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

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Abstract. Domestic violence is a persistent and universal problem occurring in every culture and social group, with lack of empathy identified as a contributing factor. On average, one in three women and girls in the Caribbean experience domestic violence in their lifetime. In this paper we demonstrate the techniques used during the creation of a low-cost, violence prevention game titled *None in Three,* targeted at enhancing empathy and awareness among young people in Barbados and Grenada. A research trip was undertaken to gather photographic reference and to meet with young people. Methods to measure the emotional state of players and awareness of characters in-game were explored. Cost-saving measures such as asset store purchases were evaluated. Custom tools were created in order to speed up production, including a bespoke event editor for multiple-choice dialogue sequences, and the use of motion capture libraries and auto-rigging tools to speed up character animation workflows.

Keywords: Game design · young people · serious games · emotional intelligence · gender based violence · violence prevention

1 Introduction

Video games have been used as a medium through which to educate children for decades, with a large number of teachers using them in the classroom. A 2013 survey found that 74% of K-8 teachers reported using digital games for instruction [1]. There are lots of games designed to educate children that focus on the development of hard skills directly related to the curriculum, such as *Starfall* [2], a game aimed at enhancing children's reading and arithmetic skills.

Recently, educational games have attempted to teach soft skills as well. In order to achieve this, these games have attempted to provide a role-playing experience, through which players can explore scenarios and perspectives they may not have experienced in their own lives. Through such role play, players can develop interpersonal empathy towards real-life situations and interactions [3].

These games present more challenges in design and technical implementation than their hard skill counterparts, due to the range of character expression and possibility that role playing intends to offer. Increased technical challenges typically require larger teams, more time and as a result larger budgets to overcome.

Although abstraction of the themes and visual elements can reduce the time required to develop detailed content, this can limit how closely a player can relate to the situations on screen. Are there design techniques that can be used to make the most of small teams? What technologies can be used to reduce the workload when designing games featuring 3D characters, animation and branching dialogue?

This paper reveals the design considerations made during the creation of a low-cost Domestic Violence (DV) prevention game, created for children and young people in the Caribbean as part of the None in Three project. *None in Three* is a European Union funded project, aiming 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. As part of this project, a serious gaming intervention has been developed, aimed at facilitating behavioural change.

2 Serious Games for Raising Awareness of Sensitive Issues

There are numerous different approaches to games for wellbeing. Some games are designed to be provocative, and encourage the player to think about issues that may not directly involve them. The designers of these games may go about addressing these issues in subtle ways, so as to appeal to a larger audience. *Papo & Yo* [4] is a 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 substance is an 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 [5].

Other games can be more upfront with their themes, presenting them through gameplay systems. *Papers, Please* [6] 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 checkpoint. However, players can choose to sympathise with the situations of individual characters and let them through at the risk of their own family's safety. Due to the nature of these gameplay systems, the game raises awareness of how borders can separate families, and presents players with a moral dilemma.

Bespoke games built to deal with social problems are very rare. In particular, games dealing with sensitive topics, such as child neglect and unhealthy relationship behaviour do not often reach a large audience. *Rosie 2* [7] 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 concerned. Players can choose to ask specific questions to build up a more complete picture of the situation. Players can flag objects in the background of scenes

as cause for concern, and the player is told which of these they were correct to flag, providing constructive feedback on the player's own choices.

In order to analyse emotional responses to the simulation, 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. Such technology can be expensive and difficult to implement, and so unlikely to be beneficial in resource-limited countries such as those for which the *None in Three* game is intended.

Honeymoon is a 2D visual novel created for a competition by the Jennifer Ann's Group [8], designed to raise awareness of unhealthy relationship aspects, such as controlling behaviour. The game features multiple conversation choices and decisions on how to present yourself in the game. Through dialogue, it is apparent that the player's character is becoming a victim of controlling behaviour of their new relationship partner. 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.

Honeymoon also promotes self-reflection between different scenes, by asking rhetorical questions about the behaviour of its characters. This is a way of implementing formative feedback, which can be defined as 'information communicated to the learner that is intended to modify the learner's thinking or behaviour for the purpose of improving learning' [9]. By asking questions directly related to the themes of the experience, *Honeymoon* encourages players to think critically about these issues.

3 Design and Development of *None in Three*

None in Three is a point-and-click role-playing game in which players assume the role of multiple characters related to a family who are experiencing and perpetrating domestic abuse. The game is designed to positively affect player behaviour, intending to raise public awareness of the impact violence can have on everyone involved. The game will be piloted in schools across Barbados and Grenada before being made widely available across the region. Described next are the approaches taken to designing a violence prevention game.

3.1 Behaviour Analysis Methods

As the game is intended to lead to attitude and behaviour change, a method was required to measure the impact on players. Daniel Goleman's Model of Emotional Intelligence [10] provides a framework through which various factors of Emotional Intelligence in game players can be identified. These are split into four categories, two of which are personal competencies and two of which are social competencies. The first category is Self-awareness, which refers to how aware a person is of their emotional state. 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.

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 [11]. 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 [12]. 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.

Although many physiological response measurements are non-invasive [13], 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 [11]. Because of this, non-physiological methods of measurement during gameplay will be utilised.

Players can use real-time self-reporting systems built into games to identify their emotions. This technique can be used for measuring empathetic response, by requesting players evaluate the emotional state of the characters in a game. A systematic review of literature on self-reporting interfaces by Fuentes et al. [14] discovered 26 different named self-reporting interfaces between them. Of particular note is a self-reporting interface called AffectButton [15], which allows users to select a facial expression using a single mouse click. 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. The *None in Three* game will feature a single-click self-reporting system based around the traits of AffectButton.

The second Emotional Intelligence category is Self-management [10]. This refers to how much control a person has over their own emotions, and how they then react. 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. 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.

The remaining two categories are social competencies, which revolve around recognising and managing the emotions of others [10]. Social Awareness identifies empathy as a key skill. To this end, the *None in Three* game provides 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.

3.2 Prosocial Game Elements and Benefits

Although recent educational games have focused solely on prosocial gameplay, these elements are also found in mass-market games. Many video games include elements of teamwork and cooperative play, which are required to make progress. In *Portal 2* [16], 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* [17], players can use their own medical supplies to heal other characters, and rescue them if they collapse to the floor. Although the survival of the entire team is not required to complete a level, keeping more characters alive makes the game easier.

A significant number of video games provide opportunities for the player to help characters within them. Often this is through helping quest-givers 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* [18] 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. *The Walking Dead* [19] does this by providing each game character with a memory of the player's actions. This is then intended to provide long-lasting consequences, which can cause players to be more considerate with their actions than they might be in other games.

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 affect the attitudes of players. Gentile et al. [20] 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. This is in essence a reversal of the relationship between games that provide positive feedback to violent behaviour and a player's aggression levels.

3.3 Gameplay

The *None in Three* game features a number of gameplay systems that have been designed to allow the player to role-play as a variety of characters in various scenarios. These were drawn from qualitative research on domestic violence carried

out by the project team with 109 adults (female = 49; male = 60) in Barbados and Grenada in 2016 [21]. Semi structured interviews and focus groups were recorded, transcribed and analysed thematically using a-priori themes drawn from a narrative review of the literature and the primary research questions. Key themes used to develop the case study, characters, and storyline were applied on a level-by-level basis.

The game features a multiple-choice conversation system, allowing players to question other characters to learn more about the themes that are presented to them. Being multiple-choice, replaying the game's content is encouraged, with the intended outcome being students discussing the options they chose with each other.

The game uses a point-and-click interface, with players clicking to walk to places and interact with objects. This was designed to be simple and fully controllable with a mouse by any player capable of using a computer, ensuring even children unfamiliar with computer games will be able to use it. To provide players with an interesting way to interact with the world, a drag interaction system was developed. This is used to build up tension in the first level, where players can open the door to the parent's bedroom slowly to overhear an argument the perpetrator of violence is having with his victim.

Given the game's audience ranging from children aged 10, to young adults aged 18, and the variety of skill difference among them, it is important to ensure that those who have less experience can continue to make progress. To facilitate this, a quest system was implemented to provide hints as to what actions to take. The game is designed so that players must undertake certain actions in order to complete a level. Due to the short amount of time players will have with the game, this ensures that players will complete each level, and experience more of the themes presented.

3.4 Game Structure

The *None in Three* game is based on a case study derived from original research conducted by the team and includes a variety of characters and themes. An important aspect of the game's development 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. This included a research trip to gather photographic reference and learn about the experiences of young people there. This has ensured that the game's environment, language, ambience and characters are based on Caribbean realities rather than being imported from elsewhere. To further this, the character dialogue has been recorded with voice actors local to Barbados and Grenada, who volunteered their time to speak the parts.

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 national dishes of both Barbados and Grenada are mentioned. Colloquial sayings are included, such as "*coconut don' grow 'pon pumpkin vine*" – meaning a child is not very different from their parent.

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.

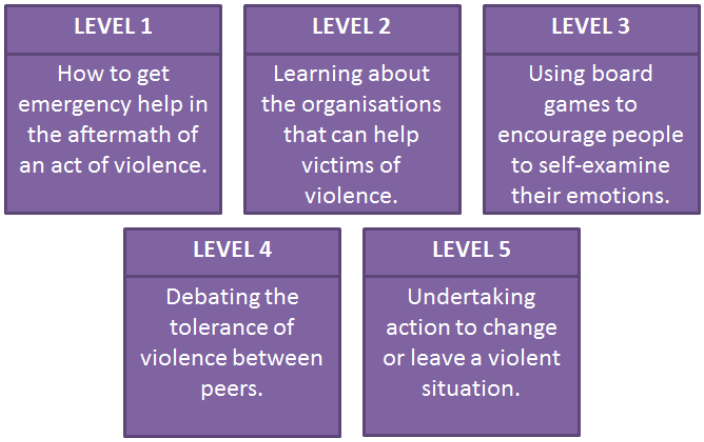

Fig. 1. The 5 level structure of the game, with each level's primary theme

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.

Level 1 is an introduction to the main characters involved, and begins on a typical evening. The main player character, Jesse, is a young schoolboy. In this level, players are introduced to the conversation system. The victim, Jesse's mother (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. Later, Rondell attacks Diana and players must help Jesse locate the ambulance number, which is the real-world number for their country. Including real-world information provides the game with an additional element of educational content. The level also references Rondell's drinking, which has been determined as a contributing factor to violence [21].

Fig. 2. Left - Screenshot of Level 1, in which players must find the number to call an ambulance for his injured mother after she is attacked by her partner. Right – photograph of a bedroom in Barbados featuring similar wood, tiles and decoration.

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. 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 [21].

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 [21]. Levels 2 and 3 may also be used to provide training for professionals such as healthcare providers, nurses, social workers and teachers.

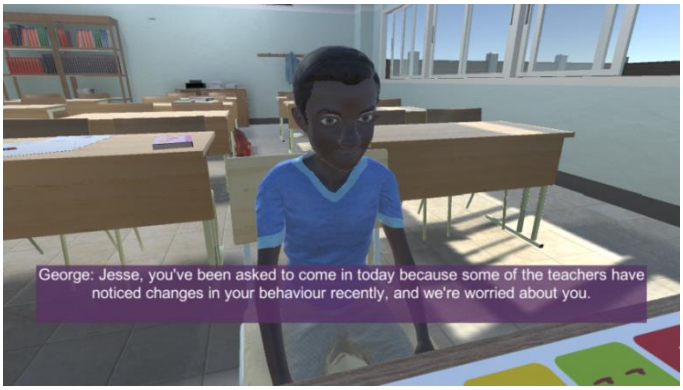

Fig. 3. Screenshot of Level 3, in which players must question Jesse through the means of a board game.

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 [21].

Level 5 follows Rondell as he listens to advice. 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 [21].

3.5 Low-cost Game Development Techniques

Due to the scale of the project and the small development team, it was necessary to explore a number of cost-saving techniques, including the automation of some processes to save on staffing costs. The first decision that had to be made was which game engine technology to use. The two primary choices were *Unity* [22] and *Unreal Engine 4* [23]. 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.

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* [24] is a piece of character generation software that allows users to modify template characters, pulling sliders and adjusting parameters until they have characters that fit their specifications. *Fuse* also contains a library of motion capture ready to apply, 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.

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 [25], a magnetic motion capture suit. This allowed for animation retargeting using *Maya* to match the Fuse skeleton.

Fig. 4. Left and Middle – volunteer voice actors local to the region. Right – motion capture suit.

Mixamo 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 plugin for *Unity* called Mixamo *Face Plus* was tested, which allows the user to make facial expressions into a webcam that are mapped onto a character using image recognition. The plugin provided inaccurate results, because of poor lighting and a lack of depth sensor information to support the webcam. Instead, manual creation of facial expressions was explored by creating blend shape poses as animation clips. 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.

As conversations in the game can have multiple paths and prompts, an event editor called Actus was created to visualise each piece of dialogue.

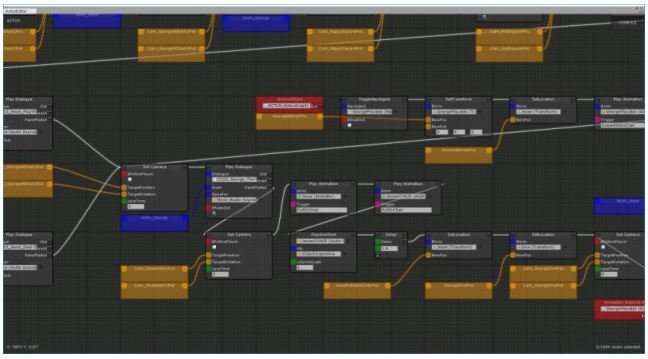

Fig. 5. The custom-built Actus Event editor, used to create branching dialogue and bespoke events for each gameplay interaction.

Actus contains variable support, multiple graphs and event handling. Function nodes are generated using reflection at editor time. Given that optimised run time performance is a project focus due to the low-specification computers in the Caribbean, the graphs created in the Actus editor are then compiled back down to C# functions and variables for speed of execution.

3.6 Game Analysis Process

In order to measure the impact the game will have, the *None in Three* team have designed an initial survey to generate a psychosocial profile of young people in Barbados and Grenada. This survey is used to ensure that the themes tackled in the game are issues that the profile reveals students being at risk of perpetrating. In addition to this, the team will create a pre-intervention and post-intervention survey instrument, which will be used to measure attitude and behaviour change in players of the game in comparison with a control group.

In order to support this, logging systems will be implemented in the game to gather player data. An Emotional Intelligence (EI) Indicator will appear after moments where a character's emotions in game have changed, and players will be tasked with describing how they believe this character is feeling by selecting from a choice of emoticons. The specific emotions used on the indicator are based on the 6 basic emotions put forward by Ekman [26]. The EI Indicator was prototyped initially to request that the player report on their own emotional state. However, Goleman's model [10] refers to both self-awareness and social awareness. As a result, the indicator is designed to provide a way for the player to guess the emotional state of others.

4 Conclusion and Future Work

In this article, we have demonstrated techniques that can be used to develop low-cost, violence prevention games. Methods used to gather data on a player's emotions were covered, including self-reporting of a player's emotional state. A number

of cost-saving techniques were utilized including the use of *Adobe Fuse* and Mixamo's motion capture store allowing for the creation of a large number of characters and a. Creating younger characters was more of a challenge, with the templates not providing as much flexibility. The creation of animated sequences and varied level events was considered a large bottleneck if tackled through traditional programming techniques. As a result, 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 object types together.

During the piloting of the game, a study will be carried out to assess player's experiences, and determine if the intervention has had any impact on player's perceptions of violence and their emotional intelligence, particularly levels of awareness and empathy.

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