in seconds.
BEGANLEVEL5	True/False flag for level beginning.
FINISHEDLEVEL5	True/False flag for level completion.
L5TIME	Total time spent in level in seconds.
TOTALNOTEBOOKS	Total entries unlocked in the player's notebook. This is a bitwise value and is not intended as part of the data collection process. It is in here to save player individual progress.
NOTEBOOKSREAD	Total entries read in the player's notebook. This is a bitwise value and is not intended as part of the data collection process. It is in here to save player individual progress.
TIMELEARNING	Total time in seconds the player spent looking at entries in the notebook, or reading the leaflet in Level 2.

#### A1.1.2 – Player Accomplishment Data

The Event Data will be recorded in a text file called EventLog.txt. This file will contain each event a player completes, along with a timestamp and their unique ID. These entries can be used to

generate a timeline of events for each player, level and event. Only the first instance of an event being triggered by the player is recorded to prevent data saturation.

Data Field	Explanation
USERID	The unique identifier of each participant in the study. Same as the one found in PlayerData.txt
EVENTNAME	The specific event ID that was triggered.
LEVEL_TIMESTAMP	The time in seconds since the beginning of the level that this event was triggered.
TOTAL_PLAYTIME	The time in seconds in total the player has been running the game from when they started the game for the first time, until the event was triggered.

#### A1.1.3 – Player Emotional Intelligence Data

The Emotional Intelligence Dial Data will be recorded in a text file called EILog.txt. This file will contain each EI Dial a player uses, along with a timestamp and their unique ID. These entries can be compared per demographic to indicate any differences in social awareness skills among different groups.

Data Field	Explanation
USERID	The unique identifier of each participant in the study. Same as the one found in PlayerData.txt
EVENTNAME	The specific EI Dial ID that was triggered.
EMOTION	The emotion a player selected for the character. This is one of HAPPY, SAD, ANGRY or SCARED.
AMOUNT	The amount a player dragged the dial to the right. Range is between 1 and 100, with 1 being 'the character is not feeling this emotion very strongly', and 100 being 'the character is feeling this emotion very strongly'.

#### A1.1.4 – System Information

The System Information of the computer will be recorded in a text file called SystemInformation.txt. This file will contain the hardware specifications of the machine a participant uses for their playthrough of the game. As gathering information regarding the system requirements of the computers earlier in the project was challenging, gathering the system information of computers used to run the game builds up an image of the computer specifications in schools in Barbados and Grenada. This could then be used to inform development of other serious games built for the region,

by making informed decisions on the Game Engine technology to use and features to implement based upon the known system specifications.

In addition, knowing how many computers were used in the trial allows the determination of the ratio of students to computers per school and country. This data may explain player behaviour in certain schools if the number of computers is limited, especially with regards to completion rates of the game.

Data Field	Explanation
USERID	The unique identifier of each participant in the study. Same as the one found in PlayerData.txt
COUNTRY	As determined by the login code. Matches entries in PlayerData.txt.
OS	The named Operating System of the computer. This will always be Windows as the game trial only involves a Windows Distribution of the game. However, it will also reveal what version of Windows, and whether the platform is 32 or 64-bit.
CPU_NAME	The Central Processing Unit (CPU)'s Manufacturer and Product name.
CPU_COUNT	Number of CPU cores.
CPU_MHZ	Overall clock speed of each CPU core.
RAM_MB	Total size of Random Access Memory (RAM)
GPU_VENDOR	The company name of the Graphics Processing Unit (GPU) vendor.
GPU_NAME	The model name of the GPU.
GRAPHICS_API	The version of the Graphics Application Programming Interface (API) the GPU is using. This is expected to be some numbered version of DirectX, OpenGL or Vulkan.
GPU_MEM	The total video memory (VRAM) on the GPU.
SHADER_MODEL_ID	A numeric value related to the level of support for different shader models. Newer shader models allow for more advanced rendering techniques.
MAX_TEXTURE_SIZE	The maximum single-texture size in pixels the GPU will support.
AUDIO_SUPPORT	True/False. Whether a sound card is detected and functional. Does not inform whether a set of headphones is actually plugged in. This value cannot be used to determine if headphones were used.
DEVICE_MODEL	The Hardware manufacturer's name for this particular model of computer.
DEVICE_NAME	The name provided to the computer upon setup.
DEVICE_UNIQUE_ID	The unique ID of this particular computer. This can be different dependant on login data, and is only used to remove duplicate entries. This data is then discarded.

### A1.1.5 – List of all Events in the game

The following is a table with every event marked for data collection in the game. Each one rewards the player with a number of experience points. Optional events and events in later levels typically reward the player with more experience points. Events are classified by mandatory (requiring completion to finish the level), choice (requiring a player to choose between two event outcomes to finish the level), and optional (is not required to complete the level). Emotional Intelligence prompts are included in this list for time-tracking purposes. All EI prompts are mandatory and highlighted.

Event ID	Description	Mandatory/ Choice/ Optional	EXP
L1_ALVIN	When the player interacts with Alvin the dog for the first time.	Optional	40
L1_BACKPACK	When the player clicks on the backpack in the child's bedroom.	Mandatory	100
L1_CALL_FOR_AMBULANCE	Use the phone to call for an ambulance using the local ambulance number (511 or 911 depending on country)	Choice	120
L1_CALL_FOR_AUNTIE	Use the phone to call Jesse's Auntie.	Choice	120
L1_CHECK_ON_MUM	Find Diana on the bedroom floor.	Mandatory	50
L1_DIANA_MY_ARM	EI Prompt for Diana on the floor.	Mandatory	50
L1_FIND_AMBULANCE_NUMBER	Find the ambulance number on either the yellow pages or the ambulance toy.	Optional	70
L1_FIND_AUNTIES_NUMBER	Find Theresa's phone number on the fridge.	Optional	70
L1_FOUND_SCAN	Found ultrasound photo in the living room.	Optional	30
L1_GET_WATER	Picked up the jug of water after starting the homework.	Mandatory	70
L1_GO_TO_BED	Open the door to Jesse's bedroom.	Mandatory	70
L1_HOMEWORK	Start doing Jesse's homework after returning to the kitchen.	Mandatory	80
L1_JESSE_BEDROOM_ARGUE	EI Prompt for Jesse overhearing the bedroom argument.	Mandatory	50
L1_JESSE_PLEASE_DONT	EI Prompt for Jesse overhearing loud noises during homework.	Mandatory	50
L1_LIE_PHONE	Lie to the ambulance operator on	Choice	30

	the phone.		
L1_LOOK_AT_PHOTO	Interact with the beach photo after returning to the living room.	Optional	100
L1_LOOKED_AT_TOYS	Clicked on the toys next to the door in Jesse's bedroom.	Optional	50
L1_RONDELL_SALT	EI Prompt for Rondell after he breaks the plate.	Mandatory	50
L1_TRUTH_PHONE	Tell the ambulance operator the truth about Rondell.	Choice	30
L1_TURN_ON_FAN	Turn on the fan in Jesse's bedroom.	Optional	30
L2_CHECK_CHART	Interact with the chart at the foot of Diana's bed.	Optional	80
L2_CHECK_WHITEBOARD	Interact with the whiteboard next to the nurses' desk.	Optional	120
L2_DIANA_HEHASONLY	EI Prompt for Diana after admitting Rondell hit her.	Mandatory	100
L2_DIANA_NOIFELL	EI Prompt for Diana after lying about Rondell.	Mandatory	100
L2_DIANA_WANTTOGO	EI Prompt for Diana after she says she wants to go home.	Mandatory	100
L2_FIND_BED_5	Interact with the hospital curtain for bed 5.	Mandatory	100
L2_FIND_LEAFLETS	Interact with the real-world information leaflets at the nurses station on the desk.	Mandatory	250
L2_JESSE_HOPEYOUSDONT	EI Prompt for Jesse after Rondell says he'll look after Diana.	Mandatory	100
L2_KRISTYN_DONTWORRY	EI Prompt for Kristyn after she tries to encourage Diana.	Mandatory	100
L2_RETURN_TO_DIANA	Interact with Diana after taking her the leaflets.	Mandatory	100
L2_RONDELL_WATCH	EI Prompt for Rondell after he threatens Theresa.	Mandatory	100
L2_SECRET_APPLE	Interact with the apple on the desk.	Optional	300
L2_SECRET_OOPS	Interact with the hospital curtain for bed 2.	Optional	300
L2_TALK_TO_JESSE	Interact with Jesse.	Mandatory	200
L2_TALK_TO_THERESA	Interact with Theresa.	Mandatory	200
L2_TALK_TO_RONDELL	Interact with Rondell.	Mandatory	200
L2_TALK_TO_DIANA	Interact with Diana.	Mandatory	200
L2_THERESA_CALLME	EI Prompt for Theresa as she leaves Diana's bedside.	Mandatory	100
L3_ASKED_ABOUT_DRAWINGS	Ask Jesse about all four drawings.	Mandatory	200
L3_BEGAN_BOARD_GAME	Begin playing the board game.	Mandatory	150

L3_DISPLAY_BOARD	Interact with the corkboard at the back of the room.	Optional	150
L3_FOUND_JESSES_FILE	Open the filing cabinet at the front of the room.	Mandatory	200
L3_GEORGE_TOPOFTHECLASS	EI Prompt for George after finding Jesse's file.	Mandatory	150
L3_GOT_PRINTED_BOARDGAME	Interacted with the printout of the board game from the back of the room.	Mandatory	150
L3_JESSE_NOT_WELL	EI Prompt for Jesse after saying his mum is in hospital.	Mandatory	150
L3_JESSE_NOTHINGSHAPPENED	EI Prompt for Jesse after he lies about his mum.	Mandatory	150
L3_JESSE_THROWSBOARDGAME	EI Prompt for Jesse after he knocks the board game over.	Mandatory	150
L3_JESSEWAIT	EI Prompt for George after Jesse storms out of the room.	Mandatory	150
L3_PLAYED_BOARD_GAME	Finished playing the board game.	Mandatory	150
L3_PRINTED_BOARD_GAME	Clicked the print button on the computer.	Mandatory	100
L3_SECRET_LOOK_OUT_WINDOW	Interacted with the second window.	Optional	200
L3_SECRET_READ_ALL_EMAILS	Clicked all three emails.	Optional	200
L3_SECRET_SKELETON	Interacted with the skeleton.	Optional	150
L3_SPIN_GLOBE	Interacted with the globe.	Optional	150
L3_TYLER_BOOKS	Interacted with the books on the desk.	Optional	150
L4_FEELING_HEMMED	EI Prompt for Rondell after he says he's feeling hemmed in.	Mandatory	200
L4_I_GREW_UP_OK	EI Prompt for Rondell after he says he grew up okay.	Mandatory	200
L4_LOOKED_AT_ARCADE	Interacted with the arcade machine.	Optional	500
L4_LOSE_POOL_GAME	Lose the pool game against Rondell.	Choice	100
L4_MIND_OWN_BUSINESS	EI Prompt for Rondell after he says people should mind their own business.	Mandatory	200
L4_PLAY_POOL_GAME	Started playing the pool game.	Mandatory	400
L4_SECRET_DARTBOARD	Interacted with the dart board.	Optional	500
L4_SHES_NOT_OKAY	EI Prompt for Hayden after exclaiming Diana is in hospital.	Mandatory	200
L4_WIN_POOL_GAME	Win the pool game against Rondell.	Choice	1000
L5_CANT_BE_REAL	EI Prompt for Rondell after hearing about effect on unborn baby.	Mandatory	300
L5_DEVIL_OR_ANGEL	EI Prompt for Old Man after weighing up Rondell's behaviour.	Mandatory	300

L5_DONT_YOU_LOVE	El Prompt for Diana after telling Rondell he makes her feel worthless.	Mandatory	300
L5_LEAVE_GET_HELP	Ending Choice 1-2. Leave Rondell, and he agrees to get help.	Choice	500
L5_LEAVE_NO_HELP	Ending Choice 1-1. Leave Rondell, and he does not get help.	Choice	500
L5_LOOK_AT_CAN	Interact with the can by the road.	Optional	400
L5_MAKE_A_DECISION	Made an ending choice.	Mandatory	1500
L5_NOTHING_FOOD	El Prompt for Rondell after he lies about the stain being food.	Mandatory	300
L5_SECRET_WATER	Interact with the water bottle.	Optional	700
L5_STAY_GET_HELP	Ending Choice 2-2. Stay with Rondell and he agrees to get help.	Choice	500
L5_STAY_NO_HELP	Ending Choice 2-1. Stay with Rondell and he does not get help.	Choice	500
L5_USE_STANDPIPE	Interact with the standpipe.	Mandatory	600
L5_YOU_TAUGHT_HIM	El Prompt for Old Man after he highlights the pattern of abuse.	Mandatory	300

## A1.2 – Non-Caribbean Participants

Non-Caribbean Participants will be identified and contacted from around the county local to the research base (West Yorkshire). They will range from young people to adults, and will complete the game in one sitting in comparison with the participants in the Caribbean. This difference is due to the time constraints of only being able to guarantee availability of participants for a single session. This intensive playthrough may influence results of moment-to-moment player behaviour, but the additional qualitative data provided will help to contextualise the quantitative data from the Caribbean.

### A1.2.1 – Usability Questionnaire

The Usability questionnaire takes place immediately after a participant of a non-Caribbean group has completed the game. They use the same login code provided to them to fill out the questionnaire. This allows their answers to be linked to the player data from the game, whilst still maintaining

participant anonymity. This login code is ensured to be the correct format in Google Forms using a regular expression.

A small set of demographic data is also gathered so that questionnaire results can be split by demographic. This is limited to age, gender, and hours spent playing video games per week. The game question is intended to determine if participants have previous experience with video games. Although it would have been possible to gather more data during this section, such as a more detailed breakdown of playing habits and target platforms, it was decided to keep the questionnaire as brief as possible, in order to make the entire trial for non-Caribbean participants fit inside a couple of hours.

#### **Introductory Section:**

- Please enter the Login Code you used when playing the game. (Short-answer text field)
- What is your Gender? (Single fixed choice, Male/Female/Other)
- What is your age? (Ranged choice field, 7 or younger, 8 – 10, 11 – 17, 18 – 21, 22 – 30, 31 – 40, 41 – 50, 51 – 60, 61 and over)
- On average, how many hours do you play video games in a week? (Short-answer text field)

#### **Modified Standard Usability Scale Section:**

- I would like to play this game again.
- I found the game contained a lot of parts it didn't need.

If you agree, what parts are not needed? (Optional Text Field)

- I thought the game was easy to play.
- I think that I would need the support of a technical person to be able to play this game.
- I found the various parts of the game were well connected.
- Parts of the game were different from each other in a way that made it difficult to play.
- I think that most people would learn to play this game very quickly.
- I found the game very awkward to play.
- I felt very confident playing the game.
- I needed to learn a lot of things before I could get going with this game.

#### **Game Difficulty Section:**

- What was the hardest part of the game for you to use?
- What was the easiest part of the game for you to use?



### A1.2.2 – Semi-Structured Interview

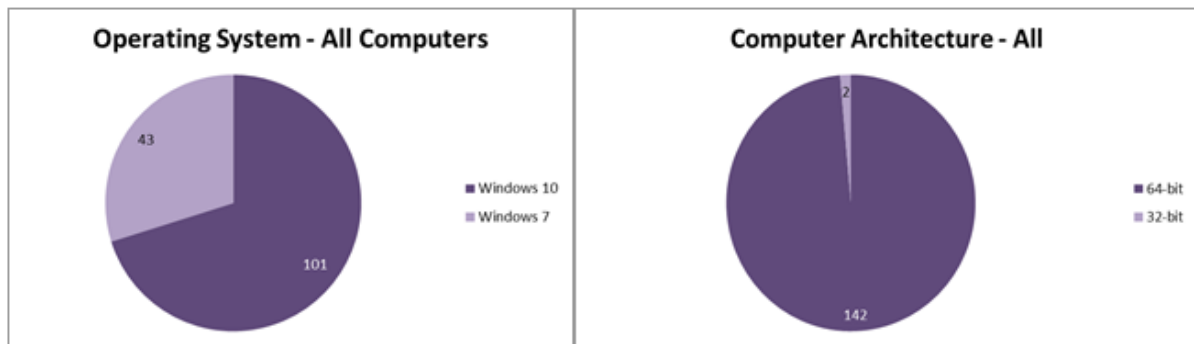
The Semi-Structured interview takes place immediately after the participants of a non-Caribbean group have completed the Usability Questionnaire. It features 11 questions about participant experiences during gameplay, and also asks them to reflect upon the issues prevented by the game.

- 1) What lessons you did you learn from the None in Three game?
- 2) Which of the five levels was your favourite, and why?
- 3) Which of the five levels was your least favourite, and why?
- 4) Which parts of the None in Three game do you feel you learned the most from?
- 5) Which parts of the None in Three game do you feel you learned the least from?
- 6) Which lessons of the None in Three game do you believe apply to everyone, and not just people in Barbados and Grenada?
- 7) Who was your favourite character, and why?
- 8) Who was your least favourite character, and why?
- 9) Did you feel as though the game gave an accurate portrayal of Barbados / Grenada?
- 10) Would you play this game again? If not, what changes would bring you back to play it again?
- 11) What did you know about the issue of domestic violence before playing this game? Are you now more informed about these issues?

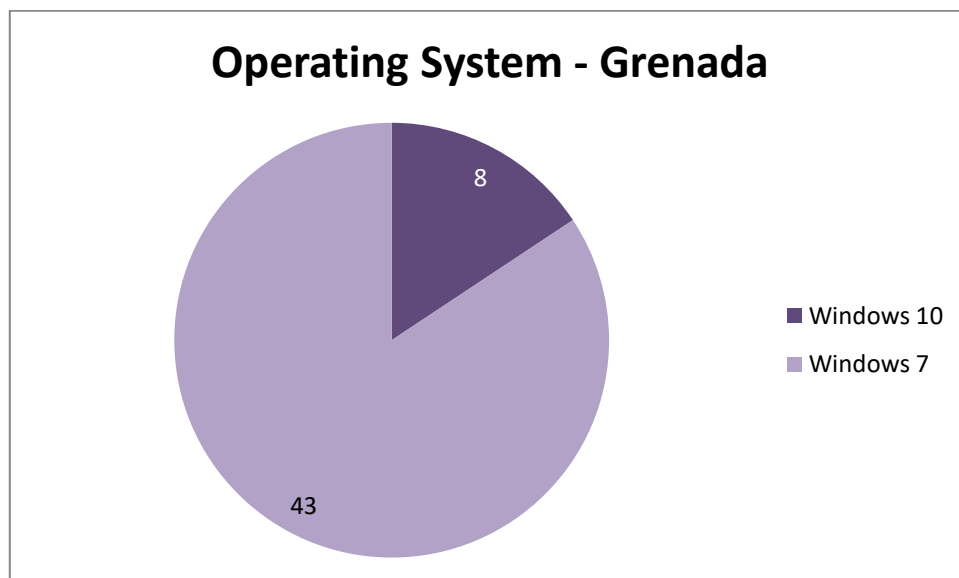
## Appendix 2 – Hardware Survey

### A2.1 – Computer Specifications in Barbados and Grenada

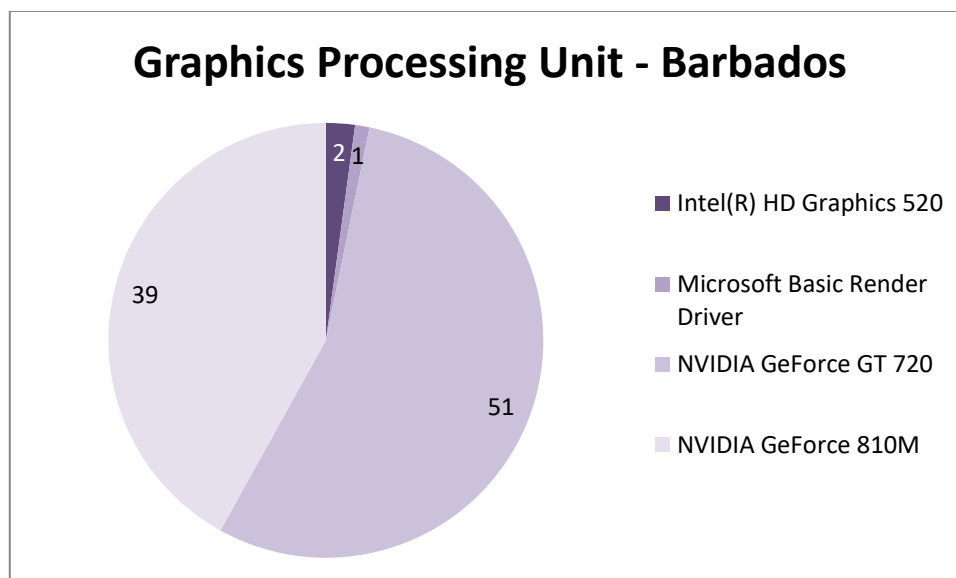
System Information was gathered automatically from all computers running the game.



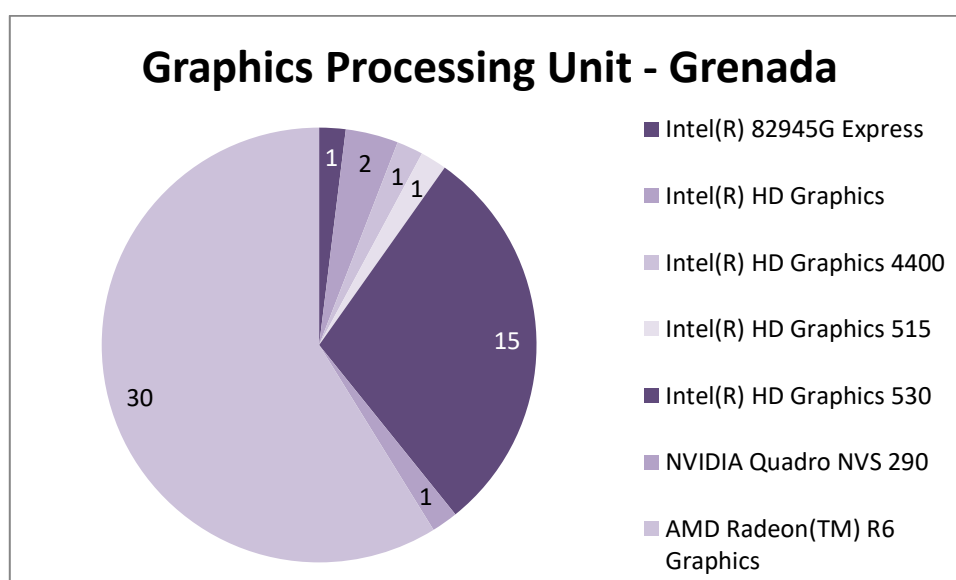
Across both countries, only Windows 10 and Windows 7 were used or compatible with the game. Windows 10 was the most popular, with 100% of computers in Barbados running Windows 10 with 64-bit architecture. Only two computers in Grenada ran on 32-bit architecture, and an alternate build was created for these computers.



Grenada had a much lower distribution of Windows 10 computers, with only 8 compared to 43 computers running Windows 7.



Schools in the Barbados trial primarily used dedicated NVIDIA GPU's, with a large portion of those being mobile GPU's.



Computers in Grenada had a wider variety of GPU's in them. Just over a third of machines used some form of integrated CPU graphics chip, with the rest being the same AMD Radeon R6. The NVIDIA Quadro GPU is possibly an IT computer used for testing purposes.

Most computers had a dual-core CPU, with only 1 computer just having one core, but with hyperthreading. CPU clock speed ranged from 1.1GHz to 3.7GHz. Memory capacity ranged from 2GB

of RAM to 8GB. Only one computer in Grenada did not support Direct3D 11, instead supporting Direct3D 9 due to an embedded graphics processor.

The 25 computers used at Blackman and Gollop Primary School in Barbados were labelled as Laptops. Specifications from 23 computers at Lawrence T Gay were identical to the Blackman and Gollop computers, but these are labelled as desktops in the computer name. Only two computers in Grenada were identifiable as laptops, a Macbook 9 running boot camp, and a Microsoft Surface Pro 4. These are high-end machines and are assumed to be owned by members of staff.

## A2.2 – Ratio of Computer availability per participant

The following table shows how many unique computers were identified in each school, compared with the total identified participants from that school. This then shows how many computers were available on average per participant.

School	Total computers	Total Participants	Ratio of users to computers
Blackman & Gollop	25	25	1.00
Deighton Griffith	25	25	1.00
Lawrence T Gay	25	23	1.09
Queens College	18	23	0.78
TOTAL BARBADOS	93	96	0.97
Anglican	7	28	0.25
Grenville	11	17	0.65
Westmorland Primary	16	14	1.14
Westmorland Secondary	17	19	0.89
TOTAL GRENADA	51	78	0.66
TOTAL PARTICIPANTS	144	174	0.84

Grenada has the two of the three worst ratios, with Anglican using just 1 computer to 4 students. Ratios above 1 indicate either a surplus of computers and thus flexibility on seating, or a game session that was started on one computer then moved over to another one due to poor performance.

## Appendix 3 – Informal Device study

During meetings with young people on the research trip, an informal tally of devices young people used to play video games on revealed that Android Phones were the most common device across both countries, with PC's and handheld devices slightly more popular in Barbados. Home console ownership was also higher across Barbados.

DEVICE	IAMAGIRL Barbados (40 girls+)	Barbados Boys (12 boys+)	Grenada Girl Guides (5 girls)	Grenada Girl Guides second group (6 girls)
PC	16	8	0	3
XBOX 360	8	3	1	0
PS3	15	5	1	1
XBOX ONE	4	2	1	0
PS4	3	4	1	1
ANDROID PHONE	22	5	4	6
IPHONE	4	1	0	0
HANDHELD DEVICE, SUCH AS PS VITA, 3DS ETC	21	5	0	3
WINDOWS PHONE	0	1	1	0
ANYTHING ELSE	0	0	0	0
WII	0	0	1	0
WII U	0	0	0	0

## Appendix 4 – Digital Resources

Further documentation and files supporting this thesis are supplied as an external digital resource.

- None in Three - Jesse.exe (requires Windows 7 64-bit and up)
- Video demonstrating the Custom Animation Workflow and Python tools developed for retargeting animation from the Noitom Skeleton to the Adobe Fuse skeleton
- All compiled research data, graphs, timelines and python tools created to generate the data
- The original archived None in Three game design document