University of Nottingham

Educational Games to Engage the Un-engagable

John Carr

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Educational Games to Engage the Un-engagable

Abstract

Behavioural, emotional and social difficulties in school-aged children are a significant problem in the UK. Such children represent a difficult challenge for educational institutions. Teachers and experts have said that these children find it almost impossible to stay on task in educational activities for more than a trivial amount of time. Interest in computer games as a medium for learning and other non-entertainment purposes has risen significantly in recent years, in part because they can provide an engaging experience to motivate users. This makes the medium an attractive tool for this demographic. There are many problems however facing designers who would attempt to integrate educational content into a game platform. The issue of effective integration between game and education has long been a problematic issue affecting educational game development. Gameplay aspects can often be overlooked in academic projects. Good educational games should integrate the learning content and game experience, this is something that is particularly difficult to achieve effectively.

This thesis details a study to design educational games to aid behavioural emotional and social learning. The methodology attempts to blend good game design principles with educational content in such a way that users can be engaged with both the activity and the educational concepts contained within. Two trials were undertaken in schools with participants suffering from a range of severe behavioural emotional or social problems. The results provide evidence suggesting that, if *educational gameplay* is achieved, these children can be engaged, not only with the game as an activity, but with the educational content on which it is based. The implications are then explored and the potential of educational gameplay evaluated in context of the wider industry of educational and serious games. While this method of integrating educational content within game platforms is effective, it is difficult to achieve, in many subject areas, perhaps prohibitively so.

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Chapter 1   Introduction

Modern educational games have many different appellations. A recent trend is to refer to games that are intended for more than just entertainment as "Serious Games". Another is to refer to attempts to use games for education as "Games Based Learning" (GBL). Serious Games is too broad a definition, this thesis is concerned with the specific use of games to enhance engagement for serious education. Game based learning implies a standalone activity, what about game based teaching? This thesis will therefore use the traditional term "educational game". The term "game", unless specifically stipulated otherwise, will refer to digital games played on computers or games systems.

This thesis will examine the potential of educational games to engage children with severe behavioural emotional or social difficulties. This group of children represent a significant challenge for the teachers, social workers, therapists and other professionals who seek to engage them with topics such as emotional literacy and behaviour.

Educators have attempted to utilise computerised games for learning since the microcomputer spread into mainstream use (eg. Malone, 1980). The motivation for this can be seen quite plainly in observing the levels of concentration and sheer effort that young children willingly put into playing commercial games in their leisure time. These often require children to develop a significant set of skills and overcome difficult problems in order to be competitive within the rules of the game. Children play, and learn how to win, extremely effectively. The potential of this motivational power, if it could be harnessed for serious education, is compelling.

The explosive growth of the entertainment games industry and a series of popular texts (eg. Prensky, 2001; Gee, 2003; Shafer, 2006) theorising the potential games based technology might have in learning has driven the increasing popularity of studies attempting to utilise games for serious education in recent years.

Good games are extremely difficult to make however. Genuinely educational games are, in some ways, an even more difficult prospect than their entertainment counterparts as good game design must be integrated in an

effective way with educational topics. This effective integration is an extremely challenging problem. Educational or serious games that do not integrate gameplay with educational content in any way risk providing motivation only in non-educational aspects of the software. Most educational games attempt to integrate educational content into the fantasy theme of the game in alliance with the early theories of Malone and Lepper (Malone & Lepper, 1987). The approach taken in this study attempts to integrate educational content with gameplay as dictated by game mechanics, as has been examined in more recent studies (Habgood, 2007). This thesis argues that the most important factor in the engaging properties of any computerised game lies in the gameplay experience. In this argument, the motivational power of games is inextricably linked to gameplay.

Designing and implementing the different elements that go into making an engaging and fun game-play experience is an expert profession in itself. Game designers and programmers who are talented in this regard are highly sought after in the entertainment games industry. In this regard, educational games have benefitted from use in institutional settings. Educational games are not generally required to compete with leisure activities and poor game design is perhaps easily overlooked when the alternative activity is a paper based maths exercise. There remain however, several drawbacks associated with use of computerised games in classroom settings. The nature of such games presents boundaries to successful integration into educational institutions and classroom routine. The justification for the use of games in schools is also questionable in some subject areas. Which games can claim to educate in a traditional, instructional subject better than face-to-face interaction with a professional teacher? The real value of custom-made games in educational settings could be in helping to teach things that are difficult to teach in traditional classroom environments. Behavioural, emotional and social topics certainly fall into this category. In this regard, a good educational game could hold useful potential for engaging children with what are complex and difficult topics.

Children with severe behavioural, emotional or social difficulties are also notoriously difficult to engage using traditional educational materials (Russell & McGuigan, 2007). The engaging and immersive properties of electronic games could offer a particularly useful tool for this problem. This thesis will detail the

design and development of two prototype educational games. Empirical evidence gained from trials with children in this demographic is then analysed and discussed.

This thesis contributes to the body of knowledge on the engaging and motivational properties of games and the effective integration of such with serious educational content. There is a specific focus on children suffering from behavioural, emotional and social difficulties.

1.2 Hypotheses

This thesis will attempt to test the following hypotheses relating to the use of educational games with children who suffer from severe behavioural, emotional or social difficulties.

Hypothesis one

The first hypothesis predicts that an educational game, designed with the needs of the demographic in mind, can be successful in engaging children with severe behavioural emotional and social difficulties for longer than they will normally engage with traditional educational activities.

Hypothesis two

Hypothesis 2 predicts that, through carefully integrated implementation of game-mechanics and educational content, an educational game can be successful in engaging these children with important educational concepts and ideas as well as trivial aspects of gameplay.

Alternative Hypotheses

The reputation of the demographic is of poor attention spans, frustrated outbursts and general lack of focus. Given this, it is perhaps likely that such children will become frustrated and disengage immediately if the game attempts to switch focus from fun gameplay to serious education, a commonplace "edutainment" approach. The games will be designed to integrate the educational content into the game experience in such a way that this change of focus does not occur. It is necessary however to ensure that the player demonstrates knowledge of the educational content in order for them to be successful in-game. As such, at certain points in the game the player will not be

able to achieve important goals without demonstrating there has been serious consideration of educational concepts.

Hypothesis three

The alternative hypothesis (three) predicts that children with severe behavioural, emotional or social difficulties may engage with the game activity on a trivial level but will disengage when gameplay mechanics begins to *require* some knowledge of the learning content for continued success.

1.3 Aims & Objectives

The primary aim of this study is to examine the potential of educational games to engage 8 to 12 year old children with severe spectrum behavioural emotional or social difficulties. Moreover, if this engagement can indeed be achieved, can it be channelled effectively towards the educational concepts on which the game is based?

Teachers, social workers, therapists and other professionals who are exposed to these children often attempt to help the child to develop coping skills in order to manage their behaviour. Professionals who deal with children in this demographic on a daily basis have asserted that these children find it almost impossible to stay on task in educational activities for more than a trivial amount of time. Their behaviour is sometimes so problematic that the majority of time must be spent ensuring the child does not damage property, their peers or themselves. This study examines the potential educational computer games could hold as learning tools when custom made for this particular demographic.

This thesis suggests the following: Children, even those considered "un-engagable" by teachers and other professionals will engage with the right kind of computer game. Gameplay is central to game design; it represents a composite of the game-mechanics through which the player interacts with the game. It is what the player does and can do in a game; it is the tool by which game designers create an enjoyable experience for the player. This *gameplay experience*, dictated by the rules and game mechanics through which players interact and compete in the game environment, is the most important factor in terms of the potential for engagement in computerised games. If these rules and mechanics can effectively integrate educational content then children who are

engaged with the gameplay experience may also engage with educational concepts in order to be successful in game.

Two fully functional prototype games are developed to examine this issue in trials with children who suffer from serious behavioural or emotional difficulties. These games are designed to integrate the game mechanics with educational content.

Trials are undertaken to test the effectiveness of the prototypes and gather empirical evidence relating to their potential to engage children with severe behavioural emotional or social difficulties with both trivial gameplay and educational content. Their engagement with the activity is observed and compared with teacher's experiences of their engagement in other traditional activities. Their engagement with the educational concepts is determined through analysis of their behaviour. Evidence of engagement with the topics of the game could include the child choosing to initiate dialogue on educational concepts with their teaching assistants. The game itself is also designed to allow for demonstrations of understanding or attempts to understand in-game concepts.

If the rule system of an educational game does not require the player to demonstrate knowledge of the educational content in order for them to win and be successful, then the possibility exists that educational content can be ignored. Sections of gameplay were designed so that players would not be able to succeed without an in-game demonstration of their understanding of the educational content. These sections will test the alternative hypothesis by requiring the player to engage with the educational content in order to be successful. At this stage, they may disengage with the activity entirely.

1.4   Overview of Chapters

Chapter Two examines the issues surrounding behavioural, emotional and social difficulties and the consequences for educators and other professionals involved with this demographic. Cognitive behavioural therapy and the "Social & Emotional Aspects of Learning" (SEAL) framework are identified as two different approaches that attempt to aid and educate children with difficulties. There has been much recent academic interest in the use of computer games to provide

motivation and engagement for serious education. The potential of the medium as a learning tool for this particular demographic is examined.

Chapter three details educational game theory with emphasis on the importance of effective integration of educational content and overall gameplay experience to the potential educational benefit of games. Theories that focus on fantasy and game mechanics are examined. This chapter does not attempt to provide a complete review of the literature involving learning games. It attempts to cover important theories that were central to the development of the prototypes games created for this study and those central to the arguments of this thesis.

Chapter Four covers the design and implementation of the first prototype game for behavioural education. The game concept and design attempt to integrate educational content through gameplay mechanics while confirming to the requirements identified in chapter three. The resulting software represents the initial prototype that was demonstrated to experts in order to examine its educational potential and safety.

Chapter Five covers the second phase of the development of the game. Both game-play and educational methodology undergo fundamental changes. These are discussed and the new design and subsequent implementation are described in detail. The resulting game titled "Hero League Adventures" was used in trials to examine the hypotheses detailed in chapter one.

Chapter Six details the process of ethics clearing and testing the second prototype game, Hero League Adventures. Trials were carried out with children at the mild end of difficulties in the target demographic in a local primary school. Some flaws in the design and implementation were exposed. Improvements and alterations were made to the software before further trials involving children with behaviour at the severe end of the BESD spectrum.

Chapter Seven contains a qualitative analysis of the events observed in evaluations of Hero League Adventures. The results are examined for evidence of engagement with the game as an activity and for engagement with the concepts on which the narrative is based. The significance of the evidence is discussed and the possible effect of bias.

Chapter Eight discusses the qualitative findings from empirical trials with respect to the hypotheses detailed in chapter one. The potential for further work and better trials to provide higher quality evidence is then examined. The potential and drawbacks of the approach taken in this study is then considered with a discussion of the possible ramifications for the wider context of educational game theory.

Chapter 2: Games for Behavioural & Psychological Education

This chapter examines the issues surrounding behavioural, emotional and social difficulties and the consequences for educators and other professionals involved with this demographic. Cognitive behavioural therapy and the "Social & Emotional Aspects of Learning" (SEAL) framework are identified as two different approaches that attempt to aid and educate children with difficulties. There has been much recent academic interest in the use of computer games to provide motivation and engagement for serious education. The potential of the medium as a learning tool for this particular demographic is examined.

2.1   Behavioural Emotional or Social Difficulties

Behavioural problems among schoolchildren are one of the biggest challenges facing UK educational institutions.

> *Over 11,000 pupils with a statement of special educational needs (SEN) are placed in out of authority special schools. These are most often children with severe behavioural, emotional and social difficulties (BESD) and autistic spectrum disorders (ASD). Many of these children have complex SEN that are not currently met by their local schools.* (Audit Commission, 2007)

Children exhibiting difficulties are classified by schools as BESD, which is defined by the Special Educational Needs Code of Practice issued by the Department for Education and Skills as:

> *"A learning difficulty where children and young people demonstrate features of emotional and behavioural difficulties such as: being withdrawn or isolated, disruptive and disturbing; being hyperactive and lacking concentration; having immature social skills; or presenting challenging behaviours arising from other complex special needs. Learning difficulties can arise for children and young people with BESD because their difficulties can affect their ability to cope with school routines and relationships."* (DfES, 2001)

Children of all abilities can be affected. Boys are four times more likely than girls to be classified with BESD and they are more likely to come from socially

deprived areas (DCSF, 2008). BESD includes autism spectrum disorders (ASD), hyperkinetic disorders such as attention deficient hyperactivity disorder (ADHD) and less obvious disorders such as anxiety, school phobia or depression. The difficulties exhibited by this group range from mild to severe. Individuals at the milder end of the spectrum could appear withdrawn and find group work or play difficult because of social interaction problems. Others may underachieve and find it hard to communicate. Those with more severe difficulties often display defiant behaviour, can be physically and verbally aggressive and find it impossible to work collaboratively. Their concentration is poor; they have low self-esteem and find it difficult to form good relationships with teachers or peers (DCSF, 2008).

BESD is an educational term and should be understood in this context. Behavioural difficulties often cause barriers to normal schooling. Conversely, separate learning difficulties can negatively affect behaviour. A disruptive and aggressive individual might be defined as having BESD within an educational context but a medical practitioner may describe the same child as having a clinical conduct disorder (DfEE, 2001). The foundation of severe problematic behaviour can sometimes stem from an underlying mental health issue.

Many factors can negatively affect a child's mental health. The Department for Education and Employment published guidelines for schools to promote mental health in 2001. They suggest that that there is a complex interplay between factors of risk to a child's mental health and those affecting their resilience (DfEE 2001).

Children who have factors in their lives which foster resiliency are more likely to develop coping strategies and deal effectively with issues than children who do not. The guidance lists the following factors as positive regarding resiliency specific to individual children:

- Secure early relationships
- Being female
- Higher intelligence
- Easy temperament when an infant
- Positive attitude, problem-solving approach
- Good communication skills
- Planner, belief in control
- Humour

- Religious faith
- Capacity to reflect

In schools, teachers must strive to meet the complex special needs of pupils with BESD while avoiding disruption and interference to the learning of others. Children whose difficulties are deemed to be interfering with the normal schooling of their peers are often partially excluded from mainstream classes. They then receive help in smaller specialised units where teachers and teaching assistants (TAs) attempt to manage their behaviour in a more controlled environment. Those with persistent or more severe problems can be sent to special schools or full time pupil referral units set up by local education authorities.

The long-term outlook for children who suffer from behavioural difficulties is poor. Studies suggest that those exhibiting behavioural difficulties during childhood are significantly more likely to develop problematic and often criminal behavioural patterns later in life (Robins & Price, 1991; Offord & Bennett, 1994; Babinski, Hartsough & Lambert, 1999).

2.1.1 Multifaceted Support (Psychotherapy, Social Work, SEAL)

Several state institutions exist to help children who exhibit behavioural problems. An individual child might come in to contact with any or all of these depending on their personal circumstances and the severity of their difficulties. Social services are often involved with working with children who have difficulties at home. Children who exhibit serious and prolonged difficulties are sometimes referred to clinicians where they could be diagnosed with clinical conduct disorder and assigned to a professional therapist.

Cognitive Behavioural Therapy (CBT)

Clinical studies have indicated cognitive behavioural therapy (CBT) can be effective in the treatment of behavioural problems. The Coping Cat CBT program has been evaluated in studies with children who were diagnosed on entry with overanxious disorders, separation anxiety disorders and avoidant disorders (Kendall, 1994). The results indicated positive changes in both the parents and the child's self-analysis scores. There were no improvements noted however in either teacher or behavioural observations scores. Another study conducted in 2001 analysed 21 published and 19 unpublished outcome studies involving CBT

treatment of anger-related problems in children (Sukhodolsky, Kassinove & Gorman, 2004). The results suggested that CBT is moderately effective as a treatment for anger-related problems and is broadly comparable to what can be expected of psychotherapy with children in general. A recent ESRC funded evidence report analysed two systematic reviews of CBT interventions and one of social skills training (Joughin, 2006). The conclusions were that child focused CBT could be effective in treating behavioural problems and conduct disorder in pre-adolescent children. While noting that the results of general CBT interventions were "positive, but modest" the authors caution that:

> *"It is likely that no single treatment approach will be sufficient for children with conduct disorder or persistent behaviour problems. The problems may be affected by both family and child factors, and may occur during interactions with parents, teachers or peers. Some children with conduct disorders do not respond to CBT; children with other diagnoses in addition to their conduct disorder, with poor peer relationships, or who come from dysfunctional families appear less likely to respond. It should also be noted that the clinical significance of the changes found in some studies is unclear; many children continue to have conduct problems after treatment."* (Joughin, 2006)

School Based Programs

Schools are now making increasing provision to target BESD through prevention, early identification and intervention. The Social and Emotional Aspects of Learning (SEAL) program is a fundamental part of this approach. SEAL is a part of the primary national strategy and represents an explicit, structured whole-curriculum framework for developing children's social, emotional and behavioural skills. The five key principles of SEAL are self-awareness, empathy, managing feelings, motivation and social skills. SEAL is implemented throughout entire schools on an institutional level. Students learn about the core topics, these are then revisited and expanded upon on each year as they progress and develop through school life.

Although SEAL is taught to every pupil in schools that implement it, extra provision is made for those who suffer from difficulties or require extra help in developing skills. SEAL incorporates a multilayered approach to support. Many

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schools run emotional literacy classes for small groups of children whose teachers feel extra help in this regard would be beneficial. Those with serious problems often receive more focused support. Children who exhibit particularly disruptive behaviour are often partially excluded and taught in specialised units separate from mainstream classes. In severe cases, teachers are forced to focus on managing the behaviour of these students rather than education.

2.1.2 A Challenge of Engagement

Poor social skills, defiant behaviour and trivial attention spans make children suffering from BESD among the most challenging students for teachers to engage with using traditional educational materials (Russell & McGuigan, 2007). Many children find it incredibly difficult to talk about their problems, especially to authority figures. Poor relationships between child and teacher or carer are commonplace. Trivial attention spans can result in teachers struggling to keep these children "on task" during activities. Children who exhibit more disruptive or overtly aggressive behaviour can force teachers to focus on behaviour management rather than education. "Quiet/Calm rooms" are commonplace within pupil referral units and other specialised institutions that deal with children with more severe difficulties. These rooms contain no objects or furniture whatsoever. Children who start to exhibit dangerous or aggressive behaviour will often be supervised, one-on-one, in quiet rooms until their behaviour becomes safe or manageable. In discussion with professionals, an issue that is often mentioned is that the child often views teachers and authority figures as "the bad guy", someone who is only interested in punishing them. This can make it difficult for teachers to develop positive relationships with such students.

2.2 Games as a Tool to Aid Emotional & Social Learning

2.2.1 Games as a Medium for Engagement

Many tools can be used to attempt to engage with children with defiant behaviour. Stories and game playing are widely utilised by teachers. Therapists have long used games and toys as third objects to involve children and lead them into the therapeutic process (Gardner, 1991; Loomis, 1957). Some child therapists have experimented with commercial computer games to engage

children and to provide opportunities and context for the therapeutic process. Some works detailing these efforts will be covered in section 2.3.

Computer games are a familiar and engaging medium for children. A national survey conducted for the entertainment games industry suggests that playing computers games is often the most popular leisure activity for young children. Among 8 to 12 year olds, 99% of boys and 96% of girls surveyed played computer games (UK National Gamer Survey, 2009).

It has been argued that games are intrinsically educational in nature. Challenge is a key component of any game, in order to win one must learn how to play or to improve.

> *"Games are thus the most ancient and time-honoured vehicle for education. They are the original educational technology, the natural one, having received the seal of approval of natural selection. We don't see mother lions lecturing cubs at the chalkboard; we don't see senior lions writing their memoirs for posterity. In light of this, the question, "Can games have educational value?" becomes absurd. It is not games but schools that are the newfangled notion, the untested fad, the violator of tradition. Game-playing is a vital educational function for any creature capable of learning."* (Crawford, 1997)

Educational games aim to harness the fun of entertainment games while integrating educational content. The aim is generally that the player will learn or gain skills through playing. The main rationale behind the development of using games as a medium for learning is usually to provide enhanced motivation by making education more fun and enjoyable.

Initial Trial with Entertainment Games

Learning games could offer a particularly potent tool for children who suffer from BESD where traditional educational materials have failed to engage them. An experiment was conducted at the beginning of the current study to test the effectiveness of commercial computer games in engaging the attention of children with behavioural difficulties (Alshanqiti, Blanchfield & Carr, 2008). Participants all attended a day care centre that caters for children with relatively severe behavioural problems. In line with the general demographic, most

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participants were boys with a small minority of girls. Many were diagnosed with ADHD and their carers stated that they were generally unable to stay on task in any activity without constant supervision. Most of the boys had prior experience in playing commercial games. The girls generally had less. One girl stated she had no gaming experience whatsoever.

Several computer games covering the sport (football), adventure, driving, simulation, platform and mini-game genres were set up for the children to play during a 45-minute session. The control schemes utilised in these games encompassed keyboard, mouse and Xbox 360 control pad. Some of the children became frustrated during the experiment if they were not enjoying or were not successful playing specific games. These children were encouraged to try a different genre of game. Most found a title that they enjoyed and settled into it with remarkable ease. Once engrossed in playing a game, many participants remained focused until the end of the session. One child spent the entire session quietly engrossed in a simple bus driving simulation. The girls with less experience of playing games had more difficulty. One experimented with a 3D platform game and found that she simply did not posses enough mastery of the Xbox control pad to progress past the very first tasks in the game. She then moved to a "point and click" adventure game controlled by mouse where she was able to make progress without being hindered by the control scheme.

The results of the experiment indicated that the *right* computer game does have the power to capture the full attention and imagination of children, even those with BESD, considered notoriously difficult to engage. The game as a medium however is not enough to ensure engagement, it must appeal to the individual and the control scheme must be appropriate.

2.2.2 Games for Emotional and Social Learning

An educational computer game could have the potential to harness this power to engage children who have difficulties with serious education. There could also be useful opportunities to cultivate the relationship between the child and teachers or other professionals. Some aspects of games are well suited to open ended and complex problems such as those involved in the teaching of emotional and social literacy. Computer games and simulations offer a medium unique in terms of the potential for interaction. They can provide a virtual world filled with

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complex characters and activities for children to explore. This world can offer a virtual space in which the child can interact with, and think about, topics that could otherwise be difficult and embarrassing, without fear of judgement from peers and without the stigma that is present in the relationship between teacher/therapist and child. Development of empathy is essential to a child's mental wellbeing and is one of the key principles of SEAL. It requires, however, emotional responses and reflection which instructional education alone would struggle to provide. Education aimed at developing emotional literacy must help pupils consider the issues in an appropriate context. The immersive properties of computer games could be useful in providing this context. Game players immersed in control of an in-game entity can experience a powerful sense of presence in the game world, something that has been described as the "*perceptual illusion of non-mediation*" (Lombard & Ditton, 1997). They feel that they have a real presence in the game world and this presence is an extension of themselves. Role-play can further develop this effect by providing an identity for this in-game presence. The identity can be something magical, fantastic or otherwise different to the way players perceive themselves, further enhancing the feeling that they are a meaningful part of the game world they are exploring. Proponents of an epistemic approach suggest that events the player encounters while exploring game worlds can be experiential rather than instructional in a powerful way (Gee, 2005). In this, there could be the opportunity for a powerful and unique educational experience in itself.

2.3 Previous Work

This section comprises a detailed examination of previous attempts to utilise computerised games to provide educational or therapeutic benefits to young people with varying levels of behavioural difficulties. These works involve the use of both standard commercial games and custom-made titles produced by both academic and commercial sectors.

2.3.1 The Use of Computer Fantasy Games in Child Therapy (Allen, 1984)
Interest in harnessing computer games to engage and motivate young people for therapy and social and behavioural education reaches back to the early 1980's when home computers first became widespread. David Allen published an examination of the benefits of a game titled "Ultima" when used in a therapeutic

context with children in 1984 (Allen, 1984). Ultima was the first in a successful series of fantasy role-playing games. The player first created an in game character from a selection of fantasy roles, warriors, wizards or thieves for example. The player would then take control of this character and move through the game, dealing with various situations along the way. It was in this direct control of an in-game avatar that Allen saw therapeutic potential.

> *"The child actually experiences first hand in the therapy session encounters and events with which he is required to cope with as part of the play. His responses reveal his coping strategies. It also offers the therapist a chance to intervene therapeutically, immediately, and also to relate it to other areas of the child's life. The child can repeatedly play until he masters it, under the close supervision, support and guidance of his therapist"* (Allen, 1984)

Ultima was designed for entertainment purposes with no consideration of therapeutic application. Allen stumbled upon it by chance and became interested in the possible therapeutic benefits it might offer. As a mainstream title, it contained aspects of game-play that have often drawn considerable bad press for being negative and potentially harmful for young children, such as violence and theft. Allen mentions these as a potential drawback. Computer games in the early 1980's were, in terms of realism, almost incomparable from the games of today. Allen argued the high resolution graphics in Ultima were an asset aiding immersion, the game was run on the Apple II computer which had a maximum resolution of 280x192 pixels and was capable of displaying only 6 colours.

Allen used Ultima over a 9-month period in therapy sessions and documented several perceived benefits of the games use. He argued that the structure of the game itself has therapeutic implications, encouraging impulsive children to plan ahead, be more cautious and timid children to be more adventurous. He also claimed that there were practical benefits offered to the therapist in observing a client engaged in game playing of this kind. For example, while observing one of his clients, Allen identified a maladaptive defence mechanism in that client's behaviour patterns and was able to intervene and discuss this immediately within a useful context.

Allen's work was conducted using a game designed for entertainment. Despite this, he was extremely positive about the potential of computerised games for use in therapy. Access to such games in the home or office was extremely new at the time, however, and the novelty surrounding them may have been a factor in their perceived benefits over non-computerised alternatives.

2.3.2 A Computer-Assisted Therapeutic Game for Adolescents: Initial Development and Comments (Clark & Schoech, 1984)

In this publication, Betty Clarke and Dick Schoech describe the development of a custom-made computer game for behavioural psychotherapy. The game, entitled "Adventure of Lost Loch" was a text based adventure game designed specifically for adolescents in therapy and represented a significant attempt to scientifically test the hypothesis that computer games can deliver therapeutic benefits. To this end, Clarke & Schoech set out the target population, the specific problems they hoped to treat and the therapeutic techniques they hoped to deliver. They reasoned that adolescents have a tendency to resent therapy and therapists, noting that they are often forced to attend treatment. Computer games were just beginning to spread from arcades to the home and Clarke & Schoech wanted to utilise the widespread popularity of electronic games with adolescents to enhance motivation in therapy. Low impulse control was specifically targeted when designing the system. This issue is exhibited in many adolescents with various behavioural disorders. Clarke & Schoech recognised the need for a solid therapeutic base for the game and were careful to take this from "existing treatment modalities" so as to avoid the treatment itself becoming something new and untested. They argue in favour of cognitive behavioural techniques embedded in fantasy-based play therapy. The aim was to implement two techniques used by cognitive therapists in-game: to encourage the player to consider alternative methods of solving problems and to teach self-statements designed to help the player cope with errors and mistakes.

The game itself, unlike Ultima, was entirely text based and played via a teletype printing terminal due to the unavailability of a CRT monitor at the station where testing was carried out. The story was based on a fantasy quest to lead a band of adventurers through a dangerous cave in search of the stolen crown of the King. The player was required to navigate through 10 different rooms in the cave. In each room, a scenario was provided presenting the player with three to

four possible decisions regarding how they could proceed. A score was given to the player based on the impulse level of the decision they selected, points were added or subtracted based on the level of "impulsiveness" implied by their choices. When the player lost all their points, the game was over. Good decisions were rewarded and poor decisions presented additional problems. Cognitive therapy techniques were incorporated via a coaching system, which took the shape of a character called "Mentor". The Mentor character provided therapeutic feedback as the player made decisions based on the following principals:

- Planning is important
- Think before you act
- Consider alternatives carefully
- Keep your goals in mind
- Remember to consider the consequences

The game was tested by four children aged 11-17 all deemed to have presenting problems associated with low impulse control. These included fighting, stealing and playing truant from school. The results were described as positive. The clients involved seemed eager to play the game and attendance of the therapy sessions increased from an average of 66% to over 90% with only a single session being missed. The therapist involved with the test found that talking with children about the decision making process within the game easily led to talking about real problem behaviours in a therapeutic context without leading to resistance to the therapy.

The positive feedback gained from these sessions led Clarke & Schoech to be optimistic regarding the potential of computerised games as therapeutic tools. This is evident when reading the final words of the paper:

> "This chapter began by stating that computers evolved from automating existing processes and procedures to automating processes and procedures that were impossible before computers. Our computer game typifies this evolution and points to the potential of developing many new types of therapies that were not possible before the computer. Presently, computer technology far outpaces its use in therapy. As computers are increasingly used in therapeutic processes, traditional therapeutic underpinnings will be replaced by concepts we have yet to discover."
> (Clarke & Schoech, 1984)

The trials involving Adventures of Lost Loch certainly indicated some exciting potential for custom made therapeutic games. The results suggested an increase in the engagement of the participants with the therapeutic process through use of the game. Therapists used this engagement along with the context provided by in-game events to discuss important issues.

The game itself was extremely simplistic however and contained a limited amount of content. The extent to which the mere presence of a computerised game, rare and exotic technology at the time, might have affected the trials is certainly an issue. It is questionable whether Adventure of Lost Loch would have inspired such interest in adolescents were the world saturated with electronic games as it is today.

2.3.3 The Story of Dave & Dave's Dilemmas (Neary, 1988)

"The Story of Dave" was a three-part commercial adventure story/game released for the Spectrum 48k home computer in 1984 by M&L software, a two-man company comprising Martin Hodge and Viv Neary. It possessed full colour graphics, animation and sound. In this, it was technologically ahead of the academically designed software of Clark and Schoech. The Story of Dave follows an adolescent skinhead as he begins to get in trouble at school and then the law. M&L software released a follow up title, Dave's Dilemmas in 1987.The Story of Dave could arguably be classified as a game. There were game characteristics present; the system quizzed the user on events in the game and on knowledge of the justice system. It kept a point based score of correct answers. There was also interactivity although this was minimal. Dave's Dilemmas however removed these characteristics entirely and was better categorised as an electronic story where the player guessed, with no outcome, what decisions the main character would make.

The psychological background for the titles stems from Neary's career as a social worker specialising in work with adolescents. His employers, Norfolk Council, were working towards developing community-based alternatives to detention centres such as Borstal[1]. It was from his work in this area that the idea for The Story of Dave developed. In the June 1988 edition of Community Care, Neary

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[1] Personal communication with Viv Neary, April 2008

describes his motivations for choosing the computer as a medium for social work. The problem, he reasoned, is that while social workers are generally very good at language, in many cases the recipient is not so comfortable with words.

"For most of my social work career I have been working with children and young people, variously angry, insecure, sad, damaged, delinquent and alienated. It often seems words by themselves have been an ineffective tool. I have seen barriers going up in the eyes of youngsters who have been dressed down , told off and out reasoned by a succession of adults, parents, teachers, social workers, probation officers and policemen, all of whom were better at words than the youngsters." (Neary, 1988)

He first came across the idea that a computer program could have some potential as an aid to communication in perhaps an unexpected place, his local department store. While shopping he noticed a group of youngsters "messing around" with several microcomputers, which had been placed on display for customers to try. Neary believed had they been messing around with typewriters or hi-fi equipment they would have been removed from the store. At the time, this new medium seemed to somehow, *"belong to them"*.

"It seemed to me that The medium not only created interest, it demanded active participation; it seemed to belong to young people rather than adults – they were often familiar and comfortable with it; it seemed almost infinitely flexible; the equipment was quite cheap" (Neary, 1988)

After contacting several treatment centres known to use computers and finding nothing relevant, Neary contacted Martin Hodge, a friend who had studied computing and mathematics at university and developed an interest in programming. Hodge was keen to develop software with a serious application rather than the usual entertainment titles. The divide between the two fields of expertise that each brought to the project initially caused some difficulty regarding communication. Neary admitted he knew very little about computers and Hodge knew little of social work applications. Neary likened the difficulties they encountered to *"an Eskimo and an Arab trying to find a common language and frame of reference"* (Neary, 1988). On completion however, Neary specifically marked out this collaboration between two different areas of expertise as one of the reasons for the project's success. He also advised those

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who might attempt similar projects to beware the temptation to venture beyond their own skills and specialisations.

The software itself was similar to an electronic comic strip. The story of the main character, Dave, was told using scrolling text and short animations. During the story, there are several junctures where Dave must make a decision on a particular course of action to take in response to a difficult situation. The player had no control over this but was asked to guess which option Dave would choose. In the Story of Dave, the characters choices get him into increasing amounts of trouble with the law, the consequences of such were then examined. This involved a graphical representation of the amount of time and money he can spend on enjoyable things decreasing because of his actions and the corresponding punishments he receives. Dave's Dilemmas was more general and the characters decisions, while often ill advised, were not overtly wrong, bad or criminal, though they often had very negative effects. Dave's relationships with family members and friends were graphically represented and after each decision, these were examined. If Dave lied to his parents, for example, then this might have a negative effect on their relationship if he was found out. The player was asked to think about and guess whether a decision will affect Dave's relationships in a positive or negative way. The graphical representation of these relationships was then updated with an explanation of the reasons for the changes and the feelings of the characters involved.

The programs were marketed at intermediate treatment centres and aimed towards social workers and others involved with direct work with older children and adolescents. They were designed as tools to aid these workers rather than the children directly. As such, the software was packaged with a guidebook with advice on how to use it effectively as a tool for opening up communication with the children. The following quote is from personal correspondence with the author behind the educational content.

> *"Therapeutic, or change work with troubled young people is an art rather than a science and we always emphasised that our programs were not intended to be a stand-alone E-learning tool. The facility to pause the program for discussion and reflection was always written in and I'm sure*

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that the better the social work or groupwork skills of the staff, the better the results." (See footnote[2])

The Story of Dave and Dave's Dilemmas were published for the spectrum home computer. The former used game characteristics such as a point scoring system to engage users. Dave's Dilemmas relied on game-like graphics and well-written narrative. They both represented a useful tool for social workers to communicate with young people and discuss difficult topics. Neither could claim to be structured games and are better described as computer-based narratives utilising game technology and graphics.

2.3.4 OPTEXT Adventure System - Software Development in Practice - A Case History (Cowan, 1995)

The OPTEXT system was developed in the mid 1980's when the creator, Les Cowan, was working through a "preparation pack" for young clients involved in adoption breakdowns during his time as a social worker. This pack included a number of exercises detailing scenarios involving fictional characters placed into problem situations commonly faced by children involved in adoption breakdown. The child was then asked to consider a selection of choices the character could make in response to each situation. The pack contained a corresponding set of outcomes and repercussions related to each choice, which could then be discussed with the child. His work as a social worker required direct contact with children. Cowan was acutely aware of the difficulties faced by such professionals when attempting to open up effective communication with clients, stating:

> *"When it comes to counselling about past events and future changes, the subject matter can be both too hypothetical and highly abstract to capture the attention or interest of children and adolescents. How then can the worker engage a client who may lack many of the skills basic to such a discussion?"* (Cowan, 1995)

Cowan had an interest in personal computers and had purchased a home microcomputer which he learned to program in his spare time. He reasoned that a computerised version of these scenarios would be relatively easy to achieve and would have benefits for the client over the paper-based system. The OPTEXT

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[2] Personal Correspondence with Viv Neary, April 2008

adventure system was then developed for exactly this purpose. It allowed children to explore a computerised version of the situations and consequences from the preparation packs in a text based adventure game format. OPTEXT was eventually expanded to function as an authoring tool to allow non-technical workers to create customised adventures to explore any set of situations and consequences that was required. The system would read structured content from files that could be written by non-programmers. This enabled the system to explore many different situations tailored to an individual client's situation. Cowan stressed the need for the scenarios and choices to be specific and relevant personally to the client in order to be effective. Exploration within the system was encouraged with users able to select an option purely to explore the consequences then go back to the previous stage and try again. Selections of positive choices were accompanied by a sound, higher in pitch than the sound played by choices deemed negative.

The system comprised a control scheme that allowed input from the child by either keyboard or joystick, but was never intended for individual use. The author was keen to stress that benefit cannot be derived from the system itself without careful thought and consideration of the circumstances portrayed: "*It is readily acknowledged that pushing the 'right' button is a great deal easier than sustaining the 'right' perspective in the face of pressures from peers, parents and past experiences*". OPTEXT was designed as a tool for both child and worker to examine problems together while aiding communication by focusing on the central character of the adventure, thus avoiding the feeling of the child being lectured at.

In 1994, continuing from his development of OPTEXT, Les Cowan founded the company Information Plus which would produce "social learning software". His first title was a computerised multimedia adaptation of a popular book used in practice with children named "Bruce's Multimedia Story". In 1999, he updated the original premise behind OPTEXT into a full multimedia adventure called Billy Brakes the Rules. Information Plus, at the time of writing, offers more than 30 social learning titles.

The OPTEXT system was a faithful, computerised, representation of a paper based activity used in social work with children. The exploration of hypothetical

but relevant situations and subsequent discussion of the issues with a trained social worker could be an extremely beneficial activity for children with difficulties. The computerised version of this activity utilised a text-based adventure game format. Cowan hoped to make it more interesting for children by offering instant feedback, sound and joystick input. Beyond these novelties, however, there is no reason to believe the computerised activity was inherently more engaging than the paper-based alternative. The full multimedia title released 13 years later added voice acting, full colour graphics and animation. No further game-like characteristics were included however. Billy Breaks the Rules is easier to define as a multimedia educational title rather than a game.

2.3.5 Electronic Technology and Rehabilitation: A Computerised Simulation Game for Youthful Offenders (Resnick, 1986)

Hy Resnick, then a professor at the University of Washington's School for Social Work, published initial design details of his computer game in 1986. The game, entitled BUSTED, was designed to reduce antisocial behaviour in young offenders through development of consequence awareness. The game was targeted directly at young people in corrective institutions or care homes. The design was based around a computerised board game with a layout similar to a Monopoly board. Players moved around the board by rolling (computerised) dice. Placed around the board were situation squares, upon landing on such the player was given a random situation and a number of possible actions they could take in response. A consequence related to the selected action was generated randomly from a pool related to each choice. Points were generally subtracted in addition to some kind of trouble for the scenario character on receipt of a poor choice. For example:

> *"Your friends drive by in a new car and invite you to hop in for a ride. You know they have stolen the car and riding in it could get you into trouble.*

You:

    1. Tell them to buzz off
    2. Get into the car and drive off with them
    3. Tell them to turn the car in before they get caught

Example consequences to choice 2:

*The police stop the car for speeding and all the players are busted. Lose
ten points and wear the dunce cap. Or: Your parents hear about it and get
angry. They ground you for a week. Lose 5 points."* (Resnick, 1986)

There was also an action square, which examined pro-social behaviour rather
than difficult social situations. Points were handled in this case by an adult
supervisor to allow for flexibility of response.

BUSTED was designed to be played in groups of up to six adolescents while
overseen by a human services worker. Players were encouraged to read
situations aloud and discussions about the issues involved were encouraged
between group members. Though the game was only a prototype at the time of
the publication, a preliminary evaluation was completed in two high schools with
positive feedback from teachers and pupils. BUSTED remained unfinished for a
further 15 years when it was eventually passed on to and finished by Les Cowan,
author of the OPTEXT adventure system described previously. Resnick met
Cowan at the first HUSITA (Human service information technology applications)
conference that was held in Birmingham 1987 where he was demonstrating his
OPTEXT software[3]). The conference, incidentally, was co-organised by Professor
Dick Schoech from the school of Social Work Arlington, Texas, and author of
Adventure of Lost Loch. Resnick was not a computer programmer and required
funds to finish BUSTED. Cowan had begun producing software for his company
Information Plus. Resnick was no closer to finishing BUSTED and so agreed to
hand over development to Cowan, provided source code was exchanged on
completion to create a version of the game localised for a US audience. BUSTED
is on sale in UK through Information Plus at the time of writing, the American
version has not yet been completed, however.

Busted was designed as a computer based board game. Given the social aspects
of play, it is certainly debatable whether a non-computerised version might have
been superior. There seems to be no major advantage offered by the use of a
computer as a medium for this game other than the perceived popularity of
computerised games in the target demographic. The rule system, which allowed
positive outcomes for negative choices and negative outcomes for positive

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[3] From personal correspondence with Les Cowan, March 2008

choices, also proved controversial. This was a deliberate feature which intended to mirror the real world where making a good choice does not guarantee a positive outcome. It could be argued however, that a learning game that allows players to make negative choices, like stealing, and still receive positive outcomes could set a bad example. In this case, is the lesson that there is always a chance of getting away clean if they attempt to do something wrong?

2.3.6 Can the Mario Brothers Help? Nintendo Games as an Adjunct in Psychotherapy in Children (Gardner, 1991)

James Gardner published his findings regarding the use of commercial games consoles in play therapy in 1991. He set out the purpose of formal games and play in psychotherapy as to heighten interest in sessions and promote fantasy expression and ventilation of feeling. At the time, the first home gaming consoles, computers built for the express purpose of running electronic games, were becoming popular. Gardner examines the potential of computerised games over traditional card and board games:

> *"Not only do the games provide excellent behavioural observation opportunities for the therapist, they also provide innumerable chances for the therapist to model selected appropriate game-playing behaviours while reinforcing [the] same on the part of the child."* (Gardner, 1991)

The paper outlines several case studies where the Nintendo Entertainment System was used as a regular part of therapy sessions with different children. Mario, a platform game, was used as a mechanism for teaching self-control to a child with impulse control and aggressive behaviour problems. The child's tendency to rush impulsively through the game led to his failing to progress. This in turn led to angry outbursts. The therapist modelled controlled behaviour and consequential thinking while playing through the game. As progress was made, the therapist would describe how these approaches were beneficial both in general and to become better at playing the game. By the tenth session, the behaviour of the child was *"markedly improved in all areas"*.

Zelda, an adventure game, and Jeopardy, a computerised quiz game, were used in the therapy of a girl with anxiety problems and fear of school. The quiz game allowed the therapist to encourage the child to attempt to answer questions on her own, something she was initially fearful of doing. Zelda allowed the child to

explore a virtual world. The client's timidity and anxiety while playing Zelda prompted many conversations with the therapist regarding how fear can often keep people from important endeavours. This client similarly exhibited a *"vast improvement"* on completion of therapy.

The games were used only as a part of the child's therapy, an adjunct to a programme, which would typically include activities such as storytelling, restructuring of contingencies, drawing, and playing with figures or dolls. Gardener notes however, that for the children in the case studies, the computer games were, perhaps, the most useful factors in the child's therapy. He makes it clear however, that games were used as tools in therapy and convey no benefits inherently:

> *"It is not suggested that the use of these computer games was anything more than an adjunct to the psychological improvement of the four emotionally disturbed children previously described. However, in these and many other cases, such games have proved to be a very important therapeutic tool."* (Gardner, 1991)

Gardner's work using commercial games in child therapy expanded on the earlier work of Allen described in section 2.3.1 by using game consoles and different game genres for different therapeutic tasks. This demonstrated that different types of games provided different challenges and these could be utilised for different purposes in play therapy.

2.3.7 Experiences Using a PC in Play Therapy with Children (Kokish, 1994)

At the time of publication, Ron Kokish was a therapist working with victims of physical and sexual abuse. He became interested in using computer games in therapy when he read about Adventures of Lost Loch and the work of Allen with Ultima some ten years after their publication. Kokish admits to being fascinated by the possibilities of such games in therapy, particularly the clinician designed Adventures of Lost Loch. He contacted the authors to enquire if he could get access to the game only to be informed that it remained incomplete, no further work was planned, had not been translated to DOS so would not work on a PC and even the incomplete version was unavailable. He then spent three months attempting to acquire copies of the commercially available but then much very out of date, Ultima, as was used by Allen.

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The experiences of Kokish in using Ultima as a tool in therapy were comparable to those of Gardener and Allen before. Timid children would struggle to progress in the game without taking risks and impulsive children would find their character perishing if they played rashly and without forethought. This allowed the therapist to engage in dialogue regarding these behaviours and coach alternative methodologies. It also enabled a setting with which to set goals and practice these skills.

Kokish once again reinforced the position of the computer as that of a tool alone, stating, "*It must be remembered that a computer is no more inherently therapeutic than a crayon or paper bat*" (Kokish, 1994). He also noted that learning to use computer games, as an effective tool for therapy was a harder and longer process than was anticipated. Overall Kokish was highly positive, going so far as to say that the potential of computer games in therapy seemed "limitless". He describes specific advances he would personally anticipate as the release of graphical role-playing games similar to Ultima but less violent in nature with the facility to negotiate, and to the availability of clinician designed titles like Adventure of Lost Loch but tailored to specific therapeutic goals.

The experiences of Kokish are telling with regard to the lack of progress made in this area between the first publications in 1984 and his own publication ten years later.

A Decade in Abeyance

There is a distinct lack of publications detailing efforts to develop new computerised games or to examine the use of commercial games for therapeutic or behavioural education for between the mid 90s and 2005. The mid 90's saw the advent of multimedia, which coincided with a fall in the interest in games as a medium for education in general. There has been a recent resurgence games as a serious medium, which grew from the continuing advancements seen in the entertainment industry and some popular academic theories. These will be examined in detail in chapter three.

2.3.8 Adventure in Zip Land (Zipland Interactive, 2005)
In 2006 Zipland Interactive, a company based in Tel Aviv Israel and headed by child therapist Chaya Harash released a research based psychological computer

game designed to help children deal with emotional distress stemming from a parental divorce. The game, named Earthquake in Zipland, was designed to implement Strategic Paradoxical and Solution Focused principles in therapy. The game features a full multimedia interface with animated characters, sounds and voice acting. The story revolved around a moose living in a land divided into two halves via a zip. No specific mention of divorce itself was made during the game, which instead focussed on metaphors, initially an earthquake separating the two continents with each parent on one side. The player then embarks on a quest to reunite the continents and the two separated parents. As the story unfolds, it becomes apparent that this is an unrealistic and unachievable goal. The following is taken directly from the Zipland Interactive website.

> "We've created a safe transitional space where the child coping with divorce can explore his or her situation and feelings. The situations represented in the game include: guilt about the divorce, blame and responsibility for the loss of the old family structure, being torn between two households, exploring the fantasy of bringing the parents back together again and other psychological effects of divorce on children...
>
> During the Forest episode, the hero finds himself walking along a path. When he reaches a crossroad, he has to decide whether to go right or left, while each parent tries to pull him to their side through a very humorous and witty dialogue. This symbolic situation in the game represents how often children of divorce may find themselves in a powerful conflict of loyalty between mother and father in issues such as: whom do they want to live with, whom should they live with, what is right? Where, in fact, is home? Who needs them more, who will stay with them and take care of them? Though the subject of divorce is painful, the humoristic and witty dialogue dissolves much of the stress experienced by the child and enables him to approach the above questions." (Source http://www.ziplandinteractive.com/about-us/ April 2008)

The interface of Adventure in Zipland was derived from point and click adventure games. The player uses the mouse to move around the screen, pick up and use key items in order to progress through different game screens. For example, on

the first game screen the player must combine a rope and a crab together to escape from a raft on which they are stranded.

There are two different versions of Adventure in Zipland. The mainstream title is available to parents to use at home with their children. It is intended that both parent and child play through the game together and make use of the issues addressed in the game to discuss personal situations relating to the family. There is additionally a therapist-focused version of the game designed for use in professional sessions. This version is identical to the mainstream title but allows the therapist to select individual portions of the game to address relevant situations and emotional issues. The therapist can then use the game as a targeted tool for addressing specific situations rather than having to play through the entire game.

Adventure in Zipland is a commercial title; there is a lack of empirical evidence regarding its efficacy in helping emotionally distraught children. It has been at least moderately successful in the commercial market, as it remains available at the time of writing.

Adventure in Zipland is a structured game, it follows the formula laid out in many successful commercial games and utilises similar game mechanics to provide challenge. The educational content however is not related to the gameplay in any way. This comes instead from the narrative. The player must manipulate items and solve puzzles to progress through the game. In each new area there are cut scenes, which introduce issues related to divorce, these provide context for parents and therapists to discuss these issue with children. This approach uses a real gameplay experience to provide motivation and engagement of the player. It does so however in a way separate from the educational concepts regarding divorce. The narrative may help engage children with these issues and therefore aid in useful dialogue between child and adult. The gameplay aspects of the activity however will not as they are separate from the educational content.

2.3.9 Personal Investigator, Computer Mediated Adolescent Psychotherapy using an Interactive 3D Game (Matthews, Coyle et al., 2005)
A team of academics at the Computer Science Department, Trinity College Dublin developed a computer game in 2005 entitled Personal Investigator (PI).

PI attempts to implement what is described as "Computer Mediated Adolescent Psychotherapy". The computer plays the role of intermediary between the therapist and client. The model itself has roots in narrative psychotherapy, encouraging the client to re-tell their personal stories to give insight into their life and conflicts.

The game follows the framework laid out in solution-focused therapy (SFT), a form of psychotherapy that is goal oriented and focuses on solutions rather than causes. The player assumes the role of a trainee 'solution detective' at a training academy. The objective of the game is to graduate and become a master detective by searching for and discovering solutions to personal problems. The player receives a detective notebook, which appears at the bottom of the screen, and is used throughout the game to record goals, thoughts and notes. There are five other master detective characters in the game with which the player can interact. These offer advice and provide stories from other adolescents about how they managed to overcome problems in their lives. For example, in one area, the player meets a policeman who attempts to educate the player on the need for support and invites them to watch a video testimony from one of his former pupils. This pupil describes how they overcame a personal problem by talking to a family member. In order to progress through the game the player must identify their own strengths and resources and note them in the detective notebook. When this is complete, they receive a key and can move on to the next area. The authors propose the following benefits of the system over conventional face-to-face therapy sessions:

> *"The game provides the therapist an opportunity to observe the adolescent and analyse their answers. Adolescents have less difficulty giving answers because questions are not posed directly by the therapist but by the computer and also because they can type their answers instead of speaking them. Some of the answers given by the adolescent can stimulate further discussion. The therapist can elaborate on the subjects brought up by the game or answer more specific questions from the adolescent in relation to their situation. Throughout the game the therapist is a partner in the exploration of the game world and is no longer an interlocutor."* (Matthews, Coyle et al, 2005)

Personal Investigator was used in a pilot scheme involving four patients and three therapists. All three therapists rated the software highly as a tool for opening up lines of communication with adolescents and for keeping them focused on therapeutic task for an extended period. The authors argue that the less direct and less confrontational communication between therapist and adolescent helped reduce client stress and aided in the development of the therapeutic relationship. The four adolescents involved in the trial rated the game as very helpful in assisting them to think about and solve personal problems. The video testimonies of other adolescents were marked out as particularly memorable.

Personal Investigator is described by the authors as a game. It contains, however, very few game-like characteristics besides the interface. The result of trials indicated that it was a worthwhile computer based activity when used in therapy sessions. It is questionable however, considering the lack of gameplay elements, whether the software held any motivational benefits over non-game based activities.

2.3.10 Can Serious Games Engage the Disengaged? (Brown, Shopland et al., 2007)

A team at Nottingham Trent University were commissioned by the National Learning and Skills Council to create a serious game to address the development needs of 14 to 19 year old students at risk of social exclusion. These young people are described as having low self-esteem, poor levels of confidence, aggressive tendencies, and lacking basic and employment related skills.

The resulting game, titled Quest, was a first person role-playing adventure game. The narrative tasked players with escaping from an island doomed by an imminent volcanic eruption. They could achieve this only by *"undertaking personal development tasks (self esteem, managing aggression, responding appropriately to stress) where each successfully completed task earned a vital crew member to aid their survival"* (Brown, Shopland et al., 2007). After the player successfully escapes to "Fish Island", the focus shifts and they are tasked with training for sustainable employment in the islands fish factory.

The educational content of Quest was made up of seven, forty-five minute learning objects. These were themed on the following concepts:

[37]

- Improving self esteem
- Managing aggression
- Your response to problems and stress
- Self development and your support network
- What an employer looks for in an employee
- Your first days at work
- Your rights and responsibilities

These learning objects (LOs) followed a common structure that comprised four key stages:

"1. START: where learners were introduced to the LO selection interface and control configuration.

2. INTRODUCTION: where learners were introduced to the educational content of the LO via either simulated activities, cut scenes, character narrative, and text/audio equivalents (always present)

3. PRACTICE: where learners demonstrated their understanding of the educational content they have encountered either acting as a mediator, by carrying out environmental tasks, holding an appropriate conversation or by achieving a goal.

4. REFLECTION: Where learners can receive feedback on their performance within each learning object and reflect upon what they have learnt. This was achieved via cut scenes, suitable rewards, character narrative feedback and level progress." (Brown, Shopland et al., 2007)

The game itself was portable, consisting of shockwave 3D movies and flash animations that could be embedded in HTML. The authors explicitly stated their intention was to provide graphics and sound in a form consistent with current console gaming platforms.

Quest was trialled across six different venues with 26 students in the target demographic. Quest's potential for engagement and learning effectiveness was evaluated in these trials. In terms of learning effectiveness, most students who volunteered to complete pre and post test questions showed an increased knowledge of the educational content. The small scale and duration of the trials as well as the difficulties inherent in pre & post testing reduce the impact of

these results however: *"The confidence in the significance of these results (although encouraging) is therefore low"* (Brown, Shopland et al., 2007).

The most interesting outcome from the evaluations of Quest was the encouraging levels of engagement demonstrated by the 17 participants who were reported as suffering from "concentration or engagement difficulties". In some cases participants engaged with the game for considerable durations despite tutor predictions that they would not take part at all due to serious behaviour problems. The authors stress however that tutor expectations might not be an objective baseline:

> *"Some discussion during the field trials suggested that using tutors'* *expectations of student engagement as a baseline measure might not be* *the most robust or objective measure to take. These measures were* *undoubtedly based on the experience of many dedicated professionals,* *but it was felt that sometimes tutors' expectations could affect student* *performance."* (Brown, Shopland et al., 2007)

The authors do not discuss game design methodologies in detail. Because specific detail is sparse, it is impossible to analyse the effect the gameplay experience of Quest had on enhancing motivation and engagement.

2.3.11 A Serious Game to Support Psychotherapeutic Treatment of Children (Brezinka, 2008)

Treasure Hunt is a computer game, which attempts to utilise CBT techniques as a support tool for psychotherapists. It was developed by a partnership between the Department of Child and Adolescent Psychiatry and Computer Aided Architectural Design at the University and ETH in Zurich, Switzerland. The game was specifically designed for eight to twelve year olds who are actively receiving cognitive behavioural treatment for various disorders. It is not intended to substitute therapist interaction, rather to offer opportunities to rehearse basic psycho-educational parts of treatment and to provide electronic homework assignments for patients.

Treasure Hunt takes place aboard an old ship, captained by an experienced sailor, Captain Jones, whom needs the players help to decipher a mystery held within a treasure map. The Captain Jones character exists to guide the child

through the game, that he requires the child's help in solving the mystery attempts to incorporate the premise that children should be experts in the scenario themselves. Game play revolves around solving a variety of puzzles. When the puzzles on a level are solved, a starfish is collected that is placed onto the treasure map allowing the relevant section to be revealed. There are six levels in the game and each is designed to represent a certain step in cognitive behavioural treatment. It aims to support therapy by offering attractive electronic homework and allowing the child to practice basic education and skill training. Cognitive behavioural concepts are introduced playfully using metaphors intended to be helpful to children.

Limited evaluation of the game was undertaken with children in therapy sessions. This was undertaken with the client using the software inside therapy sessions, as use of the unfinished product unsupervised by the therapist was deemed unsuitable. The authors report positive early impressions:

> "Originally, Treasure Hunt was developed to offer attractive homework assignments in between therapy sessions. However, the pilot showed that therapists like to use the game as reinforcement during therapy sessions – 'if you work well, we will play Treasure Hunt for the last ten minutes'. Moreover, the game seems to help young or less experienced therapists to structure therapy sessions and to explain important cognitive-behavioral concepts like the influence of thoughts on our feelings or the distinction between helpful and unhelpful thoughts."(Brezinka, 2007)

The majority of authors of computer games for therapeutic purposes have been careful to point out that they are intended to be adjunct or complimentary to the therapeutic process and not a substitute. The authors of Treasure Hunt make particularly strong statements in this regard:

> "Last but not least, unrealistic expectations with regard to a psychotherapeutic game should be discussed and cleared up. In September 2006, we presented the prototype of another game that has never been carried out but was described in the media; we keep receiving demands of parents where they can buy the game, often paired with long descriptions of the psychological problems of their child"- "A word of caution should also be issued. A psychotherapeutic computer game will

never be able to cure or ameliorate childhood disorders on its own. Moreover, Treasure Hunt is not designed as a self-help instrument. Only a behaviour therapist can make optimal use of the game during treatment, as the underlying concepts are self explanatory merely in a superficial way."(Brezinka, 2007)

The authors describe Treasure Hunt as *"the first psychotherapeutic computer game based on principles of behavior modification"*. The game itself however is fairly simplistic and follows the trend now established of a substantial lack of game characteristics. It is instead made up of several different educational activities in the style of multimedia learning software. The first "game level" simply requires the user to repeatedly spell out the words "thoughts feelings and emotions" by un-jumbling the letters. This activity introduces the words and could provide an opportunity for therapists to engage with the user on their meaning, it is difficult to imagine any real benefit or motivation in the activity itself. As such, the overall usefulness of this kind of software lies in the way it is utilised by individual therapists. The statements made by therapists involved in the pilot suggest this usefulness is likewise limited as they preferred to use the game as a reward for less trivial work" *if you work well, we will play Treasure Hunt for the last ten minutes"*.

2.3.12 Summary

People have attempted to use computerised games as therapeutic third objects, for observation and communication in play therapy and in social work for as long for as the microcomputer has been available to mainstream society. At the time of writing, no game has made a significant impact in real practice outside academic circles in this subject area.

One trend that has emerged from personal correspondence with authors involved with some of the projects detailed is that of the computer aversion of some human service workers. Les Cowan pointed out that educational software is widespread in general education and schools. Teachers are well prepared and, indeed required to use software whereas, in his experience, human service workers are hesitant to try electronic aids[4].

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[4] From personal correspondence with Les Cowan, March 2008

Many of the detailed projects showed promise in trials, but were then shelved and remain incomplete. The experience of Ron Kokish, who enquired about a project that showed exciting results and promise for the future only to find it abandoned and unavailable, is somewhat telling. Some projects have also attempted to use very simple mechanisms to teach very complicated ideas. It is certainly questionable whether simplistic software such as Adventure of Lost Loch, which appeared to aid motivation in therapy, could be effective in actually improving impulse control as was intended by the authors.

Although many academic works have been evaluated in small-scale trials, which generally indicate positive results, there is a lack of substantial empirical evidence indicating efficacy. Computer game based activities could certainly be considered a novelty by children when used briefly in place of traditional activities; this "novelty factor" could have introduced bias to results. Early works were particularly sensitive to this, electronic computer games at the time being new, exciting and exotic pieces of technology. This is a particularly important issue for any who hope draw inspiration from earlier works for application today. Games are no longer a novelty for today's children. Electronic games are everywhere and accessible to all society. The environment is, in many ways, opposite to the one in which early works were conducted. Children today are unlikely to be wowed by the presence of a computer. They are far more likely to be completely underwhelmed if serious games exhibit poor production qualities. It is extremely difficult for low budget, academically produced games to compete aesthetically with multi-million pound budget entertainment games to which today's children have easy access.

One of the most important themes emerging from this literature review is the almost exclusive focus on educational concepts with little or no emphasis on gameplay or game design. Education is, after all, the primary reason for the existence of these pieces of software. Game aspects are, at best, secondary. If user motivation is not a critical issue then an educational game does not necessarily need to provide fun gameplay in order to be successful as an educational activity. The level to which users are willing to engage with educational games is likely to be affected as much by their individual motivation to learn, undertake tasks given by authority figures and their possible alternative activities as by the motivational powers of the software. An educational game,

[42]

which aims to motivate players to play outside school during leisure time, must surely aim to provide an entertainment experience that can compete with other leisure activities. One designed for use in classroom settings has only other classroom activities for competition.

Another issue that is particularly relevant when considering the target demographic is that of ensuring games-based software really teaches the material that it covers. Many entertainment games encourage players to test their rule systems as a method of learning effective strategies with which to play. This type of behaviour can be seen by giving an experienced game player control of a new game without instructing them on how to play. Often, the first technique they will employ is to attempt to learn how the game works by playing and experimenting. They will immediately experiment by pressing the buttons to see what happens. They will also experiment with strategies that they have used in other games. It is possible, in many games, for players to learn the underlying systems by experimenting in this way. In educational software, this could lead to players developing effective strategies by pattern matching while ignoring the educational content the designers intended to be the primary focus of attention. None of the papers detailed discuss strategies for ensuring the educational content is learned in order for the player to be successful in-game.

These issues are extremely important considering the needs of the target demographic. Children who, in dialogue with professionals, have been described as almost un-engagable, children who need constant supervision to stay on task in any activity. It is extremely likely that a serious game with only trivial game-like characteristics will fail to motivate these children sufficiently to facilitate learning. This study will attempt to apply state of the art theory on educational game design to this problem. These theories will be examined in detail in chapter 3.

2.4   Conclusion

This section has detailed the theoretical foundations for a custom made educational game to aid emotional, social and behavioural education for children exhibiting difficulties in these regards.

Games could offer a useful medium because of the difficulties involved with engaging this particular demographic. Good games can offer an extremely engaging activity. A literature review of similar projects however has exposed a general lack of focus on game design concepts and discussion on how to utilise the medium of games effectively for this kind of education.

This study will examine these issues and attempt to utilise state of the art theory on educational game design, to harness the full motivational powers of computerised games, and direct this motivation towards important educational concepts.

Chapter 3 - Educational Game Theory

This chapter details educational game theory with emphasis on the importance of integration, fantasy, game mechanics and overall game-play experience to the potential educational benefit of games.

This chapter does not attempt to provide a complete review of the literature involving learning games. It will attempt to cover important theories that were central to the development of the prototype games created for this study and those central to the arguments of this thesis.

3.1 Games and Play

3.1.1 Structured Games

There has been much discussion on the meaning of games and play (eg. Huizinga, 1944; Caillois, 1961). It is useful to discuss the position of modern video games as the manner in which they provide enjoyment and engagement is critically important. It has been suggested that the distinction between "play" (from the Latin paidia) and "game" (Latin word ludus) holds particular significance for computerised games and simulations (Frasca, 2003). Playfulness can occur in any activity undertaken by playful beings. Parents who have witnessed very young children, on Christmas morning, ignoring their new toys and games instead playing gleefully with the wrapping paper and cardboard boxes will testify to the power of mundane objects to provoke play. Games (ludus) represent a more structured activity with specific rules and win or lose states. Entertainment video games, almost universally, follow this formula, they rely on rules and the potential for the player to win or lose. This is an important aspect of their power to motivate - gamers game to win, and they are motivated to avoid the "lose states." This has been detailed elsewhere. (Carr & Blanchfield, in print 2011).

Structured games make for naturally engaging activities. They can be successful in this despite being simplistic. An activity to explore probability in which a child rolls a dice fifty times and notes the results is, by most standards, a mundane activity. This activity can be turned into a game by providing rules and a win or lose state. The child could be challenged to see if they can roll five sixes

consecutively within a maximum of fifty tries, if they succeed they win. Another important aspect of games is competition. Add another player, the rules become the first one to get five consecutive sixes is the winner and the other player is the loser. The activity has now become much more game-like. In fact, many extremely successful games use exactly this formula. Cross-and-Circle games like "Ludo" rely entirely on these trivial mechanics and competition to achieve a win state. The player's fortunes in game are dictated by random chance via dice throws. A turn can have good outcomes (advancement of pieces, landing on an opponent's piece) or bad (piece returned to the start).

Children who enjoy competitive games are likely to engage and become more involved with the game version of the dice activity despite both involving essentially the same process.

3.1.2 Simulation or Game

Computer simulations are computerised recreations of real world systems. If the recreation is accurate, they can be powerful educational tools (Aldrich, 2005). Flight simulators can teach novice pilots important skills without the danger involved in real flights and landings. On the surface, many simulations appear almost identical to games. Technologically they work in much the same way, they often utilise real time rendering of 3D worlds. There are important differences however, simulations have rules but these rules mimic the rules of the simulated system, they are not necessarily game-like rules. Simulations do not need to have win or lose states. Most important are the different aims each has at their core. Games aim to provide fun and engagement, simulations are *"more challenging experiences which rigorously develop skills and capabilities"* (Aldrich, 2009). Educational games attempt to bridge the gap between the two.

There is a motivation for educational products to describe themselves as games. Games are perceived as fun, education, generally, is not. As such, there are a plethora of products, both academic and commercial, which describe themselves as games despite a complete lack of game-like rules and win/loss states. Children, who are increasingly familiar with entertainment games, expect and demand these features from the medium. The "Brain Training" games found on Nintendo gaming systems are an example that has achieved widespread commercial success. These products are generally classified as games largely

because they utilise a game-console platform. They consist of various educational activities with the inclusion of instant feedback and systems of rating the player's performance. They lack game characteristics however and do not provide a gaming experience comparable to those provided in entertainment games. This does not necessarily imply that they do not offer an engaging or enjoyable experience however.

In the last decade, there has been considerable academic interest in using games as a medium to teach a huge range of subjects. Many focus entirely on education but utilise a game-like interface to present materials to children in a, supposedly, more palatable way. These titles may appear game-like, but they often contain no game characteristics whatsoever. One recent study attempted to create a game based educational environment to teach literacy skills to primary school students (Moore & Price, 2009). The software described was developed using a 3D engine from an entertainment first person shooter (FPS) game. The control scheme utilised a game-pad. The player moved around in a 3D environment. It could appear on the surface to be very game-like to someone with no experience playing modern computer games. As an activity however, there were no game elements whatsoever. Players moved around a virtual school and completed electronic recreations of traditional paper-based literacy exercises. This software was described as a game and demonstrated in a conference on game based learning. This is just one example of many small-scale academic works who admit their use of games was inspired by a desire to communicate with Prensky's "Digital Natives" (Prensky, 2001).

The use of the word game to describe educational titles without any game elements can be problematic. It is extremely likely to affect children's initial expectations from the system. Aldrich has argued recently that the lack of a common term to describe systems that attempt to teach in this way has held the industry back. A model has been suggested that views simulations, games for education and virtual worlds as points along a continuum and describes all as highly immersive virtual environments (HIVEs) (Aldrich, 2009).

> *"The HIVE model asserts that virtual worlds, games, and simulations are all different; each has its own affordances and purposes."*

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"a game is not an educational simulation. Playing SimCity will not make someone a better mayor. Some players of, for instance, World of Warcraft may learn deep, transferable, even measurable leadership skills but not all players will. The game does not provide a structure for ensuring learning. Just because some players learn these skills playing the game, that does not mean either that most players are also learning these skills or that it should be adopted in a leadership development program. Conversely, a purely educational simulation may not be very much fun. The program may have the three-dimensional graphics and motion capture animations of a computer game, but the content may be frustrating. Specific competencies must be invoked, and students' assumptions about what the content should be, likely shaped by their experiences with games, will be challenged." (Aldrich, 2009)

The focus of the current study is to utilise the engaging and motivating aspects of games to promote learning in children with severe BESD. As such, this thesis is exclusively concerned with software that attempts to utilise the tools of structured games (their rule systems, mechanics and motivation to reach a win state) to enhance motivation for serious education.

3.2   Educational games - Entertainment vs. Learning

Educators have long attempted to use technology for education. It did not take long for academics to question whether the motivational power seen in popular entertainment games could be utilised in educational contexts. Important research was conducted into the use of games for educational purposes even in the late 70's before digital games had begun the widespread shift from arcades to home use (eg. Malone, 1981).

3.2.1 Integration of Game and Educational content

Early educational games attempted to harness the engaging power that the medium appeared to offer by using gameplay as motivation for the completion of learning exercises. Titles like Math Blaster did not attempt to integrate gameplay and learning, instead offered a fun activity (game) as a reward for completing a boring one (learning). This approach, often referred to as "edutainment", was largely unsuccessful (see eg. Kerawalla & Crook, 2005;

Prensky 2001). Some suggested that this kind of approach blended the worst aspects of both education and games (Papert, 1998). While the aim was to provide both fun and educational benefit it was argued such titles succeeded in neither because of a methodology which treats fun like a sugar coating for an educational core, something which *"makes about as much sense as chocolate dipped broccoli"* (Bruckman, 1999).

Pioneering academic work on the motivating factors of games was published in 1987 by Malone and Lepper. They set out three key characteristics of games - challenge, curiosity and control that would, along with fantasy, competition and cooperation, make up their "Taxonomy of Intrinsic Motivations for Learning" (Malone & Lepper, 1987). This work criticised the approach taken in "edutainment" products for providing extrinsic motivation for learning. Much of the recent work on educational games has followed the principle of *"intrinsic integration in alliance with Malone and Leper. That is, integration of the game idea with the content to be learned"* (Kafai, 2001). This "intrinsic integration", focuses on the role of fantasy to integrate game and educational content.

Interest in the development of custom-made "serious games" has been resurgent in recent years despite the poor reputation left by the earlier generation of "edutainment". This has been fuelled by the ongoing explosion in the popularity of commercial games, as well as a series of popular texts theorising the potential benefits of learning games (see eg. Prensky, 2001; Gee, 2003; Aldrich, 2004; Shaffer, 2006).

> *"Although most attempts at "edutainment" to date have essentially failed from both the education and entertainment perspective, we can – and will, I predict – do much better." (Prensky, 2001)*

The issue of effective integration of game and education remains, however. Integration purely through the fantasy theme of the game often seems ineffective. Although educational game developers no longer set out to follow the "drill and practice" routine seen in early edutainment, poor integration of game activity and education can often ensure similar results.

Jacob Habgood recently conducted research on the validity of the theories of "intrinsic integration" of game and educational content as originally put forward

by Malone and Lepper. His findings indicate that the fantasy based perspective of integration results only in trivial association between game and education. He instead identifies *"gameplay mechanisms or game mechanics"* as more critical to effective integration than fantasy" (Habgood, 2007).

3.2.2 Gameplay Mechanisms - Game Mechanics

This thesis argues that gameplay is the most important aspect concerning motivation in computerised games. Marc Prensky, one of the most widely referenced writers on educational games states:

> *"Great games are about Gameplay.*
>
> *Gameplay is all the doing, thinking and decision making that makes a game either fun, or not. In a puzzle game, the Gameplay is the physical and mental activities in the puzzles. In a shooter, it's the player's and the opponents' speed and abilities. In a strategy game it's the available options and tactics. Gameplay includes the game's rules, the various player choices, and how easy, gradual or hard the road to success is."*
>
> *"How does Gameplay create motivation? By keeping the player engaged at every moment."* (Prensky, 2002)

The gameplay experience is dictated by a composite of simple mechanisms or "game mechanics". Game mechanics is a term used by game designers and has been defined as the "*mechanism through which players make meaningful choices and arrive at a meaningful play experience*" (Salen & Zimmerman, 2004). In his work on effective integration of educational content and digital games, Habgood argued that game mechanics are more important than the fantasy or theme of the game.

> *"The fantasy context of chess may be a good analogy for feudal society, but this is not the player's focus while playing the game. You could swap the feudal playing pieces for the latest Disney characters without changing the way that the game is played. Therefore the fantasy provides only a superficial way of integrating learning content within a game, when compared to the game's underlying rule systems or game mechanics."*
> (Habgood, 2007)

At the heart of this argument is the essence of structured games, players strive to win, not to lose. As such, there is intrinsic motivation for the player to concentrate on the mechanisms that they must master in order to win. Anyone who has played the popular "Guitar Hero" (Harmonix & Activision) games will testify that it is almost impossible to pay any attention whatsoever to the visuals in the background while playing. Players are effectively forced to direct all of their attention towards the note track in order to play successfully.

This has important consequences for "learning games". If gaining increased knowledge of the educational content in a learning game does not have a positive effect on the players ability to win then it is possible for them to ignore the educational content entirely. They are likely to focus on the task that they are motivated to achieve - to be successful in game and reach a win state. In the case of un-motivated learners, this is particularly likely. In order for a game to be an efficient medium for leaning, gaining an increased understanding of the educational materials must become an essential part of the rule systems that dictate the outcomes. Additionally, if games are to successfully direct the player's motivation to win towards serious educational content then the mechanics by which the player plays, and wins, must be integrated effectively with this content.

James Gee has written extensively on entertainment computer games as examples of effective teaching systems (Gee, 2003; 2005). Rise of Nations is a real time strategy game. Players who are experienced in other strategy games will find gameplay familiar and easy to pick up. To a novice however it could seem almost overwhelmingly complicated. Gee has written about his experiences of learning to play Rise of Nations and being aided by extremely effective learning systems implemented by games designers to help novice players get up to speed (Gee, 2003b). While it is certainly important to examine how commercial entertainment games teach novice players how to play effectively, it is perhaps more important, when considering their potential for serious education, to examine *what* they teach.

Two recent studies have examined the potential educational benefits of playing historically themed entertainment strategy games. The studies were based on the commercially successful title Civilization 3 (Squire, 2004) and Europa

Universalis II (Egenfeldt-Nielsen, 2005). Both games were designed for entertainment rather than education but were based upon accurate historical information. These studies reported some potential in the games as educational tools but also, significantly, difficulties regarding students developing a non-trivial understanding of history.

> *"Civilization III was effective for introducing students to related geographic and historical concepts but not as good at facilitating deep conceptual understandings of them. Evidence of this pattern abounded; throughout the units and in post-interviews, researchers would ask students what particular concepts meant (e.g., monarchy); most students were able to do little more than describe its basic features"* (Squire, 2004)

The problem is that, in any game format, players are motivated to develop strategies that will enable them to win. This highlights the separation that exists in these games between the gameplay experience and the fantasy theme. Civilisation 3 requires the player to become the leader of a historical tribe and guide their progress using trade, technology, diplomacy and combat. One might expect that in playing a game so entrenched in history that it would be difficult to avoid learning some useful historical information. Civilization 3 is a game in the strategy genre and as such, it shares many aspects of gameplay with other titles. To be successful the player must manipulate a series of gameplay systems made up of trivial mechanics. These mechanisms control the gameplay experience. They control *how* players can utilise diplomacy, accumulate resources, research and trade technologies, develop and deploy troops for strategic combat with enemies. The problems inherent in attempting to utilise the fantasy setting of games to impart information are apparent when considering that the gameplay, goals and core challenge of the game would be largely unchanged if the player controlled and interacted with civilisations of robots or aliens. The context and the feel of the game would certainly change, but the gameplay experience of playing a strategy game would not. The player would still win or lose based on the same strategies and through interaction with the same game mechanics. Civilisation 3 certainly contains a considerable amount of content that is valuable in historical education. The gameplay does force players to interact with this content on a trivial level, but as the strategies by which they are successful do not rely on *knowledge of history* the important

information is too easily overlooked. Theme and fantasy remain useful tools in enhancing motivation however. A good game based on history or law may inspire players to engage and learn more about these subjects. The critical factor is the significant difference between what *could be learned* from the activity of playing an educational or entertainment title and what the game *encourages or requires to be learned* in order for the player to be successful.

3.2.3 Motivational Tools of Gameplay

Game designers put a lot of effort into designing gameplay systems that will motivate players to continue to play and learn game systems through playing. "Levelling up" a character is a common feature of games which include a role-playing element. It has been argued that such systems are important regarding the educational potential of complex games.

> *"The most important feature of these, and the one most often cited by players, is getting better through "leveling-up." Leveling-up literally means getting to the end of one level and starting another. Emotionally, though, it means feeling yourself getting better at the game. In the words of one young gamer: "I love getting level-ups – knowing I'm getting better. I started at level one and now I'm on 40. Now I can do more things. I can keep going and it's really fun." Players of all ages and sexes invariably give similar answers – they love the feeling of "getting better" at something, of achieving mastery over something difficult and complex – something they couldn't do at all when they started. Very often a player who has just taken one character to a very high level in a complex game will start another from scratch – just to show him or herself how much faster they can do it – i.e. how much they have learned.*
>
> *This should not surprise us. It is the same feeling we get from getting better at our sports, our hobbies, and (if we are lucky) our jobs."*
> (Prensky, 2005)

Levelling mechanics are an important aspect of role-play games. They provide motivation and allow players to control the development of their characters. The best examples also actively encourage players to learn the mechanics of the game. The next section will examine perhaps the most effective example of this type of system.

This section will examine how game designers use mechanics such as levelling to provide motivation and build complexity using an example which is one of the most complex, and arguably the most engaging (if not addictive) games ever created. World of Warcraft (Blizzard) is the most popular massively multiplayer online role-play game ever created. Over ten million people worldwide were paying for a subscription early in 2008 (Alexander, 2008). It has a reputation in the gaming community for keeping players hooked for inordinate amounts of time. The author has experience playing World of Warcraft at the highest level and has personally logged in excess of 2000 hours in-game.

On the surface, World of Warcraft appears to be a level based game. It is not. Players start out at Level 1 and gradually work their way through to the level-cap (the maximum achievable level). The player collects experience points (XP) by completing quests and dispatching monsters. When they reach the target number of XP, they level-up and start the process again. On each level-up the player's character becomes stronger, sometimes gaining entirely new abilities. As the player progresses they need substantially more XP to get to the next level so must complete harder quests and kill harder enemies. Success in this is simply not possible using the abilities and talents with which they started the game. In order to progress, the player is *required* to customise their character's talent tree and learn to use new abilities and strategies. By the time the player reaches the level-cap, the system of talents and abilities is huge and incredibly complex. It is so complicated that even a veteran RPG gamer would have no clue how to play effectively if given a level-capped character to control from the start. They would be lost in a confusing sea of information and, most likely, simply give up. The levelling system is a method of providing step-by step motivation for the player to continue making progress by granting periodic rewards early on in the game. Much more important, it is an incredibly effective way of ensuring the player learns an extremely complicated system around which the end game revolves. Players are exposed to the system gradually and in manageable chunks, their knowledge of it is continually refined in different contexts. Attaining the top level in World of Warcraft takes longer than it takes to exhaust the entire content of almost any standard complex game. Only when players reach the level-cap, however, and the focus switches from levelling to

content, does the majority of the game become accessible. Veteran players spend, literally, thousands of hours playing and working in-game to improve their characters long after they have reached the level-cap and stopped gaining levels.

Games are Effective Teachers of Gameplay

Levelling can teach players, very effectively, complicated systems on which games are based. Could it then be used to teach other real world systems? The issue is that the system that is learned through the levelling mechanic in World of Warcraft is still specifically, and inextricably, concerned with trivial aspects of gameplay and game mechanics. The levelling mechanic requires the player to experiment with, and learn about, the systems that make up the game in order to graduate to the top level. These systems however *are* the composite of game mechanics, that is: the behaviour of the AI, the combat system, the talent trees, the spells, weapons and abilities. These are the systems the player *experiences through gameplay*. They learn how different talents affect the equations in combat, which abilities are useful in which situations, how the AI behaves, which abilities *offer a good defence against physical or magical damage etc. They do* not necessarily learn about the political and military struggle between Horde and Alliance, which is the fantasy setting of the game. The quests contain a huge amount of content and narrative on this subject for those who are interested; reading through it however is entirely optional. In the experience of the author from interaction with hundreds of long-term players, the vast majority skip the narrative entirely and concentrate on gameplay; this is after all, the essence of the game.

3.2.4 Epistemic Games

Motivation is not the only aspect of computerised games that inspire educators to attempt to utilise them for education. It has been suggested that computerised games offer other potential benefits. Prominent academics including Gee and Shaffer have argued that games can provide education in a different way to traditional instructional education by allowing players to learn by assuming identities and performing actions in virtual worlds.

Epistemic games follow a model that allows players to experience learning from within the epistemological practices of real world roles. It is argued that in the

adoption of these roles, players can experience the ideologies associated with them first hand. They learn how these professionals think, behave and solve problems.

> *"Computer and video games can let students learn using the techniques of communities of innovation—ways of learning that stress immersion in a practice, supported by structures that lead to expertise, professional-like skills, and innovative thinking. Epistemic games are thus one way to solve the innovation crisis."* (Shaffer & Gee 2005)

Gee has suggested that, using this model, some commercial games are effectively state of the art instructional systems. In a number of papers, Gee uses "Full Spectrum Warrior" (Institute for Creative Technologies & Pandemic Studios) as an example of the potential games have for learning in this way.

> *Full Spectrum Warrior is based on a U.S. Army training simulation, though the commercial game only retains about 15% of the Army's simulation. Full spectrum Warrior teaches the player (yes, it is a teacher) how to be a professional soldier. It demands that the player thinks, values, and acts like a soldier to "win" the game. The player cannot simply bring conventional game playing skills, such as those needed to succeed at Castlevania, Super Mario, or Sonic Adventure 2 Battle, to this game. The player needs not only these skills, but others as well. In Full Spectrum Warrior, the player must acquire the professional skills of a soldier commanding two teams of a dismounted light infantry squad.* (Gee, 2005b)

Gee and other proponents of an epistemic approach to learning games use this example to theorise how similar games could be used to teach doctors and lawyers.

> *"Thus we can imagine a range of epistemic games in which players learn biology by working as a surgeon, history by writing as a journalist, mathematics by designing buildings as an architect or engineer, geography by fighting as a soldier, French by opening a restaurant. Or, more precisely, by inhabiting virtual worlds based on the way surgeons,*

journalists, architects, soldiers, and restaurateurs develop their epistemic frames." (Shaffer, Squire et al., 2005)

There is no suggestion how a similar game experience would be achieved in these very different roles however. Herein lays the difficulty in using Full Spectrum Warrior as an example of the potential educational use of such games. It might be true that it is an example of a real game, which does require players to take on board military information, which is then applicable in real life. The issue is the fact that, at its core, Full Spectrum Warrior is a real time strategy game, part of an established and popular genre of commercial entertainment game. It is a specialised example, and Gee points out that the player cannot be successful using only the skills commonplace to the genre. The fact remains however that there is an established entertainment genre, which lies beneath the specialisation. The game was even criticised in the gaming press for lacking many features common to the strategy games.

> *"The thing is, Full Spectrum Warrior isn't a fully featured strategy game, either, and it relies on a fairly simple, surprisingly abstract gameplay model that has trouble sustaining a rather short campaign (which can be played alone or cooperatively online). Indeed, the game often ends up feeling like a string of puzzles whose solutions are pretty obvious."* (Kasavin, 2004)

The combat-based strategy genre of entertainment game is obviously a good fit for a game where military tactics must be learned. Developing tactics and strategies that are effective in the rule system of the game is the main challenge of the strategy genre. Despite this there was some controversy surrounding the version of the game the Army received. Lt. Col. Jim Riley, chief of tactics at the Army's infantry school at Fort Benning, said his school rarely used the game because it didn't offer a realistic simulation of urban combat. *"It's a neat game, but I'm not seeing where I can train with it."* (Adair, 2005)

Full Spectrum Warrior is an entertainment title based around an established and enjoyable gameplay experience. As such, it is easy to see why it has been picked out as an example. It is much harder to imagine a game where the player would assume the role of an engineer and learn mathematics through the gameplay experience itself however. There are no established genres within the

entertainment industry that are an immediate and evident fit for these subjects. Without the all-important gameplay experience, the system becomes a simulation rather than a game and the argument changes significantly. The question is then not so much about motivation, rather it becomes whether or not *epistemic simulations* can teach differently, more efficiently, cheaper or better than the alternatives.

This issue is also problematic. Full Spectrum Warrior can teach military tactics in the same way that the football game franchise "Fifa" (EA Sports) can teach the rules and strategies of football. There is value in a simulation to teach military strategies as this removes the potentially catastrophic consequences of failure. It is more questionable whether or not this approach is valuable in any way for a potential footballer. Similarly, it is questionable whether a simulation to teach math to mathematicians, geography to geographers or history to historians is worthwhile.

Shaffer has worked on the development of an epistemic game, Madison 2200, where students take the role of urban planners. The system is indeed more akin to a simulation than a game as it contains no real game-like characteristics. This is something of which he is aware:

> "*Perhaps this epistemic game doesn't seem very game-like—not as game-like, say, as SimCity or Full Spectrum Warrior. The students in Madison 2200 did enjoy their work. But more importantly, the experience let them inhabit an imaginary world in which they were urban planners.*" (Shafer, 2005)

The intention was to provide a fun learning experience based on play in the paidia sense rather than the structured ludus approach more commonly seen in entertainment games. "*This was play. Most serious play. Epistemic play. And as a result, it was fun, too.*"

3.2.5 Transfer

Learning games, especially epistemic examples as described above, are susceptible to problems involving transfer. The issue of knowledge transfer is relevant to all forms of education. Non-abstract skills learned in the classroom must transfer to real world practice to be of any use to the learner. This issue

has been discussed for over a hundred years (eg. Thorndike & Woodworth, 1901; Dewey, 1910)

It is apparent that modern entertainment games often require a significant skill set if players are to complete the harder challenges. Good games actively teach the player to develop these skills very effectively. The effectiveness of games in serious learning contexts however is contingent on the knowledge the player develops in the simulated world transferring, and being useful in real world practices.

Once again, the separation of the game theme and the skills required by the game mechanics is a critical factor when considering this issue. Which aspects of games have the potential to be useful in real world settings? There are a large number of successful entertainment games themed on a wide variety of different sports. The skills required to play them however are often completely separate from their real life equivalents. Olympic themed games such as Beijing 2008 (Sega) stand as obvious examples. Much of the gameplay revolves around the player pressing alternating buttons as fast as possible. The faster the buttons are pressed, the better the result in-game.

It is apparent that game players do learn some things from games. It is critical that the limits of what can be learned from such games, and whether such learning results in knowledge or skills that are useful in real world practice, is understood.

3.3   Conclusion

The literature involving the use of computer games for serious education paints a confusing picture. Much has been written regarding the potential of computerised games for educational purposes. Prominent academics go so far as to argue (in strong terms) that these games will revolutionise education. Papers with titles including words like "*future of learning*" (Shaffer, Squire et al., 2005) or "*REAL 21st century learning revolution*" (Prensky, 2002) have been commonplace. Such theories have inspired academics and educators around the world to become interested in the use of educational games. This "revolution" in the educational world has, as of yet, failed to materialise despite the increasing interest in serious games. Many of the theories on the potential of games use

entertainment titles as examples, but it is difficult to imagine such systems working in educational contexts. Clark Aldrich has written extensively on simulations and games. He succinctly describes the theoretical status of games for formal education:

> "As far as the theory goes, it sounds good. And almost all who hear this new theory nod and think, "This makes a lot of sense. This could be big." But there are **no** examples of it working the way it is described. At best there are precursors that are "sort of" similar. Or a wild success in a different industry is help up as a model.

> For example, "Schools and classes are so bad that computer games, popular entertainment with deep, inherent learning, will provide a much better model for formal education." Theorists would defend this claim by focusing on examples of bad classes and on the success of the computer game market.

> Maybe instead of ideas in the "theory" stage, we could call them wide-ranging hypotheses, organised pre-proof, established by reason. That would be WHOPPER for short." (Aldrich, 2005)

His latest book however, contains stinging attacks on the educational institutions of today *"It doesn't matter whether the class is on history or math or project management. What students learn in any classroom is how to be a student in a classroom"* (Aldrich, 2009b).

There is also a worrying lack of real evidence regarding the efficacy of computerised games in learning. There is no substantial evidence from systematic, controlled experimentation to back up much of the literature and conjecture surrounding the theorised potential of learning games.

> "Looking at the research into educational use of computer games, one is struck by the quite optimistic tones from most studies; however, one should be cautious. Indeed many of the studies have severe flaws related to researcher bias, short exposure time, no control group and lack of integration with previous research. Overall, this undermines the strength of each study – the incremental learning process within the research field is as of yet still weak." (Egenfeldt-Nielsen, 2007)

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A recent meta analysis found that trainees using simulations and games exhibited better learning of knowledge and skills than those who did not, but also noted that *"the results provide strong evidence of publication bias in simulation games research"*(Sitzmann & Ely, 2010). Large scale, rigorous studies are still required in order for more high quality and reliable evidence to be gained regarding the efficacy of learning games.

Much of the recent academic work on the creation of game based platforms for learning report success and high levels of motivation despite an almost exclusive focus on education rather than gameplay. It is important to note that titles which focus entirely on education, as well as those with trivial integration of game characteristics and educational activity, could still be useful educational activities given a user base made up of motivated learners. The presence of graphics, game like qualities and instant feedback could make for an activity that may be more interesting than paper based alternatives. This approach usually fails to make the core learning experience any more interesting however and this could be problematic if user motivation becomes an issue. While a game-like interface may indeed be appealing to children, it is likely to be insufficient if the learning activities within are identical to traditional alternatives that are considered boring and tedious. In this case, mini-games and other game play mechanisms that are implemented separately can become little more than a distraction. Children can rush through, or skip entirely, learning activities deemed to be boring in order to focus on the more entertaining mini-games.

It is possible that the settings in which educational games are generally trialled and the nature of the learners who play them are critical factors regarding positive results. That young people who will willingly engage with tedious paper based exercise in classroom settings, will also engage with educational games regardless of a complete lack or poor implementation of game characteristics, is not surprising.

It would be interesting to research this idea by conducting an experiment with an educational game deliberately designed to contain no game characteristics. This would contain a simple computerised representation of traditional paper based exercises but would be packed in a rich 3D world and controlled use a game controller. Trials would be conducted in an average classroom setting with

participants made up of motivated learners. These trials could then compare this to a standard computer based e-learning exercise and a second game based system that implements game characteristics in a trivial way (trivial story, point scores & missions). The students may find the 3D interfaces more pleasing and enjoyable to work with, but motivated learners will engage with educational activities in classrooms when their teachers instruct them to. Would there be any real difference in either engagement or learning between the three versions?

3.3.1 Requirements for a Learning Game for the Un-engagable

The experiment detailed in chapter two indicates that the "edutainment" approach of complete separation of gameplay and education is highly likely to result in frustration and disengagement of children with severe BESD. Trivial integration of learning content and game theme is also likely to be ineffective. This thesis argues that the most important aspect of computerised games is the gameplay. This dictates the essence of the experience of play and more importantly, the strategies and actions required to win. Gameplay is made up of many trivial mechanics that together shape the experience of play. There are established formulas in entertainment video games. Commercial game makers follow these almost exclusively. Very rarely will a genuinely original game idea arrive on the market. This is because something new is also something untested, there is no real guarantee anyone will actually find a new idea fun or exciting whereas there is an established market for racing or fighting games. When you break down these genres to their component parts and game mechanics, they are all remarkably similar. What separates good games from bad games is subtle and hard to quantify. This section draws inspiration from educational game theory to explore the requirements a prototype should meet in order to maximise potential for engagement with children who suffer from severe BESD.

Offer Educational Gameplay

In order to utilise the engaging and motivating essence of games as seen in entertainment titles, educational games must attempt to offer a similar experience. This is particularly challenging. The component parts of gameplay that together make for the engaging activities that are entertainment games usually involve the manipulation of trivial systems. These usually require strategic thinking, quick reactions or hand-eye coordination to master. In these systems there is very little that could realistically be utilised for any kind of

conventional instructional education. Despite the difficulties, the educational game must strive to utilise gameplay and game mechanics that both offer a play experience similar to entertainment games and the opportunity for genuine education.

Follow Game Convention

Popular entertainment games are categorised in a surprisingly small number of established genres. These are full of conventions, themes and gameplay that is common across different titles of the same genre. An experienced player of first-person shooters would expect that most of their core skills would transfer between games made by different publishers and on different games systems. The same is true for other genres such as racing games. Because of this, there is a level of deliberate standardisation in the control schemes utilised by games designers. Players become familiar with the play styles and control schemes common to a genre and a non-standard layout may act as a barrier to uptake in experienced gamers. Convention in games is extremely important in the entertainment games industry. Games and television pundit Charlie Brooker attempts to describe his frustration at the difficulties involved with sharing his enjoyment of computer games with non-gamers:

> *"Veteran players have years of experience. We're schooled in the way games work. It's as if we have learned a new man-made language, like Esperanto. And games are the equivalent of Esperanto-language movies – except they're better than movies. They're engrossing and exciting, playful and challenging, constantly evolving, constantly surprising. They're interactive and, thanks to the rise of modern multiplayer, infinitely more social than mere television. But because they're in Esperanto, it's hard for non-speakers to appreciate them."* (Brooker, 2009)

Educational game developers will increasingly find their audience is comprised of *experienced gamers.* As described in chapter two, the vast majority of today's children, especially the male demographic, play games regularly, for many children it is their primary choice of leisure activity over watching television and using the internet. To ensure that the educational game is familiar to gamers and to maximise the chances of providing a fun experience to individual gamers it must follow game conventions and an established style of play.

Follow a Non-specialised Control Scheme

Most commercial entertainment games require the player to master complicated control schemes. The players increasing speed and proficiency in this are often the key to their success. This aspect of games is undesirable in an educational title aimed at children. While children who are experienced using game controllers such as the Xbox pad are likely to be proficient enough to succeed and even gain motivation from such a system, it would act as a barrier preventing less experienced players from being successful unless they develop skills that are not beneficial in terms of the educational goals of the game. To ensure the educational game is as accessible as possible it must minimise focus on specific game mechanics that require mastery of specific control schemes or hand-eye coordination.

Play to Win - Learn to Win

Game players are motivated to achieve a win state and avoid a lose state. This is the paramount focus in any structured game. The rules and systems that dictate these win/lose states are always going to be foremost in the mind of engaged players. In order to utilise the motivation that structured games provide for educational ends the educational goals must align with the gameplay goals. There must not be any way around this as entertainment titles often actively encourage players to test the boundaries of the rule systems of their games to discover shortcuts and effective strategies. If the player discovers a way of being successful in-game without focusing on the educational content then it is likely that is exactly what they will do. The educational game must ensure the player absolutely cannot win unless they learn and demonstrate they are learning the educational content.

Chapter 4 - Initial Game Design

This chapter covers the design and implementation of a prototype game for behavioural education. The game concept and design attempt to integrate educational content through gameplay mechanics while conforming to the requirements identified in chapter 3. The resulting software represents the initial prototype that was demonstrated to experts to examine its educational potential and safety.

4.1 Theoretical Background

4.1.1 Cognitive Behavioural Treatment

Cognitive Behavioural Therapy (CBT) is a form of psychotherapeutic talk-therapy. The therapist attempts to help the patient identify and solve problems relating to dysfunctional thinking patterns, emotions and behaviours through a goal-oriented, systematic procedure. CBT combines both cognitive and behavioural principals into a single psychotherapeutic discipline. Cognitive therapies focus on cognitions and the negative effects that maladaptive or unhealthy thoughts can have on behaviour and emotional wellbeing. Behavioural therapy deals with skills training aimed at changing problem behaviour. Clinical child psychologists have defined two central treatment goals of child focused CBT as helping children to augment their coping repertoire via new skill acquisition, refinement of existing skills and the development of new or modified ways of experiencing and understanding the world (Southam-Gerow, 2003). This process revolves around enabling children to practice new ways of thinking about themselves, their thoughts and emotions and of new ways of acting. The therapist should provide feedback aimed at shaping new or improved coping behaviours. The following strategies have been identified as particularly relevant to child focused CBT with antisocial youth (Southam-Gerow, 2003):

- Relaxation training
- Social problem solving
- Cognitive restructuring
- Attribution retraining
- Contingent reinforcement

Attribution retraining involves exploration of the assumptions the client might make in their mind. The validity of faulty attributions are examined and broken

down with focus on valid, more positive alternatives. Contingent reinforcement has been described as a cornerstone of behavioural therapy (Southam-Gerow & Kendall, 2000). It is described as the attempts by the therapist to shape the child's behaviour to be more adaptive, with the eventual goal being to teach the child to evaluate their own behaviour. Cognitive restructuring is another central technique in cognitive therapy.

> "The process of examining ones thinking with an effort to change faulty cognitive functioning and replace it with more adaptive thinking is sometimes called cognitive restructuring. The first step involves helping children to identify their self-talk. To do so, children may be asked to think of thoughts running through their heads as 'thought bubbles,' similar to those seen in comic strips. Once the content of their self talk has been identified the therapist helps the children assess the veracity and helpfulness of the cognitions. If the thoughts are judged inaccurate or unhelpful, the therapist coaches alternatives" (Southam-Gerow, 2003)

Clinical studies indicate CBT can be effective in the treatment of behavioural problems. The Coping Cat CBT program for children has been evaluated in studies with children who were diagnosed on entry with overanxious disorders, separation anxiety disorders and avoidant disorders. The results indicated positive changes in both the parents and the child's self analysis scores, there were no improvements noted however in either teacher or behavioural observations scores (Kendall, 1994). A recent study conducted in 2001 analysed 21 published and 19 unpublished outcome studies involving CBT treatment of anger-related problems in children (Sukhodolsky, Kassinove & Gorman, 2004). The results of this suggested that CBT is moderately effective as a treatment for anger-related problems and is broadly comparable to what can be expected of psychotherapy with children in general. A recent ESRC funded evidence report analysed two systematic reviews of CBT interventions and one of social skills training (Joughin, 2006). The conclusions were that child focused CBT could be effective in treating behavioural problems and conduct disorder in pre-adolescent children. While noting that the results of general CBT interventions were "positive, but modest" the authors caution that:

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"It is likely that no single treatment approach will be sufficient for children with conduct disorder or persistent behaviour problems. The problems may be affected by both family and child factors, and may occur during interactions with parents, teachers or peers. Some children with conduct disorders do not respond to CBT; children with other diagnoses in addition to their conduct disorder, with poor peer relationships, or who come from dysfunctional families appear less likely to respond. It should also be noted that the clinical significance of the changes found in some studies is unclear; many children continue to have conduct problems after treatment." (Joughin, 2006)

4.1.2 Computerised CBT - Computer delivered Psychotherapy or Psycho-education

Computerised delivery of CBT, known as CCBT, has been described by a National Institute for Clinical Excellence assessment report as a *"self help therapy"* which aims to offer CBT to patients while using reduced amounts of therapist time (Kaltenthaler et al., 2006). The report investigates self-contained computer delivered CBT packages for the treatment of anxiety, depression, obsessive-compulsive disorder, and phobias. Growth in CCBT has been fuelled by therapist shortages; this problem was outlined as follows:

"Although many patients with depression would prefer psychological therapy to drug treatment, the huge demand for these services compared with the resource of trained staff available means that they are not available to the majority of patients." (Kaltenthaler et al., 2006)

The results of various clinical trials involving numerous pieces of software were examined in detail. The conclusion was that there is evidence for the effectiveness of some but not all of the software packages detailed. This indicates that well made CCBT packages can be effective in certain circumstances. The clinical areas in which positive results were documented were depression, anxiety and phobias.

Because CCBT is essentially self-administered treatment, it requires a motivated, cognitively developed patient. Cognitive restructuring, described earlier, is an important technique in CBT. A computer program can educate about this process, it can give examples of unhelpful cognitions and alternatives but it

cannot accurately analyse and offer advice on the real and individual thoughts of the user. Computer technology is simply too limited for such complex interactions. For a motivated user, there is benefit in the psycho-education on self-thoughts, maladaptive attributions and core beliefs that CCBT aims to deliver. These benefits are significantly harder to deliver via an automated process to a child as opposed to an adult. Existing CCBT systems require a level of cognitive development and reasoning skill that it is unreasonable to expect of younger children.

4.2   Computer Games as a Medium for Psycho-education

The theories and potential benefits of educational games were covered in detail in chapter 3. This section will examine the potential benefits and drawbacks of the computer game as a medium for psycho-education.

4.2.1 Psycho-educational Advantages

A bespoke computer game could offer many benefits when delivering CCBT style educational techniques. Strong character narratives and development can be delivered through interactive story telling. Computer games are powerful mediums for storytelling because the user can be actively involved, not only in the telling of the story, but the fabric of the story itself. CCBT often makes use of fictitious characters in order to demonstrate how individuals can fall into thinking in unhealthy ways, hold distorted views of themselves/others and how this can affect the things they do. Computer games could offer the player the means to interact with characters such as these in a more immersive way than could be achieved through other mediums.

The control of an in game character or avatar is something that takes place at a distance. In an absorbing game, the player can feel that their minds have actually been expanded into the medium itself. Story based games attach a virtual identity to the player which they can control in this powerful way. Popular educational game theory suggests that control of an in game identity in this way can then become a "hook", freeing people to think and learn in new ways, including learning, or least thinking about, new values, belief systems, and world views (Gee, 2003).

In commercial titles, skills such as the precise timing of jumps to scale obstacles or strategies to triumph over an enemy must be perfected. Psycho-education requires the development of skills such as conflict resolution and problem solving and social skills. Consequential thinking and, fundamentally, the ability to question one's own thoughts and behaviours are also important goals. Computer games are limited in the extent in which they can educate on these complex issues. The immersive aspects of games and virtual environments, however, can offer opportunities that talk-therapies cannot. Researchers have found immersive virtual environments to be effective in rehabilitation of troops suffering from post-traumatic stress disorder when returning from combat (Rizzo, 2005). There are areas where games could offer a useful experience in educating on these topics. Principles such as the identification and analytical challenging of automatic thoughts could be made central to the game's storyline. Common thinking patterns and behaviours can be modelled by in-game characters. There could be the opportunity for a powerful educational experience in learning techniques for questioning the validity of faulty cognitions in a third person context, especially if the player relates personally to these characters. This process could then be repeated in a meaningful and fun role-play environment.

4.2.2 Built in Tools for Psycho-education & Skills Training

Purpose built tools could be built into computer games to allow focus on particular areas of psycho-education. Some common features of commercial games could be adapted to meet educational goals. Reputation systems are common among role-playing games. They give the player a representation of their standing with various groups within the game. Helping or hindering a group will affect the player's reputation in various ways. There are always benefits and drawbacks to having high or low reputation with any given group. Various strategies can often be chosen to overcome particular obstacles. There are often 'good' and 'evil' ways of proceeding to suit the player's style. For example, they might do a favour for a character in order to earn a required item or they might simply steal it. Good games often require the player to make choices that are, as is often the case with real life problems, harder to categorise as right and wrong. This kind of system could encourage forethought and consideration of difficult problems. It could also provide an opportunity for social skills training, aided by

systems representing the relationships and reputation between the player and different characters. For example, the player could be given a difficult choice with no clear right or wrong answer. The consequences of their choice could then be examined in detail, including how their choice has affected their relationships with other game characters. This can again be given meaning and context through a complex story line.

A further example of a potential in game tool for education could be a game mechanism for encouraging inward and outward reflection. At various difficult points in the storyline, the player could press a button and be removed from the situation and tutored by a special character on the greater meaning of what is going on and examine the perspective of other characters before being returned to play.

4.2.3 Disadvantages

Computer games share the drawbacks associated with computerised systems when dealing with something as personal as psycho-education. The experience can be personalised to a certain extent by adapting to the choices and play style of the player but it remains limited to the ideas and content provided by the designers. As with CCBT, the personal thoughts and feelings of the player cannot be effectively analysed, instead they are usually provided with a pre-written statement that they then rate and compare to their own thoughts.

Simplistic input control schemes can be both an advantage and disadvantage. The exclusive use of a control pad makes the game more accessible but the lack of a keyboard or more flexible input device limits interaction between software and user. Any text, for example, would have to be input using an on screen representation of a keyboard, which would be navigated using the control pad.

The danger with any educational game is that it will fail in one of its dual purposes. A game that is genuinely educational but no fun to play looses all benefits regarding engagement and motivation that are the advantage of the medium. Conversely, titles which are enjoyable to play but ineffective educationally or do not teach that which is intended are arguably no more useful than off the shelf entertainment games.

4.2.4 Educational goals

Because of the extremely limited nature of communication possible between human and computer, it is impossible to deal directly with the child's individual thought processes. As with CCBT, example characters must be utilized to demonstrate dysfunctional cognitions. There are multiple reasons why attempting to administer CBT techniques aimed directly at the child is unacceptable in this situation. The most important is the safety implications this would cause. Attempting to place the player-controlled character into stressful situations or asking them difficult questions could be potentially hazardous psychologically. Any attempt to utilise such methods would have to take place exclusively under direction of a professional therapist. Additionally, attempting techniques such as cognitive restructuring of the child's thought processes necessitates the pre-dictation of cognitions and asking the child to compare his or her own thoughts to our suppositions.

Both of these difficulties can be avoided by attempting to educate through demonstration and example. By creating a fictitious "patient character" to be the target of the therapeutic education and training, the unhealthy thought processes and resulting behaviours can be stipulated exactly. These can then be examined in detail and psychiatrically proven treatments and training can be undertaken under the guidance of a "therapist/mentor character". Using this method avoids placing the child into presupposed categories of cognitions and behaviours directly, but retains powerful educational potential through learning by association. This premise integrates two important therapeutic techniques, modelling and role-play. Modelling presumes that behaviour can be acquired, eliminated or altered by observation and is considered a powerful tool in CBT (Southam-Gerow & Kendall, 2000). In therapist led CBT, modelling is undertaken using either videos or live actors to demonstrate similar situations to those in which the patient is having difficulty. In live modelling, the patient directly observes another person coping with the difficult situation. Symbolic and live modelling are used to encourage the patient, through repeated observations of the same sequence, to understand different parts of the actor's behaviour on each viewing. Role-play allows the child to act out difficult situations and provides an opportunity for the child to practice coping skills and to experience solutions in a non-threatening, supportive environment.

The initial game design developed in the current work attempts to provide education based on the cognitive behavioural principle of symbolic modelling. The child is placed in the role of the Hero. They must observe non-player characters who suffer from various behavioural problems and attempt to find solutions and coping strategies in order to help these characters and progress through the game. Three different behaviours are modelled: Negative thinking, loss of temper, and negative attributions. Lessons corresponding to these problems are built into the game. The player must seek out these lessons and then attempt to help the characters who suffer from these difficulties. Game mechanics are built-in to encourage the player to think about and understand both behaviours and the lessons. The player must observe the behaviours of the non-player characters and choose the correct lesson that corresponds to that problem in order to succeed.

The child then has the opportunity to learn about self-thought and ways of developing coping skills from playing a part in the resolution of the patient characters particular mental and behavioural dysfunctions. The educational and motivational benefit will be maximised if these problems, and the associated mental processes, are relevant and comparable personally to the child. Observing and actively participating in the journey of a character with similar difficulties and thought processes as they learn how to develop coping skills that make an evident positive change could be extremely beneficial and motivating. This could be enhanced by involving the player directly in assisting the patient character. This provides positive reinforcement educationally and removes the focus on the child as being the problem instead allowing them to be an active part of the solution.

In Chapter 2, certain factors were listed that are considered to aid resiliency against mental health problems in children. The initial design focuses on content that attempts to foster these traits in the following ways:

- Positive attitude, problem-solving approach
  - ➢ Problem solving will be central to progress through the game, often the player will be faced with choices where there are no clear right and wrong answers

- ➢ Positive thinking and the problems that can be caused by a negative outlook are central themes throughout
- Good communication skills
  - ➢ There will be numerous opportunities to interact with other characters throughout the game
  - ➢ These will include many good and bad ways of communicating with people and the consequences of both will be explored in the storyline
- Planner, belief in control
  - ➢ The concept that behaviour can be changed with a little knowledge and effort is again a central theme
  - ➢ The message that we are each largely in control of our own destinies is explored through observation of the different choices made by both player and characters and the consequences of these choices
- Humour
  - ➢ Humour can be an important part of a fun gaming experience, as such there will be things purely designed to be light-hearted and humorous
- Capacity to reflect
  - ➢ The ability to reflect on events and consider the meaning of the characters stories will be critical to progressing through the game, without reflection it will not be possible to win

4.3   Game Design

A Participatory design methodology where children in the target demographic were involved with important decisions at the design stage would have been preferred for this study. Unfortunately, this was not possible because of the timeframe involved in ethical clearance and other practical difficulties. A parallel product review was carried out and entertainment game genres and game mechanics were examined for their suitability for a learning game focused on behavioural and emotional education.

4.3.1 Engine design

Visual stimulation is important when considering computer game design. This is especially true considering that pre-adolescent children today are very familiar with big budget commercial games that set very high standards aesthetically. They are used to high polygon models with motion captured animation and

professional sound. An academic project with limited budget has no possibility of rivalling these commercial titles on technological levels. Solid gameplay is more important than production qualities terms of the creation of an engaging game experience (Salen & Zimmerman, 2004). It remains important however to utilise technology effectively to produce a product that looks professional to the greatest extent possible. Gameplay takes time to experience and it is possible that a game with particularly poor visuals will be disregarded by children immediately. The XNA framework released by Microsoft provides a managed execution environment and library of classes that implement commonly used game-functionality. It supports rapid loading and manipulation of 3D models, textures, shaders and sounds. Utilising this inbuilt functionally allows rapid game development in either two or three dimensions. XNA game projects can also be compiled and run on Microsoft's state of the art games console, the Xbox 360. This concept is unique among current console manufactures with development kits usually prohibitively expensive for non-commercial developers. Xbox functionality provides the benefit of a control scheme and brand that is well known among children.

A 3D game engine based on interchangeable game components was developed using XNA specifically for this study. It allows a fully animated avatar to move around in a textured 3D world filled with 3D scenery and non-player characters (NPCs). A collision detection system ensures the player cannot move through solid objects. A system of interactions allows for firing of in game events. Interactions are stored in XML. Interactions fire when the player enters an area of the environment where it is active. Interactions can then alter the state of the game upon finishing.

Control Scheme and Interface

During the initial trial with entertainment games (detailed chapter 2, p18) it was observed that many children who played computer games in their spare time were familiar with the control pad and to a lesser extent the mouse and keyboard. Children who do not play computer games struggled more with the control schemes in general, and especially in 3D games such as Ant Hero.

Interfaces ranged from very simple, as in the sports game "Fifa" which showed only a score and the game time, to very complicated with Viva Piñata exhibiting

a variety of options and selections available at any one time. The children quickly became frustrated if the control scheme or interface were too complicated hindering progress.

The experiment demonstrated the need for simple and easy to follow interfaces when targeting children, especially those with low attention spans. Information displayed to the player should be kept to a minimum and should be displayed in a straightforward easy to follow way.

An uncomplicated and non-skill related control scheme is also essential in order to ensure accessibility for those less familiar with computer games and control pads. As such, the control layout is kept as simple as possible while conforming to industry standards. The analogue sticks control selections during interactions with the various menu systems in the game. The left analogue stick controls the rotation of the player's avatar. The right stick controls the speed and direction of movement (See fig 4.3.1).

Button	Action
Left analogue stick	Rotate camera angle
Right analogue stick	Move character around environment Make selection in interaction
A button	Confirm selection

fig 4.3.1: Control scheme

There is a large focus on dialogue and text. Because of the poor literary and reading skills commonplace in the target demographic it was necessary to ensure that dialogue displayed in text format was accompanied by voice-acted audio.

4.3.2 Game Genres and Gameplay

It is important that the game follow a well-established play style to ensure it is familiar and approachable and to maximise the chance of providing a fun experience. Taxonomies of game types and genres to suit different learning objectives have been published (Wastiau, Kearney & Van den Berghe, 2009). These do not focus on gameplay at the level of game-mechanics however and

are therefore of limited use in this study. The nature of the subject matter substantially constrains the choice of appropriate game genres. Emotional and behavioural topics are open-ended, complex and personal. This dictates the necessity for complex characters, communication and rich dialogue to nurture the sense of association between player and in-game characters. Role-play games (RPGs) rely on gameplay that focuses on characters, storyline and dialogue. As such, they represent potential for a game of this kind. The strengths of the RPG genre for learning games has also been documented elsewhere (Swartout & Van Lent, 2003; Gee, 2007).

4.3.3 Role-Playing Game Fundamentals

Computer Role-play games (RPG) are an established genre of entertainment computer game. The origins of the computerised RPG are in pen and paper based games like Dungeons and Dragons. They typically utilise similar game characteristics such as the use of chance (dice) based combat mechanics. One of the most distinctive traits of RPGs is that the player usually takes control of a character in a detailed narrative. This character develops and grows stronger as the player makes progress through the game.

A typical RPG involves the player exploring a detailed environment, interacting with non-player characters, undertaking quests, engaging in combat, developing their character and collecting items and equipment. The manner in which the player's character develops can be dictated by different systems. A levelling system is a common example, where players gain experience in order to "level up" and gain access to new skills and strengths. Other systems track the manner in which the player interacts with the game and develops their character accordingly. If the player favours combat their character will become stronger, for example, if they favour a stealthy approach they will gain skills that help them to hide or sneak around. A detailed story is usually a vital motivating factor of RPGs. These stories are often linear in nature, some titles attempt to allow the player some freedom of choice within a fixed narrative and others attempt to offer interactivity that is more complex.

4.3.4 A Non-violent Gameplay Mechanic

Almost universally, some kind of combat is the gameplay system upon which entertainment RPGs rely. One notable exception is the "Animal Crossing" series

developed by Nintendo. Animal Crossing is a computer game franchise popular with both young and older children and is entirely non-violent. The formula for all Animal Crossing games is the same. Gameplay revolves around the players interaction with a small town inhabited with various detailed characters and items. They are given a small house and a mortgage that they must pay off before they can upgrade to a larger one. The aim of the game is to increase the size of this house and acquire various decorations, items and rarities to place within the house. Furniture and decorations can be bought and sold. Money can be made from various activities including fishing, growing fruit, catching butterflies and completing tasks for other characters. The player's avatar is human, the rest of the towns inhabitants are all different kinds of animal. These characters wander around the town, or sometimes visit the player's house to ask favours, trade objects and write letters. Each character has its own personality that, along with actions taken by the player, governs its actions. A central theme is again collection and development, this time of furniture, rare items and the progression towards a larger house. Communication with the animals inhabiting the town makes up a large portion of gameplay. Interaction with these characters is persistent and advanced, subsequent encounters with an individual character will depend on the manner of previous encounters, even including nicknames bestowed upon the player by various characters.

It is hard to classify Animal Crossing as a classical role-play game precisely because of the lack of any kind of combat-based mechanic. It does however follow the majority of the RPG formula and has won awards in this category (AIAS Interactive Achievement Award for Best RPG 2003). It is a useful example because it demonstrates that games following the RPG formula can be successful without relying on combat and violence, even in the highly competitive entertainment market.

Combat mechanics in RPGs typically challenge the player to defeat various kinds of foes using the strengths of their character. Opponents become progressively more difficult to overcome as the game progresses. To continue to make progress the player will typically "level-up" somehow and increase the power of their character, as well as finding new and more powerful weapons or spells. The design of the prototype in this research follows typical RPG formula to a certain extent. Mechanics based on combat or violence of any kind is, however, entirely

unsuitable considering the target demographic. The entirety of gameplay must be non-violent but must also allow for integration of educational content. As such, a trading card style game was designed as a non-violent alternative to traditional combat mechanics.

4.3.5 The Trading Card Style Game

The card style game designed for the prototype is entirely non-violent but incorporates the same principles found in combat-based RPG mechanics. It follows a formula similar to the one found in the Pokémon games on the Nintendo platform. Pokémon is an RPG franchise popular with children in the target age group. The formula revolves around the collection of creatures (Pokémon) that each possess special powers dependant on their type. The player starts the game with a single Pokémon. They then explore the game world and collect items in an attempt to develop a collection of Pokémon. The primary objective is to capture as many "wild" Pokémon as possible, train them to advance their abilities and to use them in duels with other characters throughout the world and in organised leagues. The bulk of the player's time is spent travelling around the world, performing tasks to gain access to new areas, collecting money and items to use and collecting and training Pokémon. The battle system takes place away from the main game environment. When the player meets a wild Pokémon or character to battle the game changes from a third person isometric view of the environment to a two dimensional representation of the battle. The player selects a Pokémon to use in combat then selects which abilities the creature will use. Moves are turn-based rather than real-time with the player and opponent taking turns to perform attacks or actions. The core gameplay in the Pokémon franchise involves the exploration of a large and interesting game world, the collection and development of new Pokémon and using these to triumph in turn based battles.

The prototype in the current research uses collectable cards much in the same way as Pokémon are used. The player starts the game with an extremely small collection of cards. Each card has certain values attached to it; some are stronger than others. During the game, the player will encounter many characters that they will be required to challenge to "card battles". They win by using stronger cards against weaker ones. As the game progresses the must defeat some special "boss characters" in order to continue through the game.

Cards that are more powerful can be collected by trading with NPCs and defeating characters in card battles. The player must build a collection of good cards in order to be able to continue to win against stronger opponents.

This system allows educational themes to be incorporated into the card games themselves. This could be achieved by giving each "card battle" and each individual card a specific theme, based on a particular thinking or behavioural problem. This would work in a similar way to the elemental system in many RPGs. Water type attacks are more potent against fire type defence for example. If the player chooses cards that correspond to the theme of the battle then these cards will receive a bonus. This could serve to encourage the player to consider the meaning of these themes in order to succeed in-game.

4.4 Implementation

This section covers the initial implementation of the initial prototype game as it was first demonstrated to experts. Not all features from the design were present at this stage.

A playable prototype game was developed to demonstrate to experts and to examine the theories outlined in chapter two. The fantasy setting for the game was based on comic-book style super heroes. This theme was found to be popular with children in the target demographic and allowed the player to take on a fantastical character who could be a positive influence on the narrative.

Two full levels were implemented. The first was intended as an in game tutorial. It introduced the key characters, rules and controls before the player moved onto the first full level. Level two was a fully functional but "bare bones" implementation of the design. The card game was present but card and battle themes were not yet implemented. The entire main-quest content is present. Side quests, additional characters and opportunities for the player to obtain new cards were also not yet implemented.

4.4.1 Storyline and Game Structure

The narrative sees the player take on the role of a trainee superhero attempting to join the "Hero League", a group sworn to protect children everywhere. The player must rise through the ranks by helping others; each rank will allow the

player to choose a superpower that will allow them to progress further in the game.

The game starts with a tutorial level at Hero League Headquarters. A mysterious place filled with glowing crystals and strange sounds. The player is introduced to "Rex" the assistant and the mentor character "Captain Concept" (See Fig 4.4.1). The card game is introduced and the player is given their first deck before being taken, step-by-step, through a tutorial game.
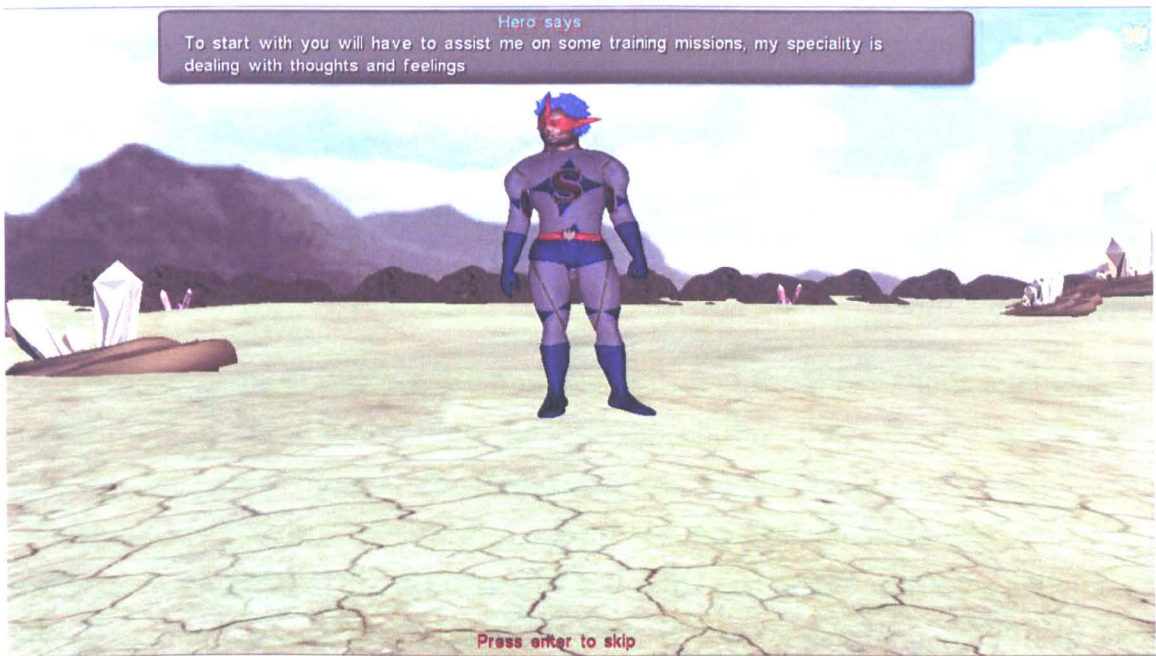
Fig 4.4.1: Captain Concept speaks during the introduction

The first level involves a character called Gary who is going to be expelled from school for lashing out violently at his classmates. Captain Concept uses his superpowers to show the incident as it will happen if nothing is done. Gary is being picked on and he ends up losing his temper. Captain Concept then shows the incident again and identifies what Gary is thinking and feeling as the incident unfolds (See Fig 4.4.2). Gary makes some common thinking errors during the incident; negative thinking, lack of empathy and of anger management. Captain Concept then gives the player the task of retrieving three special cards, which represent these issues, from a shadowy group called the "Chaos Agents", sworn enemies of the Hero League.

Fig 4.4.2: Captain Concept explains Gary's thoughts and feelings

The player then must explore the environment, find the three chaos agents and defeat them in a card battle (See Fig 4.4.3). Each time they obtain a special card they must return to Captain Concept who uses it to show another incident involving Gary that provides further insight into his problems. He then explains the deeper meaning of the incident and the problems dictating Gary's actions before turning the card into a special "lesson card" that can be used to help Gary later in the game.
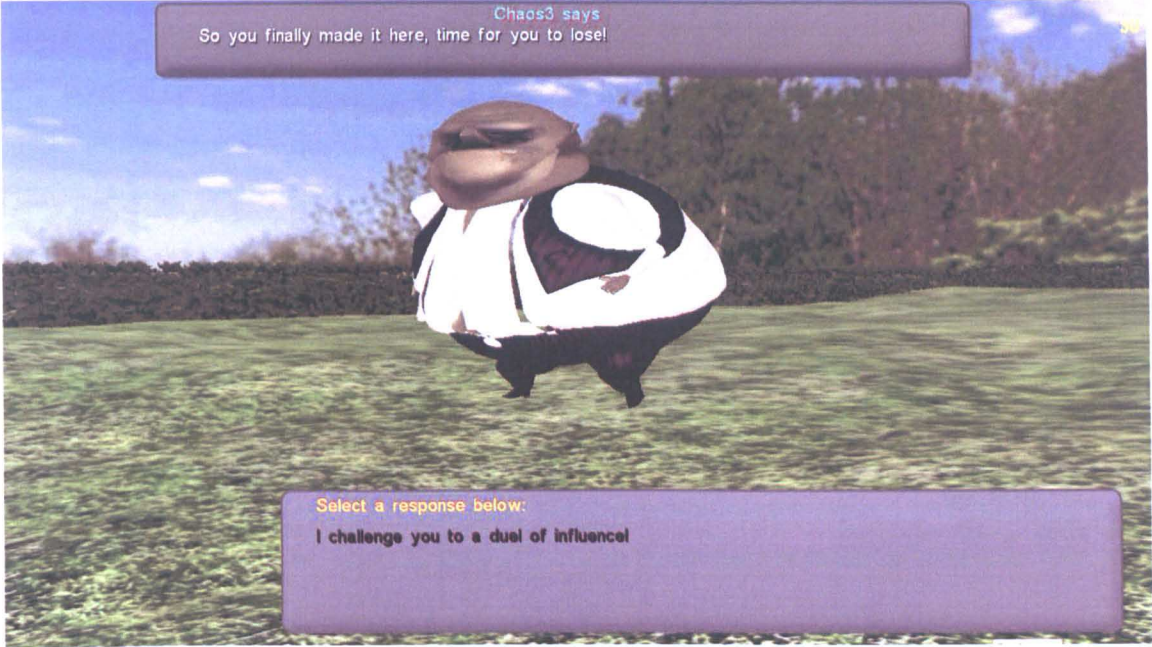
Fig 4.4.3: A Chaos Agent issues a challenge

The Empathy card shows one of the other children playing with a new toy (See Fig 4.4.4). Gary really wants the toy so he steals it and runs away. The player is shown what Gary was thinking at the time and asked if they can identify the problem. Captain Concept then shows the thoughts and feelings of the child whose favourite toy was stolen. He points out that Gary had not considered the other child at all.

The Negative Trap card shows Gary being told off by his teacher for stealing the other children's things. The teacher implores Gary to talk to her about things but Gary refuses to talk and winds up being punished. Captain Concept shows that Gary is thinking that he is just a no good kid, that his teacher hates him and only wants to punish him (See Fig 4.4.5). The player is asked to guess what was really going on. He then shows that the teacher did not think that way at all. She wanted him to talk to her so perhaps she could find a way to help.

Fig 4.4.5: Captain Concept shows Gary's thoughts

The anger card shows Gary in the playground walking past his classmates. He slips over and all the other children laugh and point at him (See Fig 4.4.6). Gary tells them to "shut up" but they continue to laugh and point. Gary loses his temper and runs after the other children in a rage. The player is asked what Gary should have done. Captain Concept then shows how Gary felt during the incident. He shows how his anger got worse and worse until it exploded and the triggers he could have recognised.

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Fig 4.4.6: Children laugh and point at Gary

When all three cards have been collected, the player revisits the incident from the start of the level where Gary makes several thinking errors before losing his temper. The player is given the task of using the lesson cards at the right time to trigger the correct lesson (See Fig 4.4.7). For example, when Gary is thinking overly negative things they should use the Negative Trap card. If this is done successfully, Gary is removed from the situation and teleported to the player and Captain Concept where he is taught about the lesson behind the card.

The Empathy Card sees Captain Concept attempt to explain that Gary's actions had hurt the other child when he had stolen the toy. Gary is not convinced so Captain Concept uses his powers to send Gary back to the incident with the roles reversed. This time, it is Gary's toy that is stolen and he experiences how that feels first hand (See Fig 4.4.8). Gary is then returned to the original incident where he decides to apologise for stealing.
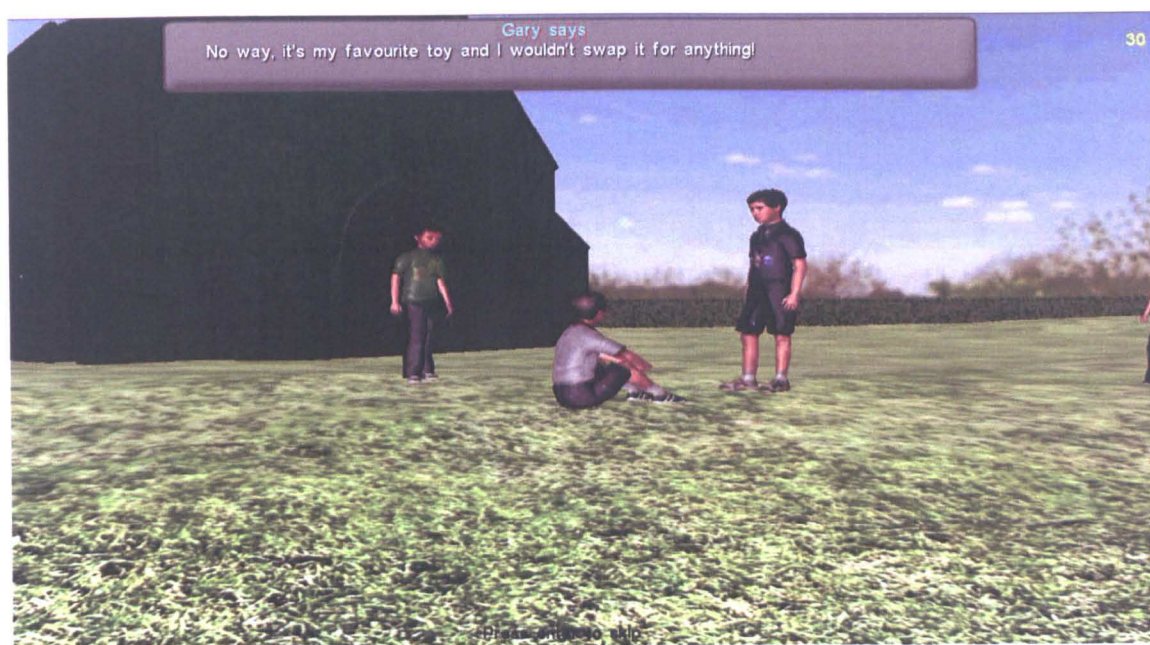
Fig 4.4.8: Gary experiences what happened from the other boy's perspective

The Negative trap card sees Captain Concept challenge Gary about his negative thinking. He shows the incident where Gary was talking to his teacher. Gary can now see what his teacher was really thinking and is surprised (See Fig 4.4.9), but he does not know how to change what he is thinking. Captain Concept tells him to challenge his thoughts, when something negative pops into his head, question whether it is justified. Gary returns to the original incident. When he starts thinking negatively, he stops himself and makes an effort to find a positive alternative.

Fig 4.4.9: Gary discovers what his teacher was really thinking

The anger card sees Captain Concept take Gary back to the incident where he slipped in front of the other children. He goes over how Gary felt as he started to get angry and shows him some basic anger management techniques he can try when he starts to feel like this, such as taking several deep breaths and counting to ten (See Fig 4.4.10). He shows Gary what would have happened if he had not lost his temper, the children quickly forget about what happened and continue playing. This situation is diffused without any drama.

Fig 4.4.10: Gary attempts to control his temper

If the player used two of the three special cards correctly, including the anger card, then Gary has learned enough to handle the situation differently. Rather than lash out violently he takes deep breaths and counts to ten. The other children continue to antagonise him but he does not lose his temper. The teacher then arrives to break the situation up. The main antagonist gets into trouble for bad behaviour and Gary is not expelled.

4.5   Ethical Issues and Testing

This section details the process of evaluating the game before possible trials with children in the target demographic. Ethical constraints demanded significant consultation with experts and clearing an internal ethics committee before further progress could be made.

4.5.1 Initial Play-testing

The prototype was tested informally with children in the target age groups. The participants did not suffer from any kind of behavioural, emotional or social difficulties and were achieving at normal levels educationally. The purpose of these tests was to examine the suitability of basic gameplay, theme, control scheme and language for an audience of experienced gamers. .

The game was tested by 5 children aged 7 to 9 in informal, non-educational settings. All were experienced gamers who regularly played commercial games. Initial results proved largely positive. The super hero theme was popular. The language used was appropriate and understandable for the children in the youngest end of the target age group. No problems were observed in relation to the card game, the children found it straightforward and fun. The interface and control scheme were appropriate for the age group and were intuitive for experienced gamers. The content also seemed appropriate. The material and language was complex and difficult for the children to follow in some cases. The end of level interaction was challenging but, because of the limited number of choices, too easy for the children to simply guess.

Each play through took around 35 minutes to complete. The children managed to complete the level without difficulties. The storyline provided context for some interesting conversations during play.

When asked about events surrounding the empathy card one player said, *"I thought that Gary was feeling that he wanted the toy car 'cause it would make him look cool. But if he stole it James would probably be very sad."* On the Negative Trap, he said, *"If Gary said something he probably thought he would be in more trouble"*. When asked what caused Gary to lose his temper during the Anger card scene he said *"He was feeling embarrassed and when the kids laughed at him he wanted to destroy all of them cause it's not nice that they were laughing at him "*

The participants seemed to engage with the game and content in an extremely promising way. By the end of the level, the children could articulate opinions on the events of the game, the characters and some of the concepts like anger and empathy.

Limitations

The tests indicated that the control scheme, theme and use of language in the game were generally appropriate for experienced gamers in the target age group. Because of the differences in demographic however, the evidence gained is unreliable at best. While the results were certainly encouraging, they provide little evidence for the potential efficacy of the game when used by children in the

target demographic. The children involved with the tests did not suffer from any of the common problems associated with children with BESD. They were in fact motivated learners. They engaged well with the game as an activity, but it is likely they would engage equally well with a 35 minute traditional educational activity because they are already motivated to learn and driven by a desire to do what is asked of them by their teachers and authority figures.

4.5.2 Demonstration to Professionals & Experts

Strict ethical requirements surrounding the use of prototype software with a vulnerable group necessitated significant feedback be collected from experts before proceeding to the next stage, an internal ethics committee. This would involve assessment regarding the suitability of the software for use with children in the target demographic as well as feedback regarding the potential usefulness of the activity.

The prototype game was demonstrated to experts so that feedback on the validity of the educational content and the manner of its delivery could be gained before proceeding to the ethics committee stage. These included a large group of social workers from the NSPCC who were involved in working with children in the target demographic; teachers responsible for running a specialist unit at a local primery which catered for small numbers of children with severe BESD; and a senior social worker who specialised in the use of technology for social learning.

Several minor issues were identified. The voice acting resulted in the children in the game sounding "middle class" for example. It was suggested that this would extremely problematic with regard to the player developing association between themselves and in-game characters.

More concerns were voiced over the way in which the game played as an activity. Important information is covered using cut-scenes. These scenes go on for several minutes. During this time, the player has no control over the game and must listen passively until they are over. The consensus between experts was that these scenes would not hold the attention of children with short attention spans and behavioural problems.

Doubt was also expressed over the implementation of the trading card game. Experts were concerned that the game itself would not be useful in helping children to think about the meaning of what are very complex and personal issues.

There was also a concern internally that the prototype might not be approved by an ethics committee. The game was designed to utilise techniques derived from cognitive behavioural therapy. However, in attempting to educate through symbolic modelling alone it was hoped that this approach would be considered safe for children who are not currently receiving this kind of treatment. This is, however, impossible to establish to the level of certainty required without serious collaboration with professional psychotherapists. This level of involvement with psychotherapists never materialised however. There could be potential in the software, at this stage, as a tool for professional therapists to engage children with therapy. In 1994, Ron Kokish wrote of positive results in his work with commercial games and hoped the future would bring custom-made games designed specifically to aid therapists. There are many challenges however in implementing games of this kind.

Treasure Hunt (Brezinka, 2008), described in chapter 2, has precisely this aim. While the creators report that children enjoy the game its actual usefulness to therapists is certainly debatable. In initial testing, it was indicated that therapists ended up using the game as a reward for working well in the session rather than for therapeutic education.

Face-to-face interaction with a professional therapist is a highly specialised intervention. The therapist can delve into their patient's individual problems, their relationships, their situations, their thoughts and their feelings. Computer games that attempt to provide educational benefit in the activity of playing itself are extremely limited in this context. The real benefit will always lie in interaction with the therapist and not with the game.

The benefit computer games can offer in this context is as tools that help engage children with therapeutic processes and provide context for the therapist to work with. In this case, in order to maximise effectiveness, the game should be developed with and personalised for the therapists who will use it. Therapy is highly specialised and personal. What could be a useful tool for one

therapist/patient combination could be unsuitable for another. At this stage, it had become apparent that the prototype game had several evident flaws in design and implementation. These were no doubt exacerbated by the lack of a participatory methodology, which would certainly have drawn attention to issues such as the duration of cut-scenes much earlier. The decision was thus made to re-examine the educational and game-play methodology of the game before proceeding to an internal ethics review.

Computer games, like all educational software, are limited to pre-programmed content and thus are more suited to educational goals that coincide with set curricula. SEAL, as described in chapter 2, offers a suitable curriculum with similar, though less specialised, goals and will be examined in detail as an alternative methodology in the next chapter.

Chapter 5: Redesigning the Game

This chapter covers the second phase of the development of the game. Both game-play and educational methodology underwent fundamental changes. These are discussed and the new design and subsequent implementation are described in detail. The resulting game titled "Hero League Adventures" has been used in trials to examine the hypotheses detailed in chapter 1.

5.1 Theoretical Changes

As discussed in chapter 2, there is some empirical evidence suggesting the efficacy of CBT for children with conduct related disorders. The adoption of CBT derived methodologies in Hero League Adventures, however, proved problematic.

5.1.1 The Social and Emotional Aspects of Learning (SEAL) Approach

The SEAL framework was born out of research conducted for the Department for Education and Skills by the University of Southampton in 2003. The study examined how to develop children's emotional and social competence and wellbeing at national and local level (Weare & Gray, 2003). The report suggested a holistic approach targeting all school children in a "whole school" approach. It was also explicit in recommending the initiative should target children early on in their development and continue long term.

> "There is strong evidence, and a strong consensus among the case study LEAs, that initiatives need to start early, target early and take a long term developmental approach. A holistic approach does not preclude targeting or special provision, and it is recommended that the DfES encourages schools and LEAs to identify those with problems early and target them quickly, in a flexible, low key, non-labelling way as part of the broader whole school approach. Schools need to do more work to find out where people are starting from and target specific help swiftly." (Weare & Gray, 2003).

The resulting framework is now part of the primary national strategy and is implemented by an ever-increasing number of schools.

The first prototype was intended for children receiving help with regard to behavioural problems from schools, social services or other professional institutions. It attempted to utilise cognitive behavioural techniques through modelling alone and therefore preclude the necessity of a CBT therapist. This approach was ultimately unsuccessful.

The redesigned prototype underwent a change in educational methodology by following an approach based on the less specialised SEAL framework. The material involved is taught to every child at schools that implement SEAL. This vastly increases the potential user base of the game as well as ensuring simpler and more straightforward ethical restraints with regard to possible testing.

The storyline for the second prototype game was developed using concepts and stories taken from the SEAL materials as used by primary schools. The first level focuses on empathy development. Subsequent levels will introduce other topics such as self-esteem and peer pressure while building upon and reinforcing the topics that have already been explored.

Specialised Help for Specialised Need

The SEAL framework recommends multi-tiered support for children who may be experiencing difficulties. At the basic level, there is quality first teaching of social, emotional and behavioural skills to all children, then small-group intervention for children who need additional help in developing skills. At the top of this hierarchy, there is individual and multi agency support for children with more severe difficulties (See Fig 5.1.1).
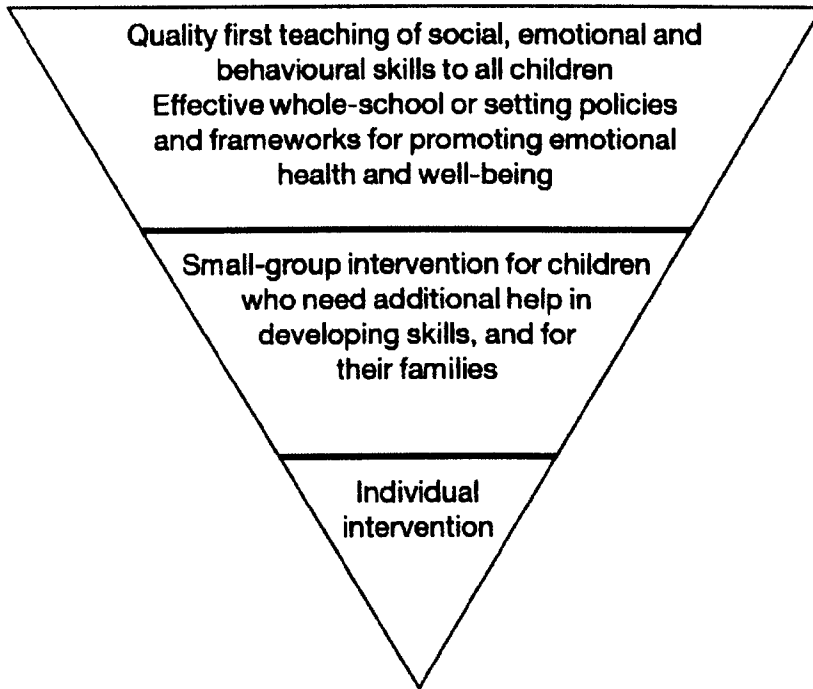
Fig 5.1.1: An illustration from SEAL guidance materials (DfES, 2005)

These children are highly likely to be at least partially excluded from mainstream classes. Children who do participate in mainstream classes will attend SEAL lessons where they will learn about the same issues and undertake group activities and role-play sessions with peers. An educational game based on SEAL could offer excluded children an activity that is both engaging and identifiable to them. More importantly, it could offer an opportunity for role-play and the examination of social concepts without the difficulties, embarrassment, and stigma of the relationships with their peers and teachers.

Because the narrative of the game is based on standard SEAL materials, the prototype should represent a suitable activity for any child attending a SEAL school. The greatest potential benefit of the game as a medium for learning of this kind, however, lies in possible potential to engage those students who are the most challenging for teachers, especially those who suffer from more severe behavioural emotional or social difficulties.

5.1.2 Narrative for Developing Empathy

Part of the difficulty in using gameplay mechanisms for serious education is the loose association between complex ideas and the activity of play. This could be

seen in the trading card game of the first prototype. Giving battles and cards themes in categories such as empathy and self-esteem is a very trivial representation of incredibly deep and complex concepts. This was never going to be an effective way of encouraging children to think about the real meaning of these concepts. Game mechanics are generally trivial in nature. This is not to imply they are easy or uncomplicated but even complex games are made up of trivial interactions with complex systems.

The real opportunity for conveying the meaning and depth of these subjects through a role-playing game lies in the narrative itself rather than the game mechanics.

There has been discussion on the importance of narrative in learning. It has been argued that human beings are predisposed to engage with narrative out of evolutionary necessity (Tooby & Cosmides, 2001). Humans accumulate knowledge throughout our lives through experience. The mind's ability to imagine and engage with narrative worlds and to place itself inside them gives us the ability to learn from *"surrogate experience"*.

> *"Fictional worlds engage emotion systems while disengaging action systems (just as dreams do). An absorbing series of fictional events will draw out of our mental mechanisms a rich array of emotional responses— the same responses that would be appropriate to those same events and persons if they were real. We care about the people involved, we identify our welfare with one or more of the characters, we may be afraid, or disgusted, or shattered, as if (in the emotional channel) those events were happening to us."*(Tooby & Cosmides, 2001)

Narrative offers a useful approach for education on topics such as behaviour, thoughts and feelings. The SEAL materials contain stories relating to different core principles to help teachers communicate these ideas to children in a context in which they make sense. These stories attempt to utilise narrative to encourage the listener to associate with characters and promote empathetic reactions.

The redesigned game features gameplay that attempts to engage the player with the narrative and give them more control over the fabric of the story. If the

player engages with the narrative and characters in the game it could prove a powerful learning environment as well as an engaging game experience.

5.2   Game-play Design Changes

The first prototype had failed to integrate learning materials effectively with game-play. The trading card style game was simple and engaging in itself, but too distinct from learning materials and the narrative to be effective in ensuring either engagement or learning. Attempting to resolve this issue would require a new approach to gameplay based on different mechanics. Narrative and in-game dialogue is central to the pedagogy. The player must develop an understanding with the game-characters and their stories. To be effective in engaging the most difficult students with the ideas and educational goals of the game, gameplay itself must revolve around the narrative in a meaningful way.

The redesign also attempts to address the gameplay issues described above by altering the core game mechanic. The underlying framework is similar to the first version, using identical graphics and models. However, the level model, gameplay and story structure were completely redesigned.

5.2.1 Core Game Mechanics

Gameplay is dictated by the mechanics that dictate the experience of play. Every game has what game designers refer to as a "core mechanic". This represents the most important aspect of gameplay. It is the mechanic that controls the majority of the player's interactions with the game:

> "Every game has a core mechanic. A core mechanic is the essential play activity players perform again and again in a game. Sometimes, the core mechanic of a game is a single action. In a footrace, for example, the core mechanic is running. In a trivia game, the core mechanic is answering questions. In Donkey Kong, the core mechanic is using a joystick and jump button to maneuver a character on the screen."

> "A game's core mechanic contains the experiential building blocks of player interactivity. It represents the essential moment-to-moment activity of players, something that is repeated over and over throughout a game. During a game, core mechanics create patterns of behavior, which

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manifest as experience for players. The core mechanic is the essential nugget of game activity"

"Very often, when a game simply isn't fun to play, it is the core mechanic that is to blame" (Salen & Zimmerman, 2004).

The first prototype did not have a specific core mechanic. This in itself indicates it would have made a poor game. The redesign had to utilise a core mechanic that both offered established gameplay and allowed the core activity of play to incorporate the educational content.

5.2.2 Role-Play Games Dialogue Systems

Dialogue systems have been common features of entertainment role-play games for many years. A typical RPG will allow the player to explore an environment filled with non-player characters. A dialogue system is a mechanism for players to be able to interact with the characters they come across in game. These systems were simplistic at first, allowing the player to ask set questions about the locations or keywords regarding quests. The Wizardry series (Sir-Tech) popular in the 1980s and The Elder Scrolls series (Bethesda Softworks) in the 1990s are examples of games that utilised this kind of system to handle interaction with NPCs. Dialogue systems became more complex to meet player's demands for greater interaction with in game characters. Dialogue trees were used to imitate the back and forth discourse found in conversation. These more advanced systems opened up new possibilities in gameplay. Not only could the player interact with the NPCs, they could begin to choose a path through the narrative. When encountering an NPC guarding the entrance to a building, for example, the player could employ different strategies in attempting to get past rather than traditional combat. They could attempt to convince the guard to let them in by bribing, tricking or threatening them. These different options could lead down different paths in the narrative with completely different outcomes. These systems can also be combined with in-game skill checks and scripted events. Modern dialogue systems offer the player a way of interacting with the game through text. This has become a key gameplay mechanic in itself in some RPGs. Many highly successful commercial RPGs have made extensive use of dialogue trees to shape the players experience and path through the game. Some prominent examples include: Planescape: Torment (Black Isle Studios),

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Baldur's Gate (BioWare), Knight of the Old Republic (BioWare), Arcanum (Bard Games), Bloodlines (Troika Games), Mass Effect (BioWare) and Dragons Age: Origins (BioWare).

In the original prototype for the current research, the player would learn about in-game characters through cut-scenes showing their behaviours and thoughts. They would then explore the environment and play the trading card game against Chaos Agents to unlock further parts of the story. The redesign places the narrative central to gameplay itself by way of an interactive, branching dialogue system similar to those found in popular commercial entertainment RPGs. The player becomes part of the narrative with the ability to shape the development of the story by interacting directly with important characters. In each character encounter, the player is given several different options of how to interact and what to say. Their choices shape the direction of narrative as they proceed through the game. This approach both keeps the educational aspects central to the activity and makes for a more involved experience.

This interactivity could also improve the educational potential of the system. Empathy development is one of the core topics of the SEAL approach. Previous studies have attempted to utilise virtual learning environments to explore issues such as bullying and empathy development. These have indicated that empathetic engagement is increased if the participants believe they can affect characters through interactions within the environment (Hall, Woods et al., 2005).

5.2.3 Identity

In early RPGs, all in game content was delivered in text format. In modern titles, it is common for all dialogue to be dictated by voice actors. Many games now abandon on screen display of text for dialogue entirely. The options presented to the player, however, are still universally text based.

In games like Mass Effect, the player takes on the role of a specific character with a voice and identity of his/her own. During cut scenes and interactions, the player-controlled character performs scripted events and engages in dialogue (including voice acting) which the player has no control over. When interacting with NPCs the player can dictate the tone of proceedings by selecting a short piece of text representing the kind of response they would like on a very trivial

level, a positive, negative, dishonest or threatening response for example. The player's character then takes actions in a corresponding way. The resulting dialogue is accompanied by voice-acted audio. The player is not aware of the exact wording of what his/her character will say until they have selected the desired response type. The manner of their selections dictates whether the player's character becomes a paragon or renegade. Other games, such as Dragons Age: Origins, give the player more control over the type of character they assume the role of and thus take a different approach to dialogue. The player's character is not voiced by actors and has no audible identity in the dialogue system at all. The player selects choices from a text only display of the available options in the dialogue, this decision in itself represents the player's transaction in the conversation and there is no need for accompanying audio. The NPCs voice acted response is then shown.

In both types of game described above, the player's possible options are given in text only format. This is because to assign a voice to them would infringe on the players sense of identity. The choices *belong* to the player and are theirs to make rather than the character whose role they play.

This issue presents a problem when considering the target demographic of this study. The high incidence of poor basic reading skills requires that all text-based content must be voiced by actors so that it can be understood. This must include the choices available to the player in the dialogue system. To counteract this problem an in-game construct was designed to provide a mechanism where text content can be accompanied by audio dictation without encroaching into the player's identity. This device is called the "Gizmotron".

The Gizmotron is designed to resemble an in-game smart phone type handheld device. It represents an interface through which the player can interact with the game in different ways. Through the Gizmotron, the player can save the game, view statistics, activate superpowers and direct interactions through dialogue trees. When the player is in a dialogue-based interaction, the Gizmotron is displayed on screen along with a text representation of their options. The currently selected option flashes red to indicate this option is the active one. When the audio recording of the NPCs dialogue has finished playing, the Gizmotron dictates the text behind the currently selected option in a robotic,

monotone voice. This voice is also recorded by actors but is filtered to sound robotic. Text continues to be dictated as the player cycles through the available options, a selection is made with a single press of the A button. There is no additional voice acting for the player's character. The act of selecting the desired option represents the players transaction in the conversation, what follows is the NPCs response.

The player's identity and control are not negatively affected because the options are dictated by a machine that has a fantasy use fitting with the narrative. It maintains the requirement that no reading of on screen text should be necessary in order to play the game. It likewise maintains the player's sense of control over his or her own character.

5.2.4 Cut-Scenes to Interactions

One of the biggest difficulties stemming from the design of the first prototype was the way in which information was conveyed to the player. Non-interactive cut scenes were used to explain complicated topics and explore the behaviour of in-game characters. These scenes could last for several minutes before the player could once again control the game. Teachers and other experts asserted that the more challenging children would simply not sit through these cut scenes.

The redesign utilises the new interactive dialogue system as the method for communicating important information to the player. The goal is to involve the player directly and allow them to experience the narrative in a different way. They dictate the pace of events and have influence rather than passively watching an unfolding situation. Where the first prototype would introduce a character and explain aspects of his behaviour to the player while showing a cut-scene depicting this, the second prototype allows the player to explore the environment and start a dialogue-based interaction with the same character. They are able to ask questions and make decisions that affect this character while observing the resulting behaviours in a more "first hand" manner.

It is technically possible to make every interaction in the game interactive using dialogue trees. The amount of work involved in this, however, makes it a practical impossibility. Each choice offered could result in an entirely different

game state. The amount of content required when designing the level would rise exponentially with each additional option if states were not reused.

Most interactions in the final design do have a degree of interactivity. The significance of the changes these choices have on the game state varies with the importance of the interaction. For trivial interactions, the choices made by the player can have at most only a slight effect on the game path. Important interactions can result in the narrative branching in very different directions depending on the choices made by the player. Interactions not involving user input are kept intentionally much shorter than the cut-scenes of the first prototype.

As an example, the cut-scene introduction to level one in the first prototype lasted approximately three and a half minutes before the player took control and could move around the environment. The introductory interaction in the redesigned prototype lasts approximately forty five seconds. The player then takes control and discovers the important details regarding the characters and storyline by interacting with the players inhabiting the environment.

5.2.5 Super Powers and the Hero Points System

The fantasy setting for the game is largely unchanged. The player again begins the game as an apprentice in the league of super heroes. In order to gain superpowers they must advance through the ranks of the league by helping people. The Hero Points system was introduced in order to control levelling up and the granting of superpowers.

The interactive branching dialogue system forms the foundation of the game-play experience. The player can select options to ask questions, advise NPCs what to do, agree/refuse to perform tasks and select responses to on-screen events depending on the situations depicted in the interaction. Some of these options are overtly sensible. Some quite negative options have also been included. For example, at one stage a NPC can make a rather unkind comment about another character. The player can choose several different responses to this, including one to point out that such comments aren't particularly nice and another to return a similarly unkind comment to the perpetrator. Hero Points are awarded for choices that lead to outcomes that help the in-game characters. Choices that are more negative sometimes result in Hero Points being deducted

from the players score. The player will "level up" when they reach a certain threshold of Hero Points. The player then gets to choose from a selection of available superpowers. These powers open up new paths through the game and give the player new ways of dealing with obstacles.

5.2.6 More Devious Chaos Agents

The first prototype saw the Chaos Agents act as largely static guardians of the special cards that the player had to collect. They take a more prominent role in the second prototype. They now actively move around the environment interacting with the same characters as the player. They cause general mischief and attempt to hinder the player's efforts to help the other characters. The player will also interact directly with the Chaos Agents. During these interactions, they give the player a flawed view of the topic the level is based on. During level one, for example, the Chaos Agents disseminate the view that empathy does not exist and everyone is merely out for themselves.

The player, as a member of the Hero League, is given the task of helping to capture Chaos Agents at certain points in the game. If the player has gained enough points to possess superpowers then these can be utilised to help capture the agents. Captured agents are then taken back to Hero League Headquarters where they become important pedagogical tools. This will be discussed in detail in the following section.

5.2.7 Pedagogical Elements of Gameplay

The core concepts of each level are built into the storyline. The first level focuses on bullying and empathy. The storyline was developed based on short stories in the SEAL materials in which a girl is teased and bullied by a small group of children at school. A good understanding of empathy is not likely to be something that can be gained through instructional education alone. It requires emotional responses and takes time to develop. It is not sufficient to explain what empathy means and try to get the player to remember this information.

During each level, various game-constructs attempt to require the child to consider the ideas behind the level and their meaning in the context of the story. The Hero Point system is a key mechanic in this respect. This system awards points to the player for choices that are relevant to the core concepts of the level. It also takes points away for choices that are poor in this context.

This system starts out offering choices that are reasonably obvious in their nature. The player must pick from clearly "good" choices or some that are clearly "bad" or unwise. It is not important which direction the player decides to go at this stage. It is also irrelevant whether the player would choose this particular course of action in real life. The intention of the game is not to show good choices and bad choices and try to encourage the player to favour the more correct options. The goal is to get them to really think about and consider the topics on display in each level. It is likely that many children will be tempted to make some clearly "bad" choices just to see what the consequences will be, this represents one of the strengths games offer as a medium. Bad choices can be made without real world consequence. The in-game ramifications of these choices can however be examined and discussed both through the narrative and with discussions with teachers and teaching assistants.

Gameplay requires that the player accumulate Hero Points in order to level his character up and gain superpowers. They need superpowers to complete important aspects of the game. Once it becomes apparent that some choices result in points being gained and some in points being lost, the rule systems of the game dictate that players who are motivated to win are *required* to make choices that result in the former. The educational benefit in this process comes from the consideration the player gives to the different options when attempting to select a correct one. While the system starts out offering choices that could be considered "black and white", the nature of these choices soon becomes more opaque. As the game progresses and the player has more and more exposure to the concepts involved the choices they have to select from in important interactions can all seem, at face value, to be "good choices" unless the player has some real understanding of what the concept means in context. An engaged player who lacks the necessary understanding of these concepts should want to be able to make the right choices so they can win the game. In this instance, there could be tremendous educational opportunities for teaching assistants to step in and discuss extremely difficult topics like empathy, bullying and social skills with students who are actively engaged with these issues and are motivated to understand.

5.3   Implementation

The following section details implementation of the second version of the prototype game, Hero League Adventures. The resulting software represents the version that was initially trialled. The super-hero based fantasy setting of the first prototype was retained. New game-play concepts are explored. Details of design features that did not make it into the initial prototype are covered. The section then concludes with a detailed examination of the narrative and game structure.

A fully functional prototype consisting of two levels, one tutorial and one full-content covering empathy and bullying were developed for this study. The original game engine was modified to enhance the interaction system and allow for deep branching dialogue trees. Graphics, textures and models were also reused from the first prototype.

5.3.1 Levelling-up and Superpowers

The player can now level up and acquire a superpower by accumulating 75 Hero Points. The requirement is then doubled to 150 for the next level. There is a maximum total of 135 points available in the first full-content level. This is dependent upon the player completing optional encounters and making the most correct choices at every interaction. There is an additional 50 available points as an end of level reward. It is likely most players will level up at some stage during the first level. Players following the most sensible route through the game are likely to achieve this before major interactions involving the Chaos Agents where superpowers are beneficial. There are not enough points, even given optimal play, for the player to level-up a second time before the end of the first full content level. Consistent selection of poor choices and the resulting deductions in points can result in the player completing the level without being able to level-up at all.

When levelling-up a special animation with sound is shown on the Gizmotron congratulating the player. They then are prompted to choose from the two different superpowers available. These are super speed and super size. These powers can then be activated by bringing up this Gizmotron and selecting the "Use Power" option from the menu. Super speed triples the rate that the player can move around the environment. An additional sound of wind passing by

rapidly is played to enhance the sensation of speed whenever the player moves around while using this option. The super size option triples the size of the player's avatar. They move at slightly slower speed and thundering giant footsteps are played in place of the usual sounds to enhance the feeling that the player has become huge and heavy. Upon activation, the power-up mode lasts for ten seconds before expiring. The interaction system can also react to the specific superpowers available to the player and change the nature of the interaction and the options open to the player accordingly.

5.3.2 The Gizmotron

The Gizmotron device is given to the player in the first interaction with the mentor character "Captain Concept" (see Fig 5.3.1). The player can bring up the Gizmotron screen at any time by pressing the start button on the controller.
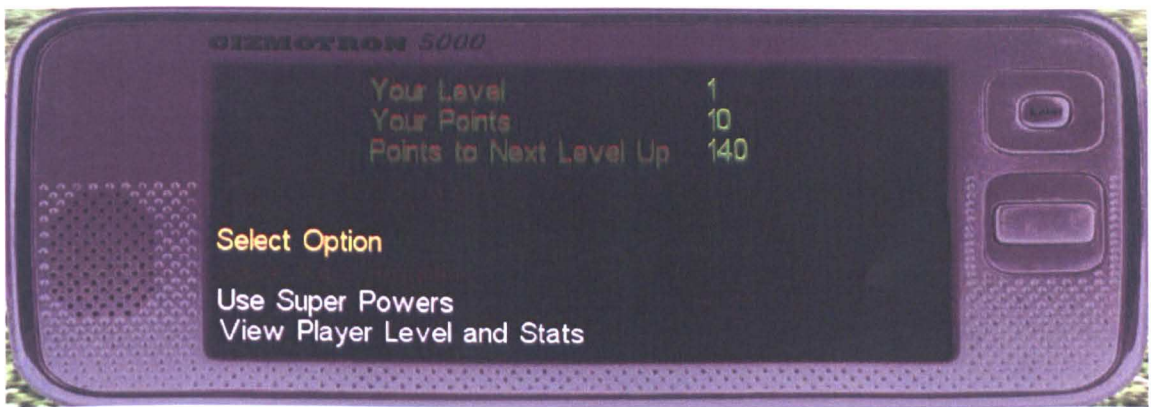
<div align="right">Fig 5.3.1: The Gizmotron</div>

They then cycle through the menu system using the analogue stick and the A button to select. Using the Gizmotron the player can save their progress, view statistics such as time played, their level, current game level, points and the number of points required to level up. If the player has unlocked any superpowers, these can also be activated using the Gizmotron.

5.3.3 Un-implemented Design Features

The following section describes aspects of the game design that, due to time and budgeting constrains, were not implemented at the time of the first trial.

Side Missions

The design incorporated side missions, which would require the player to obtain superpowers before they could be completed. These would be separate from the main storyline but would incorporate the educational topics of the level. These missions could be solved in a variety of different ways depending on the choices made by the player and the specific superpowers they obtain. Side-missions were only partially implemented. As they were incomplete at the time of the first trial, they were removed.

End of Level Tests

The first level attempts to engage the player with the concept of empathy, its meaning and its importance in the context of the narrative. When this level is complete there needs to be some type of challenge or test for the player to demonstrate their understanding of this topic. This should allow children who understand the fundamentals to receive in-game rewards, status and motivate the children who do not to think more carefully on the issues and seek help from teaching assistants. These tests could be implemented in a variety of different ways. It is particularly important that players be required to show some understanding of the issues of the level in order to succeed in the challenge. They must not be able to win by guessing, pattern matching, or testing the options in a combinatorial way. These tests will be discussed in more detail in chapter six.

Topical Orbs

At the end of the first level, the player obtains an empathy orb. This orb is able to show the meaning of empathy to in-game NPCs. In subsequent levels, the player will collect orbs relating to other topics, a self-esteem orb for example. These orbs are symbolic of the topic they represent. The player will be able to attempt to use them on NPCs in further levels. This functionality will allow previous topics to be built upon and revisited throughout the game. As the player moves through the game, they should develop an understanding of the different topics on which each level is based. They will then be required to attempt to recognise when a particular scenario is specifically related to a topic for which they possess an orb. Successfully recognising that the behaviour or actions of an in game character is related to lack of self esteem or empathy for example, will be one of the challenges the player must aspire to overcome.

5.3.4 Storyline and Game Structure

The branching nature of the second prototype means there are a large number of paths through the game depending on the choices made by the player. This section does not attempt to detail all possibilities. To do so would make the section both exceedingly long and especially hard to read. Instead, this section will detail the main events of the level and the major paths available to the player. Some variations and options are not described here, for the sake of clarity, but these can result in only minor differences to events and to the story.

The storyline develops as the player moves around the environment and interacts with the in-game characters. The following section summarises the flow of the narrative and major branching points. During a game session, a player might come across information in a different order than described below depending upon the characters they interact with first. Refer to fig 5.3.22 for a diagrammatic representation of the game structure.

Tutorial Level

The game, again, starts with the player arriving at the Hero League headquarters. They are greeted by Rex (See Fig 5.3.2).

Fig 5.3.2: Rex welcomes the player to Hero League Headquarters

The tutorial level is significantly shorter than that of the first prototype. Explanations are kept to a minimum with more information being given to the player as they explore the game. Captain Concept greets the player, explains the Gizmotron device and demonstrates it with a simple example (See Fig 5.3.3).

Fig 5.3.3: Captain Concept introduces the Gizmotron

He then immediately takes the player to level one where there have been reports of Chaos Agents causing trouble for some children who are having problems at school.

Level One

Level one begins with an introductory interaction with Captain Concept. This interaction is minimal and lasts only a few seconds. The player is told that the only detail currently known by the League is the name of the child they must help. The player is then released into the environment with the mission of interacting with characters and finding a girl named Laura (See Fig 5.3.4).

Fig 5.3.4: Captain Concept gives the player their first objective

Chaos Agent (CA1)

The chaos agent is standing outside the entrance to a building at the far end of the map looking suspicious. If the player interacts with the agent at this stage, they are told, abruptly, to leave. The player has several options to respond to this but at this stage none will move the agent (See Fig 5.3.5).

Fig 5.3.5: The Chaos Agent guards a doorway

[109]

Natasha is located in a prominent position in the environment. She is playing spinning round wildly in front of the school. On interacting with her the player can ask various questions, if the player asks about Laura it becomes apparent that Natasha does not like Laura and she says some nasty things about her. The player can either win or lose Hero Points depending on how they react to this (See Fig 5.3.6). Being nasty back to Natasha will cause a small loss of points. Examining her reasons for saying this will result in the player gaining points, how many depends on the suitability of their responses. If the player is unkind to Natasha, she will refuse to speak to them later in this section of the level.

Fig 5.3.6: The player must respond to Natasha's unkind remarks

The Teacher (T1)

The teacher is standing outside the entrance to the school. If the player enquires about Laura, they discover that the she is in fact a student of this particular teacher. The teacher has been worried about her, as she has not been going to school (See Fig 5.3.7). The player is advised to talk to the other children.

Fig 5.3.7: Laura's teacher does not know where she is

Gary and James (G1)

Gary and James are playing around the side of the school. If the player enquires about Laura, the children mention she has been seen around a building at the other end of the map. If the player has interacted with Natasha, they may enquire why some children do not like Laura. This option results in more information about Laura and some Hero Points are gained (See Fig 5.3.8). Gary and James say no one likes Laura, "she is weird and plays on her own".

Fig 5.3.8: Captain Concept sends a message on the Gizmotron

After the player interacts with Gary and James, an option is opened up to ask the Chaos Agent about Laura. When the player does this, the agent becomes agitated and asks where the player heard about Laura. The player again can select a variety of responses. Each result in slightly different events but all eventually result in the Chaos Agent threatening to "get" the player. Captain Concept then appears on the scene and chases the Chaos Agent away (See Fig 5.3.9).

Fig 5.3.9: Captain Concept arrives to save the player from the Chaos Agent Laura (L1)

With the Chaos Agent gone the player now has access to the building. On knocking on the door, Laura comes out. When the player asks her name, they receive a message from Captain Concept congratulating them on completing their first task (See Fig 5.3.10). They then receive 25 points.
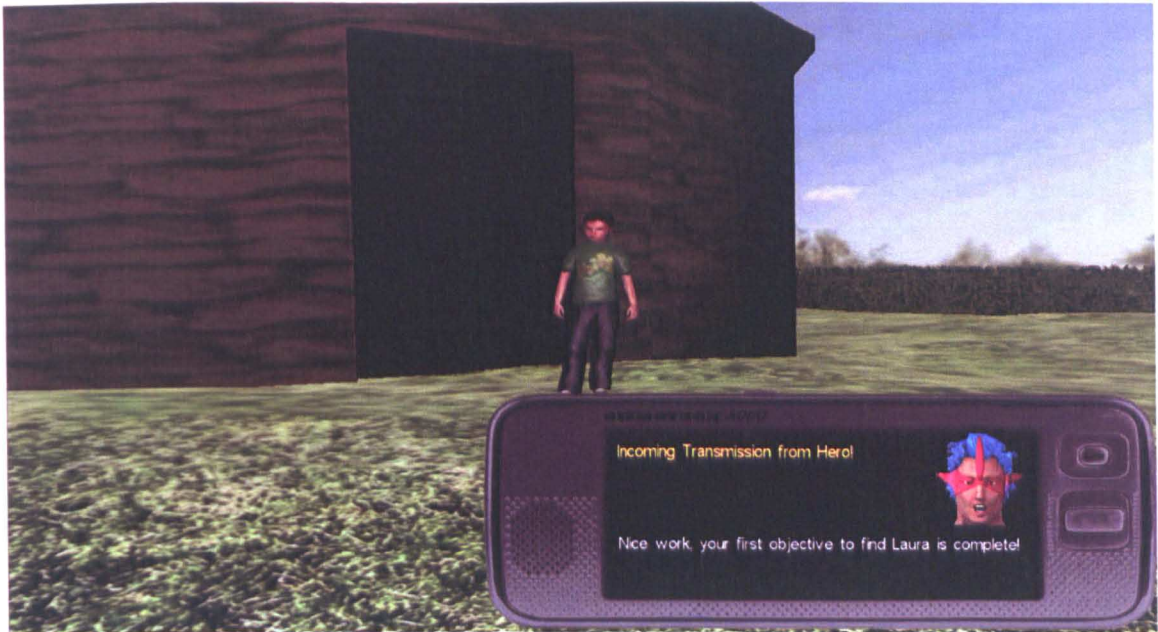
Fig 5.3.10: Objective complete

The player can then ask Laura about her problems. Laura says the other children pick on her all the time and that she has been playing truant from school because of this, hiding out in this building. Depending on how the player handles the interaction, it can end in different ways with the player winning or losing some Hero Points. Laura can become upset and run away or the player can offer to help and she promises to wait until they return.

Captain Concept (CC1)

Captain Concept then uses the Gizmotron to contact the player and set up a meeting. He uses superpowers to search back in time to find out what has been happening to Laura. He then shows the player a scene where Natasha, James and Gary have Laura surrounded. Natasha is saying some very unpleasant things to Laura (See Fig 5.3.11).
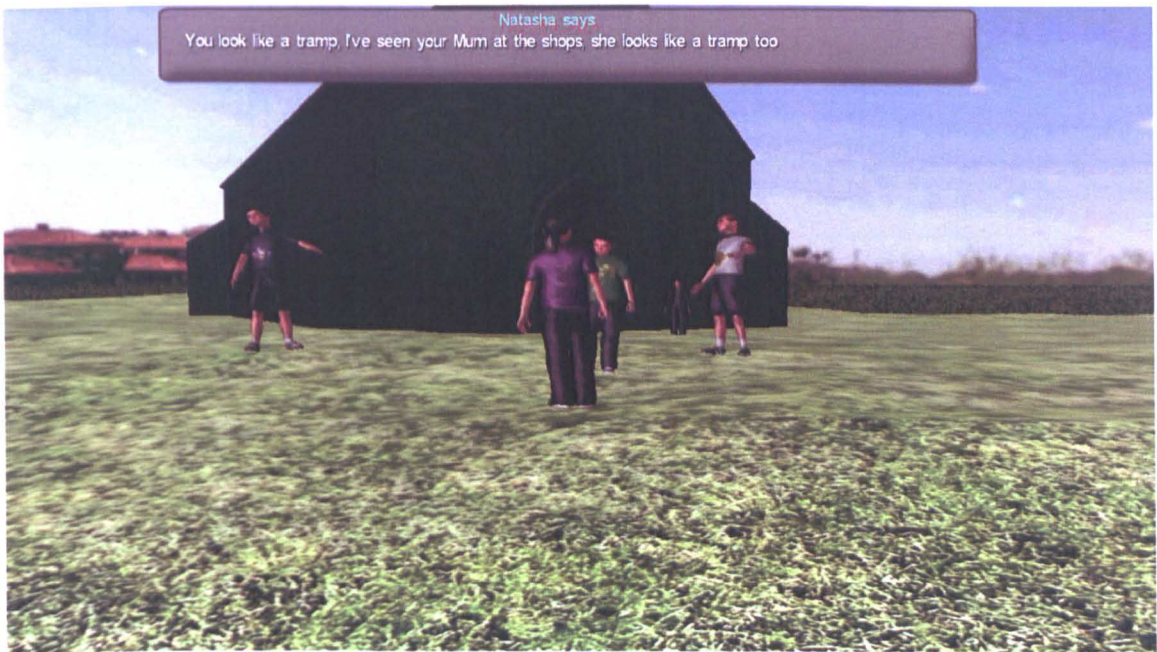
Fig 5.3.11: Captain Concept shows how Laura has been picked on

The other children laugh and Laura runs away in tears. Captain Concept then advises the player that bullying is a serious issue and the player must be very careful in dealing with it.

Teacher (T2)

The player can again interact with the teacher after meeting Laura and Captain Concept. They then have the option of discussing exactly what has been happening to Laura. The teacher states she was unaware of the bullying and implores the player to advise Laura to come and see her. She wants to get all the children together to talk about what has been happening. The player can refuse or accept to take this advice and offer it to Laura and gain or lose some points accordingly.

Chaos Agent (CA3)

The Chaos Agent will initiate an interaction as the player approaches the area where Laura had been hiding. He says that the Chaos Agents want to help Laura too by keeping her away from school and therefore away from potential harm. He implores the player to advise Laura to stay away from school because no one cares about her. As long as she is hiding, no one can hurt her (See Fig 5.3.12). The player can win or lose points depending on how they react to this suggestion.

Fig 5.3.12: The Chaos Agent making mischief

Laura (L2)

When the player returns to Laura, they can inform her of either the teachers or the chaos agent's advice. Laura does not like either of these ideas. The teachers

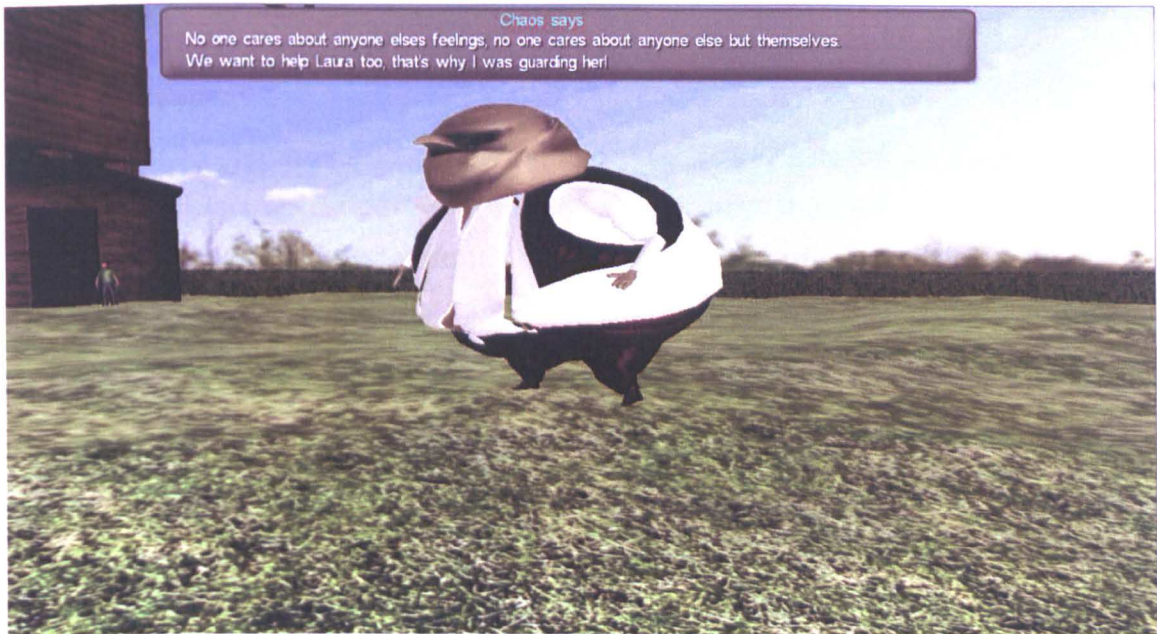plan is embarrassing and too frightening. She does not want to stay away from school forever either, she is miserable and lonely. Laura suggests an alternative idea. She wants the player to go and find the children who have been picking on her and warn them never do to it again - "or else!" (See Fig 5.3.13).
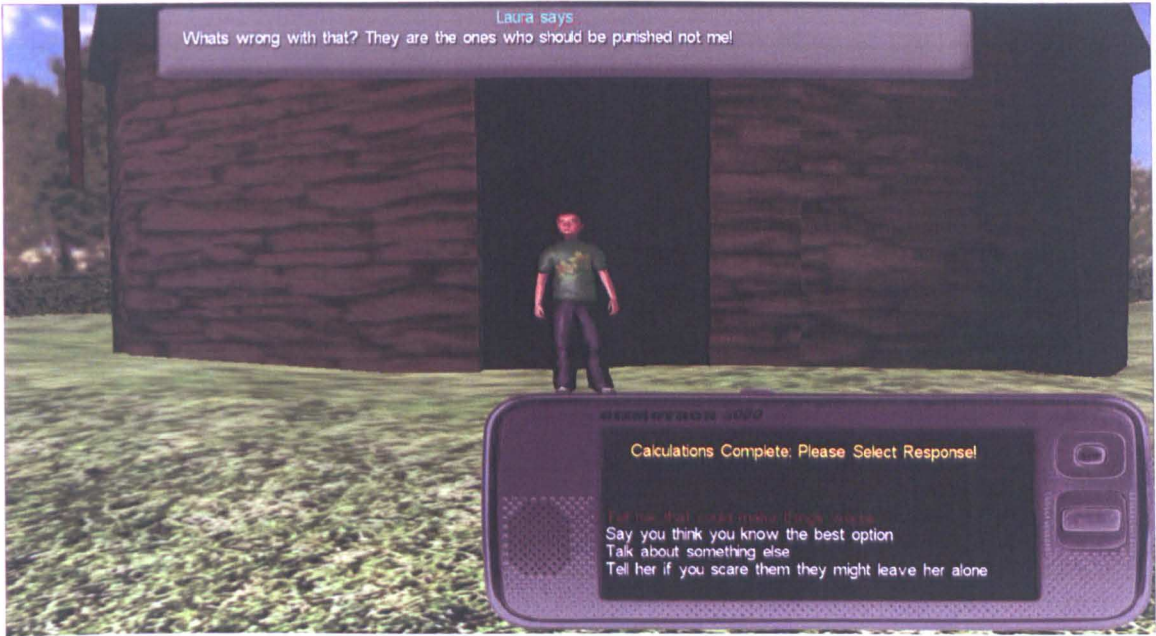
Fig 5.3.13: The player must advise Laura how to proceed

This interaction is large and deeply nested. The player can ask Laura about her feelings and discuss her different options. Eventually, the player must advise her to take a certain course of action. At certain stages of the interaction, the player has the opportunity to contact captain concept for advice. If they choose to do so Captain Concept will explain the likely motivations each character has for the plan they have suggested, hinting that going to the Teacher is the only sensible option before leaving the ultimate choice to the Player.

Laura's Advice (LA1)

If the player chooses to follow Laura's advice then they do not lose any points initially. The player must then go and seek out the other children who are playing in the middle of the map. They can then tell the children to be nice to Laura. The other children, led by Natasha, refuse to be ordered around by the player, pointing out that they are not a teacher or their parents. The player can then leave or threaten the children to leave Laura alone - or else! If this option

is taken the other children become scared and run away and the player can return to Laura and report that her plan has been carried out. Laura excitedly hurries back to school. The player then observes a scene where Laura tells the other children to be nice to her or she will tell her friend from the Hero League. The children run away and leave Laura alone. The player can then explore the school and interact with the children. Any attempt to interact with Gary, James or Natasha results in them running off scared. Interacting with Laura will reveal that she is still unhappy as the other children always run away from her (See Fig 5.3.14). She is still lonely and miserable. At this stage, the player loses Hero Points. Captain Concept can then be found talking to the teacher at the school. He explains that Laura was scared about seeing her teacher but that threatening the children had been the wrong choice. He then offers to go with you to convince Laura to go and see her Teacher. After this is done, Laura goes back to school and Captain Concept calls the player for a mission briefing.

Fig 5.3.14: Laura is still unhappy

The Chaos Agent's Option (CA1)

Laura reluctantly agrees if the player chooses to follow the Chaos Agent's advice and tells Laura to continue hiding from school, though she is obviously not happy about it. After this, the player receives a request to meet Captain Concept. Losing points at this stage is inevitable. He asks what the progress of

the mission is and what is happening to Laura. During the interaction the player can tell the truth or lie about the advice he gave to Laura, he can also attempt to justify his decision. The option chosen dictates the number of points that are lost. Captain Concept explains that the Chaos Agent had tricked the player into making a poor choice and offers to go with them to convince Laura to go and see her Teacher (See Fig 5.3.15). After this is done, Laura goes back to school and Captain Concept calls the player for a mission briefing.

Fig 5.3.15: Captain Concept intervenes

The Teachers Option (TO1)

Laura is opposed to the idea of going to see her teacher. It is therefore harder to convince her to take this option. The player must select the correct options to convince her that this is the best course of action before she will agree. This involves telling her that she need not be present when the teacher talks to the other children. If they do this, the player gets a positive message from Captain Concept and gains a considerable amount of points. Laura then goes to see her Teacher and Captain Concept calls the player for a mission briefing.

Convergence (CON)

At this stage, the various paths converge. All the paths available to the player involve the following interaction. Captain Concept requests a meeting with the

player behind the building where Laura was hiding. He explains that the teacher is going to gather the children who had been bullying Laura and explain the effect their actions have had on Laura. At this stage, the word "Empathy" is used for the first time. Captain Concept explains what the word means and how the teacher's strategy relies upon empathy.

Teacher (T3)

The following interaction is taken, word for word, from a story in the SEAL materials. It is the longest non-interactive part of the level. The teacher tells the children what has been happening to Laura and then describes in detail the effect this bullying had on her life and how it made her feel (See Fig 5.3.16). The teacher's words seem to have an effect with Gary and James who both tell the teacher they will try to make sure Laura feels better. Natasha remains quiet, when prompted by the teacher she grudgingly concedes that she might let her play with her sometimes. Natasha then goes off alone to think.
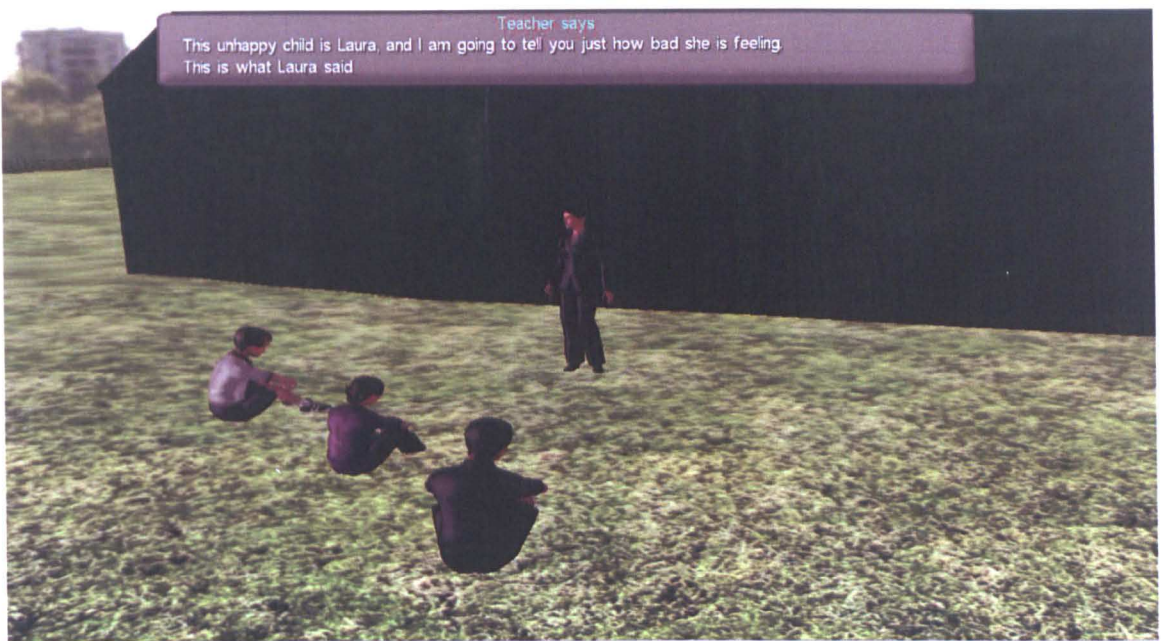
Fig 5.3.16: The teacher talks to the children

Chaos Agent and Natasha (CAN)

At this stage, the Chaos Agent instigates an interaction with Natasha. He says that he was listening to her teacher and implores her to pay no attention. He asks why she should care about Laura's feelings. Surely, her own feelings were

the important ones, not someone else's (See Fig 5.3.17). The interaction ends with the Chaos Agent telling Natasha to ignore the meddling influence of the Hero League. Captain Concept then uses the Gizmotron to contact the player, telling them to get to the Chaos Agent quickly and confront him.
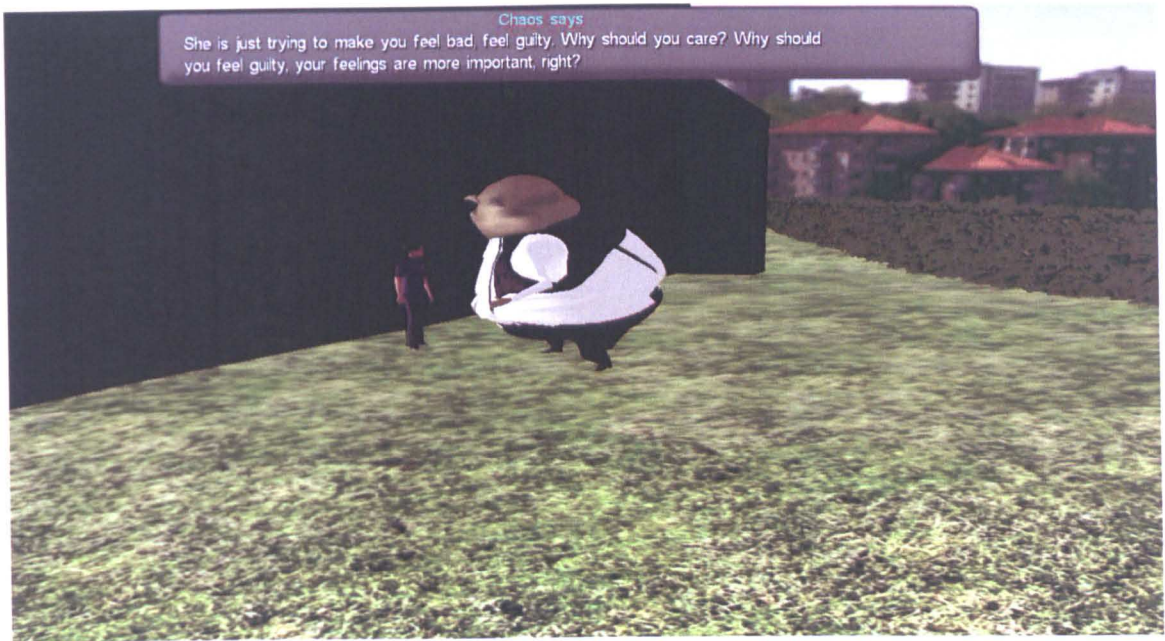
Fig 5.3.17: The Chaos Agent tries to corrupt Natasha

Catch the Chaos Agent (CCA)

At this stage of the game, depending on the choices they have made, the player may have levelled-up and gained a superpower. The following interaction differs according to the superpowers available to the player. If the player has the speed power, the chaos agent will flee and the player must use his speed to catch up (See Fig 5.3.18). If the size power is available, the player becomes huge and the chaos agent submits. If no powers are available, captain concept must rescue the player once again from the chaos agent. All possible scenarios end with the chaos agent being taken back to headquarters with Captain Concept. The player is then released to explore the environment.

Fig 5.3.18: The Chaos Agent attempts to escape

Children Playing (CP1)

The only characters now in the environment are the four children who are playing in front of the school. When the player approaches, they see Gary and James talking to Laura. They ask her if she would like to join in their game. Natasha protests that the others would even think of letting Laura play with them. Gary and James tell Natasha to remember what the teacher said. Natasha insists that she does not care what the teacher said or about Laura's feelings (See Fig 5.3.19). Gary and James then go elsewhere with Laura and leave Natasha on her own. Natasha is upset that her friends have abandoned her.

Fig 5.3.19: Natasha refuses to change her behaviour

Captain Concept's Solution (CCS)

Captain concept then requests a meeting with the player. He asks the player what has happened with Laura and brings up the topic of Empathy once again. He asks if the player remembers what empathy means. The player is given three seemingly good options, that it is being good, doing what you are told or understanding other people's feelings. There is also one overtly incorrect option present, largely, for humour - that empathy is the name of Captain Concept's dog. The player can gain points for getting the answer correct but looses no points for an incorrect answer. If the player does not get the answer correct, Captain Concept gives another brief overview of what empathy means in relation to the characters of the story. He says that the way to help Natasha is to help her to understand this concept herself. He gives the character a special item, the "Empathy Orb" which will, when shown to a character, have some magical effect that shows them the meaning of empathy (See Fig 5.3.20). He gives the player a final mission, to show this orb to Natasha and watch carefully what happens next.

Fig 5.3.20: Captain Concept explains the Empathy Orb

Natasha's lesson (NL)

When the player finds Natasha, they now have the option to show her the Empathy Orb. When this happens, Natasha is whisked back to the playground where the scene of Laura being bullied took place. This time however, Natasha is on the receiving end and Laura is the ringleader. The same hurtful things that were said to Laura are now said to Natasha (See Fig 5.3.21). When it is over Natasha finds herself back at the school, she is shocked and has trouble taking in what has happened. She asks if that was how Laura felt when she was in that position.
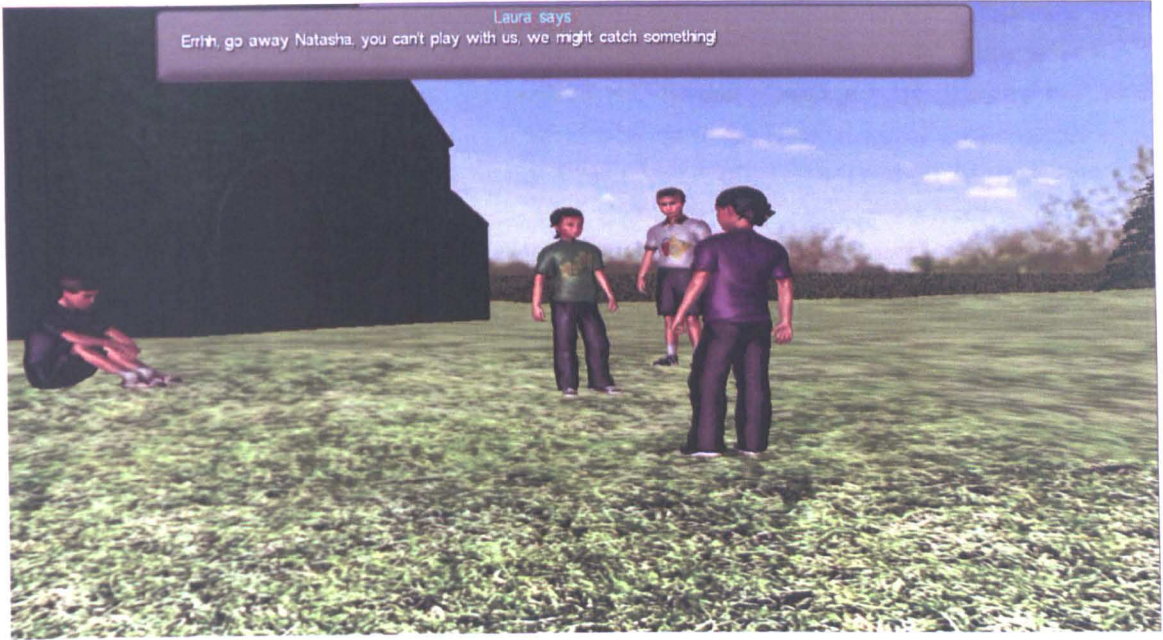
Fig 5.3.21: Natasha experiences the consequences of her behaviour

Fig 5.3.22 below depicts an abstraction of the game structure. It does not contain every interaction, rather it intends to give an overview of the major paths available in-game. Sections that implement content from SEAL materials are highlighted. Interactions are titled by the abbreviations used in the descriptions covered previously in this section.
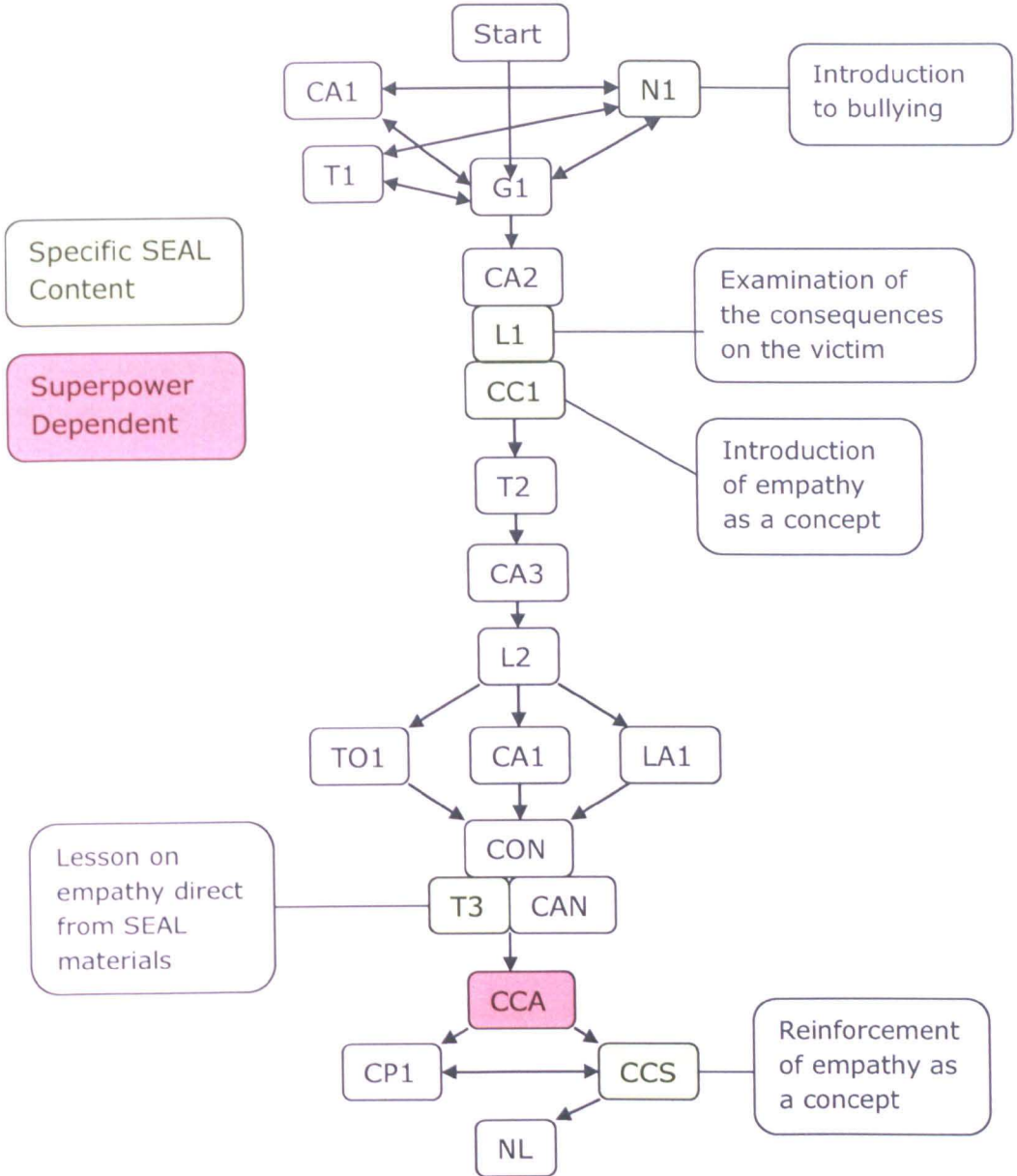

Fig 5.3.22: Flow Diagram

Chapter 6 - Testing Hero League Adventures

This chapter details the process of ethics clearance and testing Hero League Adventures. Trials were carried out with a child at the mild end of difficulties of the target demographic in a local primary school. This resulted in some flaws in the design and implementation being exposed. Improvements and alterations were made to the software before further trials involving children with behaviour at the severe end of the BESD spectrum.

6.1   Ethical Constraints

The redesign follows the educational methodology of SEAL rather than the psychotherapeutic principles of CBT. This simplifies ethical issues surrounding the potential use of the software with vulnerable children. Educational content is derived directly from teaching materials used in schools that implement SEAL. As such, it is entirely in line with content any child, not just those who suffer from difficulties, will be exposed to as a part of normal schooling. The player is, at no time, the focus of any concern regarding behaviour and emotions. There is some mild threat stemming from the involvement of the Chaos Agents but this is mild compared to other content in entertainment products aimed at children in the same age group.

Permission slips were created for distribution to parents of potential participants. The content and aims of the game were explained and it was made clear that the activity would be voluntary. The participant could decide to stop playing at any stage and return to class. Participation was opt-in so only children who had express permission from parents would be available for the activity.

Hero League Adventures cleared the internal ethics procedures without issue. There remained difficulties in finding teachers who were interested in the potential of a game for education on subjects like behaviour. Nick Owens, an educational psychologist with an interest in this area contacted the University of Nottingham after seeing the game detailed in an online seminar. He was interested in being involved with trials but had to wait for permission from higher management. This permission was never granted, something that was later attributed to capacity issues. Nick also noted the potential for controversy regarding technology in this specific subject area.

"I think the area of behaviour itself is a difficult one. We are always contrasting attitudes that people have towards learning/teaching behaviour as compared to say literacy" (See footnote[5])

6.2 Initial Testing

Trials were eventually organised directly with schools whose head teachers and SEAL co-ordinators were interested in the potential of a computer game for children with BESD. This section comprises detailed qualitative findings from the first such trial and changes and improvements made to the software as a result.

Testing Methodology

In order to test the hypotheses described in chapter one it was necessary to observe the participants closely and record evidence of engagement or disengagement. Video recording and analysis of the participants was a preferred methodology, due to practical and ethical issues however, this was not possible. Audio recordings were taken and analysed for all participants. Each was also observed by two researchers (one independent). The following types of behaviour were monitored for evidence of engagement with the game activity.

Positive Facial Expressions

- Concentrating / Attentive
- Concerned
- Surprised / Shocked

Negative Facial Expressions

- Bored
- Distracted

Positive Body Language

- Focussing on screen
- Leaning towards screen
- Settled

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[5] From personal correspondence with Nick Owen

Negative Body Language

- Fidgeting
- Looking around the room

Positive Comments Made

- Discussion of game elements
- Laughter
- Assertion of enjoyment

Negative Comments Made

- Assertion of boredom
- Discussion of issues outside the game
- Requests to stop the activity

Positive In-game Behaviour

- Staying on task
- Listening to / Following instructions
- Time spent contemplating choices

Negative In-game behaviour

- Aimless exploration
- Ignoring choices in dialogue system
- Ignoring tasks

Attempting to gather evidence of engagement with the educational concepts on which the game requires more focused analysis of the participant's behaviour. The following list described behaviours that were considered positive evidence for engagement with educational content.

- The player exhibits knowledge of the educational content in context of game events, through in game behaviour (selection of appropriate actions, responses) or through discussion with teachers
- The player initiates discussion on educational content that they do not understand

- The player attempts to discuss/understand the reason for bad outcomes (loss of points for poor a decision)
- The player makes comments which demonstrate contemplation of the educational content
- The player seeks help from teachers in understanding the issues in game when such understanding is required for progression

Evidence relating to the alternative hypothesis, that participants may disengage entirely with the game if focus is forced onto the educational content, is gathered through observation of players during the in-game test (see 6.3.3, utilised in trial 2 only). The exclusive focus of the game at this stage is a discussion on the educational content.

6.2.1 Trial One - Local Primary School

The first trial took place at a mainstream primary school in Nottingham. The pupil involved was male, suffered from ADHD and had behavioural issues that had necessitated one-to-one supervision by a teaching assistant.

The game begins by placing the player into the game environment. They must then walk up to a NPC to initiate an interaction before they are told what to do. The pupil instead chose to walk in the other direction and spend some time exploring the environment and walking into rocks and crystals just to see would happen. He had trouble keeping still and would fidget constantly and glance around the room. When prompted, he decided to go and see the main character and began the main level. During the first few minutes of the session the pupil showed several signs that he was distracted & disengaged. He ran around aimlessly in-game. He would fidget and often looked away from the screen at his surroundings or out of the window. He did not appear to give any thought to the dialogue quickly selecting the first available choice in character interactions. He seemed unsure what to do next after receiving in-game instructions on his next task.

He discovered very early on that, during the interactions, selecting the first option in the list would usually result in progress and began to select the first option immediately without exploring the alternatives. This behaviour continued

when he reached an interaction where the option at the top of the list was simply to leave the interaction. He then tried again twice, still selecting the first option and seemed slightly surprised that he was immediately dropped out of the interaction. He then tried a third time, this time taking the time to listen to the other options, and continued by selecting an appropriate action. After this, he paid more attention to the other options available to him in interaction, though he often selected the first one he thought appropriate without exploring the full range of options available to him.

After discovering that there were characters in the environment that he could actively interact with his level of engagement rose considerably. He leaned in towards the screen, fidgeted less and stopped looking around the room entirely. He began to pay more attention to the dialogue and stayed on task within the game, moving directly to his next mission when instructed.

He enjoyed getting hero points and exclaimed "Yay!" more than once when getting a substantial haul of points. The novelty of this appeared to wear off slightly as the game continued however. His current tally of points, as well as the total required to "level-up" and gain a superpower, could have been viewed by bringing up the Gizmotron. The player was either unaware of this or did not have sufficient interest to do so however. He was therefore unaware how many more points he needed to gain a level.

The Chaos Agent was also popular. He said, "He is rude!" when first encountering him and later when the Agent is shown giving bad advice to Natasha he loudly said "UT OH!" He laughed aloud at one point and his facial expressions showed interest and enjoyment.

He generally picked sensible options and levelled-up his character towards the end of the level. He chose the super speed power and then spent a minute or two testing it out by firing around the landscape while leaning in towards the screen as if leaning into the wind. He laughed and appeared to be having a lot of fun.

He finished the game content after around 35 minutes of play. The game-play had kept him engaged throughout. There had been, however, a lack of concentration on the dialogue, especially in the first half of the session. As a

result, he had not given issues such as empathy and bullying any real thought. He had paid enough attention to know what he had to do next throughout most of the game, although he was unsure which character was Natasha after one of the later interactions when he had been told to go and find her. He had interacted with her several times at this point. He also was unable to answer the in-game question about empathy, as he could not remember what it meant.

After the game session had finished he was asked a few questions. He enjoyed playing the game and stated he would like to play it again if the opportunity came up. He liked the Chaos Agent and the superpowers the most. He could not answer some basic questions about the story line, the characters and the content on empathy however. It was clear that, while the game format was successful in engaging his attention (after the gameplay had been learned), he had paid only superficial attention to the dialogue and hence, the educational materials.

The game, at this stage, exhibited potential in terms of engagement but due to several shortcomings was failing to require contemplation of educational concepts. Several changes would be required to attempt to ensure that players could not complete the game with good outcomes, as the participant in trial one did, without being required to consider these concepts.

6.3   Updates and Improvements

6.3.1 Issues Identified

The first trial provided some interesting results. While it took a few minutes before the player understood how to play the game, he certainly enjoyed the activity. His engagement levels rose visibly as he began to understand how the game worked and he remained obviously engaged with the activity throughout the remainder of the session. There were no outward signs of frustration or boredom, the activity only ended when the available content was completed. While it was clear that the game had provided an engaging activity for this particular pupil, it had been less effective in engaging the player with the concepts like empathy, bullying and the stories of the in-game characters. Some flaws in the implementation of the game had contributed to this by allowing the

player to progress without considering, carefully, the dialogue and the options available in each interaction.

The initial level design deliberately allows the player to experience the educational concepts gradually and without much pressure. One of the requirements of the game is that to progress, and to win, some understanding of the educational content must be demonstrated. Some changes to the software were required to ensure the player could not win without demonstrating this understanding. The important question would be whether the game could continue to offer an engaging experience when it began to force the player into serious consideration of the in-game issues in order to progress, or whether this would result in players becoming frustrated and losing interest in the activity as a whole.

6.3.2 General Improvements

Both levels begin with introductory interactions. These did not trigger automatically. Instead, the player was placed in the environment directly in front of the character they needed to interact with first. It was envisaged that players would initially move forwards and interact with these characters before doing anything else. In practice, the opposite proved the case. In both levels, the player initially moved backwards to explicitly avoid the character directly in front in order to run around the environment first. As he had been given no instructions he was unsure what to do next, then had trouble locating the correct character to start the introduction. The system was then modified to ensure the introductory interactions would activate before control was handed over to the player.

The analogue stick was used to scroll through the available options and menus in the Gizmotron. It was observed that the player consistently attempted to use the digital pad when attempting to control the Gizmotron. After several unsuccessful attempts, he would then try the analogue stick. The engine was modified to allow either the analogue sticks or digital pad to be used to ensure this was no longer an issue for some players.

The order in which potential options were displayed to the player was obviously a serious issue. During the design phase, the option that was implemented first often resulted in a positive path through the game, alternative options tended to

be added afterwards. The options were simply displayed in the order they were implemented in the XML. This resulted in a viable option often being placed at the top of the list of the players options. Game players often learn through experimentation, by pressing buttons and observing what happens. In the first trial the player started by just pressing the A button whenever an interaction appeared. During the first quarter of the game, he managed to proceed without exploring the other options available to him by simply selecting the one at the top of the list. He even became stuck for a while at the first interaction where the top option would not allow him to progress even though this option was simply to "leave". This was perceived as one of the major reasons for the lack of engagement with the dialogue. He was largely able to skip through interactions without paying much attention and still get positive results. The system was then altered to display all options in a randomised order at the lowest level, each time an interaction is activated. This change should make it very unlikely that a player could click through without paying attention to the options available to them in each interaction.

It was observed during the trial that the player was not aware of his current score and the system of levelling-up. This information was available through the Gizmotron. They player had no actual requirement to access this information during the game, however, so never chose to explore these options. This had a negative effect of his motivation to gain points. He could not see how many he had or how many more he needed to level-up. Points without any visible reward soon lose their motivational power. After the trial, a Hero Points meter was added to the screen to display how many more points were needed to level-up throughout the game. Points are added, gained or subtracted incrementally and accompanied by appropriate sounds to enhance the feeling that the player is counting down towards a set target.

The end of level test for level one was not yet implemented at the time of the trial. It was clear however from the player's responses to questions about empathy that he would have struggled at this stage of the game. It was vital to implement this system prior to further trials to ascertain whether the game could continue to engage players under these circumstances. The following system was implemented after the initial trial. It attempts to achieve two goals: To provide an in-game challenge to which players cannot gain a good outcome

without some genuine understanding of the topics involved. To provide gameplay based motivation for players to overcome this challenge.

6.3.3 Chaos Agents as End of Level Tests

The Chaos Agents found in each level represent a negative view of the topic on which it is based. Players must help the Hero League to capture these agents, which are then sent back to headquarters. At the end of each level, the player gets two opportunities to interact with chaos agents that have been captured previously. These end-of-level tests are deliberately difficult and substantial in-game rewards are received for completing them (See Fig 6.3.1).
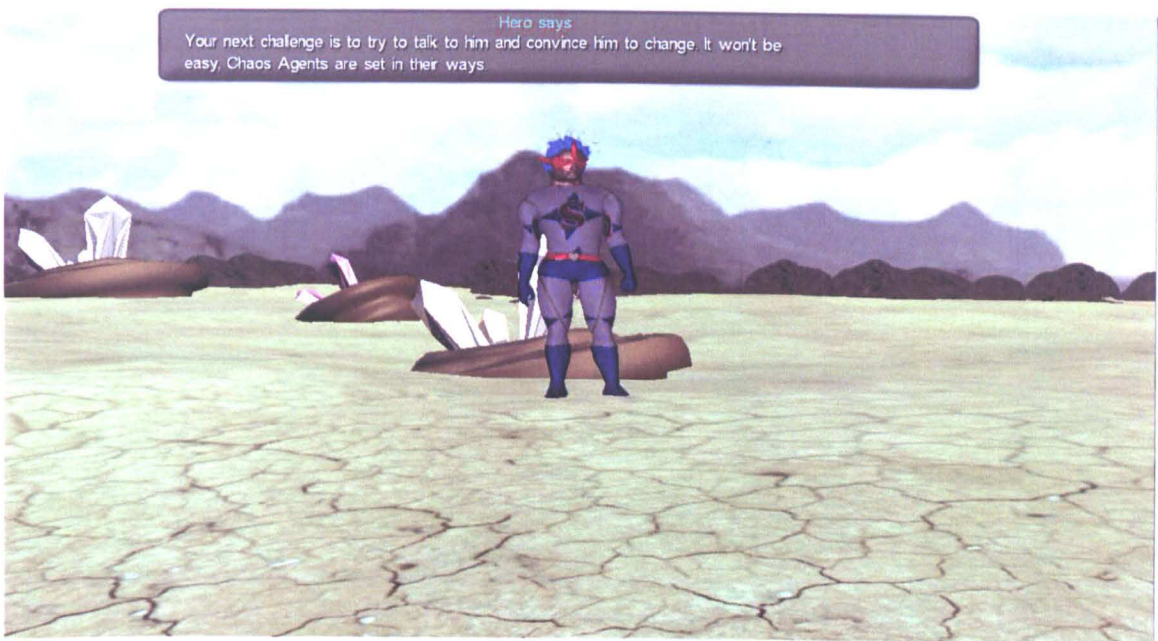
Fig 6.3.1: Screenshot showing the challenge to "reform" the chaos agent

They must try to "reform" the Chaos Agent by teaching them about the relevant concept. This involves going through a deep branching and complex dialogue tree where the majority of the options could seem reasonable (See Fig 6.3.2). Incorrect choices quickly result in failure. In order to succeed the player must consistently pick options that are relevant to the concept the agent represents, the context of the conversation and events of the level.
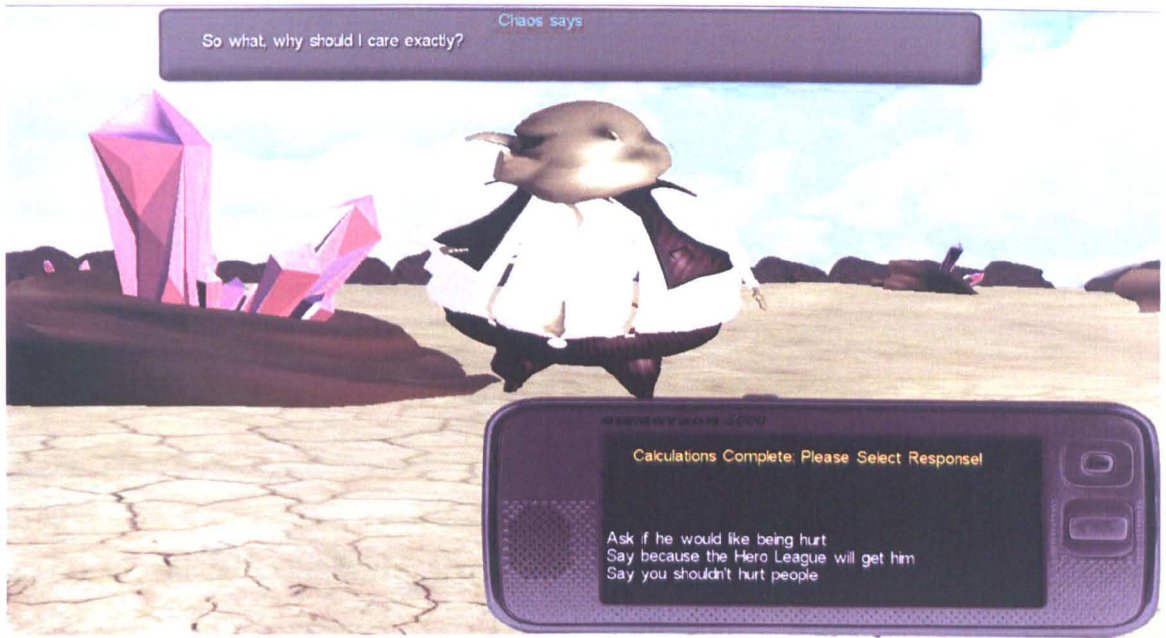
Fig 6.3.2: Screenshot from the test interaction

The player is limited to two attempts per level for an important reason. These interactions are difficult. The chance that a player could succeed by guessing and selecting the correct responses are minimal. If a player could repeat the interaction infinitely, they could potentially attempt to find the correct path a combinatorial way by selecting different options until they find choices that take them further into the interaction. The fact that this opportunity is overtly limited to only two chances also serves to heighten the importance of each choice to the player. They will know that on their second attempt, a wrong choice could end their chances of reforming the agent until later in the game. This drives motivation to ensure that each choice is carefully considered.

If the player is successful, they gain a substantial amount of points, attain a new rank in the hero league and receive a medal prominently displayed on the Gizmotron. The reformed agent joins forces with the Hero League and pledges to help you in subsequent missions. The agent from level one, for example, becomes "Agent Empathy". Reformed agents then act as an in game construct through which the topic can be further developed. Empathy will be related to topics in further levels, players who have reformed the Empathy agent will have access to the NPC at appropriate times to develop the topic further and they will get slightly harder questions relating to this topic. Players who have not yet

reformed the agent will receive easier questions and further content on the basic topics as found in level one.

6.4   Trial Two

The first trial was conducted at a mainstream primary school that does not cater for children with more severe difficulties. A further trial was organised at a local pupil referral unit in order to test Hero League Adventures with children with difficulties at the more severe end of the spectrum.

6.4.1 Trial Two - Local Pupil Referral Unit

Trial two took place at a special educational unit located in Nottingham that caters for children who have been excluded from normal schooling.

> *"Pupils are from Key Stages 2 and 3. Girls are admitted as well as boys, but the great majority are boys. All have been permanently excluded from other schools mainly because of severe social, emotional and behavioural difficulties. Many have not attended school regularly prior to admission. Pupils' social skills and their educational attainment on entry are often well below those expected for their age."* (This quote cannot be referenced as this could identify the institution where trials were performed)

A meeting was arranged with staff to go over the game content, ethical issues and to work out the logistical issues regarding setting up a trial with some appropriate children. During this meeting, the staff were unsure how many of their children would be willing to play the game. They were also concerned about the potential duration of each session. They were extremely sceptical about the possibility of reaching 35 to 45 minutes with any of the children. They asserted that 5 minutes would be all that could be reasonably expected.

Some of the teaching assistants who work with the children on a regular basis were present. They expressed a concern that many of their children played adult only entertainment games like Call of Duty at home, and so might think an educational game based on super heroes and feelings would be un-appealing or "corny" to them.

6.4.2 Testing

The tests took place at the end of school term just before the summer break. Two laptops were set up in a room next door to the classroom. Sessions were conducted with seven different pupils, either in groups of two using separate laptops, or individually. These pupils had been attending the unit for up to three years and as little as a month. Some were regularly in trouble in the community outside of school, some had outside agency involvement. Most were working well below national average for age. Some had trouble with social skills and found group work difficult. All were male.

They suffered from a wide range of problems, these ranged from the very severe to the milder end of the severe spectrum. All had difficulties serious enough to have been excluded for mainstream schools. The following is a small selection of behaviours that the participants had been observed to exhibit either frequently or constantly:

- Physical abuse - peers & staff eg with intent; use of weapons.
- High Level of risk to others: deliberate targeted aggression; random violent outbursts with no regard for safety; throwing dangerous objects
- Running off school premises - dangerous situations (hiding) eg exiting class without supervision; running away from close situations. Leaving seat when staying in place is expected
- Physical abuse - peers: eg hitting; kicking; biting; deliberate but may be random; in public; may fight others, bullying nature
- Targeted abuse - verbal: eg systematic teasing; abuse; name calling; racism; sexual etc
- Oppositional behaviour: eg defiant towards staff; deliberately non-compliant; Argues with adults
- Calculated behaviour: eg deliberate attempts to disturb/upset others; spiteful/vindictive
- Lack of self-awareness: eg inability to recognise/identify one's own difficulties; may lead to targeted bullying/social isolation
- Damage to property: eg deliberately ruining work; breaking equipment/furniture
- Focused Verbal Abuse: eg intentional and targeted; identifying weaknesses/concerns of others; displays intent and knowledge
- Disaffection: eg patterns of absence/avoidance
- Hyper-vigilance: eg displays mannerisms indicating anxiety - flinches; avoids contact; overly alert/aware
- Stress: eg unduly worried about situations; anxiety; false perceptions
- Worrying patterns: eg absences on specific days; avoidance of particular situations; repeated behaviours

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The following account will refer to each player by number in the order in which they tried the game. These trials were monitored and assessed by an independent researcher.

Players 1 and 2 (concurrent session)

Both players had played commercial games before. They immediately recognised the game controller and asked if it came from an Xbox. When asked what games they liked they mentioned Grand Theft Auto, Saints Row and 50 Cent: Blood on the Sand, all extremely violent, adult only titles. They were both confident in the use of the Xbox controller. They started the game confidently and both seemed interested in where the other was up to. Player 1 was more vocal than Player 2 and seemed to be having more fun. He was slightly ahead of Player 1, he would shout over whenever he found out something new. "Hey, Laura is in the door, she is in the door!" Player 2 was less enthusiastic and showed several signs that he was not being engaged by the activity. He did not seem to pay much attention to the dialogue and started running aimlessly around the environment rather than interacting with the characters. "This is boring", he said. His facial expression showed signs he was slightly frustrated. Meanwhile Player 1 seemed to be genuinely enjoying himself "He is going to smash me!" he said upon encountering the Chaos Agent, his facial expression showed excitement. Player 1 would regularly tell Player 2 what he was doing and ask where he was up to. Player 1s enthusiasm seemed to spur Player 2 on to progress within the game. He stopped running around aimlessly and started to interact with the in-game characters. He asked player one what to do when he became stuck. Player 1 said, "I've got a score!" Player 2 said, "So have I" Player 1 - "I got that fat man!" Player 2 - "So did I".

Unfortunately, after about 12 minutes of play, the software malfunctioned in Player 2's system. The randomisation of the order in which the interaction options were displayed had introduced an intermittent bug that did not show up in testing prior to the trials. This fault could, in certain circumstances, result in an infinite loop. Several minutes passed while attempts were made to fix the software, it then became apparent that, unfortunately, the only options open to Player 2 at this stage were to restart the game from the beginning or return to class. He decided upon the latter, but seemed disappointed to do so.

Player 1 no longer had a peer to communicate with and became much quieter. Up until this point, he had been animated and enthusiastic. Only a few minutes after his peer had left he asked if he could stop playing and go back to class. His TA encouraged him to play on, he agreed to do this but the levels of engagement he showed earlier had obviously dropped off. He stayed on task in game and seemed to pay attention to his choices but the visible and audible signs of real engagement had ebbed away. He asked again to stop a few minutes later and this time, after 25 minutes of play, saved his game and returned to class.

Player 1 did however return later in the day having asked his teacher if he could come back and continue where he left off. Despite a gap consisting of several hours he remembered where he was up to and what had just happened. He finished what was left of level one quickly. He did not get the first question on empathy correct. He, again, seemed excited particularly by the challenge of getting the chaos agent to change his ways. His first attempt ended quickly however as he rushed his first decision and failed. He was far more cautious on his second attempt, spending much more time going over each option before making a decision. He failed again despite being reminded that he should try to get the agent to think about empathy. It was clear he was unsure of the concept and its meaning in the context of the conversation. He asked if he could try again despite the rule dictating only two tries. On his third attempt, he deliberately took different options than he chose previously. He still failed early in the interaction. Despite this, he was desperate to try again and this time asked his TA for help. On his fourth attempt, he discussed each of the options with his TA before making a decision. With systematic help, he made it through the interaction and converted the agent. He was extremely pleased about this and left happy. It was clear that did not have the understanding of empathy to get through the interaction unaided. His second session lasted approximately 20 minutes. This time he remained engaged throughout despite the lack of a peer with which to share the experience.

Player 3
Player 3 suffered from ADD and was, at the time of the trial, undergoing assessment for possible Asperger's syndrome. He had very poor social skills and had particular difficulty with heeding instructions, usually having to be instructed

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several times. He had less experience playing games and was not so confident with the Xbox control pad. Despite this, he settled into the game without any particular difficulty. He got the hang of the controls quickly and knew intuitively how to play. He seemed deeply engrossed in the story. His facial expression showed excitement during general gameplay and concern when the Chaos Agent showed up. He appeared to be genuinely pleased when making progress. He expressed his worry that he could not find Laura and seemed delighted when he located her "I found her in the windmill" he exclaimed.

He lost points early on and after that seemed particularly cautious when making choices in game. He went carefully over all the different options available to him before selecting one. He occasionally came across an option he did not understand, a positive sign regarding engagement was that rather than simply discarding it to pick another he would actually ask his TA what it meant.

He spent a long time considering each option when he got to the interaction where the player must advice Laura what to do. He was unsure which choice was best and actively sought a discussion with his TA over which he should pick. His instinct was to pick the option that Laura wanted, which was to threaten the other children. His TA tried to advise him against this. After some discussion, he decided on the option advised by his TA and sent Laura to her teacher.

He then got enough points to level up and chose the speed power. He enjoyed using the speed power so much that he went to the trouble of activating it whenever he needed to move around the environment even if it was a very short distance. On one occasion the extra speed resulted in him completely missing the character he was attempting to approach, "Woah!" he said before laughing aloud.

In the interaction where Captain Concept asks the player about empathy, he laughed at the suggestion that it was the Captain's dog's name. He wanted to pick this option just to see what happened but was discouraged by his TA. He eventually picked that it was being nice to people as he was convinced this was the correct answer.

After about 30 minutes of play, he had completed the first level and moved on to the challenge with the chaos agent. He failed the first attempt quickly, it was

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evident from his discussion with his TA that he had not grasped what empathy was about at all. Perhaps sensing this, his TA asked if he would like to stop at this stage. He immediately dismissed this idea and went back to Captain Concept to try again. To the surprise of his TA, he selected the option to be told again what empathy means. He then tried again to convert the agent. He evidently wanted very much to succeed and he deliberated for some time over each of his options. He did not have requisite knowledge of empathy to get through the interaction however and he failed again. Unperturbed, he asked if the game could be fixed so that he could try again despite the limit of two tries, he was only prevented from doing so by another software glitch. He then returned to class, he had played for 43 minutes non-stop. He stayed on task in-game throughout proceeding to his next destination immediately. He appeared to be engaged to a high level throughout the entire activity. The only small signs of disengagement he showed in the entire session were during a long non-interactive section where he looked away from the screen several times and fidgeted slightly.

Player 4

Player 4 was also an experienced game player. He liked Grand Theft Auto and recognised the Xbox controller immediately. He started the game with no difficulties and immediately grasped the controls including how the Gizmotron operated.

Early in the first level, one of the previous players popped his head round the door to see what level the current player had got to, wondering if he was doing better than he had done.

Player 4 seemed very engrossed in the story. The section where the chaos agent approaches the player he exclaimed "Oh no!" Later when selecting a point scoring option he shouted "25 points!" His facial expression showed interest and excitement when making progress and gaining points. He progressed reasonably quickly tending to pick the more obviously sensible options. When his character levelled up he too picked the speed power, saying, "That's well fast!" when trying it out.

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On the first in-game mention of the word empathy, his TA asked him if he was listening. He said yes, when asked if he knew what empathy meant he said no, not really.

When the Chaos Agent approaches Natasha and starts giving bad advice he gasped loudly and said "Oh no, she is listening to that guy!" then "Oh, I'll get him now, I'll get him!" He laughed aloud when Captain Concept arrived to capture the agent. "There we go!"

He also enjoyed using the speed power to get around, laughing gleefully as he occasionally shot past the character he was aiming for.

On the empathy question, he listened to each option and then selected the correct one without hesitation.

Player 4 finished the first level after about 27 minutes. He rushed his first attempt at converting the chaos agent and picked the first option that sounded right without really thinking about it. On failing, he quickly rushed back to Captain Concept to try again. He selected to be told again about empathy. His TA advised him to listen to all the options available and not just pick one without thinking. He deliberated his options carefully on his second attempt. At one stage he was unsure of how to continue, his TA reminded him the topic was empathy and asked him what that was, "that people feel" was his response. With this nudge in the right direction, he continued carefully and took all the right options. When he got to the end of the interaction the word Empathy was in one of the options, he recognised this and said "OH, oh, oh! I think I am going to get him to change his ways!" He got the final selection right and converted the agent. He got a round of applause from his TA and seemed genuinely delighted with his success. He played non-stop for 36 minutes and seemed engaged from start to finish. He stayed on task throughout and gave many visual and audible signs of a high level of engagement. He also put genuine thought and consideration into the dilemmas that were put before him and by the end of the session he could articulate the basic idea of empathy.

Player 5 and Player 6 (concurrent session)
Player 5 came in at break time with Player 4. He had heard about the game from his peers and wanted to be the next one to play it. He then ran off to ask his

teachers if he was allowed. Having received permission he excitedly ran back to start the game. He settled into the game easily and seemed to find the controls intuitive. Like most players, he lost points early on. This seemed to make him consider his options more carefully in subsequent interactions.

Player 6 was also an experienced gamer. His favourite game was also Grand Theft Auto. He had to wait for a few minutes while the game was set up for him. During this time, he was disruptive and un-cooperative. When he finally began to play, he seemed uninterested from the start. He ignored the in-game tasks almost entirely. His facial expression indicated that he was bored. He fidgeted and looked around the room before turning his attention towards Player 5. He repeatedly shouted the other player's name trying to get his attention. Player 5 was far more engrossed in the game and tried to ignore Player 6. He persisted however and increased the volume of his shouts. Player 5 responded by saying "SHUSSSH I am trying to listen!" loudly and going back to the game.

Player 6 grumbled and continued to play, his TA tried to get him back on course by suggesting he go and talk to the next character. He said, "NO, I'm going here!" before running aimlessly around the environment.

Despite interacting with some characters, he seemed uninterested in the available options, preferring to push the buttons without listening. His fidgeting quickly got worse and he started kicking the underneath of the table loudly. His TA suggested he should look at all the options before selecting one. He dismissed this idea saying, "Nah, I just pick any". He got as far as the bullying scene and said "Bored", and sighed. His facial expression indicated he was thoroughly fed up. His TA asked what his last instructions were, he responded, "I dunno, just leave me!" He tried once more, without success, to gain the attention of Player 5. He then decided he would like to go back to class. He played for around 12 minutes, but never really engaged with the game at any time.

Meanwhile player 5 was making good progress through the game. He seemed engrossed in the story. He also seemed to be genuinely annoyed that Player 6's interruptions were making it difficult to follow events in game. During these interruptions, his facial expression indicated he was annoyed and disturbed. He progressed through the game generally taking the more obviously sensible

options. His facial expression indicated concentration rather than enjoyment. He levelled up choosing the speed power. He then successfully navigated the first question on empathy. He completed the first level and moved on to the challenge of converting the chaos agent. He obviously had a good grasp of the concepts involved and seemed to find this interaction reasonably straightforward. He listened carefully to each option but seemed confident in his choices, which were correct. He was pleased but seemed un-surprised by his success. He played non-stop for approximately 38 minutes and appeared thoroughly engaged, despite the distractions provided by Player 6, throughout the activity. He remained on-task in game and seemed to focus on the dialogue and concepts from the start.

Player 7

Player 7 immediately mentioned the Xbox upon entering the room and seeing the controller. He liked games and said he favourite was Grand Theft Auto 4. When asked what he liked most about it he said, "You get to nick cars and stuff".

He started the game with no difficulties. The controls were intuitive and he grasped the concept of the Gizmotron remarkably quickly. He seemed to engage with the story similarly quickly. He took time in considering the options available to him and, unlike most other players, often chose ones that were not the obviously sensible choice. He lost points on several occasions but seemed unperturbed by this. He was the only player who selected to hear what the chaos agent had to say when confronted by him. His facial expression indicated he was intrigued by in-game events.

When the first empathy question came up, he got the correct answer immediately. He seemed to enjoy the characters and showed genuine excitement at some of the in-game developments.

Despite not taking the most straightforward route, he completed the first level quickly and with almost no help from his TA. On the second level, he approached the challenge to convert the chaos agent with far more caution than shown by other players. He had listened and heeded the warning that it would not be an easy challenge and he would have to think carefully what to say. Most players failed their first attempt almost immediately as they had come across an option

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that sounded like it should be right and assumed this would be the correct choice. Player 7 however, on his first attempt, went over each individual option slowly, considering the connotations of each before deciding which to take. He got successfully most of the way through the final interaction when, unfortunately, the session ran out of time and he was called away for another activity. It was clear, however, that he was prepared to consider each step and understood the issues well enough to complete the interaction successfully. He played for approximately 35 minutes non-stop, remained on task in-game and appeared to concentrate fiercely throughout the session.

Summary

Player	Session Length (mins)	BESD	Previous Game Experience	Area of Game Reached	Observations
1	12	Severe aggression Defiant behaviour Long time resident in unit	Experienced	L1 -Progress halted by game bug	Few signs of engagement Fidgeting / Not on task in-game Appeared motivated by his peers success
2	25 + 20	Moderate aggression Moderate social problems Working well below average for age	Experienced	Game completed test passed but significant help given	Consistently exhibited signs of engagement Did not seem to understand empathy Was motivated to understand to reform chaos agent Asked assistants for help understanding empathy

3	43	Severe social problems Possible Asperger's syndrome Working well below average for age	Limited	End of level test - not completed	Consistently exhibited signs of engagement Could not articulate basic concepts related to empathy Highly motivated to succeed in-game Asked assistants for help understanding empathy
4	36	Specifics not available - See list in 6.4.2	Experienced	Game completed test passed	Consistently exhibited signs of engagement Could not answer questions on empathy early in game Appeared to have some understanding of the concept at the end and passed the test without significant help
5	38	Specifics not available - See list in 6.4.2	Experienced	Game completed test passed	Consistently exhibited signs of engagement Could answer questions on empathy early in game Appeared extremely focused on achieving in-game
6	12	Specifics not available See list in	Experienced	G1 - Player decided to quit	Almost no evidence of engagement Many signs of

		6.4.2			frustration / bordom Actively disrupted others
7	35	Specifics not available See list in 6.4.2	Experienced	End of level test - not completed due to time	Consistently exhibited signs of engagement Appeared to have basic understanding of Empathy from the onset Chose unconventional path through game Un-peturbed by setbacks / loss of points Succeeded with minimum support

Chapter 7: Analysis of Results

This chapter contains a qualitative analysis of the events observed in evaluations of Hero League Adventures. The results are examined for evidence of engagement with the game as an activity and for engagement with the concepts on which the narrative is based. The significance of the evidence is discussed and the possible effect of bias examined.

7.1   Trial One

The initial prototype was only tested with a single participant. This session, however, yielded some interesting results. When the player began the game, he was fidgety and unsettled. This reduced noticeably as he became engaged in the game. The session certainly indicated that the game was successful in engaging this particular participant. Indications were less positive regarding his engagement with the core educational topics of the game.

The participant was obviously enjoying the game, he also paid enough attention to the dialogue to know what task he was supposed to carry out next. Some confusion arose, however, over which character was which. It became apparent that the amount of information regarding the narrative he was retaining was superficial. He was not taking in much of the story and he did not grasp the importance or meaning of empathy. The main problem exhibited by this session was that Hero League Adventures version 1 (V1) had failed to encourage him to consider these topics in any meaningful way. Some flaws in the technical implementation of the game meant that he could play through successfully despite paying only superficial attention to the issues. It is reasonable to suggest that Hero League Adventures V1 worked well as a game and had the potential to engage players with educational topics. It did not however *require* this engagement.

7.2   Trial Two

Changes made to the software in Hero League Adventures version 2 (V2) attempted to prevent players progressing through the game with good outcomes without some contemplation of the educational content within. These changes appeared to be very effective. The randomisation of the order in which

interaction options are displayed ensured that players could not effectively attempt the strategy of selecting the first available option. All of the participants who successfully engaged with the game routinely checked though the available courses of action, considering carefully which they should take. There was however, a tendency for them to pick the first option they came across which seemed like a good choice, often neglecting to check and remaining options for the possibility of something better.

The Hero Points display was also successful in motivating players to get more points. They were conscious that the points they received counted for something. As a result, there seemed to be tangible increase in the motivation to maximise points during the interactions. This in turn led to greater consideration of the situations

Five of the seven participants completed the entirety of available game content. Of these five players, two managed to beat the final integration and reform the chaos agent. Player 7 ran out of time at the last minute but is highly likely to have completed the interaction successfully. He was engaged and considering his choices, he was able to demonstrate a good understanding of Empathy in discussions with his TA. The remaining two players could not pass the interaction despite multiple attempts. They did not appear to have gained enough understanding of the topic to succeed.

7.2.1 Engagement

The five players who completed the available content appeared to engage with the activity to a surprising level. Their body language was positive although many seemed unsettled or fidgeted at the beginning of their session. As they engaged with the activity this reduced or stopped entirely, some leaned closer to the screen. Facial expressions in many cases indicated enjoyment, intrigue and concern. All five remained on task in-game without showing signs of disengagement such as ignoring instructions or running around the environment aimlessly. There were also many audible signs of engagement with players laughing and making comments on the storyline and gameplay to their TAs.

The two players who didn't seem to engage with the game as an activity would ignore the tasks given to them in-game, preferring instead to run aimlessly around the environment and try running into various pieces of scenery to see

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what would happen. For Player 6, this lost its appeal quickly and he attempted to gain the attention of the other player present in the room. When he was unsuccessful, he decided to give up entirely. Player 2 also ignored in-game instructions in this manner. In this case, however, interaction with a peer, Player 1, seemed to have a positive effect. Player 1 would regularly call out to inform his peer of his progress. When this happened, Player 2 seemed to re-engage with the game and seek out his next task in order, perhaps, to keep up. It appears unlikely that Player 2 would have completed more than a trivial amount of the game without the extra motivation that seemed to come from the involvement of a peer. He seemed to find the game quite boring and paid little attention to the theme and characters within. Likewise Player 6 seemed to find little interest or enjoyment to be had in the activity. He seemed bored throughout and only played for a trivial amount of time.

These negative results could indicate that enjoyment of games is subjective. It would be reasonable to assert that no game will provide an enjoyable activity for absolutely everybody. The initial experiment conducted with commercial games showed that children in this demographic can become bored, frustrated and disruptive is they do not enjoy and engage with the game they are playing. It also showed that different children enjoy different kinds of games. Given the right game, they generally will engage and do so for extended periods. Hero League Adventures failed to engage some of the children who used it. This does not mean to say that a different game covering identical topics would not be successful. A change in the theme or nature of game mechanics could perhaps offer a more motivating experience for these individuals. It should also be noted that, despite the popularity of gaming for entertainment, not all children would necessarily engage with games in school environments.

Five of the seven children showed extremely positive engagement during the activity. They focused on the tasks given out by NPCs with little deviation. Some participants spent a trivial amount of time testing the collision system by seeing if they could walk into things, but they generally proceeded to the location of their next objective without undue delay. The points system was effective in drawing them into the story. They wanted to make the right decision to gain points rather than lose them but as the level progressed, the more correct option became less straightforward to select. Some interactions saw players

deliberate on their potential reactions for some time. They moved slowly over each option and thought about them before repeating the process. At this stage, some asked for advice from teaching assistants. They seemed to engage well with the characters and the narrative, some laughing or gasping audibly at various stages. Superpowers were popular with those who gained them, though curiously no player chose the super size power. The end of level interaction where the Chaos Agent can be reformed proved difficult enough that every player had to consider his options carefully in order to proceed. No player was successful on his first attempt, though Player 7 came close. Every other player who reached this stage failed at the first attempt. Critically, all such players wanted to try again, they were engaged and motivated to beat this interaction despite the fact that it was difficult and challenged them to think about difficult concepts. The two children who could not complete the interaction on the second attempt both asked for the rules to be bent so they could try again. They were extremely motivated to succeed in this task.

One aspect of game-play that had been identified as a possible source of concern prior to trials was the possibility the player would have points removed from their score. The concern was that, considering the demographic, any kind of setback might result in frustration or even the player giving up entirely. In practice, all the players lost points at some stage of the game but this did not seem to faze them at all. On no occasion did a loss of points give rise to any undue frustration. In many cases, players would spend more time considering their choices after their first negative score. Most participants were used to playing commercial games. As such, it is likely that they are familiar with negative game-play mechanisms such as limited lives, negative scoring and other such methods of requiring good play.

Issues

It is disappointing that a software malfunction affected Player 2's trial. He was clearly not being engaged by the game itself but the social or competitive aspects of playing with a peer appeared to motivate him. Whenever Player 1 reached a milestone, he seemed to actively re-engage and try to catch up. It would have been very interesting to discover if he would have played through the entire session in this situation. The engagement levels of Player 1 also

dropped off noticeably after Player 2 went back to class. This issue is an interesting one. Player 5 had been told that his friend had managed to complete the game so he was very keen to try it himself. He spent several minutes running around trying to get permission. He also seemed to show more determination to do well and less enjoyment than other players did. It seemed that because his friend completed the game successfully, he wanted to show he could do it too. Several times during the sessions children would come to the door to see how others were getting on, asking what level they were on. Even the player who had showed the least interest, Player 6, came to see what was happening. The competitive and social aspects of games are considered one of the strong points of entertainment games. This aspect of the medium clearly had some impact on the children's motivation. This study has not focused on possible ways to exploit competition and collaboration between peers for enhanced engagement with this demographic but it could represent an interesting area for further research.

There was also a demonstration of the negative aspects of social play in the last concurrent session. Player 6, who was obviously not impressed by the game, seemed intent on disturbing his peer's session. Disruptive behaviour is a common problem with children in this demographic. It is difficult to predict his motivation and the role the nature of the activity itself might have played in this, though he was clearly bored and unengaged.

Interactivity

The section of the game where the teacher discusses the bullied child's feelings with those who had been responsible for the bullying lasts for around 2.5 minutes. This interaction deliberately implemented content exactly as found in the SEAL materials without any changes for the game format. This part of the story is exactly as it would be if read out by a teacher in class. It is also the longest non-interactive part of the game. This was evidently an issue for some players, their level of interest visibly ebbed away as the interaction wore on. Some started pushing the buttons on the controller to see if they could somehow skip it, some started fidgeting and glancing around the room. The interaction is in line with the rest of the game in terms of content. The loss of engagement appeared to be simply due to the length of time they had to sit and listen in a

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sedentary manner, even though this would be a trivially short amount of time for a healthy child. Once it was over and the children took control again the signs of disengagement disappeared.

7.2.2 Educational Engagement

Game players are motivated by a desire to "win" the games they play. This certainly appeared to be the case for the majority of participants in the trials. They wanted to gain points, to level-up, gain superpowers and get the right outcomes. The game mechanics in Hero League Adventures v2 attempts to require engagement with the educational concepts of the game in order for players to be successful in these aspects of gameplay.

The points system encourages players to choose options that result in gaining rather than losing points. This motivates players to undertake careful consideration of the options available to them at each stage in order maximise their points and level-up their characters. This task is relatively straightforward at first with choices obviously polarised, "Say it is not nice to be mean" an example of a good option and "Say she is stupid" as a poor option. It is easy at first for the player to receive points for choosing the option that sounds like the good choice. As stated in the previous chapter, the goal of this mechanic is not to demonstrate good and bad choices, rather to provide an in-game motivation for the player to consider important issues. As the game progresses, the choices offered to the player become less polarised and so harder for children to determine whether they are correct or incorrect. This motivates an engaged player, who wants to gain points in order to level up and be successful in-game, to think about the situations that occur in the game on a non-trivial level.

This aspect of the game appeared to be extremely successful in the trials. Many players deliberated over their options for a considerable amount of time when unsure which would be the most correct. Some actively asked their teaching assistants for advice. The advice that was offered was generally basic, in part, because TAs were not familiar with the layout, content and pedagogy of the game. This could hold truly powerful potential however. Teachers and TAs familiar with the game and its educational goals could use this opportunity to discuss difficult educational concepts with students who are motivated to learn about them. .

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Understanding of empathy is something that is difficult to measure effectively. It is also important to note the system's reliance on language is certainly a limitation in this. Language is not necessarily the strong point of children in this demographic. Evidence of active engagement with the educational content can be seen however in the effort the players put in to understanding the concepts and situations of the narrative in order to make the right choices in-game.

End of Level Tests

The end of level test interaction was designed to require that players demonstrate an understanding of empathy in order to be successful. The results indicate that this was effective in the trials. The children who could not pass this interaction engaged in discussions regarding the problem with teaching assistants in between attempts. These discussions indicated that the children did not have the necessary understanding of the empathy. Despite careful consideration of the available options and multiple attempts, they could not complete the interaction without step-by-step help. Those who were eventually successful, however, were able to articulate the basics regarding empathy in discussions with TAs.

The educational content in the completed levels contain lessons on the meaning of empathy in a context comprising multiple characters with different motivations. Some of the children who successfully engaged with the game showed no real understanding concerning this concept even after playing through the level. These children could not complete the final interaction and reform the Chaos Agent. Every single player who got to this stage, however, wanted to attempt it again. Moreover, they wanted help in order to be able to beat the interaction and reform the agent. These children were actively asking their teaching assistants about empathy, they wanted to understand what it meant within the context of the game. They had not gained a sufficient understanding of the topic through playing through the games content alone. They were actively engaged with the concept itself however for this was central to their ability to win. This offered teachers the opportunity to discuss complicated and socially difficult topics such as empathy with an engaged child who wanted to understand. This is potentially truly powerful especially

considering the difficulties associated with educating children in this particular demographic.

Some children managed to pass the end of level interaction. These children seemed, at the end of the game, to have a reasonable grasp of the fundamentals. None of these players knew the meaning of the word "empathy" when asked the first time it was mentioned. The extent to which playing through the game content in itself helped convey the meaning of this topic is difficult to judge. The participants obviously had different backgrounds, different levels of development and prior understanding of issues such as empathy. Player 3, who was suspected of suffering from Asperger's Syndrome, had particular difficulty in understanding topics such as empathy.

Hero League Adventures v2 was not successful in engaging some of the participants at the trial. Those who did engage with the game on a trivial level showed evidence of engagement with the educational concepts to some extent. This suggests that gameplay was sufficiently integrated with educational content that engagement with the former required some engagement with the later.

Issues

Some of the pupils wanted to explore options in game that were not the most obviously correct available. They were discouraged, however, from doing so by TAs. The game is designed to allow for some poor choices, the consequences of which can be examined before moving forward. It could have been more beneficial to allow them to make bad choices without advice so that the results could then be discussed. In this regard, TAs were un-prepared to use the potential of the game as a context for useful discussion. They were aware of the basic layout and theme of the game. The finer details such as the results of certain courses of action taken by the player were not discussed beforehand however. To this end, some material on effective use of the game as a teaching aid could be produced for teachers and TAs.

The game appeared to be quite successful at engaging players for sessions of around 30 to 45 minutes. In order for the game to have potential as an effective teaching tool for SEAL principles there would need to be much more in-game content, perhaps eight to ten levels of similar size to the prototype. This would

allow the game to introduce other topics while revisiting and building upon those encountered previously. Whether or not the game would continue to offer an engaging experience as a regular activity to players who enjoyed the first level remains unproven. Good game-design principles such as increasing difficulty, adding additional features and facets of game-play could help to ensure that the player's interest does not diminish as the time spent in-game increases.

7.2.3 Bias

The results of the trial are largely positive. The evidence seems to suggest the potential of the game to engage children with severe behavioural emotional and social difficulties with educational topics from the SEAL framework. There are several factors, however, that could bias events and skew results in this direction.

Hawthorne effect

The "Hawthorne Effect" describes a situation where the results of experiments can be biased purely because the participants involved are being studied. This effect is particularly difficult to mediate against in trials such as the ones undertaken in this study. The game was a new activity for the children and it was accompanied by observation by strangers. This is in itself is highly likely to have influenced the participants' behaviour at least to some degree.

One factor that perhaps offsets this to some extent is that all the participants from the PRU in trial 2 had relatively severe problems. Several outbursts of aggressive behaviour were witnessed during the visits. This indicates that the children were not inhibited entirely by the presence of strangers. The five participants who engaged with the game successfully showed such high levels of immersion and motivation as to indicate that, while the Hawthorne effect was likely present to some extent, it was probably not a critical factor in terms of results.

Novelty Factor

The use of a computer game in a school setting is often something of a novelty for children used to traditional lessons. Teachers have observed in other studies that it is amazing the levels to which children will engage with any sort of educational game when the alternative is a hard maths lesson (Habgood, 2007).

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This factor could have biased the results, especially in trial 1 as the participant in this case was excused from a traditional lesson in order to play the game. In the second trial, this issue is far less likely to have been a factor. The sessions took place at the end of term, the class from which the participants were drawn were watching videos and playing games throughout the day. There was also a Playstation available to the children who would each be given a turn to play commercial games for short periods. Hero League Adventures, in this case, was not competing with hard work in a tradition lesson. Therefore, the novelty offered by the activity is unlikely to have resulted in any serious bias.

Further Trials to Minimise Possible Bias

In order to test the results for the presence of the above forms of bias it would be useful to conduct further studies that remove or minimise these factors. One way of removing the possibility that observation itself would influence results is to place teachers and TAs in the role of observers. The game could be installed on a resident computer at the school and used as a regular activity. Players would then be observed by familiar adults rather than strangers. Novelty would also be reduced, as players would become used to the game as an activity. The single level developed for the prototype offers insufficient content to cater for this approach however. This type of trial would need to be undertaken after the entire game had been developed.

Chapter 8: Conclusions & Further Work

This thesis set out to explore the potential of educational games as a medium to engage children with severe behavioural, emotional and social difficulties. Trials were undertaken to test the potential of a prototype game to engage these children with a game-based activity and with educational concepts that attempted to integrate with the gameplay experience. This chapter discusses the qualitative findings from empirical trials with respect to the hypotheses detailed in chapter 1. The potential for further work and trials to provide higher quality evidence is then examined.

This study has attempted to integrate gameplay and educational content at the level of game mechanics. The potential and drawbacks of this approach is then considered with a discussion of the possible ramifications for the wider context of educational game theory.

8.1 Conclusions

Hypothesis 1

The first hypothesis that states that an educational game can provide an activity which children with severe spectrum BESD will engage with for longer than traditional activities. The evidence gained from testing Hero League Adventures suggests that this hypothesis does hold for some games with certain children. This is not a surprising result, as no game will appeal to every player. During trials, several children with severe problems engaged successfully with the prototype game as a trivial activity. They played the game for the entire duration available, considerably longer than what was expected by their teachers and carers. It should be noted however that, in this case, teacher expectations of student engagement were not precise and therefore not necessarily the most objective measure.

The children who did not engage at all had not yet reached a point in the game where they were required to start considering any complex issues. It is likely that they simply did not find the game a fun activity. This could have been due to the educational nature or the theme of the game. It may be possible that a different kind of game based on the same educational principles would have

appealed more to these children than Hero League Adventures. It is also possible that the children were simply not willing to engage with an educational game in a school setting and the type of game was in fact, irrelevant. None of the children, however, displayed any reluctance to play the game on commencement of their session. Neither did any give up entirely without giving the game a reasonable chance, all played for at least ten minutes before deciding to stop. It is perhaps then more likely that Hero League Adventures did not meet the requirements of these individuals to be an enjoyable game experience, it was just not the right kind of game for them, and this is the main reasons for its failure to engage.

Hypothesis 2

The second hypothesis states that effective integration of gameplay and educational content can be successful in engaging this demographic with difficult educational topics as well as the trivial aspects of gameplay. The trials were sufficiently small scale that it is difficult to assert conclusively that this hypothesis holds, despite the evidence supporting this unanimously (for those players who were engaged by the game on a more trivial level). All five children who enjoyed and engaged with the game as an activity showed evidence that they were also engaging with the educational concepts to some extent. The evidence gained from trials does support the hypothesis that it is possible to engage children with severe social, emotional and behavioural difficulties with educational topics if the effective integration of gameplay and learning content can be achieved.

Alternative Hypothesis

The alternative hypothesis states that children with severe social, emotional and behavioural difficulties will disengage from the game activity when gameplay begins to force consideration of educational topics in order for the player to be successful. The evidence strongly suggests that this hypothesis can be discounted. Hero League Adventures was not successful in engaging all participants in trials. None of the children who did show positive engagement with the game, however, could be observed to disengage in any way during the end of level test. The complete opposite was in fact observed, the children seemed to concentrate harder at this stage, because the challenge was hard,

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they were limited in the attempts they could make and most importantly, they were motivated to win. The only focus in this interaction was on the educational issues and answering difficult questions on empathy. Not all of the players understood the concepts well enough to succeed in this task. These children tried and failed several times, they took their time and considered their options but were still not successful. This did not result in any of them getting frustrated and giving up. In all cases in fact, they wished to have more opportunities to try again than were afforded in the game design.

Summary

The evidence coming from the trials does seem to suggest that if the game offers an engaging activity; if players are involved, immersed and have a desire to be successful in-game; if the educational content is integrated effectively into gameplay then these children can be engaged with difficult and complex education content while playing.

The motivational aspects of the game seem to be effective in motivating children in the target demographic to engage with the educational content. This is especially evident when a demonstration of this knowledge is required in order for good outcomes to be achieved in-game. Establishing whether this can be translated into an increased understanding of such content however requires further study.

The evidence strongly suggests that students with severe BESD will not necessarily disengage with an educational game that integrates gameplay with education effectively, even when forcing focus on difficult educational topics like empathy. Several children with a range of severe behavioural emotional and social difficulties engaged with Hero League Adventures as an activity and attempted to engage with the concept of empathy during the end of level tests. They did not disengage even though this interaction was difficult and required knowledge of educational content.

8.2   Further work

This section describes future work that could be undertaken to develop the prototype version of Hero League Adventures into a full product and learning

activity. It will also examine the possibility of further experimentation and trials examining the long-term effectiveness of the activity.

8.2.1 Interactivity

The only area of the game where several players did show obvious signs of becoming disengaged was in the section lifted directly from the seal materials. It is highly unlikely that nature of the content was responsible for this as it entirely in-line with the rest of the level. It was almost certainly due to this section being the largest non-interactive part of the game. The players went from being involved participants in the story to passive bystanders, listening to a lecture in a virtual school environment. This almost immediately resulted in a visible drop in engagement levels. Had this section been longer in duration it might have resulted in some players losing interest entirely and deciding to quit.

The intention behind this section of the game was to ensure that some important educational content was delivered in exactly the same manner as it would have been in a traditional SEAL lesson. It was not intended to test the effect of interactivity on the motivation of players with behavioural difficulties and short attention spans. This was certainly an interesting observation however and could make for an avenue of further research. Interactivity alone is not enough to ensure engagement. The complete lack of any engagement demonstrated by some players in the trials is testament to this. However, when interactivity was taken away for short periods the result was an obvious drop in the engagement of players who otherwise had enjoyed the activity. This is also an issue in the entertainment games industry. Many in the gamers' community are extremely vocal in their dislike of lengthy and un-skipable cut-scenes found in certain games.

It would be interesting to add trivial levels of interactivity to the same section of game-play, such that it would be in-line with much of the level's content. This would have an extremely limited impact on the content of the interaction, which would continue in much the same way regardless of decisions made by the player. It would also result in a slight increase in duration, as the player would take time to make choices. The two different versions could then be compared to examine whether the trivial choices made during this period, regardless of any

real impact on content, could preclude the drop in engagement observed in the non-interactive version.

8.2.2 Content

The major issue preventing more meaningful trials with Hero League Adventures is the lack of content. The current prototype consists of tutorial level, a single full-content level and a test level. The completion of all three generally takes between 35 and 45 minutes. Due to the branching nature of the story however, the full amount of content involved is far more substantial. There are over 850 audio recordings of in game dialogue, this alone represents more than an hour listening time.

The design is based around a multi-level system. Additional levels and content could be added easily without altering the design or the engine. The theme and characters made up of Heroes and Chaos Agents could extend to cover the other core topics of SEAL: Self-awareness, managing feelings, motivation, and social skills.

Ten full content levels could be implemented in order to provide a regular activity that covers a significant portion of the curriculum. The first five levels would cover a single aspect of SEAL. The final five would mirror the spiral approach of SEAL and revisit each topic in turn, elaborating and building upon the principles explored previously.

In the prototype it is only possible for players to level-up twice, each time they need to collect double the Hero Points required the level before. Every time they level up, they gain a new superpower. The longer duration of a full product would result in players levelling their characters many more times. In this case, the player would start gaining superpowers at set intervals rather than on every single level-up. This type of system is commonly utilised in entertainment RPGS.

Each of the five aspects of SEAL would be covered in a different level. These would comprise different characters and a different narrative within the overall Superhero theme. This fact helps prevent the gameplay from becoming stale. The concepts and challenges of the levels are different. The final five levels involve revisiting topics explored earlier. These would be more complicated to provide increased difficulty. Innovative use of the Superpower system could also

be used to add additional layers of gameplay as users become more accustomed to the game. This is a solid game design principle to ensure continuing motivation.

8.2.3 Further Trials

The completed version of the prototype, as described above, would offer between five to eight hours of content. As such, it could be utilised as weekly activity in educational institutions such as nurture groups, special schools or pupil referral units. Use of the game in such circumstances could minimise, and possibly eliminate, the main possibilities of bias in trials.

Teachers and teaching assistants who deal with the participants on a daily basis would be placed in the role of observers. The "Hawthorne Effect" would thus be eliminated, as the activity would no longer involve observation by strangers. Trials using a completed game would involve up to ten weekly sessions and would therefore become an activity comparable to others in the children's educational timetables. The duration of which would be enough to rule out any serious bias caused by the novelty involved in the trivial aspects of a game-based medium, the presence of a game controller or 3D graphics for example.

Such trials could then be used to explore the potential of Hero League Adventures as a real tool with which teachers could attempt to engage students with SEAL principles. If this engagement is evident, as it was in the trials detailed here, and this continues through different levels and topics, the activity could offer teachers a powerful opportunity to teach children about their own behaviour, emotions and social skills. There could also be the opportunity to measure participants for actual improvements in behaviour. Several systems offer a mechanism for evaluating behaviour in children (eg. Reynolds, 2010). Pre and post test evaluations could provide evidence of any changes. As such, these trials could examine the true potential of Hero League Adventures, as an educational activity and as a mechanism of providing engagement and discussion of behavioural, emotional and social issues.

8.3 Reflections

The following section contains thoughts and reflections on the issues involving, and arising from, this study. The educational potential of Hero League

Adventures and other games, which would attempt to educate through gameplay, is discussed. Finally, the implications for the wider context of educational and serious games are examined.

8.3.1 Educational Games or Educational Gameplay

The experiment conducted at the onset of this study utilised commercial games from several different genres to test their potential for engagement with children in the target demographic. The results indicated that the "pain and reward" approach found in edutainment titles would result in frustration. It was also anticipated that trivial integration of gameplay and educational content based on fantasy alone would fail to engage this demographic with anything other than the fun aspects of gameplay.

Hero League adventures utilises several game characteristics to provide a coherent gameplay experience. Players undertake mission, gain points, lose points, level-up and gain superpowers that allow them to perform superhuman feats in the game environment. The core game mechanic on which the entire game revolves however is the branching dialogue system, which allows players to interact with the characters inhabiting the game world. This mechanic was carefully chosen for its ability to focus on flexible content combined with a proven record of accomplishment as a successful game mechanic in entertainment role-play games. The system of interactions is the only non-trivial way in which the player interacts within the game world. Their success or failure in-game is entirely dependent on choices made using this system. Educational concepts, empathy in the prototype level, can be effectively integrated with the *experience this mechanic controls* - the interaction with narrative and characters. The gameplay experience of Hero League Adventures can therefore be considered in itself educational to some extent.

8.3.2 Educational Game or Supervised Learning Activity

Hero League Adventures tells the same stories that are found in the SEAL materials as used in schools. Teachers use these stories to encourage children to think about and discuss important issues such as empathy. The game exists for the same educational purpose, but represents a different approach. Children in mainstream classes will attend SEAL lessons where they will learn about the same issues and undertake group activities and role-play sessions with peers.

These kinds of social, collaborative learning experiences are in many ways preferable to a game based activity. Where the game could offer real benefit is in helping deliver SEAL lessons to those with difficulties, for whom collaborative work is often impossible.

Hero League Adventures has limited educational potential as a standalone activity. The storylines themselves offer an exploration of the issues. The results seen in trials indicate the game mechanics do require players consider these issues carefully if they are to be successful in-game. Players can also learn about empathy and its meaning within the context of the storyline. The potential for far greater educational benefit lies in the possibility the game will engage children with difficult concepts such as empathy. Even in a single session lasting no more than 45 minutes, players will encounter difficult problems that are not straightforward to answer. Engaged players are highly receptive learners at this stage precisely because they are engaged and immersed in the world of the game. They are focused on winning and gaining an understanding of the educational concepts will help them to do this. The potential educational benefits that could result from interventions by teachers with these children, who already are engaged with these difficult issues and motivated to understand them, could be substantial. This is an especially exciting potential considering that the assertion of experts is that this type of engagement is particularly difficult to achieve with this demographic of children. There is also the possibility for powerful positive reinforcement in the relationship between teacher and student. The teacher is no longer the "bad guy" forcing unwanted education on the child. They are helping them to win a game. The teacher also has the opportunity to explore the child's natural reactions. Many children in trials picked options that indicated they thought other people's feelings were important because "it's the rules". This is a valuable insight for teachers into the way their students view the world.

For these reasons, Hero League Adventures requires one-on-one supervision with a suitably trained adult to fulfil its maximum potential for education. This in itself would prove prohibitive in normal classroom settings. Children with severe spectrum BESD, however, routinely receive one-to-one supervision from teaching assistants and other professionals. A weekly 45-minute session using the game with one-to-one supervision from suitably trained teaching assistants

would fit in with usual routine with minimum disruption in many PRUs and special school units.

Social Competition

The mass-popularity and socially competitive nature of games as a medium could offer motivational benefits in these types of setting. Children talk about games and compete with each other on scores and their progress. Several instances of this kind of behaviour were observed during the trials. Children who had played the game were interested in the progress of their peers. On several occasions, children came to the doorway to enquire how many points and what level the current player had reached. They were particularly interested in which players managed to complete the game successfully by reforming the Chaos Agent. This aspect of games could provide benefits should the game be used in weekly sessions. Children could be motivated to compete with each other to see who make the most progress in a session and who can get the most points.

8.3.3 Gameplay vs. Traditional Storytelling

In chapter three, gameplay is described as the many trivial aspects of game rules, controls and mechanics which go to create the experience and feel of game playing. On close examination of the core mechanics and the gameplay in Hero League Adventures involves a simple interaction with text. The majority of the gameplay experience involves a two-way interaction with characters and a detailed narrative. The exact story the user experiences is dictated by the decisions they make in game. The overall volume of text involved however is no more than found in a short story. Is the game-based method of experiencing this narrative any more inherently educational than a simple text based story however? This is likely to be dependent on the engagement and immersion of the reader.

The interactivity in the narrative, the direct interaction with characters and the trivial game mechanics such as points/rewards make Hero League Adventures an extremely engaging and immersive activity in which children can experience the story. Anyone who has read a good book knows that narrative itself can also be engaging and immersive. The potential for educational benefit of the narrative in the game and a simple text based short story are likely to be similar given an equally engaged and immersed audience. The amount of work required

to produce a modern computer game however is an order of magnitude greater than a simple story. A huge amount of thought and effort went into the design of Hero League Adventures over a three-year period. Much less time was spent on actual implementation. An engaging short story is still required, in a game format however, it is only the first building block. A huge amount of alternative text is required to make the story trivially interactive. Whether or not this represents a cost effective investment for the creation of learning tools depends entirely on the intended audience.

8.3.4 Limitations of Gameplay Based Learning Platforms

Chapter 3 examined the theory and literature surrounding the use of games as a medium for serious learning. It argues that the approach traditionally taken, one of separation or trivial integration through fantasy, of the gameplay and learning content has resulted in the failure of educational games to fulfil the potential long theorised in popular literature. This thesis argues that meaningful integration between gameplay and learning content must involve the basic constructs of which the gameplay experience is comprised - the game mechanics. Could this type of integration, however, be utilised by educational game developers to fulfil this thus far elusive potential - any subject matter can be incorporated into the fantasy theme of a game but can game-mechanics be utilised to teach any subject?

Marc Prensky, in 2001, dismissed objections from "Digital Immigrant" educators that games would not work in their particular subject as "nonsense" and argued that this was simply lack of imagination (Prensky, 2001). He defended this position in a 2005 paper on the need for complexity. He argues that trivial games, such as mini-games, can be useful in education only on a trivial level, and that complex games are inherently different and require massive investment from the player to complete:

> *"Unlike mini-games, complex games are not trivial, and are not limited to one small topic or skill. Complex games are deep – the time kids spend playing a complex game (on average about 40 hours) is the same as they spend in class in an entire course in school. Complex games have the potential to teach, and teach well. They are big enough to include and teach entire bodies of material, and even entire courses."* (Prensky, 2005)

It is certainly the case that complex games are different to and more sophisticated than mini-games. Entertainment RPGs often contain enough activities and content to keep players engaged for more than 50 hours. Complex games provide a more in-depth experience than mini-games by utilising a composite of many separate game mechanics. They rely on in-game rewards, adding new elements of gameplay, allowing different strategies, having an evolving story and increasing difficulty to keep the gameplay experience fresh and to retain the element of challenge. These games are carefully designed to offer an engaging experience to users for long periods. The length of the experience in itself allows complex games to provide a detailed narrative where mini-games cannot.

This study has examined methods by which non-trivial educational content can be integrated effectively with gameplay mechanisms. Play styles and game mechanics from a wide variety of complex games were examined to assess their suitability for integration with non-trivial content. One of the two methods implemented, the themed card game, attempted to utilise a system of mechanics based on a variation of those in the established and popular Pokémon games. The result was a game that could only convey an extremely trivial representation of complicated issues. Pokémon is undoubtedly a complex game. Players who wish to complete the hardest challenges can continue to progress well past 100 hours of playtime. On close examination, the systems and gameplay that define the experience of playing a Pokémon RPG are extremely trivial in nature. The core-mechanic is a turn based battle system where players use sets of Pokémon to battle against those of a foe. There are many different kinds of Pokémon whose abilities offset each other's in the style of "rock, paper scissors". To be successful the player must put together an effective team of six Pokémon with different strengths and weaknesses in order to beat different kinds of foe. They must build the strength of their Pokémon and get them to "level-up" to continue to be successful against harder foes. The player spends the vast majority of their time finding, training, and battling their Pokémon. Although the Pokémon games are complex, the core mechanic, and indeed most of the gameplay system, is made up of trivial interactions. It is difficult to conceive of *any* method of integrating non-trivial educational content on SEAL topics with the gameplay mechanics of the Pokémon games in any way that

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would not result in only a trivial representation of such content. Parents of young Pokémon fans will agree however that learning is involved, veteran players can reel off a veritable encyclopaedia of knowledge on the hundreds of different Pokémon in the game, theirs strengths, weaknesses, even how you can breed and evolve them into different forms. It is certainly possible that this model of game could be used for other types of educational content but the content must fit the gameplay system, not the other way around. Players learn about Pokémon because utilising their abilities in battle is the core-mechanic of the game.

Limitations of Educational Gameplay

The approach taken in this study uses proven mechanics and systems from the entertainment games industry to attempt to provide motivation for learning. The core mechanic is not educational in itself however, it is the branching dialogue system, which ensures that to play and to be successful the player must engage and interact with text. It is not this trivial interaction of gameplay but the narrative of the game that provides educational content. The gameplay appears to work educationally only because it incorporates this narrative into the core of the activity. The core mechanic involves a non-trivial interaction with the story. Motivational systems from entertainment games (points, character levels) are then utilised to enhance motivation and engagement.

It seems reasonable to suggest that the approach taken in this study could be utilised to teach other subjects where meaning can be conveyed through narrative. The strategy genre also has potential for educational gameplay provided understanding of the rule systems on which the game is based is educationally beneficial. Most game mechanics found in entertainment games are so trivial however, that it is difficult to imagine they might be employed for serious learning.

This is the case with almost any traditional entertainment computer game. They can be challenging, contain complex systems, and take an extremely long time to master and complete. No matter how complex the game, the core-mechanic it is based on - *"the essential moment-to-moment activity of players"* is always, at the basic level, a simple and trivial interaction between player and game. Every first person shooter ever made has, at the heart of the activity of playing, almost

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identical core mechanics made up of *"interrelated actions of moving, aiming, firing, and managing resources such as health, ammo, and armor"* (Salen & Zimmerman, 2004).

One glance at the game-pads used to control almost every game yet released on the PS3 or Xbox system conveys that the player is limited in his potential to interact with games systems on anything but a trivial level. Players interact by making movements and decisions using a variety of simple button presses and movements of directional sticks.

Games are Effective Teachers of Gameplay

Good games contain complex systems that the player must learn in order to play at a high level. Game designers use levelling mechanics and other methods of encouraging players and teaching them to master these systems. These are highly effective, this has been written about extensively in the literature theorising the potential of learning games (eg. Gee, 2003b). These motivational systems are effective teachers, but they teach players how to play. They are specifically, and inextricably, concerned with trivial aspects of gameplay and underlying game mechanics. If educational games can be genuinely educational on the level of gameplay and game mechanics then these systems *could* work in serious educational contexts.

Integration of game and educational content through fantasy is achievable and it allows almost any subject to be inserted into a game. This has thus far proved ineffective however. Educational gameplay could offer a way in which the full motivational power of games can be utilised for education. The concept of truly educational gameplay is a challenging one in itself however. Prensky argued that mini-games are useful educationally on only a trivial level *"Mini-games may have their place, but they will always be mini, and therefore mostly trivial"* (Prensky, 2005). The same could be argued for education through game mechanics, as these are likewise trivial in nature. RPGs incorporate narrative to such an extent that the motivational systems they utilise can be effective educationally if the narrative is educational. Not all subjects can be taught in this way however. Can game mechanics be utilised for serious educational use without the reliance on narrative exhibited in this study?

Jacob Habgood was an experienced, professional games designer at the time he conducted his study into learning games. He designed his own core mechanics that would integrate mathematics into his game, Zombie Division. This was successful although in an extremely limited way. If gameplay and game mechanics are to be effectively utilised for serious learning in games on a wide variety of topics then genuine innovation will be required from educators, in partnership with professional game designers attempting to invent new core game mechanics and gameplay experiences that preserve the fun of games while providing opportunities for real education.

8.3.5 Final Thoughts - Engaging the Un-engagable

"We need to raise the bar for educational use of computer games - asking under what circumstances do we learn and how do computer games compare with other learning experiences. It is hardly enough to establish that we learn from computer games as this is essentially true for any activity we engage in. The real question is what computer games offer that set them aside from existing educational practice" (Egenfeldt-Nielsen, 2007)

This thesis has detailed the design and implementation of prototype games intended to aid the education and engagement of children with severe spectrum BESD. The design requirements stipulated that players must not be able to win without learning about, and engaging with, the educational topics within the game. There must be no way around this as game players are adept at testing systems for boundaries and shortcuts, these behaviours are encouraged in commercial entertainment games. The gameplay and theme of game must also provide an engaging activity for the tastes of the player as an individual. This, in effect, makes it impossible to cater for everyone with a single game. Hero League Adventures attempted to cater for the widest possible audience by adopting a super-hero theme that is widely popular in appeal with the target age group and a familiar RPG style of gameplay.

The evidence emerging from trials involving Hero League Adventures suggests that, if these requirements are met and players are motivated to win or succeed, children with severe behavioural, emotional and social difficulties will indeed engage, to some extent, with extremely difficult topics in order to succeed in-

game. Some players were obviously willing to put considerable effort and consideration into understanding the in-game issues relating to empathy in Hero League Adventures. None of the evidence supports the hypothesis that children in this demographic will disengage from the activity when gameplay forces consideration of difficult educational concepts; providing gameplay itself offers an enjoyable experience to the individual player and is effectively integrated with educational content.

These findings do not mean to imply that computerised games are the most appropriate medium for education in this demographic as children. They could represent an extremely useful tool for engaging children with difficult concepts. As a medium for conveying serious educational content however, games are at best, inefficient when compared to traditional instructional methods. Zombie Division (Habgood, 2007) employed a core game mechanic which required mathematical techniques be applied in order for the player to be successful. It was impossible to argue that the system was justified in a classroom context however, precisely because of the inefficiencies involved. Something the author concedes:

> *"Zombie Division teaches only a tiny section of the curriculum, and the technical and organisational overheads for both children and teachers would almost certainly be prohibitive to its use. Moreover, Zombie Division teaches learning content which teachers can already teach effectively, so there would be little motivation for teachers to make the additional investment required to use it. Any future for games in the classroom almost certainly lies in teaching learning content which is difficult to learn in any other way: such as an appreciation of systems and processes, or in working with learning content which would otherwise be too dangerous or expensive to experience. Only in situations which provide something beyond traditional teaching can the investment of classroom time really be justified."* (Habgood, 2007)

Games and virtual environments can indeed provide learning that cannot be easily replicated in the classroom however. Work has been conducted on categorising learning situations where similar technologies (virtual reality) offer

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learning opportunities that would be dangerous or difficult to achieve elsewhere (Pantelidis, 1997).

One of the most important themes emerging from this study has been the difficulties inherent in attempts to integrate game design and educational concepts in an effective way. Countless educational games with separate or trivially integrated gameplay and education have been released in the last 30 years. Even the most ardent supporters of digital games as a medium for learning admit these have been largely unsuccessful (Prensky, 2001). Attempting to achieve real and meaningful integration of games and education through game mechanics may offer a way of better harnessing games systems for education. It also presents difficult problems for educators. Creating educational games which utilise game mechanics to create educational gameplay is extremely difficult (possibly prohibitively so in many subject areas) due to their trivial nature.

Computerised Games *can* be tremendously powerful educational tools in the hands of capable teachers, with the right subject matter, the right gameplay and with the right audience. They certainly do not represent a "silver-bullet" for learning. Academics, parents and teachers have watched in awe as young people concentrate, hour after hour, in their leisure time, playing entertainment games. They dreamed of a world where they would do likewise with educational titles and learn all manner of skills traditionally only taught in schools. This world has yet failed to materialise. The author of this thesis believes that it never will. The theories surrounding educational games in the popular literature are compelling but there are many difficulties involved in their real world implementation

Despite the issues involving the use of games in education, there is a real and powerful motivation to use them for the audience described in this study. They enjoy and understand games. Traditional educational materials have failed to capture their attention. The medium does have the motivational power to engage them, and not just with trivial things. In this case, the results are certainly worth the effort required and inefficiencies inherent to the medium.

This could represent the true potential of serious and educational games technology - the potential to engage audiences that are difficult to reach through other mediums and to help teach concepts that are difficult or dangerous to

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convey using traditional instructional education. The entertainment gaming industry is continuously pushing technology forward. New and innovative motion control schemes as seen on the Nintendo Wii, the Playstation "Move", and "Kinect" from Microsoft are opening up new areas where games technology can offer exciting potential for serious use. There are tremendously valuable things that could be achieved using games as a medium for more than entertainment. There are many areas where games technologies offer exciting potential as specialised tools. A recent patent application by Microsoft, for example, indicates the prototype version of the camera based Kinect system can recognise and interpret sign language (Latta, S., K. Tsunoda, et al. 2009)

This thesis has described a study to design and develop educational games to aid the education of children suffering from severe behavioural emotional and social difficulties. These attempted to provide a proven gameplay experience comparable to entertainment titles while channelling engagement, and the motivation to win, towards the development of understanding of difficult educational concepts such as empathy. The results were certainly encouraging. It must be stressed, however, that trials were small in scale and testing conditions were not ideal. Further research in this area is required to substantiate the findings of this study. In the wider context of games for serious education, the problem of effective integration of the two paradigms remains. Gameplay is what empowers games to engage and motivate. It also brings limitations in educational contexts and is extremely difficult to integrate with non-trivial content. Games do have the power to move, to inspire and to engage, even those described as "un-engagable". The strengths and limitations of the medium must be understood, however, if they are to be utilised effectively as educational tools.

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