Code of Everand

Final Evaluation Report

Ian Dunwell\textsuperscript{1}, Simon Christmas\textsuperscript{2} \& Sara de Freitas\textsuperscript{1}

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\textsuperscript{1}Serious Games Institute, Coventry University

\textsuperscript{2}Simon Christmas Ltd.

Cover image: frequency illustration of players’ responses to “What lesson do you think Code of Everand might be teaching you?”
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Produced by:

The Serious Games Institute
Coventry University Technology Park
Cheetah Road
Coventry
West Midlands
CV1 2TL
United Kingdom
rsgi@cad.coventry.ac.uk

In association with:

Transport Research Ltd.
Simon Christmas Ltd.
ChildWise Ltd.
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1 Executive Summary

The Code of Everand (CoE) was a multiplayer online game for road safety commissioned and developed in 2009 as part of the Department for Transport’s THINK! Campaign. The game was marketed to children 9-13 years old through an advertising campaign which used both television and the Internet as a means to reach its intended audience. The ultimate aim of the game was to contribute to a reduction in child pedestrians killed or seriously injured (KSI), with a particular emphasis on children transitioning between primary and secondary schools, as research had shown high risk amongst this group.

Background

Children in the 9-13 group are difficult to reach, and whilst studies have shown they can frequently demonstrate knowledge about correct road crossing protocols, they can also fail to apply them in practice. Two main reasons have been put forward for this (Tolmie et al., 2006): Firstly, they do not have much practical road crossing experience, as they are usually accompanied on most journeys and have not often crossed roads alone. Secondly, road crossing is not a top priority for children and therefore is not ‘top of mind’ as other dangers such as bullying and substance abuse. The issue is compounded by a sense that safety awareness is not ‘cool’, and hence it has been difficult to change behaviour and attitudes through traditional messaging approaches, such as TV adverts.

To address this challenge, the campaign objectives of Code of Everand were specified as:

- To encourage 9-13 year olds to put their existing knowledge of pedestrian road safety into practice
- To find a way of making pedestrian road safety skills more interesting and more ‘top of mind’– to contribute to making alertness at the roadside valued so that 9-13 year olds both as individuals and amongst their peer group understand and apply safe behaviour
- To employ a more active and participatory form of communication than simply ‘messaging’ the audience

The game was developed a leading serious games developer, Area/Code, who constructed a fantasy land called Everand, criss-crossed by spirit channels, with players assuming the roles of Pathfinder heroes in the game. The game created many metaphors to real-world road safety through its fantasy land, allowing players to rehearse existing skills and gain a new perspective on their application. The game was launched on 19th November, 2009, alongside online search and display advertising on child-targeted websites which ran until 6th December. Two bursts of television advertising during holiday periods (25th December – 10th January 2010, and 12th February – 31st March 2010) were supported by paid search, along with fan sites for the game set up on major social networking sites including Facebook,
MySpace, Bebo and Twitter. By January 2011, this led to a total of 541,310 unique visits to the game’s website, and a total of 173,069 signups, leading to 107,357 characters being created within the game. Refer to Annex I for a complete timeline.

In March 2010, a research programme was commissioned by the Department for Transport through the Transport Research Laboratory to evaluate the success of the game against these campaign objectives. The research programme was led by Coventry University Serious Games Institute, with input from Transport Research Laboratory, Simon Christmas Ltd and ChildWise. The programme sought to:

- ‘Baseline’ attitudes (and behaviours) amongst the target audience
- Establish the various ways in which we expect the game to effect attitudes and behaviours around pedestrian road safety practice
- Capture and measure the effects of the game (at various levels of participation) on these various indicators
- Produce recommendations on altering or adding features to the game to improve its efficacy

In addition, the programme sought to better understand the audience that the game reached, and the extent and nature of their interactions with the game. This report details the findings of this research.

**Method**

The method adopted (Section 4) precluded a control-study approach to examining the game for two principal reasons:

- The scale that would be required to screen a nationally-sourced sample for *Code of Everand* players to serve as a sample would not be practical. An exploratory 1,108 child national survey seeking to gain insight into the gaming habits and internet use of children yielded 33 players.
- Deployment of the game within a more pragmatic randomised trial setting (e.g. on school sites), would not be representative of the games intended usage context, as the game seeks to utilise leisure time rather than replace existing training materials or schools.

Hence, this report details the findings of an mixed-method approach, which combined a range of sources of data to gain both qualitative and quantitative insight into the reach and efficacy of the game:

- Data from the game engine, which captured data on all players over the life of the game (November 2009 to January 2011) and their in-game behaviours was analysed (4.2).
• Qualitative work was undertaken in the period February-March 2011, introducing a small sample of children to the game and analysing their responses and behaviours (4.3).

• A national survey of 1,108 children in December 2010 was supplemented by a survey of 1,038 Code of Everand players contacted by email (4.2) in February-March 2011.

The research expanded upon the initial target age group of 9-13 to consider a broader group aged 9-15, to examine if any potential for impact in this wider group existed. Informed consent from participants was achieved through the sign-up process for the game, as well as a number of additional standards applied to survey and interview activities. Ethical approval was obtained from Coventry University Ethics Committee (4.4).

Key findings

A principal key finding of this report is that game-based learning, deployed and promoted on a large-scale, was able to reach and engage a sizable audience representing a hard-to-reach demographic. This was shown through the uptake of the game, and the reporting from a number of surveys, which showed that:

• An estimated total of 62,000 UK children within the broader 9-15 age bracket played the game. In the more specific case of the 9-11 age group, a particular risk group undergoing the transition from primary to secondary school, the estimated player total is 30,000 (5.1.4). The total of 62,000 corresponds to 1.3% of the total UK population aged 9-15.

• 1 in 5 children who heard about the game went on to play it (5.1.2)

• Half of all players experienced Code of Everand as a single session of less than 31 minutes. The differences between the median\(^1\) of 31 minutes and mean\(^2\) of 93 minutes demonstrate a clear separation on the player-base into a majority who experienced Code of Everand in a single session, and minority who played the game frequently over the long-term: 1,471 players revisited the game more than 20 times (5.1.6).

• Though skewed towards a male audience (only 1 in 5 players were female), the game reached a broad range of areas and ethnicities, with only a slight trend towards greater uptake in less deprived areas (5.1.5)

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1 The value between the top 50% and bottom 50% of all playtimes: i.e. 50% of players spent less than 31 minutes in-game.

2 The average, achieved by summing all playtimes then dividing by the number of players. This is larger than the median as a result of a minority of players with extensive playtimes (see Section 5.1.6).
Self-reported attitudes of children towards the game showed a broadly positive attitude towards serious gaming in a road safety context (5.3.5), with only 12% agreeing the game being educational made it more ‘boring’.

Quantitative evidence (5.3.1) shows the children that responded to the player survey to self-report safer behaviour than the national sample. On the surface, this is an encouraging result: however, no link was observed between total time spent playing and improved self-reporting, and the difference in context between the two surveys, making it difficult to conclude this difference was due to the game alone. Furthermore, this is restricted to self-reporting, rather than direct observation of behaviour.

Given the difficulty of reaching the 9-13 group through other methods, particularly when the group possesses the knowledge required for safe behaviour but fails to apply it, the selection of a game is in part validated through its uptake and the positive attitudes of children towards it (5.3.5). However, the median contact time of 31 minutes coupled with the indirect nature of the road safety message makes it difficult to conclude the game alone would have a concrete impact on road crossing skills or behaviour across the player base. This does not necessarily mean the game did not have the potential to stimulate children to raise their awareness or skills through other means outside of the game; as evidence suggests, serious games often work best in a ‘blended’ learning context (Annetta et al., 2006). However, this type of learning and behavioural change is extremely difficult to assess or link back directly to playing Code of Everand, given the number of other factors at work as well as the difficulties inherent to measuring behavioural change over the long-term with a school-age audience.

That said, qualitative work with learners confirmed a clear mechanism based on analogical transfer exists through which a game of this nature might achieve its objectives, whilst noting some key considerations should such approaches be revised or re-implemented in the future:

• Drawing on evidence that children in the target age range have the necessary skills and understanding to behave safely (Tolmie et al., 2006) but routinely fail to apply them (Evans and Norman, 2002), the first objective of Code of Everand was to “encourage 9-13 year olds to put their existing knowledge of pedestrian road safety into practice”. We propose a distinction between two groups of children, which highlights a potential ambiguity in the phrase “existing knowledge”, especially in so far as this knowledge is exhibited in answering questions posed by adults:

  o Group A children do ‘get’ the behavioural meaning of what they are saying, but don’t always think or want to behave in that way.

  o Group B children do not actually ‘get’ the behavioural meaning of what they are saying.
This in turn suggests that different mechanisms may be required, depending on which kind of “existing knowledge” is present. For Group A children, the primary role of an analogy is to make real world problems and tactics more salient; for Group B children, the primary role of an analogy is to supply better tactics for transfer to real world situations.

We stress that this distinction is one made in analysing qualitative findings from a very limited sample in a study which was not designed to establish such distinctions. In the absence of further research, the distinction should be considered a hypothesis only, and this research should not be cited as providing firm evidence for its existence.

- Design would benefit from more in-game ‘scaffolding’ (a structured framework for supporting the player in achieving and understanding the game’s objectives), provided for example by context-dependent help or training exercises after being defeated. This kind of scaffold is essential in particular to:
  - ensure new players master basic gameplay, and overcome early barriers to engagement
  - ensure that Group B children engage with the right problems and develop the right tactics in response to them
  - ensure that all players get the relevance of in-game problems/tactics to the right real-world situations

- Social interaction in and around the game can supply some of this ‘scaffolding’. However, it cannot be assumed that it will do so in practice, meaning in-game mechanisms are required to facilitate and support these interactions.

- With the needs of Group B children in mind, there are grounds for reconsidering the crossing dynamic to ensure that the problem set includes seeing that there are monsters and deciding whether and when it is safe to cross. However, the current dynamic of handling monsters was felt by many participants to be an engaging and original element of the game, so care would need to be taken not to undermine this successful component of gameplay.

- Other specific technical improvements would support the educational objectives of the game e.g. arranging buttons along the side of the screen so they are visible on laptops; providing audio tracks to accompany all written instructions; ensuring that designated crossings are marked on the main map in a way that gets noticed; rethinking and more clearly communicating the penalties associated with being defeated. Overall, usability is a critical concern for game-based learning interventions and designers should be aware that textual content is often overlooked or ignored by children more used to characters in games being voiced.
• The characteristics of the target age group, and in particular restrictions on both the appetite for and possibility of online communication, raise questions about the practical potential for a game-based community to play a role in changing norms in this specific audience. Both children and parents have demonstrably high levels of wariness regarding online communication; our results show (5.3.3) show how quickly Internet dangers become ‘top of mind’ when online. Limited socialization within the game (5.2.6 & 5.3.4) is a consequence of necessary safety mechanisms to restrict communications between players. Creating an online community with a young age group is difficult to achieve in the face of safety considerations.

Furthermore, comparison of results between the national survey and the survey of Code of Everand players allowed for a number of significant trends to be highlighted:

• Player survey respondents reported significantly safer behaviour in themselves across a range of questions. However, they also reported safer behaviours amongst their peers, including fact-based questions such as if they had seen an accident occur. We cannot rule out that Code of Everand players, and in particular those who responded voluntarily to the survey were likely to possess safer skills regardless of their exposure to the game, particularly as they had observed fewer accidents. There are a number of findings that support this, though inconclusively: The indices of multiple deprivation for players (5.1.5) show a slight skew towards lower deprivation and qualitative evidence suggested the game might put-off children with lower literacy skills. Neither of these factors alone are directly linked to road safety, though, much as gaming habits are shown to link to safety indirectly (5.1.1), they do reinforce this possible explanation. Hence, though these survey results are promising in the wide self-reporting of safer behaviour amongst players, the causal link – that playing Code of Everand resulted in safer behaviour, rather than safer individuals being more likely to play Code of Everand – is difficult to confirm.

• A high-level link exists between gaming habits and road safety, a consequence of traits commonly shared by gamers and higher risk groups (e.g. gender), again validating the use of games to reach a high-risk demographic. Though evidence does not address whether gaming causes more risky behaviour, several key traits of frequent gamers – most notably being young males – are equally key traits for poor self-reported safety behaviour (5.1.1). Hence an audience of frequent gamers is a desirable one to reach with a road safety message.

Conclusions

The conclusions of this report (Section 6) return to the original campaign objectives to consider the impact of Code of Everand as a whole upon its intended audience. Comparison of survey results between players and a national baseline shows significantly better safety for Code of Everand players in many areas (5.3.1), but come with a number of cautions in
their interpretation, and must be particularly considered in light of the limited playtimes. Taken with a number of other factors suggesting *Code of Everand* may have been played by children from groups with a lower risk, demonstrable large-scale behavioural impact is not conclusively shown by these results. However, the distribution of players by deprivation indices (5.1.5) shows that *Code of Everand* possessed the ability to reach a wide audience, and hence the findings broadly validate the potential for a game to reach a large audience. Thus, the key difficulty lies in sustaining engagement long enough for a viable mechanism for change to act.

In addition, the implications of this study are discussed with respect to two categories:

- Qualitative work suggested a key distinction between two groups of children emerged during interviews: Those who ‘get’ the behavioural meaning of what they are saying, but don’t always think or want to behave in that way, and a second group who do not actually ‘get’ the behavioural meaning of what they are saying. This may form a basis for future research aimed at understanding in the latter of these two groups, which may form an as yet unaddressed at-risk group.

- As children spend more time gaming and socializing online (Pratchett, 2005), a clear case exists for engaging with these emerging media to convey the safety message. However, *Code of Everand* highlights the difficulty in responding to this need to engage with new social media whilst simultaneously ensuring the requisite safety mechanisms are in place for online interactions between peers.

- For game-based approaches to change behaviour, the reach of *Code of Everand* validates the potential of serious games for road safety to reach a young audience, provided they are accompanied by sufficient marketing activity (5.1.2). The perspectives of children towards serious games were positive (5.3.5), and data from the national survey, which suggested as many as 1 in 5 children who heard of the game went on to play it, demonstrates the added value a game can bring to total engagement time.

- Research also highlighted further challenges in reaching a young audience through an entertainment or social medium: A significant proportion (53% in the national sample of 1,108) of children aged 9-13 play games targeted at adults (PEGI-18) on a regular basis, and therefore may well struggle to engage with games they perceive to be directed at children. Furthermore, social environments are difficult to enact in practice, in part a result of necessary safety concerns which other products competing for screen-time may not have to address, given the extent to which children are playing PEGI-18 games. With respect to changing attitude and behaviour a certain depth of social involvement is required - and even in a secure environment the cautious attitude of children to online communication (5.3.3) could well prove a barrier.
2 Introduction

*Code of Everand* (CoE) was a multiplayer online game commissioned and developed as part of the Department for Transport’s THINK! Campaign in 2009. The main aim of the game was to contribute towards a reduction in pedestrian casualties killed or seriously injured (KSI) in the 9-13 range, with an emphasis on children transitioning between primary and secondary schools due to the particularly high rates of KSI incidence during this phase. Children at this age are difficult to reach, and studies have shown that while they have the knowledge about correct road crossing protocols they are not applying them in practice for two main reasons: 1) they do not have much practical road crossing experience as they are used to being driven to school or have not crossed roads alone; 2) because road crossing is not a top priority for children and therefore is not ‘top of mind’ as are other dangers such as bullying and knife crime (Tolmie et al., 2006). These reasons are compounded by a sense that road crossing culturally is not ‘cool’, making it difficult to change behaviour and attitudes merely by adopting the traditional ‘messaging’ approaches of TV adverts.

The objectives of the campaign were:

- To encourage 9-13 year olds to put their existing knowledge of road safety into physical practice
- To find ways of making road safety skills more interesting - to make ‘alertness’ at the roadside valued by 9-13 year olds, both as individuals and amongst their peer group
- To make road safety more ‘top of mind’ as kids go through the key transition period between primary and secondary school
- To employ a more active and participatory form of communication than simply ‘messaging’ at the audience

*Code of Everand* was commissioned in consultation with market audience work undertaken by Carat and was developed by Area/Code. Based upon market research, the game developed was a multi-player online game. The game presented a novel approach to audience reach and to the in-game learning mechanisms developed. To reach the target demographic of KSIs (65% of 9-11 year old KSIs were boys in 2006), the approach to road crossing awareness raising responded to the uptake of new digital media forms (e.g. social networks and games) adopting new digital media inspired techniques to reach the target group.

The game’s design revolved around a ‘massively multiplayer online role-playing’ (MMORPG) concept, a subgenre of entertainment gaming exemplified by games such as *World of...*
**Warcraft**, which has around 12 million subscribers. MMORPGs are typified by large, persistent, online worlds, in which the player assumes the role of a virtual character and progresses that character over time. This progression is achieved by gradually defeating increasingly challenging game content (e.g. ‘monsters’) to accumulate items and character experience over an extended period. A further aspect of MMORPGs is their ability to facilitate interactions between players within the persistent world, forming a basis for social groups, who may be required to collaborate in order to defeat more challenging content or trade items and services. As MMORPGs typically stimulate longer-term engagement and time investment than other forms of gaming, a key reason for the selection of this genre was its potential to engage players for extended periods of time.

**Code of Everand** introduced a fantasy land called Everand, criss-crossed by spirit channels inhabited by dangerous creatures. Players in the world assumed the role of Pathfinders, heroes of the society. Pathfinders roam the land, completing quests which require elements of high-level route planning as well as application of key skills when crossing individual spirit channels. The world integrates a model for learning through analogical transfer, for example asserting the need to look left and then right in advance of crossing a channel. The game also aims to encourage children to plan safe routes and avoid more dangerous channels.

In 2010, the evaluation programme for the game was commissioned by the Department for Transport through the Transport Research Laboratory. The Serious Games Institute at Coventry University led the research programme, which included input from experts at Transport Research Laboratory, Futurelab, Childwise and Simon Christmas Ltd. The evaluation had specific aims as follows:

- To ‘baseline’ attitudes (and behaviours) amongst the target audience. The purpose here was to provide a reference point against which the impact of the game might be measured. This was restricted to metrics attainable via survey as outlined in Section 4.

- Establish the various ways in which the game might be expected to affect attitudes and behaviours around pedestrian road safety practice. Early emergent findings suggested that the average playtime was below that expected for a typical MMO experience. Therefore qualitative work sought to establish what mechanisms might exist for changing attitude and behaviour through in-depth work with a small group of children within a realistic usage context.

- Capture and measure the effects of the game (at various levels of participation) on these various indicators. A control study approach was not viable (4.1); therefore, these indicators were assessed by comparison of survey results for players against a national baseline.

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Produce recommendations on altering or adding features to the game to improve its effectiveness. Qualitative work (5.2) demonstrates several key considerations, notably the need for a simplified user interface, and a reticence amongst some players to engage with content which was purely text-based.

The overall aim was to evidence the main benefits of the approach and provide valuable insights for future serious games in the area of road crossing interventions with children. In Section 3, this report provides a background introduction to the challenge addressed by Code of Everand in more detail, introducing the game as a method for allowing the 9-15 group to improve their safety through three potential mechanisms: analogical transfer of tactics applied and developed in-game to real-world scenarios, social learning through the online interactions facilitated by the game, and wider (though hard to measure) impact through the peer-discussion and awareness the game might stimulate. To examine these mechanisms, Section 4 presents the research methodology, which implements a mixed-method approach utilising quantitative and qualitative elements.

The results presented in Section 5 are separated into three subsections: The first (5.1) examines the reach of Code of Everand and its success at engaging the 9-15 demographic in quantitative terms. Following the identification of a large user base with a playtime averaging 93 minutes, Section 5.2 presents a potential mechanism for changing the road safety behaviour of players through the outcomes of qualitative interviews. Some evidence is presented in Section 5.3 of large-scale change in ‘top of mind’, as well as survey data suggesting players reported safer behaviour when compared to a national sample, however, the outcomes of both qualitative and quantitative studies reinforce the conclusion that whilst gaming can provide greater reach and contact time than other methods, using this time effectively without compromising the perceived entertainment value of the game is a demanding task. This consideration and the broader implications of this study are reviewed in Section 6.
3 Background

This chapter presents a background summary explaining in more detail the rationale for an approach to road-safety built around a serious game. It notes the particular risk posed by pedestrian accidents to a young age group, a result of a range of factors which arise during the transition from primary to secondary school and adolescence. By attempting to develop an intervention targeting this audience, a range of studies are acknowledged which highlight the issue as not one of knowledge, but rather the failure to routinely apply this knowledge in practice. Hence, this section discusses the underlying causes behind the deviations from safe behaviour amongst this age group, and how other game-based examples have sought to influence behaviour amongst young audiences. In presenting Code of Everand, the final section discusses its potential mechanisms for fostering changes in road safety behaviour amongst players, providing a basis for the research undertaken within this project to gain insight into the potential impact of the game.

3.1 Targeting a key at-risk group for road safety

In 2008, the highest risk group for pedestrian injury on Britain’s roads was aged 9-15 (DfT, 2010). This group presents a particular road safety challenge, a result of their transition from journeying with parents to crossing alone or in peer groups, and a naturally increasing resistance to supervision and instruction. In particular, a peak in accident rate can be observed around the transition between junior and secondary schools (Platt et al., 2003), hence previous studies commissioned by the Department for Transport (DfT) sought to identify the underlying causes, resulting in the identification of several key factors:

- A shift from being supervised by adults when crossing, to being accompanied by peers (Sentinella and Keigan, 2004). A risk with this transition is the child transposing their expectations of safe-practices and guidance to peers, rather than assuming increased personal responsibility for their safety.

- Reduced experience and opportunities to learn best-practice at younger ages when compared to previous generations. A common example of this situation is a child transported to primary school in a parent’s car, then abruptly transitioning to unsupervised pedestrian travel to secondary school.

- Gender continues to play a significant role in risk, with boys more likely to be involved in fatal incidents than girls, as a result of increased willingness to take risks, as well as making more impulsive judgments on safety (Sentinella and Keigan, 2004). Similarly, large-scale reviews have identified ethnic minorities as being at increased risk (Thomson et al., 2001).
There is a clear need for safety interventions able to reach this group, who often fail to engage with initiatives explicitly targeted at younger children, viewing them as being too ‘childish’, whilst simultaneously failing to benefit from material aimed at adults which differs in the underlying causes of accidents it seeks to address. Hence, not only is this group at risk as a consequence of increasing exposure to pedestrian environments, but also as a result of a lack of experience and supervision, coupled with a naturally emerging resistance to instruction.

Knowledge of road safety is typically conveyed to children at a pre-school or primary age. For example, Kerbcraft (Thomson and Whelan, 1997) showed strong impact on the behaviour of 5-7 year olds who experienced four or more training sessions within this community-led programme. However, more passive media have been less successful in the task – an evaluation of video-based training with a similar age range, using a recording of a live stage performance on the topic of road safety, yet children’s knowledge and parental awareness did not significantly differ following the video (Zeedyk and Wallace, 2003). This would agree with conventional learning theory which frequently posits that active approaches, which promote involvement and engagement, are broadly more efficient than observation (Bonwell and Eison, 1991). Despite the insight interventions such as Kerbcraft have provided, which supports the strong link between knowledge and safe behaviour in a primary-school audience, evidence also shows the strength of this link reduces with age (Zeedyk et al., 2001). Consequently, whilst it could be posited that road safety principles are generally well-taught within the UK, their application in practice decreases with age as children become increasingly independent from adults and lean towards peer groups for behavioural reinforcement. The next section of this report illustrates why the goal of inducing a shift in behaviour amongst a secondary-age audience is not one that can easily be accomplished through knowledge transfer alone, nor by relying on knowledge already transferred at an earlier age, outlining the underlying causes of risky behaviour.

3.2 Causes of unsafe behaviour amongst 9-15 year-olds

Early interventions from the Department for Transport aimed at child pedestrians, such as the well-known ‘Green Cross Code Man’, focused on knowledge transfer in an entertaining and engaging fashion. However, despite the UK having one of the best road safety records in Europe (WHO, 2007), accidents involving child pedestrians remain a leading concern. A range of studies have concluded that amongst the 9-13 group, the effect of interventions focused on knowledge transfer alone is limited. This evidence suggests that within this age range, children broadly self-report that they have the necessary skills and understanding to behave safely (Tolmie et al., 2006), but routinely fail to apply them (Evans and Norman, 2002) (See Section 5.2 for further discussion of these findings in so far as they relate to the objectives of Code of Everand). Furthermore, studies have also confirmed children aged 9-13 have the cognitive skills required to apply their knowledge to cross safely, and therefore the issue surrounds the failure to regularly apply this knowledge, rather than an inability
(Whitebread and Neilson, 1999). A comparative analysis of three approaches to teaching safe crossing, including a three-dimensional model, board game and static materials, also reached the conclusion that in all three cases, increased knowledge was not well-reflected in children’s crossing behaviour (Zeedyk et al., 2001).

The consequence of these findings is clear: interventions which seek to further reduce incident rates must go beyond mere transfer of knowledge. They must induce change by understanding and adjusting the causal factors that lead to knowledge on safe practice being routinely ignored, or momentarily forgotten. Contemporary road safety interventions place emphasis on understanding key ‘component skills’, such as detecting traffic, making visual judgments on time and distance and coordinating perception and action (Thomson, 2007). However, development of this range of skills at a young age must be complemented by interventions which ensure these skills are fully applied by child pedestrians as they progress into adolescence. Doing so requires a four key psychological and sociological actors be addressed:

- **Limited locus of control** can manifest itself in a number of ways. Children may perceive themselves as unable to significantly impact their likelihood of being involved in an accident, viewing it as down to the driver rather than themselves (Stretcher et al., 2007). Similarly, they may view others such as parents or teachers as responsible for their safety.

- **A skewed or subjective perception of normal behaviour** can also be a key contributory factor towards risky behaviour. This is particularly the case in situations where incident frequency is easy to perceive as low, whilst severity can be high. Children are prone to observing their immediate environment and peer groups when adopting behavioural patterns, and consequently can quickly adopt risky behaviour if they observe it as the norm in their immediate social circle (Terry et al., 1999). As children learn through imitation, they may be prone to crossing in a similar fashion to adults rather than considering their own skills and pace.

- **Optimism bias** is also a common characteristic in pedestrian accidents involving children. Risky behaviour in crossing frequently goes unpunished, with the potential to result in cycles mirrored in other Department for Transport research where behaviour becomes progressively worse in the absence of positive or negative reinforcement, ultimately concluding in a severe accident, as has been shown for young drivers (Matthews and Moran, 1986). Furthermore, a child might equate the low probability of being involved in a serious accident to an impossibility that it could happen to them (“accidents happen to other kids, not me...”).

- **Failure to carry out intended behaviour** can still arise even once children report an intent towards performing it, with studies showing that large shifts in intent amongst a sample may be reflected only as small changes in behaviour (Webb and Sheeran, 2006).
The risk of momentary lapses and errors of judgment increases with lack of experience, and children have few opportunities to rehearse crossing in a safe environment. Endemic failure to execute intended behaviour can arise from peer-pressure (Litchfield and White, 2006), or a misunderstanding of safe processes coupled with a lack of negative reinforcement, i.e. the child believes they are crossing safely, but is unknowingly taking risks.

Collectively, tackling these underlying causes of unsafe behaviour is a demanding task, though one as important to an adolescent audience as teaching basic safety principles to younger age groups. Clearly, knowledge transfer alone is of limited value in addressing behaviour, and therefore other avenues must be considered for inducing meaningful change. Furthermore, the most at-risk groups are those who do not respond to existing methods of instruction, and who lack parental involvement in their road safety education. Game-based methods have been shown to provide behavioural outcomes in a range of examples, though prior to Code of Everand its application to road safety beyond a predominantly knowledge transfer role (such as the games included in Tales of the Road⁴) had been little explored. In the next section we discuss the use of a serious game to address these challenges, leading to the description of Code of Everand at the end of the chapter.

3.3 Changing behaviour through play: serious games

Serious games are indicative of a general shift away from the approach of attempting to make instruction and teaching entertaining simply by integrating game elements ad-hoc, towards the development of methods and techniques to use entertainment media as part of blended and holistic approaches to education.

The time children spend playing online games is well-documented. A recent report commissioned by the BBC (Pratchett, 2005) demonstrates the shift in media habits amongst younger generations away from passive media such as television, and towards more engaging and social forms of entertainment such as gaming and social networking. In the aforementioned study of Pratchett, 2005, 97% of 11-15 year olds surveyed played digital games. Furthermore, the common perception that gaming is exclusive to a male audience is increasingly being challenged; 55% of gamers were male and 45% female. A study into media literacy amongst children (Ofcom, 2010) found that one in eight children aged 12-15 claimed to mostly play games in a social form via the Internet, a fact supported by further surveys which have shown 78% of 9-12 year olds to use the Internet to play games (TGI, 2010).

With gaming a prevalent form of entertainment within the 9-15 age range, game-based interventions have received increasing attention as a vehicle to reach this target

⁴ http://talesoftheroad.direct.gov.uk/
demographic and sustain engagement whilst pursuing behavioural or educational goals. Similar to road safety interventions for this age range, these goals seldom lie solely in knowledge transfer: if the aim is to simply convey facts, other more straightforward methods may prove as effective. Rather, the sustained engagement players can experience with games that carefully match challenge level to ability to create 'flow' (Csikszentmihalyi, 1997) might best be used to explore deeper, behavioural, objectives. In the case of Code of Everand, a game-based approach may have the potential to reframe familiar behaviours such that pre-existing knowledge is applied and rehearsed, leading to more widespread implementation of correct procedures by children in practice. Serious games in other disciplines have been used to tackle a range of similar themes: in addressing childhood obesity, games such as Squire’s Quest (Baranowski et al., 2003, Cullen et al., 2005) have been shown to have a meaningful impact on children’s dietary selection not through the direct transfer of knowledge, but by adding incentive to apply and rehearse existing skills. Furthermore, difficult behavioural topics such as chemotherapy adherence, which requires children to take medication with severe short-term side effects for long-term health benefits, have benefitted from the application of serious games (Kato et al., 2008). In both these cases, the ultimate goal of the game is to change the behaviour of the target audience, and knowledge serves only as a backdrop to empower learners with the ability to make the change once motivated to do so.

These and other serious games address the underlying psychological causes of negative behaviour through a range of mechanisms. These include the engaging nature of gameplay, which is frequently cited as needing to precede instructional content to create an effective serious game (Zyda, 2005). Games which fail to do so risk being perceived as ‘repackaged instruction’, rather than as entertaining experiences. Yet whilst gameplay alone can be sufficient to reach a target demographic, it must be complemented by underlying pedagogic methods to ensure this reach has a meaningful impact. These methods for transfer have been explored in terms of a range of learning theories (pedagogy), which frequently include behaviourist, social and experiential approaches (Egenfeldt-Nielsen, 2005). Selecting the most appropriate method requires an accurate understanding of the learners, their context and the limitations of the representational medium (de Freitas and Oliver, 2005).

In the case of serious games deployed on a large-scale via the Internet, they may find appeal either directly through gameplay, or as a supplement to social media. Yet they must also compete for screen-time with entertainment games, a challenging barrier for entry. Hence it is even more important for such games to be grounded in entertainment and engagement, with educational content either inserted over time, or carefully integrated into the game dynamics (Prensky, 2003). For games which succeed in this fashion, the payoff can be substantial, accessing a hard-to-reach demographic for extended periods of time. Social techniques can benefit particularly from multiuser approaches, as players interact outside their real-life peer groups, typically crossing social and cultural boundaries through the anonymity online gaming provides (de Freitas and Griffiths, 2007). Though this implies an
equal need for safety and monitoring, the positive benefits have the potential to adjust the subjective norms underlying negative behaviour, resulting in lasting change. As noted by de Freitas and Griffiths (2007), MMO play in moderation may have other benefits, such as increasing literacy and numeracy skills through play – though we restrict the scope of this evaluation to focus specifically on the potential impact of Code of Everand in improving road safety behaviour amongst players.

Empowerment is a theme common to serious games targeted at younger audiences. As noted in the previous section, perceptions that events are beyond the control of an individual can strongly affect their behaviour. Games tend to place the player in the role of a powerful character or hero in the example of cancer treatment, the player assumes the role of a ‘nanobot’ blasting cancerous cells (Kato et al., 2008). As games can offer the player a great degree of control over the game-world, transposing this to real-world situations can offer another avenue for facilitating reflection and change. To do so often requires a degree of scaffolding or support (Vygotsky, 1978); a more-able partner can enable a learner to go beyond that which they may be able to accomplish individually, and assist in transferring the outcomes of experiences to changes in attitude and behaviour. Serious games can provide a range of sources for this more-able partner, from educators and tutors in blended contexts, to peers in online games, and even synthetic and adaptive virtual characters (Panzoli et al., 2010).

Feedback also plays a central role in effective game-based solutions (Dunwell et al., 2011). Games have the potential to apply powerful positive and negative feedback to simple tasks, and hence can address real-world behaviours which are characterised by the absence of effective feedback loops, as is the case with road safety. Creating an effective model for inducing change amongst players through experience (Kolb, 1984) within a game again requires careful scaffolding between the in-game event and real-world reflection. Competition can also be harnessed to increase long-term engagement (Lin et al., 2010) and many other metaphors from the gaming industry may be deployed to attract and sustain involvement with an intervention.

### 3.4 A serious game for road safety: the Code of Everand

*Code of Everand* was designed as an addition to the Department for Transport’s portfolio of road safety interventions, specifically targeted at reaching the 9-15 demographic in an engaging fashion. It focuses upon increasing the extent to which existing knowledge is routinely applied amongst this hard-to-reach group, capitalising on the intrinsic appeal of entertainment gaming to this audience in an attempt to achieve a behavioural impact in an indirect fashion. Within the game, players assume the role of “Pathfinders” within a mythical land crossed by “spirit channels”. Serving as a metaphor for roads, many elements of road safety, such as route planning, social groups and checking both directions before crossing channels are incorporated into the game in an abstract fashion. Yet the gameplay
remains at the forefront of the experience, in line with the widely held view by serious game designers that engagement must precede instruction (Zyda, 2005, Prensky, 2003, Egenfeldt-Nielsen, 2005).

Though metaphors for road safety arise in many forms throughout the game, it is not intended to serve as a substitute for the knowledge already provided by other interventions at earlier ages. Rather, it relies on allowing children to exercise their existing knowledge and understanding, whilst interacting with peers and forming social circles which may differ from those they experience in real-life. As previously described within this section, the 9-15 age group is characterized by adequate knowledge of how to cross safely, but routine failure to apply it in practice. Hence, Code of Everand does not seek to achieve its behavioural impact directly, but rather create an environment where skills already known can be applied and rehearsed, alongside positive peer-group interactions.

Two key mechanisms with the potential to induce safer behaviour exist within Code of Everand, whose efficacy is the subject of this report:

- Analogical transfer of tactics used to solve in-game problems, such as crossing spirit channels safely or planning a route to complete a quest as well as real-world problems, such as crossing the road or selecting where to cross. The immersive nature of the experience of playing is important in ensuring that in-game problems and tactics are readily accessible or ‘top of mind’ in real world situations.
Social change, fostered through the community formed by the game. This form of learning can be a powerful means for inducing shifts in behaviour (Bandura, 1977, Vygotsky, 1978). It builds upon the larger social community formed by the game as well as small scale interactions between players, parents and peers, potentially allowing them to develop a shared understanding.

A wider potential for learning ‘beyond the game’ does exist, for example the case of children being stimulated to ask parents or engage more readily with other road safety resources through limited exposure to the game. This is examined to some extent in Section 5.2, though is more difficult to assess than the previous two methods.

3.5 Summary

In this opening section, this report has identified the 9-15 group as a key at-risk demographic, illustrating the need for interventions to go beyond knowledge transfer if they wish to have a lasting and meaningful impact. In describing *Code of Everand*, we have put forward two potential mechanisms through which changes in behaviour might potentially be achieved. Demonstrating that such change has occurred is particularly challenging in the context of road safety, typified by a high cost per-incident but limited incident frequency, requires some careful consideration when designing a research methodology. The next section goes on to outline this methodology, which utilizes both qualitative and quantitative methods to examine the existence of these potential mechanisms, providing some insight into their efficacy.
4 Method

The previous section defined the nature of the road safety challenge faced by Code of Everand as one of behaviour, and the application of knowledge, rather than its acquisition. Therefore, in this section, we define our evaluation methodology as focussed upon establishing the validity of various potential mechanisms the game may have for impacting players road safety habits, and to the greatest extent possible, ascertaining the overall impact of the game. We note first and foremost that direct monitoring of behaviour amongst players is not a viable route to meaningful results, in part a consequence of practical limitations, and in part a result of the nature of the game’s intended outcomes. In Section 4.1 we note this restriction of the study and its resultant impact on overall scope. Given the inability to directly measure impact in terms of KSI rates, we outline the relevance of a mixed-method approach combining quantitative survey with analysis of the data collected indirectly by the game - with a qualitative study seeking to provide further in-depth findings.

4.1 Relevance of a mixed-method approach

When compared to more established methods of road safety intervention, a serious game represents a unique case in that few established pedagogic methods and design techniques exist by which to guarantee efficacy. As such, the underlying method for learning transfer is seldom immediately comparable to established methods of instruction, and research must establish what methods exist before evaluating their effectiveness. This is particularly the case with Code of Everand, where the method for learning transfer is not immediately equable to any existing method of road safety training - or even any formal method of learning. Therefore, while a quantitative approach may have the potential to show significant differences between a game playing and control group, without evidence outlining the process causing this difference, it is of limited value. In particular, a quantitative approach in isolation would be open to criticism that a correlation would not be indicative of causation, as children drawn to Code of Everand may be predisposed to safer behaviour, a fact we highlight throughout the quantitative results (5.3).

The game engine provides a high-volume of log data which is unique to the case of a game-based approach to road safety. In particular, this data provides tracking data for player interactions. It has the potential to support inference modelling from player and national survey results, as demonstrated later in this report for factors, such as player location and gender. However, taken in isolation, this data has few reference points to anchor it to real-world conclusions; knowing the majority of avatars in Code of Everand are male is of little use unless supplemented by analysis of self-reported gender from player survey. Similarly, analysis of the number of in-game crossings made by players carries little weight without sufficient evidence that crossings are a critical component of the overall model for
engendering safer behaviour. Therefore, the research programme defined in the following two sections draws upon qualitative and quantitative methods towards the overall objectives specified in Section 2.

4.2 Quantitative elements

The quantitative aspects of this report draw on three key sources of data:

- **The analysis of data logged and tracked by the game website and engine.** This analysis of the game engine data undertaken by the Serious Games Institute focussed on data collected over a seven-month period between November 2009 and May 2010. Over this period the game was actively promoted, leading to high usage, with a total of 315,883 unique logins and 99,608 unique players. A decline in player numbers in the absence of active promotion meant this data set encompassed the majority of the players over the game’s lifetime. In total the data falling under this analysis represents 92.78% of the total of 107,357 player characters created in _Code of Everand_ up to 23/01/11. This data was compiled from two sources: weekly update reports provided by the game’s developer, Area/Code, and a direct export of the game’s core SQL database in May 2010. This data was mined using proprietary software developed by the SGI to allow correlations to be made between the Internet (IP) address of players and their geographic location. Tables within the database on individual logins were similarly consolidated to allow further insight into playing habits.

- **A survey of a nationally-representative sample aged 9-15** was undertaken to establish the reach of _Code of Everand_, test any hypothetical links between gaming habits and risky behaviour and to provide a baseline against which to compare results for players. The national survey, containing questions on road safety, gaming habits and _Code of Everand_, was undertaken in UK schools by ChildWise in December 2010 with a total sample of 1,108 children. The survey was completed electronically by children under supervision of a member of staff. Children were able to opt-out or decline to answer any question, in line with market research (MRS) guidelines. This also included information from a national tracker survey run by ChildWise to provide baseline data.

- **A survey of the player base** which enabled the impact of the game on self-reported behaviour to be examined. In addition the survey allowed the researchers to gain a large-scale insight into the perspective of players towards the game. The player survey, due to the nature of the player base, had invitations distributed via email - with a link to an online survey. These invitations were sent by the Serious Games Institute to registered account holders of the game, who are required to authorise consent for their children to play as part of the sign-up process. From a total of 90,000 distributed invitations, 1,028 survey responses were achieved, 737 of which were completed to the end. This survey was conducted between February and March 2011.
Combining these three sources of data allows a number of significant hypotheses to be explored within the themes of the game’s campaign objectives, which can be loosely grouped under two headings:

- **Reach**: Does the game reach a high-risk demographic? Clearly with a web-based solution important baselines include the need to identify the proportion of users within the UK, and within a school age. To achieve this we describe in Section 5.1.3 the results of an approach which combines an IP trace of players to ascertain location with self-reported and in-game data from players on their age and gender.

- **Impact**: Does playing *Code of Everand* influence self-reported behaviour and attitude towards road safety? If so, what are the minimum thresholds for playtime in order for this influence to occur? This is addressed through comparison of national and player survey results with qualitative insight (5.2 & 5.3).

Noting the limitations of a survey-based approach, qualitative insight also forms a major component of this evaluation. Qualitative work was undertaken in the period January – March 2011 by ChildWise and Simon Christmas Ltd. and sought to gain insight into the potential mechanisms for behavioural change which might exist within the game.

### 4.3 Qualitative elements

Qualitative research was undertaken with the aim of looking for evidence of mechanisms by which *Code of Everand* might have achieved its objectives. The qualitative work had two strands: the first with existing players and the second with learners. The initial research design envisaged an approximate balance between players (12) and learners (12-16), but major obstacles to recruiting players, reflecting the decline in the active player base once the game was no longer promoted, meant a change in emphasis was required, focusing on learners (28) with a small sample of players (3). At the heart of the approach was a within-participant comparison between contexts – in-game and pedestrian – with a view to identifying possible learning transfers between these contexts. This approach was focused on establishing the potential for transfer and investigating the conditions which may be facilitated.

**Player fieldwork**

A total of three existing players were recruited, from volunteers who responded to a request posted on the game welcome screen or to an invitation to take part included at the end of the player quantitative survey. As there was very limited response to the request and invitation, all children that fell within the age / school year target and also walked independently were followed up; further selection in terms of demographics or usage was not possible.

Each participant was engaged twice:
Game-focused interview

The first interview, lasting approximately 60 minutes, focused on the game. It took place in-home at the computer where the player normally played the game. These interviews were carried out by experienced qualitative moderators, following a discussion guide and probing / following up interviewees as appropriate.

Key elements of the first game-focused interview included:

- A task focused on ‘teaching’ the moderator how to play the game.
- A follow-up discussion of issues, such as how the player had learned, social interaction in and around the game, player’s level of identification with their avatar, etc.

Pedestrian-focused interview

The second interview, lasting about 60 minutes, was undertaken some days later and by a second researcher. The interview followed a different, more structured format, did not take place at the computer, and was positioned as ‘an opportunity to find out more about you’. The road safety relevant tasks were interspersed with other activities which support this (selected to provide relevant additional information about the participant). The aim was, in so far as is possible, to avoid priming the participant to i) focus on road safety and ii) make an explicit connection between interview tasks and Code of Everand (though we recognise it is impossible to exclude either of these effects entirely).

Key elements of the second pedestrian-focused interview included:

- A task, using map-and-photos stimulus material, around i) taking your younger cousin to a given destination and ii) preparing said cousin to go out on their own. Note that this did not explicitly focus on road safety, though this was included among prompts if not spontaneously raised.
- Questions about the most important decisions that need to be made in a task like this.
- Questions relating to whether/how their cousin’s behaviour/route might change if they were with a friend, on their own, etc.

Learner fieldwork

28 young people who fit the profile of Code of Everand players were recruited. All were frequent internet users, all interested in playing multiplayer games. In keeping with the player base, recruitment was skewed to males. Children were aged 10-12 years, in school years 6 or 7, and all walked without adults (alone or with friends / siblings) on a regular basis (more than once a week).
During recruitment, children were asked to suggest a friend who also fits the requirements, so that we could build up friendship pairs who are playing, to reinforce involvement.

Children were recruited in geographical clusters of four, with a mix of urban and suburban locations – London (NE and SE), NW, NE, West Midlands, East Anglia (Norwich and Great Yarmouth).

**Pedestrian-focused interview**

After initial screening, each participant individually was taken through the same pedestrian-focused interview process as the players (i.e. they did this step first, not second as the players).

At the end of this interview, participants were asked to sign up to the game and commit to giving it a go, and told about the process for the next few weeks.

**Gameplay and diary exercise**

Over a period of about two to three weeks, participants played the game in their own time. During this time, they were regularly engaged, via e-mail and text message, with questions relating to what they were doing and enjoying etc. They also had a simple paper-based diary in which to record their activity.

Learners were divided into three groups for prompting during gameplay, to generate a diversity of experience:

- **Social** – these learners were recruited in friendship pairs, and received at least one e-mail during gameplay asking questions around whether they had spoken to each other about the game or interacted with anyone in Everand, alongside the normal motivational contact.

- **Mediated** – these learners were recruited as individuals, and received at least one e-mail during gameplay asking them to reflect on whether they were learning anything from playing the game, alongside the normal motivational contact.

- **Unprompted** – these learners were recruited as individuals, and received motivational contact only.

**Game-focused interview**

At the end of the learning period, participants were taken through an adapted version of the same game-focused interview as the players. Adaptations reflected the potentially lower level of exposure of this group to the game. However, statistics from the player data base indicate that the time spent in the game by learners put many of them in the top 10% of players overall.
Follow-up interview

The follow-up interview allowed us to gather further reactions to the game, and also included a repeat of the map task from the pedestrian-focused interview. This created the possibility of noting any changes over the period of gameplay in approaches taken to the map task. Clearly, any such changes noted would need to be interpreted with great care: for instance, changes might be a consequence not of playing *Code of Everand* but of having completed the task once before. In an experimental set-up, these possibilities would need to be controlled for. This, however, was exploratory qualitative work, designed to look for evidence of mechanisms of change but not to prove them. To remove one of the most obvious possible distortions, the first pedestrian-focused interview included two iterations of the map task, meaning the participant had an opportunity to learn what the task was about in the first iteration.

Summary of qualitative elements

3 players each interviewed twice:

- ‘Game’ interview
- Follow-up interview, including map activity

28 learners, each interviewed three times plus period of gameplay:

- Map activity (‘pedestrian interview’) as part of an initial ‘About You’ interview
- Gameplay for two to three weeks with motivational contact and, for some participants, prompting contact as outlined above
- ‘Game’ interview
- Follow-up interview, including a repeat of the map activity

4.4 Ethical considerations

For the player survey, given the low response rate that could be anticipated from an e-mail approach to reaching the player base, incentivization was deemed necessary to ensure sufficient responses were collected. This was implemented through an invitation to a free prize draw. In the event that incentivization bias manifested through participants completing the survey as rapidly as possible and forgoing genuine responses to questions, a click-path was implemented to allow them to quickly bypass questions through ‘don’t know’ selections. This was also a necessary requirement to ensure participants were uniformly aware that they had the right to decline to answer any question and this would not affect their eligibility for the incentive.
Informed consent is a principal consideration when undertaking Internet-based research. As the sign-up process requests that a child wishing to play gives the email address of a parent or guardian, emails were distributed on this basis. The initial link into the survey was designed to be child-friendly, clearly and simply stating the purpose of the activity. Throughout, all the data was held anonymously with the only elements of personal data collected, including email address and postcode, for the purposes of locating the geographical area of respondents and identifying large-scale trends. This data was held securely under the conditions of the Data Protection Act 1998. With respect to the analysis of game engine data, all information within the game engine is anonymous, as the player does not have the capacity to enter their own name, and there is no provision for text chat or entry. Informed consent in this case was provided as part of the sign-up process to the game which requires the player and their parent or guardian agree to clear terms and conditions, which are repeated in the registration email. Parental consent for this activity was therefore granted through:

- The opt-in nature of the registration process;
- The opt-in nature of the survey;
- The purpose of the activity and use of the data being made clear through the contact email.

Consent from the child was granted through:

- The purpose of the activity and use of the data being made clear through the first page of the survey, with the option to discontinue by closing the page being available at any time;
- The survey design, which allows the respondent the option to decline to answer any question (in addition to the inclusion of a “don’t know” option, questions also include a “don’t want to answer” option).

The national survey was undertaken by ChildWise using established school panels. Children were made aware of their right to opt-out or decline to answer any question. Consent was sought from teachers in loco parentis. As the game engine does not facilitate text-chat or other methods for communication between players other than pre-selected dialogue options there was no risk personal data could be inadvertently collected through chat logs or similar mechanisms. The only element of personal data relevant to the analysis of game engine data was players email addresses, held in a secure database. To minimise their circulation, they were removed prior to the transfer of this data to the Serious Games Institute and hence the dataset analysed for the game engine did not include any personal data. IP address in isolation is not considered personal data under the UK Data Protection Act. As part of Coventry University Enterprises Ltd. the Serious Games Institute operates under the ethical codes and procedures of Coventry University. Following comprehensive
review of the study design in three phases commencing in June 2010, ethical approval was
granted by Coventry University Ethics Committee, who reviewed all elements of the
research design including work undertaken by project partners. This included two repeat
reviews as the study design evolved throughout the research process. Details of this review
process and its outcomes are available on request from ethics.uni@coventry.ac.uk.
5 Results

Noting, and with reference to the campaign objectives stated in Section 2, that a core aim of Code of Everand was to reach an audience that are typically resistant or disengaged from other campaigns, this report includes analyses of both reach and efficacy.

Therefore, the results section of this report is split into three subsections:

- The first section (5.1) details the reach of the game to its target demographic. The campaign sought to employ a more active and participatory form of communication, and the success of a game-based approach in this context is of relevance both within the road safety domain and more generally. Therefore, in Section 5.1 this report explores the audience of the game in terms of factors such as gender, ethnicity, age, and indices of multiple deprivation. The section also reports on the total time spent playing and other salient characteristics of the player base. Overall, the section shows broad reach for the game to an approximated 62,000 children within the UK, with 30,000 aged 9-11, noting their median playtime to be 31 minutes.

- The second section (5.2) outlines the findings of qualitative research seeking to establish potential mechanisms by which Code of Everand would foster changes in children's' attitude and awareness to road safety through play. It outlines a mechanism for analogical learning transfer, and notes the reactions of players to the game through a series of in-depth interviews. This highlights a number of considerations of relevance not only to Code of Everand, but also more generally road safety policy when targeting the 9-15 age range.

- Taking this model defined in Section 5.2 as a basis for inducing safer behaviour amongst players, the third section (5.3) examines quantitatively how effective Code of Everand may have been over its deployment period. Coupling the average playtime determined in Section 5.1 to the model for change in Section 5.2 presents a need for impact to be achieved through the game relatively rapidly in order to affect a sizable proportion of the player base. In Section 5.3, some evidence is presented that the game had an impact on top-of-mind amongst players; and furthermore when surveyed, Code of Everand players reported safer behaviour in both themselves and peers when compared to national sample. In this section we explore the significance of these findings, and discuss their implications for both Code of Everand and future interventions.

We discuss the overall implications of these findings in Section 6, which include points of relevance to the overall impact of Code of Everand, future game based learning interventions, and strategy for communicating with the 9-15 audience within the UK.
5.1 Assessment of reach: Uptake and player demographics

The section details the evidence provided from quantitative work combining data sourced from the game itself with the results of nationally-representative and player surveys. *Code of Everand* was developed with the campaign objective of employing a more active and participatory form of communication to reach a young audience, and therefore a principal accomplishment of this section is to outline in detail the audience of the game. Before doing so, however, in Section 5.1.1 we test the specific validity of using a game on the basis that gamers are more likely to belong to high-risk groups for road safety. As demonstrated through correlations in the data set derived from the national and player surveys, strong links exist between gaming and road safety, not as a consequence of causation, but because of the strong influencing effects of cofactors such as gender – males are more likely to play games, and more likely to exhibit risky behaviour, an assertion supported both by the data from the studies within this report, as well as broader literature on casualty rates in the UK (DfT, 2010). Following this discussion, this section focuses more specifically on the audience attracted to *Code of Everand*. The first question addressed is how children heard of the game: the results show that whilst the television advertising campaign substantially bolstered uptake, other routes in, including web-based sources of awareness, also proved a route into the game for a significant proportion (28%) of the player base.

The remainder of the section focuses primarily on establishing the user demographic. An Internet-based game cannot be assumed to be attracting a large UK audience automatically (given the global accessibility of the Internet), and thus Section 5.1.2 first demonstrates through IP locations that 88% of 100 players were within the UK. The game reached a predominantly male (80%) audience and one with little ethnic bias, as well as a large spread across indices of deprivation, confirming that a game for road safety was able to appeal to an wide audience. In Section 5.1.6, the report considers the various playtimes of children in-game. There is evidence based on time of day that the game reached an audience aged 9-15. From the game engine data, we found that the average player experienced *Code of Everand* for 93 minutes over the period represented by the data, which we have mediated to 31 minutes as more representative (as the sample was characterised by outliers – 28% played for less than 15 minutes, and 14% for more than 2 hours). 0.8% played for a total time in excess of 18 hours. Though of course the potential remained for these players to revisit and play further beyond the period analysed, logins over the lifetime of the project (Annex I) suggest this would not have significantly impacted total playtime for the majority of players.

In terms of the game mechanic of the channel crossing, of 106,547 characters made as of January 2011, 65% experienced an in-game ‘spirit channel crossing’. Therefore, we can conclude that whilst *Code of Everand* demonstrated the ability to engagement for periods far in excess of a static website, TV commercial or similar method, a need for urgency in achieving a behavioural change remained: both qualitative (5.2) and quantitative (5.3)
methods are used to establish *Code of Everand*’s model for change, and gain some insight into its efficacy.

### 5.1.1 Gamers – a risk group for road safety?

One of the assumptions made behind developing a serious game for road safety is that the end-users will belong to a high risk demographic. A core objective of *Code of Everand* was to engage its audience in an active manner, and make pedestrian skills more interesting to high-risk groups. The dataset provided by the national and player survey provided a basis for considering whether links might exist between gaming habits and road safety, supporting this assumption and validating the use of a serious game to engage with this audience. In a survey-based approach, it is important to note the strong effect of factors such as age and gender: on immediate inspection, strong correlations exist between road safety and gaming, though a significant component of this relationship is gender. Males were more likely to exhibit unsafe behaviour, as well as play games, in our data shown for each respective case to a high degree of certainty (p<0.01), a result common to many other surveys undertaken in these individual topic areas (Pratchett, 2005, DfT, 2010).

As the only large-scale survey to-date known by the authors to specifically include both topic areas for the purposes of examining correlations, the survey undertaken in this project allows for the statistical link to be tested. Straightforward analysis of random variance (ANOVA) is not viable in this case due to the nature of the ordinal Likert-derived data which does not follow a normal distribution. Therefore, we used a non-parametric multiple regression approach, employing two methods for examining correlation suited to non-parametric ordinal data\(^5\). These allowed us to examine individually the links between survey questions on road safety, and gaming habits. In order to create measures of road safety against which to compare individual self-reports of gaming habits, the results of four Likert and multiple-choice questions were composited into three metrics based on the averaged, directed means of responses:

- **Self-reported** levels of awareness and responsibility. The purpose of this question was to assess childrens’ individual perspectives regarding their sense of empowerment and control over safety, as well as their ability to critically reflect on their behaviour. As a direct question on behaviour, it should be noted this is open to bias in responses based on perceived norms and ‘correct’ behaviour. This included the following sub-questions on a 5-point Likert scale of agreement:
  
  - “I do things that are risky when I cross roads”
  - “I generally pay a lot of attention to the traffic when I am crossing roads”

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• “In general, I act responsibly around roads”
• “I am aware of the dangers around roads”
• “Car drivers are responsible for my safety”
• “Other people are responsible for my safety”

• **Peer** behaviour, derived through reporting on observations. For this final metric a question was used which asked children to identify whether they had observed peers participating in risky behaviours. This included the following actions:
  
  ▪ Crossing without being able to see incoming traffic
  ▪ Making sure traffic had stopped before using a crossing
  ▪ Stepping into or crossing the road without looking properly
  ▪ Using a mobile phone and forgetting to look properly
  ▪ Being involved in an accident
  ▪ Looking both ways before crossing
  ▪ Crossing at a safe place
  ▪ Playing in the street
  ▪ Paying attention at all times
  ▪ Walking in the road
  ▪ Forcing traffic to slow down

• **Consolidated** levels of self- and peer- behaviour. This second measure was created by merging the results of two individual questions, the first asking the child to report their own behaviour, and the second asking them to report the behaviour of their peers. As a result, the metric is a more consolidated measure of behaviour which accounts for the observations children reported on peer behaviour as well as their own behaviour. This again used a 5-point Likert scale self-reporting frequency of the following behaviours:
  
  ▪ Finding a safe place to cross
  ▪ Using a mobile device whilst crossing
  ▪ Crossing between parked cars
  ▪ Running across the road
  ▪ Near-misses due to lapses in judgement
- Forcing traffic to slow down
- Looking both ways before crossing

Consolidated questions on peer behaviour covered:
- Knowingly taking risks
- Knowledge of correct behaviour
- Crossing when supervised
- Playing in the street
- Deliberately engaging in dangerous activities
- Running across the road

For each of these three road safety measures (self-reported, consolidated and peer), individual questions on gaming habits were analysed using Kendall and Spearman correlations. In general, the correlations were minimal; this result was expected since stronger cofactors, such as age and gender, were present as well as unknowns. However, some significance did emerge in the results with low probabilities of being obtained by chance. Throughout these results we reference the 'p' value, which refers to the probability of a correlation being incorrectly observed by random chance, due to the nature of statistical hypothesis testing. For example, a result with p=0.05 has a 5% probability of being incorrectly observed by chance, whereas a result with p=0.001 has a 0.1% probability. As per scientific convention, we principally consider only cases where p<0.05 to be significant.

It is first worth noting that there were predictably strong correlations between self-reported and consolidated metrics of safety (p < 0.0001). Children who reported safer behaviour in one of the areas were more likely to report safer behaviour in the other. This provides evidence the survey results were valid, and not subjected extensively to ‘click through’ behaviour from children. A negative correlation also exists between self-reported and consolidated measures of behaviour – children who reported high levels of safe behaviour were more critical of their peers. The consolidated metric of behaviour exhibited a stronger negative correlation to the metric of peer behaviour (p < 0.0001), hence a stronger link existed between reporting dangerous behaviour in peers and safer behaviour in the consolidated metric, an unsurprising result given that the consolidated metric includes an alternative measure of peer behaviour.

Taken as a whole, the results from comparing questions on gaming habits to these three measures of safety presented a number of considerations:

- **Platform use** is linked to risky behaviour, with users of certain platforms (handheld p=0.004 and browser-based p=0.006) reporting riskier behaviour than console and
mobile gamers. The underlying causes here may be linked to the nature of self-reporting as a measure of safety; as well as the aforementioned underlying role deprivation may have on both platform use and safety. This demonstrates some of the difficulties when attempting to infer direct relationships between gaming habits and road safety, due to the complex nature of the relationship and large number of unknown cofactors: though females are more likely to use browser based games, and a link existed between more risky self-reported safety and browser based gaming, the prevailing relationship across all platforms broadly agreed with the findings of other studies, such as males being at higher-risk of accident involvement (Elliott and Baughan, 2003) and more frequent gamers (Pratchett, 2005).

- More social online activities were linked to riskier behaviour. A possible explanation here stems from the age range and attitudes towards the Internet in both parents and young teenagers. Interacting socially online using adult social networking sites widely popular with children is generally considered a high-risk activity; children with parents who monitor and restrict their online activity are, hypothetically, more likely to have parents who also monitor their road safety. Females were more likely to spend time on these activities – in the national survey results, females were more likely to spend time on social networking (70% versus 57% of males), whereas the safety data, which would typically support higher safety levels amongst this group as a consequence of gender bias, in fact proved to be a significantly higher risk group. Therefore, it may be suggested children who spend large amounts of time in online social activities (the most popular sites having a minimum age limit of 13) are more likely to be ‘rule breakers’, and therefore at higher risk in other areas including road safety.

- Time spent online had no significant link to any of the three safety metrics. This challenges the assumption that children spending a great amount of time online are less exposed to risks on the roads, particularly when coupled with evidence showing the journey to and from school is the highest risk journey (Platt et al., 2003).

Overall, these results support the notion that a game is a sound vehicle for reaching a demographic prone to unsafe pedestrian behaviour. Though they cannot support the hypothesis that gaming in general is a cause of risky behaviour (or, conversely, that it has a positive impact) they do support an overall model in which the traits common to high-risk groups are similar to the traits of high-frequency gamers. That the correlations are not unidirectional with respect to the individual platforms shows a wide diversity in audience between these various platforms, with considerably different traits for each. Furthermore, correlations suggest console and mobile gamers tend to report safer behaviour, though no significance was found for their peers. Browser-based gamers were more likely to report negative behaviour in themselves and their peers, lending some credence to the suggestion that this is a high-risk group and well-suited to a safety intervention in such a form.
That said, it is important to note the overall weakness of the correlations. Many other factors are at work in defining the ultimate safety behaviour of children, and these results which include the impact of age, gender and gaming habits, showing correlation coefficients typically in the order of 0.05 were found to be the norm. Additional measurable factors, such as the context in which the surveys were taken, in reality must be coupled to underlying social, geographic and economic factors resulting in an overall model beyond the scope of this evaluation. Nonetheless, that gaming is correlated to the consolidated, self-reported and peer metrics of safe behaviour, as demonstrated in this section, reinforces the appropriateness and relevance of a serious game for road safety to a 9-15 audience.

It is worth noting qualitative data gained through the survey, which suggested the most commonly played game in the 9-15 bracket by a substantial margin was *Call of Duty*, named by 53% of boys and 12% of girls. That this PEGI-18 rated game ranked extremely highly amongst children’s gaming habits when compared to child-oriented titles such as *Club Penguin* (5% of boys and 13% of girls) demonstrates that to reach a 9-15 audience’s expectations of entertainment games requires some understanding of the adult gaming market. Supported by other studies which have suggested parents play a role of mediator rather than selector of children’s games (Pratchett, 2005), this finding suggests a large proportion of UK children aged 9-15 are playing electronic games principally targeted at an adult audience, and this will in turn affect their receptiveness to games overtly targeted at children - which they may find too ‘childish’. Again, it could be suggested that children playing such games are more likely to be ‘rule breakers’, and therefore fall into a higher-risk category for road safety, though this link would require further research to confirm.

Returning to the policy objectives, the comparison of survey results on gaming habits and road safety presented in this section has shown that commonalities exist between both audiences, and therefore an audience of gamers is a desirable one to reach with a road safety message, corresponding well to a target audience of children who fail to engage with other interventions. The next section considers how players heard about *Code of Everand* and entered into the game, reviewing survey responses on where they first heard of the game and the proportion that went on to play it.

### 5.1.2 The route into Everand

In the player survey, players of *Code of Everand* (n=954) were asked where they had first heard about the game. Two clear sources held substantial shares of the audience – television (29%) and from an Internet site (28%), as shown in Figure 2. Given the cost associated with television advertising, this shows some potential for a game-based intervention to offer high-value through being intrinsically promotable online: several game websites offered reviews of the game and helped stimulate usage. Friends and school-friends also represented a significant proportion of links into the game, with 21% of players reporting they had heard about the game through word-of-mouth. There was limited uptake by schools as this was not intended as a usage context for the game, and the
evidence of playtimes presented in the next section suggests little play of the game occurred during school hours. Therefore, *Code of Everand* was successful in establishing its intended usage context in-home during leisure time. Furthermore, the survey responses shown in Figure 2 demonstrate the value of television advertising in increasing the total player base, though also show the strong influence of word-of-mouth and Internet-based promotion for game-based approaches to road safety.

<table>
<thead>
<tr>
<th>Source</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>On TV</td>
<td>28.95%</td>
<td>29.90%</td>
</tr>
<tr>
<td>From teachers</td>
<td>3.55%</td>
<td>1.55%</td>
</tr>
<tr>
<td>From my parent or guardian</td>
<td>3.55%</td>
<td>7.22%</td>
</tr>
<tr>
<td>From schoolfriends</td>
<td>11.58%</td>
<td>8.25%</td>
</tr>
<tr>
<td>From a friend</td>
<td>10.13%</td>
<td>6.19%</td>
</tr>
<tr>
<td>From an Internet site</td>
<td>28.16%</td>
<td>26.80%</td>
</tr>
<tr>
<td>From a magazine</td>
<td>3.16%</td>
<td>2.58%</td>
</tr>
<tr>
<td>Don't know</td>
<td>6.71%</td>
<td>12.89%</td>
</tr>
<tr>
<td>Other</td>
<td>4.21%</td>
<td>4.64%</td>
</tr>
</tbody>
</table>

Figure 2: Breakdown on player survey responses (n=954) to the question "Where did you hear about the game *Code of Everand*?"

The national survey, by virtue of its representative sample, allowed some insight into the recognition of the game in general. A total of 16% of the total sample (n=1108) had heard of *Code of Everand*. Amongst this smaller sample, a quarter reported they did not play it because they did not like what it was about (23%), whilst a fifth (19%) simply did not have the time. A further one in six were aware of the game but were not interested in online games (16%) and around one in ten said they did not like how the game looked from the website or that they did not know how to access the game. A very small minority (1%) said lack of parental consent was the issue. The sign-up process to the game did not appear to be a barrier to usage, despite requiring the child supply the email of their parent or guardian who was then required to validate the account for play. Overall 1 in 5 children who had heard of *Code of Everand* within the national sample had gone on to play it, 3% of the 1,108 sample.
The vast majority of players experienced the game in a home setting, as shown by the player survey (Figure 3). 80% of players (plus a likely high proportion of 'don’t know' responses) played the game from home. This again confirms the game reached its intended usage context, being played in place of a leisure game in a home setting. Similarly the limited parental involvement in uptake shows children were largely attracted to the game through the television campaign, Internet, and word of mouth. Through the Internet, and the impact of Internet and television promotion on word-of-mouth, the game reached a broader audience than a television campaign might have done. If we consider evidence from the national survey suggesting a conversion ratio of 5:1, the game, with its median playtime of 30 minutes (5.1.6), is equivalent in contact time terms to a television campaign reaching 1.8 million children for 1 minute. Overall, therefore, the game-based approach sacrifices part of the total volume that might be reached by a television campaign in favour of reaching a smaller (though still considerable) audience with a greater depth.

Figure 3: Responses by players to the question "Where do you usually play Code of Everand?" (n=762)

Taken together, the evidence suggests children entered into Code of Everand in a largely unprompted fashion, having seen the game advertised or heard about it from friends. As such, it largely mirrors how any other pure entertainment medium might attract its audience. The result of these promotional activities and route into the game led to a total number of 106,547 players over the year the game was available and 541,310 unique visits to the game’s website. In the following sections, we break down this total to better understand who played Code of Everand and the reach of the game to its target demographic.
5.1.3 Geographical distribution of players

One of the first and most critical measures of reach to assess is the location and geographic distribution of players. This was achieved through IP analysis at the global level for all players. As can be seen from Figure 4, the game reached an audience - which was predominantly UK-based. As discussed in the previous section, this appears a consequence of direct marketing within the UK, with 29% of player survey responses indicating they heard about the game through the television adverts run within the UK.

![Figure 4: Breakdown of 99,683 unique players by country](image)

As part of the player survey, respondents were invited to supply their postcode, with 382 results being obtained. Firstly, this allowed a plot of survey responses to be created by converting postcodes to longitudes and latitudes; this is shown in Figure 5. As can be seen, the responses to the player survey came from across the UK, with typically higher concentrations in more populated areas. This also allowed geolocation on a regional level to be assessed by comparing player survey results to IP trace results, which indicated a mean error of 87.3km per trace, following the removal of 2% of the data set as extreme outliers. Overall this gives some confidence in the larger-scale picture illustrated in Figure 4 for the reach of the game using the larger data set generated by the game engine. There are no particularly noteworthy exclusions in the distribution within the UK, though a relatively small proportion of survey responses (22) gave postcodes in Scotland and Northern Ireland.
Figure 5: Distribution of player survey responses within the UK (n=382)

Figure 6: Distribution of geolocated UK players (n=48,152)
To create Figure 4, 48,152 of 87,810 players for whom information was available were IP-located at a city-level of granularity, with the radii of points generated based on the number of co-located points. This visualisation is limited in showing ISP location rather than specific address, though it illustrates that *Code of Everand* had national reach, and that this reach was distributed effectively across the population rather than heavily concentrated in specific areas. Playtime bore little relationship to location; eliminating players with a playtime below 30 minutes and repeating the country-level analysis did slightly increase the size of the UK-based sample to 89%, though no significance was found on a regional level for the sample within the player survey. Images were generated using OpenHeatMap.

Though KSI statistics for the period during which the game was introduced are unavailable at time of writing, analysis was conducted relating regional data to the most recent set of KSI data, to examine if the game intrinsically reached higher or lower risk areas. It is essential to note these are statistics for KSI prior to the game’s introduction and therefore this is an assessment of reach rather than impact. A relationship between KSI and area in which the game was played could arise as a result of cofactors such as deprivation impacting access to hardware or barriers caused by other factors, such as ethnicity. Factoring relative populations from the UK 2001 census into multiple regression, a significant relationship between locations where the game was played, and previous KSI rate ceased to exist (p>0.05). This is a consequence of the relatively low KSI rate for the general population, though it also suggests the game reached a broad audience rather than one which differed dramatically from the national average. Overall, *Code of Everand* reached a substantial UK audience, with a total of 538,458 unique visits to the game’s website as of January 2011 generating a total of 106,547 players of the game. Using the smaller dataset used for geolocation (n=100,038), inference modelling would suggest an approximate total of 94,000 UK players over the game’s lifetime and minimum of 88,000. This audience was broadly distributed with no immediately apparent factors affecting its distribution on a regional or city-based level, though a possible link between gaming habits and road safety was analysed in more detail (5.1.1).

In the next section, we go on to consider the traits of this sample of UK players in terms of their age, ethnicity and gender, again linking player survey results to the larger set of data available from the game engine to support the identification of large-scale trends. The following section considers this subset of UK players in more detail to ascertain what proportion fitted the target demographic of 9-15 year olds.

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5.1.4 Ages, Genders, and Ethnicities

The age of players was captured through the player survey and the registration process for the game. It is important to note that both these methods of collection were implemented after the promotional activity for the game had ended. The registration tracker was implemented in August 2010, and the player survey undertaken in February-March 2011, though since promotion had ended in March 2010, the total data collected was on 2,428 players. Inferring general trends from this sample hence carries some caution, as the proportion of new signups to the game within the period the game was promoted might be expected to contain a higher proportion within the target age bracket. Thus, figures inferred within this section are likely to be representative minimums. A comparison of results is shown in Figure 7. Both sets of data suggest the game was more popular at the younger end of this age spectrum, with school years 5 and 6 (ages 9-11) generating a proportionally higher number of sign-ups. This also suggests the player survey captured a response set representative in terms of the larger player base with respect to age.

Looking at the wider sample, the player survey also asked players for their broader age range, the results of which are shown in Figure 8. Results showed a significant correlation between gender and age; as can be seen from Figure 8, females were more likely to be older than males. 65.8% of the total responses to the player survey self-reported an age within

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7 For a non-parametric regression model
the 9-15 bracket and 76.1% were under 16. Returning to the geolocated UK sample outlined in the previous section, and inferencing these statistics, a total player base estimate as of January 2011 for UK players aged 9-15 would be **62,000**, and total under 16 of **71,500**. Through similar inferencing from the combined sample of 2,428 players, the approximate total for UK players aged 9-11 is just under half of the 9-15 total (47.9%) at **30,000**. It is important to note with these figures the cautions inherent to inferring up from a comparatively smaller sample (969 > n > 2428), though the evidence of playtime (5.1.6) further supports the presence of a substantial school-age user base.

As gender is linked to road safety, with being male a key risk factor in the 9-15 bracket, (DfT, 2010), one notion of *Code of Everand* was its potential reach to a principally male audience. This is borne out by the data from the player survey, which put males at 79.7% of the sample. To infer up from this sample, one consideration was how strongly linked real-world gender was to in-game character gender, selected by the player at the point of character creation. Analysing a total of 100,038 player accounts resulted in an avatar gender split of 82,131 male to 17,897 female, 82.1% male. Analysing specifically the effect of homophily (tendency to select the same gender) by linking player survey responses to their corresponding *Code of Everand* character accounts revealed a strong effect: 68.1% of players had an avatar of the same gender as themselves. Females were much more likely to play male characters than vice versa (70.2% of females played a character of the opposite gender, as opposed to 21.5% of males). Taking these trends within the smaller player survey sample (n=969) and projecting upwards results in a gender split corresponding to the larger scale data on avatar gender - a reasonable conclusion here is that 4 out of 5 *Code of Everand* players were male.

![Figure 8: Relationship between age and gender for *Code of Everand* players (n=969)](image)
Considering again player survey responses, ethnicity (shown in Figure 9) demonstrated ethnicity to broadly follow national levels, though ethnic minorities were 2% lower in the game’s audience when compared to data on UK schools from the Office for National Statistics (ONS, 2007). Taken as a whole, these results on age and gender infer an estimated breakdown of total players into a total of 62,000 aged between 9-15 years old. Within this sample, 30,000 were aged 9-11, 14,000 were from ethnic minorities and 50,000 were male. Again, these figures are inferred from completed responses within the player survey sample (n=911) along with those collected as part of the registration process for the game (n=2,428), and collectively point towards successful reach for Code of Everand to its target. This corresponds with the national survey result which showed 3% of a nationally-representative sample to have played the game - an estimate from census figures puts the total UK population aged 9-15 to be 4.8m, of which 3% is 144,000, roughly in-line with this data. Considering the voluntary and extrinsically-unmotivated entry by players into the game, this is a notable reach for a game-based intervention. Taking the approximation of 62,000 players aged 9-15, this would mean the game reached 1.3% of the total population aged 9-15.

Figure 9: Breakdown of player ethnicities (for UK players only) against recent data on UK schools (ONS, 2007)
This section has shown gender to be a predictably powerful factor in the audience for *Code of Everand*, as well as greater appeal for players at the younger end of the 9-15 spectrum. The data would support a hypothesis in-line with widely reported gaming preferences, that older males are more attracted to action-oriented games (ISFE, 2010), whilst females may be more receptive to an RPG such as *Code of Everand* at the upper end of the age range than males. Regardless, the data confirms the assumption that the majority of the audience for a game would be male, whilst demonstrating that a sizable number of females (around 10,000) also played. In the following section, analysis of indices of multiple deprivation form the final part of the consideration of the player demographic.
5.1.5 Social deprivation indices

Figure 10 shows the distribution of social deprivation indices for 387 players who specified their postcodes within the player survey. These indices are formulated from a combination of income deprivation, employment deprivation, health deprivation and disability, education, skills and training deprivation, barriers to housing and services, living environment deprivation and crime. This is a relatively small subsample, though as can be seen spans a wide range of indices. They have been shown to be directly linked to road casualty rates in a number of studies (McGuigan, 2010). One potential concern regarding Code of Everand is that it would fail to reach audiences in more deprived areas due to either limited access to technology, or different attitudes towards game content and style, particularly given the findings noted previously (5.1.1). However, whilst the data does show that the largest proportion of players was from the least deprived areas, the distribution does include a sizable representation across the range of indices.

![Figure 10: Distribution of player survey responses by indices of multiple deprivation (n=387)](image)

Again, this reinforces the notion that access to gaming hardware is near-pervasive in the UK (Pratchett, 2005) and therefore game-based approaches do not intrinsically exclude those from more deprived areas. Noting also that survey bias may have been a further issue, with deprived areas typically shown to have lower response rates (Parry et al., 2001), this would be expected to skew the data such that the actual distribution is potentially flatter than that shown in Figure 10. Though the total sample of 387 limits the conclusions that can be drawn from this evidence, it does suggest, along with the information on ethnicity in the previous section, that the game-based approach was capable of reaching key at-risk groups.
5.1.6 Sessions and total playtime: How long did people play for?

Having established the specifics of the demographic which played *Code of Everand*, this section goes on to examine in more detail the length of time for which they experienced the game, as well as more general gaming trends amongst the target demographic. Hence, this section firstly discusses the results from both player and national surveys on gaming habits and Internet use, demonstrating concurrence with a range of other studies that have shown both electronic gaming and Internet use to be a central part of recreational time for the vast majority of the population. This section also discusses the total time spent playing *Code of Everand*, leading to the conclusion that the game was widely perceived as a casual and short-term experience.

The national survey results suggested that children aged 9-14 used the Internet on average 5.4 times a week. More than two thirds (68%) of children said that they use the Internet every / most days, whilst a fifth (21%) responded that they used it two or three days a week. The national sample played games most frequently on consoles (such as the PS3, Xbox or Wii), using them around 3.1 times a week, games online using a web browser 2.4 times a week and games on PC / Macs or handheld consoles (PSP, DS) 1.9 times a week. Looking more specifically at gaming, children aged 9-14 responded that they spend just over an hour a day (61 minutes) on average playing games with other children over the Internet. Three in ten (30%) spent up to an hour playing, whilst two in ten (21%) spent up to three hours, and 13% say they play for more than 3 hours a day. Three in ten (31%) said that they did not play online games with other people at all. A comparison of these statistics to the sample of *Code of Everand* players is shown in Figure 11.

![Figure 11: Comparison of time spent online for players versus the national sample](image-url)
As illustrated in Figure 11, *Code of Everand* players reported lower Internet usage, but more time spent online gaming. This suggests players belong to a demographic for which the majority of online time is spent playing games. The data supports more general and larger scale surveys which have shown that gaming is a pervasive part of leisure time for the vast majority of children within the UK (Pratchett, 2005, ISFE, 2010), and that *Code of Everand* players belong to this wide demographic, which other studies have estimated to be in excess of 95% of the total UK population within that age bracket (Pratchett, 2005).

In the national survey results, children in rural areas spent less time playing online games with other people compared to those in other areas - they played for 48 minutes a day on average, compared to 71 minutes in suburban areas and 61 minutes in urban areas. Therefore, it could be inferred that the longer playtimes for *Code of Everand* suggest a more urban audience, a conclusion supported in part by the geographic distributions of players and survey respondents shown in Figures 5 and 6. Difficulties in correcting for total relative populations preclude the ability to demonstrate this conclusively, though the more general data retrieved from the national survey points towards a potential correlation between longer amounts of time spent gaming in urban areas and a higher number of associated risk factors. Within the national survey, children in urban areas were more likely to cross between parked cars (44% often or fairly often, compared to 34% elsewhere) and crossed one more road on their most common journey (5.1 as opposed to 4.1). Therefore, a positive result here for the game is the potential to reach this higher risk audience by virtue of this correlation, though it should be noted the underlying causal factors behind the correlation beyond a predictable influencing role for age and gender are difficult to identify.

Looking specifically at the time children spent playing *Code of Everand*, two data sources can be compared: the game engine data, with the data analysed including data on 315,217 discrete play sessions for 100,038 players, and the player survey results, which included a self-reported question on when *Code of Everand* was played. The mean playtime for player survey responses was 129 minutes over 4 separate logins, compared to a mean playtime for the 100,038 sample from the game engine of 93 minutes over 3 logins. The strong influence of outliers affected these means: by comparison, the median playtime for the 100,038 sample was 31 minutes with a median and modal login total of a single session. Session durations are visualized in Figure 12, as can be seen here, weekday had an effect on total session duration, with sessions at weekends likely to be longer.

From the player survey, results suggest that the game was played as intended during children’s recreational time, with only 1% of the sample reporting that they played the game during school. 9% reported they played the game ‘all the time or wherever I can’, indicating that for a small minority the game proved an extensive investment of time – the top 20 players logged between 160 and 273 hours in total over a 5-month period, and 2,016
Figure 12: Total number of play sessions by duration

Figure 13: Responses to player survey (n=737): "When do you usually play Code of Everand?"
players spent more than 10 hours in-game. With 47,895 players within the analysed game engine data playing for less than 30 minutes, however, a need exists for the game to deliver its impact quickly if it is to reach the larger sample, as this data suggests that half of the 62,000 UK located players within the target age group experienced *Code of Everand* as a single session of less than 30 minutes.

The player survey results shown in Figure 13 support the logical supposition that within a school-age group the majority of playtime for *Code of Everand* would occur during the evenings and weekends rather than the school day. Figure 14 shows the distribution of all 315,217 logins by day and time, demonstrating several traits that confirm a school age audience: these logins exhibit a brief morning peak around 08:30, followed by a slight drop and lull during the working day. The evening surge of logins is more pronounced on weekdays, dropping earlier than would be expected for a game with a more mature audience.

![Figure 14: Distribution of UK logins by day and time (n = 270040)](image)

Overall, this data supports the conclusion reached in Section 5.1.4, that a sizable proportion (~70%) of the game’s total audience was within the target age bracket of 9-15. Yet, it also highlights the brevity of the sessions, which though well in excess of more conventional approaches to road safety interventions in terms of their duration, are below that anticipated for an MMORPG game. As previously discussed (5.1.1), an open response question on the national survey asked children which game they spent the most time playing: the response was striking in a clear preference for *Call of Duty*, an adult-themed first-person shooter. Given that this game is a high-budget title with substantial levels of fidelity, it is immediately apparent that competing for a sizable proportion of children’s entertainment gaming time within this age group requires a consideration of the adult
nature of the games they play, which could readily lend to a perception of titles aimed specifically at children being too ‘childish’. Furthermore, as the security concerns that accompany child-specific gaming do not apply to adult games, the national survey results would suggest that children may expect features, such as voice and text chat, to be available in an online gaming environment which is to be experienced for long periods of time. That said, the national survey also suggested children are open to a wide range of gaming types: although the majority reported playing action and adventure games more (73% and 75% of children played these respectively), other game types such as puzzle (66%), simulation (56%) and role-playing (56%) were not far behind. Hence, whilst a lower-fidelity game has the potential to reach this age group, as evidence for *Code of Everand* coupled with national survey results suggests, sustaining play for long periods is demanding for a title which is not in the gaming ‘mainstream’ of high-fidelity console games.

Returning to the specific case of *Code of Everand*, total playtimes are shown in Figure 15. Eliminating non-UK players increased the average playtime, a predictable finding as the game was targeted at the UK market. A secondary peak emerged in the data at 45 minutes following an initial steady decline. This would suggest users are perhaps better expressed in terms of three groups of low (0-30 minute, n=47,895, 48.4%), moderate (30-60 minute, n=20,646, 20.9%) and high (60 minute+, n=30,391, 30.7%) playtimes. Playtime had a predictably strong correlation to number of logins (r=0.43, p<0.001), with players who played for 30 minutes or less likely to do so in a single session – 78.6% of players with a total playtime of under 30 minutes played for 1 session. Focussing specifically on the 30-60 minute group, single sessions made up 60.0% of instances, indicating that the majority still experienced the game only once in a longer session, though a sizable proportion of these did return for a second visit. In the final group of players with playtimes in excess of an hour,
only 12% played *Code of Everand* for a single session. A breakdown of total sessions of *Code of Everand* by number of players is shown in Figure 16. Note the exponential scale on the chart.

The overall evidence from playtime, coupled with the insights into children’s gaming habits from through the national survey, suggests a need for *Code of Everand* to impart its targeted outcomes and impact behaviour in a short space of time and within a single session rather than over the long-term if it is to reach a meaningful proportion of the user base. Evidence suggests children approached the game primarily as a short-term single-player experience, rather than long-term social environment. The total audience within the target age range was approximately 62,000 (5.1.4), and whilst the traits of the total player base across this demographic would suggest 19,000 of these players experienced the game for more than an hour, habitual play (over 10 hours) was apparent in only 2% of the total sample, indicating that 1250 players within the target group fell into this category. A core objective of *Code of Everand* was to engage, rather than message, its audience. Taken together, the findings of this section have demonstrated that the game was able to reach a sizable UK audience and that elements of that audience belonged to key at-risk groups. In terms of contact time, engagement for the game-based approach exceeded what might be attainable through direct messaging.
5.1.7 Summary of findings on reach

The key findings which have been presented in this section are:

- An indirect relationship exists between gaming habits and road safety, as a result of several key traits shared by both frequent gamers and high-risk groups (5.1.1). Hence game-based learning in general has good potential for reaching a high-risk group for road safety. In general, findings throughout the section reinforce the applicability of game-based learning in reaching a high-risk demographic, showing little selectiveness in terms of ethnicity or deprivation. The impact of age clearly shows greater uptake towards the younger end of the 9-15 range, which coupled with national survey results on gaming preferences suggests that the higher end of the range, and males in particular, may require a different style of game design for sustained appeal.

- Both television and Internet-based promotion have sizable value when promoting a serious game, and were effective in the case of Code of Everand (5.1.2). Though it may appear counter-intuitive to invest in television advertising rather than directly message through television, the benefit of this less direct approach was realised through a high conversion rate (around 1 in 5 children who heard of the game went on to play it), with the game extending the contact time beyond what would be feasible through direct television messaging. Total contact time for the game with its intended audience can be approximated by combining the results of Section 5.1.4 (62,000 total players) and 5.1.6 (93 minutes mean playtime) to give a total of 96,100 hours of contact time.

- Mean and median contact times were high in comparison to other methods for reaching the intended audience at 93 and 31 minutes respectively, though show children failed to adopt the game as an MMO in which they were willing to invest a high proportion of their time on an ongoing basis. In particular given the gaming habits of children, reaching and sustaining interest is extremely challenging, and a ‘build it and they will come’ approach has limited viability. Promotional activities had clear value in drawing players into Code of Everand, though long-term retention proved difficult.

Therefore, the main appeal of gaming to the target audience is shown through the game’s uptake, confirming its relevance as a more active and participatory form of communication. In Sections 5.2 and 5.3, we go on to discuss through qualitative findings a potential mechanism for behavioural change within Code of Everand, and determine quantitative indicators of the impact the game may have had on its 62,000 players.
5.2 A mechanism for behavioural change: Qualitative findings

As outlined in Chapter 3, the qualitative components of this research were designed to look for evidence of *mechanisms* by which the objectives of *Code of Everand* might have been achieved. These objectives were:

- To encourage 9-13 year olds to put their existing knowledge of pedestrian road safety into practice
- To find a way of making pedestrian road safety skills more interesting and more ‘top of mind’—to contribute to making alertness at the roadside valued so that 9-13 year olds both as individuals and amongst their peer group understand and apply safe behaviour.
- To employ a more active and participatory form of communication than simply ‘messaging’ the audience

**Group A and Group B: two possible types of “existing knowledge”**

**Case Study: James, 12 (name changed)**

James started playing *Code of Everand* after seeing an advertisement on television and then, the next day, hearing some boys in his school talking about the game. “*When I got home that day I saw another ad, and I decided to check it out. I watched the video and thought it was quite cool.*”

A number of aspects of *Code of Everand* appeal to James. He likes being able to travel and explore – and also kitting himself out with better clothes, armour and weapons. Sometimes he deliberately goes and makes harder crossings in order to “*train up*” his level, so that he can wear new kit. When he is completing a quest, however, he takes care to plan a route that minimises the number and difficulty of crossings he needs to make.

In the early days, he played with a friend, who showed him where to find things and suggested places to go to train up – but the friend got bored and is not playing any more. Even with his friend’s guidance and a fair bit of playtime racked up, James hasn’t realised there is a second part of the large map (the area to the right which only appears if you zoom out or scroll right).

James has spotted the analogy between spirit channels and roads: “*That’s what I picture in the spirit channels... you have to get across otherwise you can get harmed or hurt.*” He describes the moment when he first worked out what the game was about: “*I was crossing a red crossing and there was like a snarler and it pulverised me. It completely beat me. That’s when I first died... When it first opened my eyes up. That’s when I realised what the game was about.*” However, he’s also spotted some obvious differences: “*Normally I’d just...*”
look both ways and cross, but in this, if there’s something there, you can’t just wait until it’s gone. You have to battle it.”

When asked if people might learn anything from playing the game, James responds with an example from his own experience: “I’m playing it and the next day I’m crossing this really busy road... this massive road... there’s no crossing where I go on it. After a week of playing the game I thought: I’m not going to risk it. [...] I thought: cars are going four ways... and you never really had time in the middle when the light switched. You can get injured. I just decided to be safe. The good thing is it influences you to be safe on the roads.”

For James, playing Code of Everand plays a very specific kind of role alongside other positive influences, one we might reasonably call activation: “It’s not just this but I eventually realised that this helps me realise it. You see all these crossings... and it just opens up your eyes.”

James (above) provides a clear example of the mechanism for which we found evidence. This mechanism is a version of analogical transfer, with tactics used to solve problems in one context (in-game) being applied to the solution of analogous problems in another context (real world road-crossing).

How well does the idea of analogical transfer fit with the overall objective of activating pre-existing knowledge? As we saw in Section 3.2, there is evidence that children in the target age range have the necessary skills and understanding to behave safely (Tolmie et al., 2006), but routinely fail to apply them (Evans and Norman, 2002) – either because they do not think to or because they do not want to. In the classic model of analogical transfer, by contrast, someone does not know how to solve a problem until they recognise the analogy with another problem.

So, if children already know how to solve the problem of getting across the road, how can an analogy help? There are two ways of responding to this question.

- On the one hand, one could argue that the analogy operates not by supplying a tactic but by making the problem or tactics more salient. According to this approach, the reason why children fail to activate their road safety knowledge when crossing the road is that they fail to experience the task ahead of them as a problem requiring solution. Instead, to use everyday language, they cross on ‘autopilot’. The role of the analogy is to make them ‘stop and think’. As soon as they have done this, they already have the correct tactics ready and waiting to be applied.

- On the other hand, one could question whether children really do know how to solve the problem of getting across the road. Instead, one might argue, they know how to solve the problem of satisfying adults who ask them questions about road safety. Their real-world tactics for solving the problem of crossing roads, by contrast, are deficient. The challenge of activation, on this account, is one of developing better tactics which
match the ones verbally described when asked about road safety by adults. The role of the analogy, on this account, is to supply these better tactics.

This does not have to be an either/or interpretation. It is completely reasonable to think that some children need the first kind of mechanism (they have ‘got it’, but don’t always think to do it), while others need the second kind of mechanism (they haven’t really ‘got it’).

James’ own description of himself, along with other evidence from interviews, strongly suggests that he belongs to the former group of children, which we will call Group A; whereas many of the other children we spoke to belonged, by our estimation, to the latter group, which we will call Group B.

It is worth stressing that this is a distinction we have drawn in analysing the findings from this research, rather than one we were previously aware of. The distinction stands in need of further investigation and validation – all of which was outside the scope of this research. It should also be stressed that our assignment of some children to Group B was based on our interpretation of their responses in interview and in the map task in particular. The distinction between Group A and Group B is presented as a hypothesis, and should in no way be considered as validated. In particular, we draw attention to the possibility that the distinction may in fact be an artefact of the research process: i.e. Group B children may in fact be struggling with elements of the interview (such as reading maps) rather than with real issues of roadside behaviour.

Assuming that our distinction is accepted, however, it follows that Code of Everand both can and should address both groups of children. The accident statistics provide no basis for identifying priorities here. Common sense might suggest that Group B would be a priority, but this might not be the case if e.g. most children turned out to belong to Group A. More research is needed here.

The first objective of Code of Everand, drawing on research such as that cited above, was to “encourage 9-13 year olds to put their existing knowledge of pedestrian road safety into practice”. Our proposed distinction between two groups of children highlights a potential ambiguity in the phrase “existing knowledge”:

- Group A children do ‘get’ the behavioural meaning of what they are saying, but don’t always think or want to behave in that way.
- Group B children do not actually ‘get’ the behavioural meaning of what they are saying.

This in turn suggests that different mechanisms may be required, depending on which kind of “existing knowledge” is present. For Group A children, the primary role of an analogy would be to make real world problems and tactics more salient; for Group B children, the primary role of an analogy would be to supply better tactics for transfer to real world situations.
The need to address Group B raises a specific challenge for the game’s design. The problem, stated simply, is that analogies work in both directions. When children are learning how to play *Code of Everand*, i.e. how to solve the problems it presents, they may therefore apply to in-game problems the (deficient) tactics which they already use to solve analogous problems in the real-world context, instead of developing new (improved) tactics in-game which can then be applied to the real-world context. Unless *Code of Everand* contains a mechanism by which improved tactics are encouraged and developed, no benefit will accrue for Group B children. To address Group B children, the game needs to *scaffold* better tactics: this general point is discussed further over the sections that follow.

**Proposed mechanism**

With the above considerations in mind, we propose the following generalised mechanism by which *Code of Everand* might have the desired impact.

<table>
<thead>
<tr>
<th>Proposed mechanism</th>
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<tbody>
<tr>
<td>1. Child engages with game</td>
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<tr>
<td>2. Child engages with the right problems in the game</td>
</tr>
<tr>
<td>3. Child applies/develops the right tactics to solve problems</td>
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<tr>
<td>4. Child gets relevance of in-game problems/tactics to right real-world situations</td>
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<tr>
<td>5. In-game problems/tactics are readily accessible when child is in those real-world situations</td>
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</tbody>
</table>

This mechanism applies to both Group A and Group B, the key difference being at Step 3: Group A applies the right tactics, Group B develops the right tactics. As we shall see in Section 5.2.5, there is also a simplified version of the same mechanism which involves the salience of problems in-game increasing the salience of problems in the real world context, and which applies only to Group A. This simplified mechanism works as follows:

<table>
<thead>
<tr>
<th>Simplified mechanism (Group A only)</th>
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<tbody>
<tr>
<td>1. Child engages with game</td>
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<tr>
<td>2. Child engages with the right problems in the game</td>
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In the sections that follow, we review each of the five steps of the proposed mechanism in turn and assess, on the basis of the qualitative evidence, the ways in which *Code of Everand* currently delivers against them, key areas of weakness and potential implications for design.
Note that the mechanism above does not guarantee that a child will make the connection in the real-world situation and adjust their behaviour accordingly. It is not clear how any mechanism could guarantee this. Instead, the mechanism greatly increases the probability of the child making this connection. Note also that this mechanism would not address the potential challenge of children who do not want to use appropriate tactics. We return to this topic briefly in Section 6.

5.2.1 Step 1: Child engages with game

Motivations to play

The qualitative evidence suggests that Code of Everand is a rich and immersive environment which creates clear motivational hooks for a wide range of different children with different motivations. Within our sample, for instance, the types of motivation for playing listed below were all in evidence. (The typology suggested, it should be noted, is provisional, with clear overlaps between categories; moreover, primary motivations in one category might lead to secondary motivations in another, e.g. an interest in getting cool gear can lead to a secondary motivation to level up so you can wear that gear.)

<table>
<thead>
<tr>
<th>Game motivations</th>
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<tbody>
<tr>
<td>- Exploration – seeing new places, covering the map, doing your own thing</td>
</tr>
<tr>
<td>- Social interaction – helping people, having a critter, making friends</td>
</tr>
<tr>
<td>- Achievement/competition – finishing quests, levelling up, mastering skills, leader board stats, critter achievements</td>
</tr>
<tr>
<td>- Possessions – shopping, getting cool gear, amassing money/rewards</td>
</tr>
<tr>
<td>- Crossings – engaging monsters, critter arena</td>
</tr>
</tbody>
</table>

Of the areas above, Code of Everand’s weakest performance was in the area of social interaction, in large part owing to the restrictive nature of the chat function – itself a function of legal restrictions and the need to protect players, rather than a positive design choice. Those with more social motivations were also disappointed that there were so few real people in Everand – an unfortunate consequence of the fact that marketing for the game had been stopped many months prior to the evaluation taking place. (See Section 5.2.6 for further discussion of the social aspects of the game.)

Of course, not all children will engage even with a computer game that provides hooks for all of the above motivations. All of our participants were recruited on the basis that they already played some computer games, to filter out those least likely to engage; and even within this category a few did not engage with Code of Everand because they had different kinds of motivations for playing (e.g. building things – a motivation which was only minimally met by the house-building area). No game can appeal to everyone. What is
striking was the way in which Code of Everand achieved a breadth of appeal by making room for very different motivations.

Comparisons with other games

An online PC-based game such as Code of Everand may also suffer, inevitably, in comparison to more visually sophisticated games on gaming platforms. For instance, some of the children commented on the relatively unsophisticated look and feel of Code of Everand next to other major gaming titles. This does not seem to have been an obstacle to engagement for our participants, although it may have meant some of them would not have taken the time to become engaged in the first place had they not been required to do as part of the research. Look and feel, that is, seem more likely to be barriers to entry to the game than barriers to engagement.

Technology restrictions

Technology restrictions created another challenge for some children. Even children with access to high-powered gaming platforms may be using a laptop or netbook with a small screen as their computer. The presence of multiple browser toolbars can mean very little space is left in the main window. One of our participants had not realised that there were buttons along the bottom of the screen, seriously diminishing their engagement. This might be addressed by repositioning the buttons at the side of the screen.

Failure to master basic elements of gameplay

The biggest challenge to engagement suggested by our research, however, concerns mastery of the basic elements of gameplay. These are, of course, covered by a tutorial and a series of preliminary quests. However:

- A number of children simply skipped the tutorial.
- Some of those who completed the tutorial did not bother with the preliminary quests.

As a more general pattern, we noted that many of the children did not read instructions that came up on the screen. On questioning, this turned out to be a pattern common to the way they played other games too – sometimes exacerbated by specific difficulties with reading. Many of the basic concepts of Code of Everand are presented in written form.

The result of this failure to master basic elements of gameplay was that participants who were initially quite engaged might subsequently get stuck and become frustrated. In our sample, some children got stuck in this way but, because they had been given a task of playing as part of the research, persevered (or were encouraged to persist by their parents); it is very likely that in a non-research setting these children would simply have given up.
Case Study: Leon, 11 (name changed)

Like a number of our participants, Leon did not bother with the tutorial: “I just like to find out for myself because then I get used to the controls earlier.” As a result, he did not discover the map until he had been playing for some time: “I was just looking at the bars on here and I was just clicking everything and I clicked this and then I clicked this and it showed me a big map.” Until this discovery, playing was much less engaging: “You wouldn’t know where to go and it gets a bit boring.”

From comments later in the interview, it is clear that Leon’s parents played a critical role in keeping him engaged until he made this discovery: “At first I didn’t really like it... but they said just carry on and see what it’s like because it might get better.”

We think it is unlikely Leon’s parents would have got involved in this way outside the context of a research task. By the time we meet Leon, he is highly engaged with the game, playing it avidly throughout the interview. However, it seems unlikely he would have reached this point under normal circumstances.

Early barriers to engagement arising from a failure to engage with the tutorial and preliminary quests included:

- Not realising that one needed to cross spirit channels
- Not discovering the main map (sometimes because the buttons were only visible if one scrolled down)
- Not understanding that there were quests to be undertaken
- Not finding out about balloons, and so getting stuck in the Academy
- Not having any traps other than the practice traps
- Not knowing how to equip and build new traps when their first set ran out (often linked to a failure to notice that there were two tabs in the traps area of the character screen)
- We also believe there is an additional barrier to engagement that arises some way further into gameplay. Many of our participants had failed to make the link between monsters’ elemental weaknesses and the different types of trap in their inventory. Rather than selecting traps to suit the monsters they encountered, they adopted a strategy one might call ‘throw stuff at them and hope something works’. This obviously meant they used up a great many more traps and materials. By the time we interviewed our participants after a few weeks of gameplay, a number – despite being very engaged with the game – either were running out or had already run out of the materials to make traps, leaving them unable to make any more crossings and unclear how to get
more materials. These participants were also therefore unable to complete quests. They were, as a result, on the brink of disengagement.

We hypothesise that these different disengagement points may correspond to the identification of three groups of users in terms of total play time in Section 5.1.6. On this hypothesis, the low-play category would correspond to those who are disengaged early on by a failure to master basic gameplay; the moderate-play category to those who are disengaged later on by running out of traps and materials. By addressing these disengagement issues, there would be a clear potential to move more players from both categories into the high-play category and so increasing the potential of the game to have an impact on behaviour.

**Supporting players to master gameplay**

How might these issues be addressed within the design of the game?

One obvious improvement would be to provide an audio track with all written instructions, and an option to replay this audio. This would ensure that those who face challenges with reading would nevertheless be able to access instructions.

Beyond that, making the tutorial and preliminary quests ‘compulsory’ does not seem like a good idea, as this would mean players like Leon might not start playing at all. However, it might be possible to provide context-dependent ‘help’ linked to the types of engagement challenge listed above – delivered, perhaps, by the player’s critter. For instance, if a player has still not clicked on the map after a certain length of time, the critter could pop up and check they know about this button. Or again, if the player was not using the right traps to tackle monsters even when they were available, the critter might pop up with the suggestion. This context-dependent help would serve as a safety net for those (potentially, we believe, quite a large number of the target age-range) who choose to skip (or do not properly absorb) the initial tutorial and preliminary quests.

Context-dependent ‘help’ would effectively provide ‘scaffolding’ (3.3), enabling players to perform better than they would have done if doing things entirely by themselves. This basic idea will feature again in subsequent sections.

**5.2.2 Step 2: Child engages with the right problems in the game**

**Two types of problem**

At the heart of *Code of Everand* is a requirement to cross spirit channels. The core design of the game – the requirement to complete quests and travel around, combined with the arrangement of spirit channels in Everand – ensured that anyone who mastered the basics of gameplay (see Step 1 above) would engage with the problem of crossing spirit channels. Moreover, elements of the design, such as dealing with monsters, ensured that this was a positive and engaging feature of gameplay for many of our participants.
In fact, there are two types of problem, which the pathfinder in Everand must address:

- Where to cross
- How to cross

There are important differences between the ways in which these two types of problem are set up in Everand.

**Where to cross**

The problem of choosing where to cross in Everand revolves around the fact that some crossings are easier to make than others. The task for the pathfinder is to select a crossing point in which they will not be defeated.

Crossing points are distinguished in two ways:

- Designated crossing points are easier to cross than other points
- Spirit channels are colour-coded by difficulty

Most of our participants (apart from a few who had failed to master basic elements of gameplay) had recognised the colour-coding of channels both in Everand and on the main map, and the presence of designated crossing points in Everand.

However, there were a few points on which engagement with the problem of choosing where to cross might be improved, specifically:

- Not all children had realised that it was possible to cross at places other than at a designated crossing, meaning that this was not a choice with which they actively engaged.
- Almost none of our participants realised that designated crossing points were also marked on the main map – even when this was pointed out to them (see example below). As a result, route-planning on the main map did not take account of designated crossings.

**Case study: Liam, 12 (name changed)**

The following exchange from an interview is an example of how participants did not realise that designated crossings were marked on the main map, sometimes even when the markings were pointed out to them.

Interviewer: “So is there a way of looking on the map to find [designated crossings]?”
Participant: “No. You can look at where the spirit channels are, but it doesn’t tell you if it’s a safe place to cross.”
How to cross

The problem of deciding how to cross in Everand essentially revolves around selecting the right trap to match the elemental weaknesses of any monsters in the channel.

Perhaps surprisingly, a substantial number of our participants had failed to grasp the connection between traps and weaknesses – one reason why they ran out of traps and materials (see Step 1). These participants would select traps at random, on the basis of using those they had more of first, or on the grounds that some traps had worked better than others in the past. In a few instances, children making crossings during the interview would set traps without even bothering first to look what monsters were there.

Other children had developed their own theories about the relationship between traps and monsters – as in the case of Kieran below.

Case study: Kieran, 10 (name changed)

Kieran was an avid player, although a tendency to forget his password meant that he was on his fifth or sixth avatar. In particular, he enjoyed the freedom to do as he pleased in Everand – including, when he chose, the freedom not to make crossings and deal with monsters: “I feel freedom to me is like, in games it’s brilliant... Because I feel so happy because I just get to explore anywhere. If I feel like going to a village somewhere, to go on a retreat away from it all... I can just go there.”

However, he also enjoyed the element of crossing with monsters, and had developed his own theories about the relationship between traps and weaknesses which, in practice, bore little relationship to the grid patterns:

Kieran: “It’s an enemy, so I have to set a trap. And by the look of him, I think he is a muck-taker creature....”

Interviewer: “How do you work out what type of trap to use?”

Kieran: “Well, you can use any, but if you look at them and study them for a little while. [...] Because when you look at him, he doesn’t look that he would be from fire or water... He looks like he’s from a normal grassy-ish place.”

Over and above these issues, the deeper question is whether the problem of deciding how to cross in Everand, even when fully engaged with, is the right problem. As noted above, the problem revolves around selecting the right trap to match any monsters in the channel – not, as in the real world, seeing that there are monsters or deciding whether and when it is safe to cross. Regarding the latter, for instance, the option to cross is only presented when the channel has been cleared and the player has looked left and right one more time. This
may not matter to children in Group A (see Section 6); but for those in Group B, the fact that the right problem is not being set makes it hard to see how the right tactics could be developed in response.

5.2.3 Step 3: Child applies/develops the right tactics to solve problems

Evidence of the right tactics

There was clear evidence that a number of participants were using tactics in Everand which, by analogy, one would also hope they would use in the real world.

This was especially true around deciding where to cross. For instance, participants were using tactics such as:

- Sticking to green and yellow channels only (until they had levelled up) – often after having tried out and been defeated on a red channel
- Being willing to cross only green channels at a non-designated crossing point
- Going some way out of their way to avoid harder crossings (using the main map; as noted under Step 2, however, this planning did not take account of designated crossings as participants did not realise they were shown on the map)
- Sticking to the easiest crossings when ‘health’ (the term used by many of the participants for ‘concentration points’) was low

However, these tactics were not universal. For instance, while some participants planned their routes, others simply set out and only diverted if things got too hard (or if they had been defeated at a crossing point once already). A few participants were quite reckless in their approach to crossing points, entering crossings with the full knowledge they were likely to get defeated. Two possible explanations for these patterns are discussed below.

Regarding the question of how to cross, there was – as already discussed under Step 2 – a very mixed picture in terms of whether participants had learned how to match traps to monsters, with a substantial number not making this connection; and these tactics do not anyway have a useful real world analogy.

Where are the right tactics coming from?

To the extent that participants were using the right tactics in deciding where to cross, it is worth asking: were these tactics developed entirely in the game, or by analogy with comparable, pre-existing tactics used in the real world?

In order to assess this, we were able to compare the tactics used by each participant in the game to the tactics they used in the map task which they undertook before and after their period of gameplay. This map task required them to plan a route (for an imaginary cousin);
the task was purposely designed to minimise prompting of road safety – e.g. the ‘hazards’ and ‘temptations’ depicted on the map included many that were not road-safety related, and the task was to design a good route, not a safe route.

Across the sample, there was a strong resemblance between the approach taken to selecting crossing points in Everand and the approach taken to the map task. For instance, children who did not go out of their way to use a safer crossing point in the map task also tended not to go out of their way to use a safer crossing point in Everand. The indications were that children were applying the tactics they already used in the real world, rather than developing new tactics in Everand.

This is important in light of the distinction made in Section 5.2.1 between Group A and Group B. The evidence from this study suggest that Group A children were indeed applying the right tactics in Everand, but that Group B children were not developing them.

Case study: Miles, 11 and Ailsa, 11 (names changed)

Miles’ approach to the map task suggests he is a prime target for Code of Everand. His route on the first task is shown in the left-hand map below: the dotted line shows a first attempt, which – having crossed the busy and dangerous City Road away from the pedestrian crossing – he abandons only when he realises he will have to walk through a narrow and dark alley to reach his destination.

By way of contrast, the map on the right shows the response to the same task from Ailsa (who lives in the same area). Note how she goes out of her way to use the crossing on City Road.

In the terms used in Section 5.2.1, Ailsa belongs to Group A, Miles belongs to group B.
In Everand, Ailsa is similarly careful to plan a route which avoids unsafe crossing points, going out of her way when necessary. She applies the right tactics. By contrast, Miles tends to move forward in a direct line, having a go at crossings as he encounters them and only diverting if they prove too difficult. He too is applying the same tactics he used in the map task. There is no evidence that he is developing the right tactics as a result of playing the game.

Of course, it is possible that, given more time, some of the Group B children would have started to develop the right tactics. However, as argued in Section 5.1.6, time is not a luxury that *Code of Everand* has: most of our participants were already, after a few weeks of relatively intensive play, in the upper 20% of players in terms of their playtime.

In order to reach Group B children, therefore, and help them quickly develop better tactics, there is a role for more context-dependent help or in-game ‘scaffolding’ of the kind already suggested under Step 1. For instance, if a player is defeated on a crossing that is really too difficult for their current level, their critter might pop up with some guidance on route-planning; or they might have to complete a quick route-planning game before they could proceed.

**What’s at stake?**

To develop new tactics in response to problems in Everand – choosing where to cross or choosing how to cross – one has to care about the consequences of getting it wrong.

Across our participants, there was a mixed picture on this point. Some were very keen not to be defeated in a crossing, seeing this for instance as a sort of personal failure. But for some participants, it was clear that being defeated (described variously as ‘dying’, ‘fainting’, ‘losing all your health’) did not really matter that much, diminishing engagement with the task of getting better at deciding where and how to cross. For instance, some players such as Peter, below, displayed a general ‘recklessness’ in their selection of crossing points, based on their perception that failure had few consequences.

**Case study: Peter, 11 (name changed)**

Like a number of participants, Peter has not noticed that you lose money when you are defeated in a channel. He has noticed, however, that his concentration points are fully restored. For him, this benefit can outweigh the minor inconvenience of being in the wrong part of the map.

Peter: “I’ve died loads of times.”
Interviewer: “How does that happen?”
Peter: “When the monsters attack you and your concentration points go then you die... nothing really happens, everything gets restored but you go back to a certain place near the Academy.”
Interviewer: “Is dying a bad thing?”
Peter: “Yeah, well, it depends. If you’ve got zero or two then it is quite good because even though you are back to where you started it is easier to get back.”

Later in the interview, Peter’s attitude to ‘dying’ is apparent when he decides, spontaneously, to attempt a red crossing:

Peter: “I’m going to cross a red crossing that I am probably going to die at.”
Interviewer: “So why are you doing it if you are probably going to die?”
Peter: “Because it’s quicker and also it’s quite low anyway, they might attack me first... see? I resisted it. I’ve never come across these [monsters] before.”
Interviewer: “Is that a good thing to come across more monsters?”
Peter: “No, because you won’t have the right traps. I’m going to die.”

Shortly after this, Peter decides to get himself rescued. In light of the previous discussion, the interviewer asks him if being rescued is better than dying, to which Peter responds: “Probably not, probably shouldn’t have done that, considering, because I would have got everything back.”

Interestingly, Peter’s responses to the map task are ‘textbook’, with great care taken to select the safest crossings along the way. The perceived lack of consequences for ‘dying’ means he has not even applied tactics to Everand which he uses in the real world. He is very clear in his own mind about the difference between his behaviour in the game and in the real world: “He [my avatar] would be probably very very annoying. He’d be doing stupid things like killing himself. [...] I wouldn’t do REALLY stupid things, but if I was like him in this game and I knew if I died I just could come back, I would just keep on trying things.”

In his final interview, Peter estimates that he has been defeated 50 times during the few weeks he has been playing.

There are clear indications that Code of Everand might benefit from a clearer communication, and possibly a restructuring, of the penalties associated with being defeated – especially during the earlier stages of the game, when less may be at stake.

One possibility here would be to link being defeated with the types of ‘scaffolding’ task discussed in the last section. For instance, a defeated pathfinder might have to complete short learning tasks before they were allowed back out into the world - along the lines of the courses now offered by the police to those caught speeding. The surrounding narrative might be that experienced and ‘grown up’ pathfinders do not get defeated, whereas those who do not apply the right tactics and get defeated as a result have to go ‘back to school’.
This might also help to make road safety skills more ‘valued’, in line with the second objective of Code of Everand.

One final small point which might need addressing is the concentration points penalty associated with backing out of a crossing. A few of our participants had noticed this penalty (which is clearly communicated when one chooses the option) – although others had not realised there was an option to back out at all. If entering the channel is analogous to standing at the roadside, it seems that deciding not to cross after all (because the crossing looks too dangerous) is a positive tactic, and not one that ought to be penalised. This would also enable players to satisfy their curiosity about what is in channels while encouraging them to do the smart thing and pull back when things are too difficult. Penalties could still apply if a player backed out after starting to cross with the monsters.

5.2.4 Step 4: Child gets relevance of in-game problems/tactics to right real-world situations

Three types of response

There was a mixed picture across our participants in terms of whether or not they spotted the analogy between crossing spirit channels in Everand and crossing roads in the real world. Three types of response can be distinguished in our sample.

The first group of participants had spotted the analogy between spirit channels and roads. Points of analogy included the differentiation between different types of channel/road; the existence of designated crossing points; and the fact that you have to look left and right before you can cross. The following are examples of quotations from this group:

“I think the thick ones [spirit channels] are like main roads cause the big blue ones stand out to me more like they are thicker like main roads. But the long thin windy roads like this one here to me look like a village, like a little neighbourhood or close, or cul de sac. It’s a tiny road like just crossing the road.” [Girl, 12]

“The channels are like roads so you have to look left and right and then the monsters are like cars – sort of.” [Boy, 11]

As the second quotation indicates, this group were also typically able to spot some areas in which the analogy was not so strong – e.g. the fact that you have to directly engage with monsters, rather than waiting for them to pass. To put the point another way, the problem of how to cross a spirit channel is not so directly analogous to the problem of how to cross a road as is the case for the problem of deciding where to cross (as discussed under Step 2).

A second group of children drew an analogy, but to a different real world situation or problem. Spirit channels were seen by a few participants as being like rivers or, in one case, walls. Monsters, meanwhile, were linked by some children to bullies or other dangerous people (drunks, gangs, etc). In the latter case, there was some indication that children were
transferring the most salient problems in their real lives into their interpretation of *Code of Everand*.

A third group of children saw no analogy between spirit channels and anything in the real world. When asked whether anything in the real world could be used as an example to explain *Code of Everand* to someone else, these children would focus on literal similarities, such as the fact that there are people you can talk to in *Code of Everand*, or markets, or even – for one boy – air balloons; but they did not think in analogical terms. (Note that literal similarities were also pointed out by some of the children in the first two groups.)

**Being asked the question**

It was apparent, however, that simply being asked the right question can encourage some of the children in the third group, too, to spot the analogy. In one instance, a boy suddenly remarked, five minutes after being asked for real world comparisons, that the spirit channels were like roads: the idea had just occurred to him then.

At the end of follow-up interviews, children were asked directly how strong they thought a number of analogies were, e.g. “Crossing a spirit channel is like crossing a road”. Regarding this particular statement, *all* of the children – including those in the second and third groups above – either agreed or strongly agreed with the suggested analogy. A majority agreed with other suggested analogies as well.

There was no evidence that knowledge of this analogy in any way diminished engagement with or interest in the game. Of course, this is not to say that knowledge of a road safety theme would not have discouraged participants from getting involved in the first instance. There is a big difference between knowing something you are thinking about doing has an educational aspect, and discovering that something you are already doing also has an educational aspect.

To ensure that all players get the relevance of *Code of Everand* to the real world, there may be merit in including prompts (another kind of ‘scaffolding’) in the mechanics of the game.

5.2.5 **Step 5: In-game problems/tactics are readily accessible when child is in those real-world situations**

This step was the hardest to assess with the methodology used – or indeed, any other methodology which might have been used. However, two types of evidence suggest that in-game problems/tactics were accessible in real world situations: self-reports, and before-and-after comparison of an element of the map task.

*How does playing *Code of Everand* make in-game problems/tactics readily accessible in other settings?* We hypothesise that this may be a direct function of engagement in the game. Put crudely, people playing the game become absorbed in its world, in which they are investing time and energy. This is a fresh and recent part of their experience, about which
they may also think or even talk (5.3.5) when not playing. The problems/tactics in the game are therefore readily accessible in other settings. While not formally stated, this hypothesis should be intuitively plausible to anyone who has ever had the experience of being engaged in a computer game requiring active problem-solving.

**Self-reports**

The first type of evidence for accessibility is provided by self-reports, such as that given by the player James in the case study in Section 5.2.1. Ailsa, below, is another interesting example – especially regarding the contrast drawn between the ‘look left and right’ message and the selection of safer crossing points. This neatly illustrates how Code of Everand delivers against its third objective: “to employ a more active and participatory form of communication than simply ‘messaging’ the audience”.

**Case study: Ailsa, 11 (name changed)**

Ailsa quickly spotted the analogy between crossing a spirit channel and crossing a road. Asked if there is anything in the real world that could help her explain Code of Everand to a friend, she replies:

“On the channels, ‘cause you have to look left and right and you have to defeat the monsters, it kind of reminded me of a road and then you have to look left and right and you have to wait until the cars go. After you have defeated them you have to look left and right again and then you can cross.”

A little later on, asked if one could learn anything from the game, she expands on this point among others:

“I guess so, like what I said about the roads, I think that’s important if you didn’t already know that, it helps you understand it more and you...um [referring to one of the quests] ...need exercise because you did the jog and you got the reward... and things like that.”

What is noteworthy about this quotation is that Ailsa sees the ‘lesson’ about looking left and right as a didactic one – similar to the perceived exhortation to do more exercise – which is aimed at people who (unlike herself) do not already know to do this. Asked who would learn most from the game, she immediately responds “Probably like the infants, because they don’t know about the roads as much.”

To put the point another way, when asked directly about ‘learning’, Ailsa responds in terms of what she understands as learning – the didactic transfer of knowledge.

There is no mention here of the selection of safe crossing points – something Ailsa pays close attention to. However, asked toward the end of the interview if she has ever thought about Code of Everand when out and about, she replies:
“It kind of always reminds me when you see a lollipop lady or a zebra crossing because that’s kind of like the path when it is safe to cross.”

This is another kind of learning, albeit one that does not fit with Ailsa’s understanding of the term. Code of Everand has provided a set of problems and tactics which are accessible as analogies in real world situations.

Self-reports of course have to be treated with caution. There is always a danger that participants (especially children) will tell the researcher what they think the researcher wants to hear. It is impossible to eliminate entirely the subtle cues that something is ‘the right answer’ which even the most experienced researcher will unconsciously supply. However, strenuous efforts were made throughout this research not to prompt or cue responses relating to road safety, leaving us confident that there is at least some truth in the self-reports made by participants.

Map task ‘tips’

A second source of evidence for the accessibility of in-game problems/tactics in other situations derives from the before-and-after completion of the map task.

No obvious change was noted in the way in which participants addressed the task itself – unsurprisingly, given the finding in Section 5.2.4 that participants appeared to be transferring tactics from the real world into Code of Everand.

However, evidence of a change was apparent in a follow-up task, which was to give the imaginary cousin three tips to make the most out of their time out and about without adults. Before-and-after responses to this task are presented in Table 1. Responses which relate in some way to the selection of a safe crossing point or avoiding crossing busy roads – a key problem in the world of Code of Everand – have been shaded. While statistical significance cannot be established in so small a sample, the pattern of responses indicates that this problem has been made more salient by the experience of playing Code of Everand for a few weeks. The in-game problem, that is, is more accessible in a different setting.

Of course, transfer to the map task, carried out using pen and paper in participants’ living rooms and with an adult researcher, does not necessarily imply transfer to real roadside situations. Nevertheless, this evidence usefully corroborates self-reports of roadside behaviour.

How close does the analogy have to be?

Analogies can be more or less close. Clearly an analogy does not have to be perfect for a lesson to be transferred from one situation to another. The following quotations provide examples of participants making more sophisticated analogies between Everand and the real world.
“I walk home on my own after school and I’ve found not to muck around with my friends as much on the way home. Because like for example you can be defeated on here, that could happen in real life.” [Boy, 11]

“The first time I played this I had school the next day and I thought: oh, I twig on now, this is about road safety. [...] It’s basically like beating the cars to make it across, it’s like a competition really. It’s really useful to me actually, because this morning I was walking to school and... like the snails and I was thinking ‘I have to let them go and then they can cross and it will be safer; because when I walk to school there are a lot of roads that don’t have a crossing, the way I go there is only one road that has a proper crossing and the rest is just you go across when you go across. [...] Normally, I have to admit, normally if there is a car coming I would wait for it to go past, but every now and again I would run across the road. Every kid does it. You can’t say you don’t
<table>
<thead>
<tr>
<th>TOP TIPS - BEFORE</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Look both ways before crossing the road</td>
<td>Go the safest way if on your own</td>
<td>Keep to the same route until older</td>
<td>Look both ways before crossing</td>
</tr>
<tr>
<td>Look listen and think before crossing road</td>
<td>Don't walk on main road, use the path</td>
<td>Put a helmet on if you ride a bike</td>
<td>Look and listen before crossing</td>
</tr>
<tr>
<td>Make sure he crosses the road safely</td>
<td>Don't try to look cool like some mates</td>
<td>Don't stop in recc and play, mum won't know what to do</td>
<td>Always try and cross at crossings</td>
</tr>
<tr>
<td>Don't talk to strangers</td>
<td>Watch for cars when using roads</td>
<td>Stop look and listen</td>
<td>Don't talk to people you don't know</td>
</tr>
<tr>
<td>Take the safest route, not the quickest</td>
<td>Don't let your friends tell you what to do</td>
<td>Stay away from danger like dogs and roadworks</td>
<td>Don't trust strangers</td>
</tr>
<tr>
<td>Use zebras</td>
<td>Stay off main roads</td>
<td>Don't go down small lanes</td>
<td>Don't take shortcuts if not safe</td>
</tr>
<tr>
<td>Look left and right</td>
<td>Don't wear headphones when crossing the road</td>
<td>Concentrate on everything around you</td>
<td>Avoid gang areas</td>
</tr>
<tr>
<td>Health and safety</td>
<td>Look when you cross the road</td>
<td>Try not to speak to strangers</td>
<td>Avoid busy roads</td>
</tr>
<tr>
<td>Highway code look left and right</td>
<td>Pay attention, may not see a car</td>
<td>Be aware of dangers around you</td>
<td>Avoid roads where it looks like suspicious people could be</td>
</tr>
<tr>
<td>Shortest way isn't always the safest</td>
<td>Don't use phone when crossing the road</td>
<td>Stay on the pavement</td>
<td>Always use crossing / green man</td>
</tr>
<tr>
<td>Don't run about in the road</td>
<td>Use the way which is safest</td>
<td>Care at junctions cross one then the other not all in one</td>
<td>Look both ways before crossing</td>
</tr>
<tr>
<td>Don't take short cut if not safe</td>
<td>Avoid gangs of people</td>
<td>Watch the road, pay attention</td>
<td>Go long ways at night</td>
</tr>
<tr>
<td>Think - don't talk to strangers</td>
<td>Look - for all cars and traffic</td>
<td>Listen to traffic, don't talk to friends</td>
<td>Don't talk to strangers</td>
</tr>
<tr>
<td>Don't go down busy roads</td>
<td>Try to use the crossing</td>
<td>Avoid gang areas</td>
<td>Careful crossing road, cross at crossing</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TOP TIPS - AFTER</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Look both ways before crossing</td>
<td>Don't talk to people you don't know</td>
<td>Don't trust strangers</td>
<td>Don't go down quiet streets - no one to help in danger</td>
</tr>
<tr>
<td>Look and listen before crossing</td>
<td>Use pedestrian crossings if there</td>
<td>Use traffic lights</td>
<td>Avoid dangerous areas</td>
</tr>
<tr>
<td>Always try and cross at crossings</td>
<td>Don't walk on the road</td>
<td>Avoid near vicious dogs or drunks</td>
<td>Don't go where lots of people, might push you around</td>
</tr>
<tr>
<td>Look left and right and listen for traffic</td>
<td>Don't talk to strangers</td>
<td>Avoid open roads with no pedestrian crossings</td>
<td>Avoid talking to strangers</td>
</tr>
<tr>
<td>Stop look and listen when you cross the road</td>
<td>Don't go down quiet streets - no one to help in danger</td>
<td>Stay away from alleys</td>
<td>Road safety - if there's a crossing or traffic lights use them</td>
</tr>
<tr>
<td>Use zebras</td>
<td>Stay away from alleys</td>
<td>Avoid roads where it looks like suspicious people could be</td>
<td>Not to talk to strangers</td>
</tr>
<tr>
<td>Don't talk to strangers</td>
<td>Look out for where you are going and be safe</td>
<td>Look out for traffic</td>
<td>Try and avoid busy traffic places</td>
</tr>
<tr>
<td>Look out for traffic</td>
<td>Look at where you are going and be safe</td>
<td>Always use crossing / green man</td>
<td>Stay on the path</td>
</tr>
<tr>
<td>Look both ways before crossing</td>
<td>Go long ways at night</td>
<td>Don't talk to strangers</td>
<td>Look across road, make sure no cars</td>
</tr>
<tr>
<td>Look for friend, not on own</td>
<td>Go a safer way even if longer</td>
<td>Watch out for cars</td>
<td>Look for bad areas, avoid it</td>
</tr>
<tr>
<td>Careful crossing road, cross at crossing</td>
<td>If area is bad, avoid it</td>
<td>Look across road, make sure no cars</td>
<td>If area is bad, avoid it</td>
</tr>
<tr>
<td>Avoid busy roads</td>
<td>Try to be with friends</td>
<td>Look across road, make sure no cars</td>
<td>Look for bad areas, avoid it</td>
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<tr>
<td>Never go off with strangers</td>
<td>Never go where can't see down the road</td>
<td>Try not to go to smaller roads with traffic</td>
<td>Not to cross main roads</td>
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<tr>
<td>Road safety, look both ways</td>
<td>Don't go through alley</td>
<td>Don't mess about in the road</td>
<td>Look both ways when crossing the road</td>
</tr>
<tr>
<td>Don't go near gangs of people</td>
<td>Don't go near pubs</td>
<td>Avoid short cuts and dark places</td>
<td>Don't go and talk to strangers</td>
</tr>
<tr>
<td>Don't cross main roads</td>
<td>Road signs</td>
<td>Avoid teenagers</td>
<td>Don't cross main roads</td>
</tr>
<tr>
<td>Traffic - be careful of cars</td>
<td>Cross in safer places</td>
<td>Beware of people around you</td>
<td>Look out for people / strangers</td>
</tr>
<tr>
<td>Don't speak to strangers</td>
<td>Look when crossing the road</td>
<td>Stay away from people you don't know</td>
<td>Don't talk to strangers</td>
</tr>
<tr>
<td>Don't talk to strangers</td>
<td>Stop look and listen when crossing the road</td>
<td>Don't cross at a busy junction or road without a special crossing</td>
<td>Don't talk to strangers</td>
</tr>
<tr>
<td>Always stick to the safer route</td>
<td>Don't show off to friends</td>
<td>Don't talk to strangers or take money</td>
<td>Don't get in a stranger's car</td>
</tr>
<tr>
<td>Keep to what parents tell you</td>
<td>Tell parents where she's going</td>
<td>Stick to route she's given</td>
<td>~</td>
</tr>
<tr>
<td>Stay safe</td>
<td>Don't muck about on the road</td>
<td>Look both ways before crossing</td>
<td>Don't talk to strangers</td>
</tr>
<tr>
<td>Keep safe</td>
<td>Always go a route that is well lit</td>
<td>Beware of people, you can't trust everyone</td>
<td>~</td>
</tr>
<tr>
<td>Remember road safety</td>
<td>Use your own brain</td>
<td>Don't copy others</td>
<td>Have a phone</td>
</tr>
<tr>
<td>Stay safe</td>
<td>Always carry your phone</td>
<td>Don't worry</td>
<td>Always have money in case she needs to use a phone</td>
</tr>
<tr>
<td>Don't run across the road</td>
<td>Stop, look, think</td>
<td>Don't talk to strangers</td>
<td>Remember where places are</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td>Don't play in the street</td>
</tr>
</tbody>
</table>

Table 1: Before and after comparison of ‘top tips’
do it, you can’t say you will do it, but since playing this game I have taken more care of myself with crossing the roads, actually thought about...a minute ago I basically got run over [i.e. got defeated in Everand]. I have thought more carefully about the way I cross the road.” [Girl, 11]

If we take at face value what the participants here report, then what appears to be happening is that the analogy with Code of Everand is making a real world problem more salient, even though the tactics to resolve that problem are not the same in Code of Everand and the real world. Therefore in the second quotation, the participant claims to have thought about how to cross even though there is (as noted under Step 2) a very weak analogy between the problem posed in Code of Everand and the real world problem.

Cases such as these can be seen as a simplified version of the mechanism we have been discussing, in which the application and transfer of tactics is not involved. Such a mechanism could be described as follows (with the deleted elements struck through):

1. Child engages with game
2. Child engages with the right problems in the game
3. Child applies/develops the right tactics to solve problems
4. Child gets relevance of in-game problems/tactics to right real-world situations
5. In-game problems/tactics are readily accessible when child is in those real-world situations

Both the children quoted above, however, clearly fit into what we described in Section 5.2.1 as Group A. The simplified mechanism described above may work for this group because they already have the right tactics ready to hand; they simply need to be prompted to deploy them. The same is not true for children in Group B, for whom, we believe, closer analogies involving problems and tactics are required.

5.2.6 Social interaction

Research circumstances: limited numbers of players in Everand

In this report we have focused on the mechanism by which Code of Everand might achieve its objectives for which we found evidence. We were, however, also looking for evidence of other possible mechanisms, in particular those which capitalized on the potential of the game as a focus for social interaction.

In this respect, however, it was unfortunate that fieldwork took place some months after marketing of Code of Everand had been ceased, with a predictable fall-off of the number of players in Everand.
This significantly limited the potential for social interaction – with some of our players more interested in the social side of the game expressing disappointment that there were not more real people (as opposed to game-generated characters) in Everand. For our participants, the main ‘friends’ in Everand were in-game characters like Adran Trailghost, with some participants becoming very familiar with these characters and referring to them by name: but this may reflect the fact that they encountered so few other players. It is impossible to say how the experience of our sample might have been altered if they had been playing *Code of Everand* at a time when there were many more pathfinders active in it.

We also looked for evidence of identification with avatars. Apart from a widespread tendency to construct an avatar that bore similarities to themselves in terms of gender, hair and skin colour, and sometimes clothing style, no deeper evidence of identification was found. They talked about “my character” rather than “me”, and for many children the avatar was just the means by which they progressed through the game. Some noted that their avatar shared some of their own characteristics (e.g. helping people), others said specifically that they were very different (e.g. more risk taking, more into fashion and shopping), but these were incidental rather than central to their relationship with their avatar. Many could not remember their avatar name, although they generally liked the way in which the names were put together.

Several did however have a quite close relationship with their critter, choosing an animal that was similar to a real-world pet.

**Constraints on social interaction in-game**

Bearing in mind the above points, some clear constraints on the potential for social interaction and the development of a meaningful social group in Everand were nevertheless apparent. Three constraints in particular stand out.

- Children of this age are frequently told not to communicate with strangers on line, and may be subject to strict parental rules on this point. A few of our participants told us that they did not communicate with other players for this reason. This constraint will also extend for many to participation in associated fan sites (e.g. on Facebook, which they are, by the terms and conditions of that site, too young to use).

- For legal reasons – reflecting the concerns above – chat options within the game were limited to a fixed number of predetermined phrases and responses. This necessary feature of the design inevitably limited the potential for conversation. The nature of the interface also restricted chat. During one interview, for instance, another player approached and said ‘Hello’ to the participant: by the time that the participant, using a trackpad on an old laptop, had successfully negotiated the dropdown menus to get to the answer he wanted, the other player had walked off.
The design of the game does not in and of itself encourage collaboration. For instance, while players can choose to travel with each other, there is no benefit at a crossing (resources are not pooled). Quests are also undertaken almost entirely on an individual basis (though there are some joint quests at later stages of the game, not reached by our participants). Our own attempts to engineer some measure of social interaction by recruiting friendship pairs to play the game tended not to last beyond initially learning how to play the game, as the example below illustrates.

**Case study: Thad, 10 and Stuart, 10 (names changed)**

Thad and Stuart were recruited as friends and encouraged to communicate with each other about the game. To begin with, they enjoyed playing with each other – for instance, they would put the telephone on loudspeaker while they played at home on their own computers, and helped each other work out how to play. Thad remarks that:

“It’s better to play with someone. [...] Well it was a bit worrying at the start and Stuart told me what I had to do. he explained it first. That was ages and ages ago when we first got it.”  
(Note that ‘ages and ages ago’ here means a few weeks previously.)

By the time they are interviewed, Thad and Stuart are still playing together. Indeed, Thad remarks that: “When he comes off, I come off.” However, differences are also starting to emerge. Thad, who places great store by not getting defeated, has bought himself some armour. Because the benefit of this cannot be shared – they cannot make the crossings together – Stuart is now more limited than Thad in what he can do: “Stuart doesn’t tend to go across much spirit channels, if he does he dies.” As a result, staying with Stuart is also starting to limit what Thad can do: “I go on more. He just goes in the same place.”

On Stuart’s side, the reverse applies: he is being stretched beyond his current level in the game. When he logs on in the interview, the very first thing he does is get rescued: “Because I got lost yesterday. I was going where Thad showed me and then he had to come off.”

**Social interaction outside the game**

We were also keen to establish the extent of social interaction outside the game, but with the game as its focus. Again, results have to be taken in the context of the period in which the fieldwork was undertaken.

There was plenty of evidence of interaction outside the game focused on finding out how to play. For instance, friends recruited in pairs helped each other when they got stuck; parents were sometimes recruited to help in this respect; and some of the pre-existing players reported having been shown things by friends when they were starting out. Social interaction outside the game, that is, provided some of the ‘scaffolding’ required to master basic gameplay concepts and to overcome the barriers to engagement identified under Step 1.
There was no evidence of communication with others beyond this level, however. Parents, for instance, did not talk to their children about the game even when they had realised that it had an educational purpose focused on road safety. Of course, this may reflect assumptions on the part of parents that they were not supposed to talk to their children during the research period; although conversation with some of the parents suggested that this was not the case.

Social interaction with others clearly can provide the kind of ‘scaffolding’ which has been recommended in previous sections. The evidence of this study casts doubt on whether it actually is providing it in practice. These findings reinforce the need to ‘scaffold’ key elements of the proposed mechanism using in-game devices, such as contextual help or exercises to be completed after getting defeated, rather than relying on social interaction to make good any gaps.

**A learning community around Code of Everand**

One key question we wished to explore in this evaluation was whether *Code of Everand* could provide the focus for a community – in-game or externally – in which road safety skills, sometimes thought of by children of this age as ‘babyish’, might be valorised and seen as more adult. In short: could *Code of Everand* support the development of new norms?

As we have seen, however, there are clear practical constraints on such a community developing. Some of these derive from features of the game’s design, such as the non-collaborative nature of gameplay. Characteristics of the age group also loom large, however, in particular the reluctance of many to ‘talk to strangers’ and the impossibility of providing open chat. This raises real questions about whether any game could establish such a community for this age group in particular.

Care needs to be taken even with such functionality as the friends list. A number of our sample had ‘made friends’ with other players, without any real sense of this meaning anything. In general, a player had approached them, asked them to be friends, and they had said yes: in some cases, participants initiated the friendship. The entire encounter carried the same weight as saying ‘Hi’ to someone in the street: a clear example of social interaction, but not a meaningful social connection. The fact that so few friendship connections in Everand were reciprocated (5.3.3) suggests that this may have been a widespread phenomenon. The closest we saw to real social connections being formed was the case of a player who added players from the Leader Boards as friends so he could learn from them in terms of where they went and what they achieved. Connections of this kind clearly could form the starting point for a learning community. Whether we would have seen more connections of this kind in a more populated Everand is a question we cannot answer.
5.2.7 Summary of qualitative findings

The following key conclusions may be drawn from the qualitative components of the research:

- The idea of using a game to address road safety issues with this age group was justified and remains very promising, especially in light of the failure of other approaches to reach this critical audience. While Code of Everand as executed could be improved (inevitably the case for an innovative project of this kind), there is a clear mechanism based on analogical transfer by which a game of this nature might achieve its objectives.

- Drawing on evidence that children in the target age range have the necessary skills and understanding to behave safely (Tolmie et al., 2006) but routinely fail to apply them (Evans and Norman, 2002), the first objective of Code of Everand was to “encourage 9-13 year olds to put their existing knowledge of pedestrian road safety into practice”. We propose a distinction between two groups of children, which highlights a potential ambiguity in the phrase “existing knowledge”, especially in so far as this knowledge is exhibited in answering questions posed by adults:
  - Group A children do ‘get’ the behavioural meaning of what they are saying, but don’t always think or want to behave in that way.
  - Group B children do not actually ‘get’ the behavioural meaning of what they are saying.

This in turn suggests that different mechanisms may be required, depending on which kind of “existing knowledge” is present. For Group A children, the primary role of an analogy is to make real world problems and tactics more salient; for Group B children, the primary role of an analogy is to supply better tactics for transfer to real world situations.

We stress that this distinction is one made in analysing qualitative findings from a very limited sample in a study which was not designed to establish such distinctions. In the absence of further research, the distinction should be considered a hypothesis only, and this research should not be cited as providing firm evidence for its existence.

- More in-game ‘scaffolding’, provided by e.g. context-dependent help or training exercises after being defeated, should be incorporated into the design. This kind of ‘scaffolding’ is essential in particular to:
  - ensure new players master basic gameplay, and overcome early barriers to engagement
- ensure that Group B children engage with the right problems and develop the right tactics in response to them
- ensure that all players get the relevance of in-game problems/tactics to the right real-world situations

- Social interaction in and around the game can supply some of this ‘scaffolding’. However, it cannot be assumed that it will do so in practice, meaning in-game mechanisms are required.

- With the needs of Group B children in mind, there are grounds for reconsidering the crossing dynamic, to ensure that the problem set includes seeing that there are monsters and deciding whether and when it is safe to cross. However, the current dynamic of battling with monsters was felt by many participants to be an engaging and original element of the game, so care would need to be taken not to undermine this successful component of gameplay.

- Other specific technical improvements would support the educational objectives of the game, e.g.: arranging buttons along the side of the screen so they are visible on laptops; providing audio tracks to accompany all written instructions; ensuring that designated crossings are marked on the main map in a way that gets noticed; rethinking and more clearly communicating the penalties associated with being defeated.

- The characteristics of the target age group, and in particular restrictions on both the appetite for and possibility of online communication, raise questions about the practical potential for a game-based community to play a role in changing norms in this specific audience.

Separately from these conclusions regarding Code of Everand, and with potentially broader application, we have found grounds to question the view that children in the 9-11 age group know what they are meant to do but do not always do it. Our concern is that the evidence may not exclude the possibility that children in this age group know only what they are meant to say (when asked about road safety), which is not the same as knowing what they are meant to do. Hence our two groups:

- Group A children do ‘get’ the behavioural meaning of what they are saying, but don’t always think or want to behave in that way.
- Group B children do not actually ‘get’ the behavioural meaning of what they are saying.

Given the potential implications of this distinction for road safety activity with this age group, we strongly recommend that further research is undertaken to investigate and validate the proposed distinction. In the event that the distinction is validated, scaling of
segments will also be required to clarify priorities for road safety interventions with this age group in general (and not just *Code of Everand*).
This section presents the quantitative findings of the report assessing the impact of the game on self-reported attitudes and behaviour. Achieved through player and national survey results, this demonstrates multiple positive significant differences between players and non-players for elements within all four safety questions duplicated in both surveys. Due to the non-parametric nature of the data (making an approach such as ANOVA invalid due to the distribution), the analysis uses the Mann-Whitney test (Guidi and Frischer, 2005) for Likert-derived ordinal values and Chi-squared for binary (yes/no) responses.

The primary limitation of this quantitative data is that whilst it is able to show that a correlation exists, with player survey respondents reporting safer behaviour than the national baseline, insufficient evidence exists to confirm the cause of the correlation. In particular, in Section 5.3.1 an analysis is presented of the impact total playtime might have had on self-reported behaviour, yet attempts to create a statistical model linking total time playing to shifts in self-reported behaviour leads to the conclusion that within the player survey results, no significant links exist. Therefore, whilst these results confirm that player survey respondents were more likely to self-report safer behaviour than the national sample, playing the game was likely one of a range of factors which could have influenced the outcome, including the context in which the survey was undertaken. Notably, although both surveys collected the data via an online questionnaire, practical restrictions meant, the player survey had to be deployed online, among those responding to an email invitation, whilst the national survey could be conducted in-school, during school time. Similarly, the player survey was individually incentivized, though completing the survey was not required to be eligible for the incentive, whilst the national survey was incentivized at the school level only.

Despite these drawbacks, both surveys individually demonstrated some valuable findings: in addition to those regarding demographics in Section 5.1, a particularly strong response was given by players asked if the game being serious made it ‘boring’, suggesting little need exists to mask the serious nature of a game to maintain its appeal – and given the need for the player to understand the relationship between game and real-world for the behavioural mechanism given in Section 5.2 to function, it would appear beneficial to present the serious purpose to players rather than attempt to obscure it. Even so, a high proportion (45%) of players stated they thought about road safety when playing. Players also enjoyed many aspects of the game when surveyed, with travelling, questing, levelling up, and multiplayer aspects all proving popular (Section 5.3.5 - though noting that the player survey by its nature attracted the more engaged players). It is difficult therefore to highlight any particular aspects of the game for criticism – rather, players enjoyed the game as a single short experience, rather than responded negatively.
5.3.1 Impact on players’ self-reported attitude and behaviour

The first safety question within the survey instructed respondents to read a number of statements and indicate how much they agreed or disagreed with each one. The results for these questions on a 5-point Likert scale are shown in Figure 17. Statistical analysis using the Mann-Whitney test yielded significant results for five of the six questions. For the statement “I do things that are risky when I am crossing roads”, the national baseline were significantly more likely to agree with the statement (p<0.001). Similarly, for the statement “I generally pay a lot of attention to the traffic when I am crossing roads”, a significant difference was found in favour of safer self-reported behaviour by players (p<0.001). The sole question for which no significance was observed was “I am aware of the dangers around roads” – both players and non-players appeared to report similar results for this category (p=0.365). Potentially, this could be a result of the game’s intent to adjust behaviour through rehearsal and application rather than transfer knowledge.

Figure 17: Likert responses to questions on agreement with a range of key safety and risk principles - “Read these statements, and say how much you agree or disagree with each one.”
Another positive outcome for the player sample was observed for two statements around responsibility “Car drivers / other people are responsible for my safety”. In this case, significance was again observed (p<0.001), with the player sample more readily disagreeing with these statements. Hence, the sample of Code of Everand players was more willing to self-report a high level of responsibility for their own safety. The subsequent question was targeted at an individual crossing context: “Hand on heart, how often do you do the following things when crossing the road on your own?” Again, responses were significant and positive in the direction of players. Players were more likely to agree that they took the time to find a safe place before crossing (p<0.001), keep looking and listening as they crossed (p<0.001) and look both ways before crossing (p=0.03). Similarly, they reported higher levels of disagreement with negative, risky behaviour. Players were more likely to disagree that they crossed between parked cars when a safer place was nearby (p<0.001), cross regardless of whether traffic was coming (p<0.001) or run across the road without looking (p<0.001). Looking more specifically at concrete experiences, players were less likely to agree they had experienced incidences of thinking it was safe to cross, but realizing a car was travelling faster than they thought (p<0.001) and the same was true of forgetting to look as a consequence of using a mobile device (p<0.001). The results of this second question are illustrated in Figure 18.

For both these questions on self-reported behaviour and experience, the overall weighted results were in favour of more positive behaviour amongst players, with the only non-significant result being on knowledge rather than behaviour, in line with the objectives for the game described in Section 2. Going on to peer-behaviour (Figure 22), Likert responses demonstrated players were broadly more likely to report positive behaviour in their peers rather than be more critical compared to the national control sample. Again a question on knowledge yielded no significant difference; when asked for a level of agreement with the statement “They know the right thing to do when they cross the road”, no significance between groups was observed (p=0.373). Significance was observed for the fact-based “They usually only cross the road when they are supervised” (p=0.046), though this was one of the weakest significant correlations within the data set. Players also responded that their friends spent less time playing in the street (p<0.001) and were less likely to do dangerous things on purpose (p<0.001). However, no significance was observed when interrogating whether their friends ran when crossing the road (p=0.103) or did things they knew were risky (p=0.923).

This proved an interesting result, since it goes against the trend observed in the national survey (see Section 5.1.1), wherein children who reported safer behaviour in themselves were more, rather than less, critical of peers. It suggests the respondents to the player survey may have been intrinsically more safe (or, rather, more prone to report safe behaviour), than those in the national survey. Considering the deprivation indices (Section 5.1.5) is a possible explanation, discussed more in Section 6.
The final question, a multiple-choice question asking players to indicate a binary (yes/no) response to whether they had observed a range of behaviours amongst their friends, was analysed using a Chi-squared (crosstab) approach, due to the format of the data. When asked if they had seen friends cross somewhere that they could not see cars coming, players were more likely to answer “no” (with a 66% probability) rather than “yes”. For non-players, the probability of a yes/no answer was 50/50 (p<0.001). A similar ratio of responses existed when players were asked if they had seen friends step into or cross the road without looking (p<0.001). However, when asked if their friends regularly checked to make sure traffic had stopped before using a pedestrian crossing, no significance was observed for a Chi-square test (p=0.216).

Figure 18: Likert responses to questions on frequency of dangerous and safe behaviour - “Hand on heart, how often do you do the following things when crossing the road on your own?”
Continuing the analysis of this final yes/no question, players were more likely (76%) to answer that they had not seen their friends use a mobile phone and forget to look properly. Both groups majority reported that they had not seen this behaviour, with the control group only 40% likely to report seeing this behaviour, though this does conversely imply that between 1 in 4 players and 1 in 3 non-players had seen this occur — again a statistically significant difference between groups existed (p<0.001). That such a high proportion of children have observed mobile device use resulting in lapses in road safety behaviour in both national and player surveys suggests the growing use of these devices may be worthy of specific consideration with respect to its road safety impact on pedestrians as well as drivers. When asked if they had seen a friend involved in an accident, players were 7% likely to answer yes, as opposed to 10% for the non-player group. This was again observed to hold up to a Chi-squared test for significance (p<0.003). This is another potential indicator that Code of Everand players were from a slightly lower-risk demographic.

Players were more likely (60%) to report their friends crossed at a safe place, as opposed to the national sample (50%, p<0.001). When asked if their friends regularly played in the street, players were more likely to answer no (72%) compared to non-players (62%), another significant association (p<0.001). Queried if they observed friends paying attention at all times, players were again more likely to offer a safer response (70%) when compared to the national sample (55%, p<0.001). Finally, when asked if they had seen their friends regularly walk in the road rather than the pavement, players were more likely to answer no (75%) than non-players (60%, p<0.001). Hence, for this question, all but one item, whether friends regularly stopped to make sure traffic had stopped before using a pedestrian crossing, showed positive significance in favour of the player sample. The summary of responses to this question is shown in Figure 20.

The immediate question, given this wide range of positive significances in favour of the player sample, was the underlying cause. The gender distribution in both samples was not even, and whilst it would be expected that the predominantly male sample in the player survey (80%, compared to 50% in the national survey), would have a negative rather than positive effect on safety metrics, the impact of age and gender were examined by consolidating each question into a directed safety measure by summing the Likert scores of responses, corrected for the direction of questioning. For the first question (Figure 17), age, gender and being a player were all seen to be significant in a regression model, though the model as a whole was a weak fit to the data (r=0.17) suggesting other unknown factors played a significant role in these relationships⁸. Being male reduced the overall safety score (out of 30) for this first question by 0.66, being a player increased it by 1.38 and an increase in age by 1 decreased the score by 0.08. Hence, player status had roughly double the impact

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⁸ No colinearity was observed between age, gender and being a player, within the sample, as a result of the collection method for the data avoiding any potential influence.
on this combined metric of safety than gender, and age, which resulted in decreasing safety self-reporting with increasing age, was the least significant variable.

Repeating this multiple regression model for the next self-reported question on behaviour (Figure 18) yielded similar results. Though the regression coefficient indicated elements of data were missing from a complete model of the relationship \( (r=0.35) \), this was a more complete model than for the previous question. In this case:

- Gender had a stronger impact than age, with being male reducing the overall score (/40) by 1.3 compared to being female.
- Belonging to the player rather than national survey was the strongest impact factor, increasing score by 4.5.
- Increasing age had a negative impact on the metric of safety, reducing the score by 0.66 per year.
The Likert-scale question on friend behaviour (Figure 19) resulted in another weak regression coefficient ($r=0.19$), indicating that as with the other questions, multiple unknown factors had an effect on the relationship. In this case the score (/30), with increased value corresponding to lower risk) was:

- Reduced by 1.1 for males;
- Increased by 1.3 for players, and;
- Decreased by age at a rate of 0.22 per year.

Finally, the multiple choice question on friends’ behaviours yielded a similarly weak regression result ($r=0.26$). A residual plot suggested strongly in this case that two populations may have existed within the model, and hence that a further unknown actor was contributing to the relationship. Furthermore this question was unique in that gender was not observed to be significant ($p=0.382$), though age and player status were ($p<0.001$). Being a player increased the score by 1 (out of 13) and age decreased it by 0.07 per year.

Overall, these results demonstrate a striking positive difference between player and national survey results. Though overall correlations were not strong, they do show that belonging to the sample that played the game had a stronger effect than both gender and age on overall measures of self-reported safety. However, this is subject to the same affordances of any statistical analysis through regression: correlation does not imply causation. In this case, though the results show a higher level of self-reported behaviour amongst players as well as more positive reporting on their friends, there are several other key factors which may have influenced these differences:

- The context in which the two surveys were collected is a key consideration. The national survey was conducted in schools, whilst the player survey was conducted online via email invitation to the player base.
- A slight time difference existed between the collection of the national survey, which took place in December 2010, and the player survey, which was conducted in February-March 2011. To the authors’ knowledge no events or campaigns occurred in this period which may reasonably be assumed to have had a strong national impact on self-reported safety.

Players may have been inclined to report safer behaviour as a result of the survey being presented as one concerned with *Code of Everand*, rather than one focussed on gaming in general. Again, this was an unavoidable element of the study design given the need to reach the player base by email and invite them to participate in the survey. As the national sample could not be relied upon to have heard of the game, introducing the survey in a similar fashion was not possible. Expectation bias may have existed as players keen to give positive responses in the understanding the survey was assessing the impact of the game. This is
difficult in some ways to separate from genuine shifts in awareness, as a player willing to report higher levels of safety would at least be required to identify and consider for each question what constituted a safer response; however, this could lead to the increase being a result of “game plus survey”, rather than the game alone.

Figure 20: Totals of binary (yes/no) responses for questions on friends’ behaviour - “Which of the following things have you seen your friends do when crossing the road?”

To understand better the relative strengths of these potential factors, we considered for the player survey alone the impact that total playtime might have had on self-reporting. In the event significance could be observed here, it would strengthen the argument that the impact and difference in responses was due primarily to the impact of the game, rather than the potential confounding factors outlined above. However, as shown in the next section, total playtime did not appear to be a strong influence on safer self-reported behaviour.

5.3.2 Impact of total playtime

The first consideration when assessing the potential relationship between total time spent playing and self-reported safety behaviour was the distribution of the population, which had many outliers and extreme values. Playtime and number of logins were both considered for all player survey responses (n=1052), obtained by linking the email address of the survey invitation to the data from the game engine and player account. The measures were
therefore exact rather than self-reported totals for both time spent playing and number of repeat visits to the game. Populations for this data were not normally-distributed with logins and particularly playtime failing to obey a normal distribution.

For the first self-reported question on safety (Figure 17) no significance was observed for playtime (p=0.815), logins (p=0.808), age (p=0.959) or gender (p=0.508), and there was a very weak overall correlation (r=0.05). Playtime and logins were predictably covariant throughout (increased playtime resulted in more logins). The outliers in this case affected the results significantly. For the second question on self-reported behaviour (Figure 18) age and gender were observed to be significant, as was the case in the previous section before factoring playtime, however playtime was again not a significant factor (p=0.316) nor number of logins (p=0.522). Again, for the first question on peer behaviour (Figure 18) age and gender were observed to be significant, as was the case in the previous section before factoring playtime, however playtime was again not a significant factor (p=0.316) nor number of logins (p=0.522). Again, for the second question on self-reported behaviour (Figure 18) age and gender were observed to be significant, as was the case in the previous section before factoring playtime, however playtime was again not a significant factor (p=0.316) nor number of logins (p=0.522). For the final question (Figure 20), age was significant in a model that included playtime and logins, but the individual measures of playtime (p=0.896) and logins (p=0.865) were not.

Removing outliers by reducing the sample to 969, centred on the mean value, and repeating the analysis yielded similar results, though did suggest some weak links may exist. For the first self-reported safety question (Figure 17) no significance was found. However, for the second question, playtime was significant (p=0.010), though in this model, increasing playtime by 1 minute increased the safety score by 0.008, illustrating the weakness of this effect. For the remaining two questions, removing outliers had no effect on the insignificance of the results for playtime and number of logins. Noting the multiple testing problem\(^9\), the sole correlation with small effect magnitude and relatively high p-value (0.010) may be a result of this phenomena. However, it may also be an indicator that playtime did have a weak effect for the second of the four self-reported road safety measures.

We consider more fully the implications of these statistical relationships between self-reported road safety and playing Code of Everand in the conclusions of this report (Section 6). However, before doing so, we describe in Section 5.3.3 the results of questions on player’s perceptions of Code of Everand, as well as assessing its impact on how ‘top of mind’ road safety was for players when compared to the national baseline.

#### 5.3.3 Open question responses and ‘top of mind’

The player survey included firstly an open, unprompted question (prior to any questions on road safety or Code of Everand) to find out from players what they perceived as the main dangers affecting children their age. The responses to this open question are presented in Figure 23. Bullying and road safety were foremost in the minds of players. Cyber safety and

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\(^9\) e.g. if 20 tests are conducted with significance set at p<0.05, one (5%) would be expected to generate a false positive result
internet-related issues were particularly high for the player survey, a consequence of the online nature of the data collection method. Figure 24 compares the coded open responses to the top of mind question to those collected by a national tracker operated by ChildWise. Asides from the aforementioned skewing of the data towards internet safety, a shift in overall rank (but not total percentage) occurred when comparing older players to the national sample – whilst older children in the national sample tended to select road safety third, behind drugs and alcohol, player survey respondents ranked road safety first, with Internet-based crimes second and drugs third.

Figure 21: Top of mind: visualisation of open responses from players to “Thinking about the things that can happen to children like yourself, what do you feel are the main dangers affecting children your age?”

It should be noted that ‘top of mind’ is a difficult construct to measure, due to its fleeting nature and sensitivity to the method of data collection. Therefore this data should be taken in the context of a qualitative and subjective self-reported measure. However, as Figure 21 shows, it does give some insight into the priorities of children within the target age group.
As shown in Figure 22, though a slightly lower proportion of players aged 12-15 stated road safety was top of mind, this was due to a dramatic increase in Internet safety, no doubt a consequence of the nature of the data collection method. However, in terms of relative sequencing, players ranked road safety first rather than third. That this shift was apparent in the 12-15 bracket but not in the 9-12 age range may be a consequence of a reliance on understanding the purpose of the game to obtain a shift in top of mind. As shown by this reports cover illustration, a sizable proportion (45%) of players reported they thought about road safety when playing, and this factor followed age with older children more likely to understand the game’s serious purpose. It could be posited that the game needed to be perceived in terms of its objectives to achieve a top-of-mind impact, and therefore presenting the game in a road safety context may add to, rather than detract from, its value. This is particularly worth considering in light of the results in Section 5.3.5 which show a low proportion of children relating serious purpose to ‘boring’ game. This is reinforced by the mechanism proposed in Section 5.2: children need to ‘get’ the analogy to the real world for the game to have meaningful impact, and therefore it could be advocated hiding this
purpose from the players towards the goal of avoiding any negativity attached to ‘serious’ games is not necessary, and in fact may be to the detriment of the game’s impact.

### 5.3.4 Socialization and social networks in Code of Everand

National survey responses hinted at the social nature of gaming amongst the target demographic. Though three in ten children played online games alone, a quarter (27%) played with friends from school. Repeating the question specifically for *Code of Everand* within the player survey yielded the result shown in Figure 23. Comparing player and national survey results, a lower percentage played with school-friends than was reported for other online games (13% compared to 27%), though this may have been a consequence of the short playtime rather than nature of the game. The national survey identified the role age played here, with younger players more likely to play games alone rather than socially, including 86% of those aged 9-11.

![Figure 23: Responses by players (n=618) to the question "When you play *Code of Everand* online, who do you usually play with?"

Further exploration of social networks in-game was conducted using the game engine data. As a means of specifying social ties, the in-game “buddy list” forms the basis for a social network. A total of 14,100 players had at least one entry in their buddy list, resulting in a social network of 59,479 players. As social ties within the database were directed and not necessarily reciprocal, the data was further processed to generate a second data set of reciprocal ties only (i.e. where two players had added each other as a buddy), representing a reduced network of 2,685 ties (4.5% of the total were reciprocal).

The larger network of 59,479 non-reciprocal links was considered using a method (‘clique percolation’) which links and groups individuals into ‘cliques’ and larger ‘communities’ based on their social ties. Effectively, the method groups individuals by their social ties into cliques, and then seeks to group these cliques into larger communities through common social ties between cliques. As an individual can have multiple links, this method has the
advantage of being able to highlight overlaps between existing communities as well as create variations based on different ‘k’ values, which represent the number of social ties. For example, a network defined by a minimum of three links between individual members (a triangular friendship where three people each know two others) is defined as k=3. Within the data set, the size distribution was observed to arise as 5 communities at k=5, 116 at k=4, and 1,514 at k=3. This corresponds with the findings of other research into real-world social networks of children, which have shown the richest data set to emerge at k=3 (González et al., 2007), and suggests this holds true for the in-game community. We also analysed the membership of communities for each k-value: notably a single large community of 1,602 members emerged at k=3, though the modal membership of the remaining 1,513 communities was 3. Hence this large community was an exception to the rule of 3-member groups.

This suggests that children playing Code of Everand socially typically did so in small groups of three or less (93%), rather than large communities. Furthermore, they were a significant minority when compared to the large numbers of players who did not show any evidence of buddy list use or interaction in-game. Limited uptake of supplemental community resources such as the game’s Facebook page also shows a reluctance or inability to form social gaming communities by children. This may well be a consequence of concerns for safety online. However, the five large communities showed the potentially key role known community representatives could have in leading social interactions through their in-game characters, as the largest communities were formed around known community leads, with many unidirectional links between players and these characters. Over 1,600 children added a lead community representative to their buddy list, and in the longer term these characters may be able to assume a role as educators, mentors or facilitators of behavioural change – though again the need for online safety may limit the potential for any communications.

Another question raised by this analysis was whether players were playing online with existing friends from other communities, such as school, or predominantly forming new social ties in-game. Our geolocation approach allowed us to examine the networks in terms of regional co-location. Despite the limitations of the geolocation approach in guaranteeing regional co-location of two IP addresses, it could be reasonably assumed that two IPs which are not traced to the same region are not co-located. Of the total 1,635 communities, 1,323 contained no co-located members based on their IP (i.e. the geolocation returned the same region). This left 312 that may have been co-located. Significance for an impact of geographic co-location on network formation was found at p=0.012. The result of this analysis, which suggests that 312 communities might have been co-located, is in percentage terms very close to the percentage of players who claimed to play with friends from school (14% co-located versus 13% of survey responses). Overall the social network data supports the conclusion that players who socialised were a minority, though a sizable one, with 14% of players using the buddy list functionality. Analysing the impact and form of these social interactions between players lends itself more to a qualitative approach and is therefore
discussed in Section 5.2, leading to the conclusion they were likely of limited significance; however the further conclusion is that the majority of players approached Code of Everand as a single-player experience. Yet, the form of the social networks does suggest that community leads could play a strong role as facilitators and role models in reaching players who might be more resistant to more conventional methods of road safety instruction.

5.3.5 Players’ perceptions of the game

The player survey took the opportunity to ask players which aspects of the game they found hardest. Results, shown in Figure 24, indicate several trends. Firstly, account creation was viewed as the easiest activity, suggesting again that the sign-up process was not a barrier to entry for children. Secondly, making friends with other players was not cited as hard by the majority of players. Coupled with evidence from the game engine and survey on how the game was played, which suggests only 13-14% of players socialized in a substantial way (5.3.4), it appears this low level of socialization may have been a result of low playtimes leading to players approaching the game as a single-player experience, and therefore not attempting to make friends (and hence finding it hard to find friends), rather than being willing but unable to do so as a result of the interface.

![Figure 24: Breakdown of player survey responses to the question "How do you rate the following aspects of Code of Everand"](image)
A second question (Figure 22) asked players how much they agreed with a range of statements. The highest levels of disagreement were to the question “I think the game is boring because it is educational”, which a significantly higher proportion of players (59%) disagreed or strongly disagreed with than any other question asked, and which only 12% agreed or strongly agreed to.

The remainder of questions were broadly similar in their responses. Finishing quests was one of the most strongly agreed with positive activities within the game, emphasizing the importance the quest structure might play in guiding and directing players towards goals. More than 60% of players agreed that they liked the graphics, story and multiplayer aspects of the game. No particular areas of criticism for game design emerged from this question, though the player survey sample was self-selecting and hence may have been less critical than a general audience. Qualitative data included later in this report details specific cases of feedback from players regarding design.

Therefore, players were unable to single out any specific points for criticism when surveyed. Noting the playtimes presented in Section 5.1.6, evidence would suggest the game was received positively by players, though as a short gaming experience rather than a prolonged one. Whilst player survey responses towards the game are widely positive, this does not include the opinions of those who visited the site or viewed the television advert then opted not to play, who would likely be more critical. Even then, the national survey suggested that of the 16% who heard of the game 3% went on to play it, a very high proportion. Certainly the game attracted a sizable audience, though this audience did not approach the game as a long-term investment of time. Given the result of the national survey suggesting the most popular game amongst 9-15 year olds to have been Call of Duty, expectations amongst children for high levels of fidelity, interactivity and communication in games may need to be met for longer durations of engagement. To reach a large audience may not require a level of investment equal to Call of Duty (a $200m game), but to sustain engagement, particularly given the attention span of children, appears a far more demanding task.
In light of qualitative findings (5.2), the social networks in-game were predictably limited in their form and scale. It could be suggested that future development intending to support social learning would need to facilitate greater communication between players to generate a critical social mass. However, as discussed in some depth in Section 6, this may well not be viable in a serious game for children given both the associated risks of online communication, and children’s attitudes, which, as highlighted by the top-of-mind survey...
demonstrate considerable awareness of this risk and caution. It is worth reiterating the recurrence of several key characters within the social network point to children looking towards community leads and players with publicised profiles, suggesting interactions between players, virtual characters, and these official community leads may ultimately prove a more viable and manageable method for implementing a social form of learning than online peer interactions.

Though the difference between national and player samples across a broad range of questions (5.3.1) showed a wide range of safer responses from players, a principal drawback of any quantitative approach seeking to compare two samples is that evidence of correlation requires a validated model supporting causation. If it were to be argued that playing Code of Everand was the predominant factor in the widely safer self-reported behaviour amongst player survey respondents, then corroborating links, such as one between total time spent playing and safety metrics, would be expected to be observed. The fact that these links were either absent or weak (Section 5.3.2), coupled with the qualitative finding that 31 minutes of playtime (the median playtime) may allow the player to do little more than get to grips with the mechanics of the game (Section 5.2.1), leads to a significant question: Were Code of Everand player survey respondents intrinsically safer than the national sample, as a result of underlying demographic factors? There are several points raised in Section 5.2 which point to Code of Everand being more well-received by children with higher levels of literacy, given the text-heavy nature of some game elements, which can in turn be linked to deprivation and accident risk. Though the data on indices of multiple deprivation shown in Section 5.1.5 does show that the game reached a broad audience, this is indeed slightly skewed towards an audience from less deprived areas.

Older players (12-15) had a more marked response than younger children in their response to top-of-mind questions on road safety. One supposition, reinforced by the national survey data showing a significant proportion of children were playing games intended for an adult audience, is that older Code of Everand players might have been less mature in their approach to gaming than the average child in the national sample, and thus more likely to overlook commercial adult-oriented titles in favour of a more child-friendly game such as Code of Everand. Hence, this group might be similarly less exposed to dangers and independent pedestrian travel as a consequence of more active or protective parenting. Overcoming this issue may be difficult with a serious game, as it would require creating games with mature content to appeal to an audience of children which are regularly playing adult games, which in turn could easily be viewed as inappropriate outside of the demographic.

In the final section, the findings of this report are combined our findings to discuss the overall impact of the game against its campaign objectives, as well as a range of implications for both road safety interventions and serious games.
6 Summary and Conclusions

This final section concludes the report by considering firstly the relevance of the findings presented in Section 5 against the campaign objectives for Code of Everand. We note that the game was a success in several key respects, drawing in a sizable audience and retaining them for duration in excess of many other methods. The difficulty in measuring behavioural change as well as shifts in top-of-mind presents itself, although multiple indicators are highlighted which show the strengths of a game-based approach, as well as several drawbacks. Sections 6.2 and 6.3 present considerations relevant to road safety policy and serious games respectively as a result of the findings of this report.

6.1 Review of impact against campaign objectives

Considering the findings in Section 5 in light of the campaign objectives stated in Section 2, we note that the nature of the game, as well as the limited feasibility of a control-study approach, limits the ability to be conclusive particularly with respect to the game’s efficacy as a tool for changing behaviour. However, many noteworthy indicators did emerge throughout the research process. We summarise these below with respect to the individual objectives.

- Did Code of Everand work as a way of making road safety skills more interesting?

  Uptake during the period the game was promoted was solid, and the game reached an audience spread across indices of deprivation, ages and ethnicities. Only a small proportion of players surveyed considered the game boring because it was educational (12%), and the total of over 100,000 players, of which our evidence suggests 62,000 were in the 9-15 bracket (Section 5.1.3) and 30,000 within the key 9-11 group, engaged with the game for a considerable period (averaging 93 minutes, with half of players experiencing the game for more than 31 minutes) when compared with other interventions. However, as a game, Code of Everand did not retain this audience for as substantial a period of time as might be desired by a commercial entertainment ‘MMORPG’. Another question is whether Code of Everand functioned to make road safety skills more interesting, as they were not explicitly presented to players in the game. Qualitative work showed that players found elements of the game to be engaging and entertaining, and despite minor usability issues identified a clear method of transfer through analogy.

  In addition to the uptake numbers, the perspectives and attitudes of players towards the game were positive, and that 1 in 5 children who heard about the game went on to play it (Section 5.1.2) is a noteworthy statistic. Certainly when compared to any other intervention which requires children to participate of their own volition, Code of Everand proved highly effective at drawing in its audience.
• Did *Code of Everand* make road safety more top of mind as kids go through the key ages 11-15??

45% (Figure 23) of surveyed players said they thought about road safety whilst playing, indicating that for a significant proportion of the player base recognised the analogies in game, and for these players an impact on top-of-mind is likely – though long-term duration in this shift is more difficult to assess. Also as shown by the cover image of this report, a visualisation of open responses to the question “What do you think *Code of Everand* might be teaching you?” this significant proportion of players did “get” the serious purpose of the game.

Top of mind is notoriously difficult to measure as the measurement process can easily influence the results: this is seldom more apparent than in an online environment, when as shown (5.3.5), Internet dangers quickly move to the top of mind. However, our results when directly asking children to name the main dangers affecting children their age did show a positive shift for road safety towards top of mind when compared to ChildWise tracker data for a similar unprompted approach to a national sample within the 12-15 age range. Again, the overall result here is positive; though with the proviso that top-of-mind can be fleeting and difficult to measure.

• Did *Code of Everand* encourage 9-11 year olds to put their existing knowledge of road safety into physical practice?

Quantitative evidence demonstrated uniformly higher self-reported safety awareness and behaviour amongst player survey respondents when compared to the nationally-representative survey. Though the increase was generally slight on a per-question basis, it was routinely statistically significant (typically p<0.05) and showed a clear trend towards safer self-reported behaviour amongst players. However, this data must be taken in the context of the data collection approach, as well as the limitations of statistical approaches in general when seeking to imply causation.

Several factors emerged to challenge the assumption that *Code of Everand* was a sole causal factor in this safer self-reporting: firstly, players also reported safer behaviour in peers, whilst the national survey demonstrated that children who reported safer behaviour in themselves were more likely to be critical of peers. One interpretation of this result might be that *Code of Everand* players are intrinsically more likely to belong to a safer demographic. Though the analysis of deprivation indices (5.1.5) is not conclusive in this respect, it does point towards this as a potential explanation.

A second drawback when considering the evidence linking players to safer behaviour is the fact total playtime had no significant impact on behaviour. Either *Code of Everand* was achieving its behavioural outcome through a shift in top-of-mind, which might lead to children thinking more about road safety after only playing the game for a few
minutes, or the shift was due to external factors, such as the differing contexts of the two surveys. A further control study may have the potential to offer future insight, though as noted in Section 4, would be difficult to enact in a realistic usage context. Therefore, whilst our evidence is certainly positive in favour of the impact of the game on self-reporting, it is difficult to conclude with great certainty the game was the most significant factor behind the shift in reported behaviour, particularly given the findings of qualitative work and the consideration of actual time spent playing, against time that would reasonably be required for changes in behaviour to occur under the model presented in Section 5.2.

A further number of conclusions supplemental to the campaign objectives may also be observed from this research:

- The idea of using a game to address road safety issues with this age group was justified in terms of its immediate appeal and reach to children, though issues – particularly cost-efficacy - would need to be carefully considered for future interventions. While Code of Everand as executed could be improved (inevitably the case for an innovative project of this kind), there is a clear mechanism based on analogical transfer by which a game of this nature might achieve its objectives.

- Drawing on evidence that children in the target age range have the necessary skills and understanding to behave safely (Tolmie et al., 2006) but routinely fail to apply them (Evans and Norman, 2002), the first objective of Code of Everand was to “encourage 9-13 year olds to put their existing knowledge of pedestrian road safety into practice”. We propose a distinction between two groups of children, which highlights a potential ambiguity in the phrase “existing knowledge”, especially in so far as this knowledge is exhibited in answering questions posed by adults:
  
  o Group A children do ‘get’ the behavioural meaning of what they are saying, but don’t always think or want to behave in that way.
  
  o Group B children do not actually ‘get’ the behavioural meaning of what they are saying.

This in turn suggests that different mechanisms may be required, depending on which kind of “existing knowledge” is present. For Group A children, the primary role of an analogy is to make real world problems and tactics more salient; for Group B children, the primary role of an analogy is to supply better tactics for transfer to real world situations.

We stress that this distinction is one made in analysing qualitative findings from a very limited sample in a study which was not designed to establish such distinctions. In the absence of further research, the distinction should be considered a hypothesis only, and this research should not be cited as providing firm evidence for its existence.
More in-game ‘scaffolding’, provided by e.g. context-dependent help or training exercises after being defeated, should be incorporated into the design. This kind of ‘scaffolding’ is essential in particular to:

- ensure new players master basic gameplay, and overcome early barriers to engagement
- ensure that Group B children engage with the right problems and develop the right tactics in response to them
- ensure that all players get the relevance of in-game problems/tactics to the right real-world situations

Social interaction in and around the game can supply some of this ‘scaffolding’. However, it cannot be assumed that it will do so in practice, meaning in-game mechanisms are required.

With the needs of children who can report, but do not fully understand correct behaviour (“Group B”) in mind, there are grounds for reconsidering the crossing dynamic, to ensure that the problem set includes seeing that there are monsters and deciding whether and when it is safe to cross. However, the current dynamic of battling with monsters was felt by many participants to be an engaging and original element of the game, so care would need to be taken not to undermine this successful component of gameplay.

Other specific technical improvements would support the educational objectives of the game e.g.: arranging buttons along the side of the screen so they are visible on laptops; providing audio tracks to accompany all written instructions; ensuring that designated crossings are marked on the main map in a way that gets noticed; rethinking and more clearly communicating the penalties associated with being defeated.

The characteristics of the target age group, and in particular restrictions on both the appetite for and possibility of online communication, raise questions about the practical potential for a game-based community to play a role in changing norms in this specific audience.

6.2 Implications for future road safety interventions

Separately from these conclusions regarding Code of Everand, and with potentially broader application, we have found grounds to question the view that children in the 9-11 age group know what they are meant to do but do not always do it. Our concern is that the evidence may not exclude the possibility that children in this age group know only what they are meant to say (when asked about road safety), which is not the same as knowing what they are meant to do. Hence our two groups:
• Group A children do ‘get’ the behavioural meaning of what they are saying, but don’t always think or want to behave in that way.

• Group B children do not actually ‘get’ the behavioural meaning of what they are saying.

Given the potential implications of this distinction for road safety activity with this age group, coupled with existing studies that also suggest this might be the case (Tolmie et al., 2006), we strongly recommend that further research is undertaken to investigate and validate the proposed distinction. In the event that the distinction is validated, scaling of segments will also be required to clarify priorities for road safety interventions with this age group in general (and not just Code of Everand).

To ensure meaningful impact of future game-based interventions, further research would be required into mechanisms for effective change in safety attitudes and behaviours, as well to better understand and anticipate the contact time the game would have with the target audience. The model for analogical transfer presented in Section 5.2 requires some considerable time investment on the part of the player, and it may be the case that alternative methods or mechanisms could prove more effective in delivering rapid outcomes. However, given the relatively infancy of game-based technology as a means for changing behaviour, the form these models might take is difficult to anticipate, and should consider carefully the learners, usage context, representational medium and pedagogy or behavioural theory (de Freitas and Oliver, 2005).

Socialisation and social aspects of Code of Everand were difficult to measure as a consequence of the research being post-hoc to the 5-month period in which the game was actively promoted and played, though their absence following this period is noteworthy. Following the cessation of promotional activities, the game world proved largely empty and therefore qualitative work was not able to assess social interactions in any great detail. Quantitatively, the limited number of reciprocal ties within the in-game ‘buddy list’, and tendency towards 3-player groups, suggests that socialisation was limited during the active phase, possibly by the inability for players to directly communicate. Naturally, given the age range and need for safety, this was not viable, and therefore the core learning mechanism within Code of Everand centred upon analogical transfer as described in Section 5.2. However, some pointers did exist as to the future potential of social learning: a very high proportion of players added key names of community leads and leaderboard winners as friends. The potential for these leads to act as role models in an online game or world may be a strong one. However, given the need for safety, as well as the reluctance of children well-aware of the risks of communicating online, this would be difficult to enact in practice.

Fundamentally, Code of Everand demonstrates the difficulty in embracing new social media effectively whilst retaining sufficient control over peer communications to ensure safety and policy adherence. Evidence from research showed that children were routinely playing social online games intended for an adult audience (Section 5.1.1); yet developers of these
games do not make the same concessions for young audiences that are necessary for games which seek to explicitly target them. In the particular case of road safety interventions, which must foremost ensure the protection of young players, a difficult question must be faced as to whether social media can be embraced in a fashion which viably competes for children’s social online time, particularly when compared the adult media they so commonly access. Our research here suggests future projects and policies based around engaging with audiences through social media must be carefully considered in light of these constraints and their implications.

6.3 Implications for game-based approaches to behavioural change

With game based approaches to changing behaviour still being in their relative infancy, tested models and techniques are of obvious value when seeking to develop new interventions. A key question from a game-based learning perspective, therefore, is whether the model at the core of Code of Everand presented a viable basis for achieving these goals. A straightforward answer is unfortunately not simple to offer: if we define this model more formally in terms of analogical transfer (5.2), then it becomes, certainly from qualitative evidence, difficult to argue that the typical playtimes within Code of Everand (5.1.6) would have led to all the steps within the behavioural model being attained by the majority of players within the 31-minute median playtime. Hence, the question becomes whether a blended approach to introducing game-based elements would be more relevant, or if the brief period of contact time might act effectively as a stimulus for further change through actions and activities beyond the game. To convey and measure behavioural outcomes effectively requires a model created at the design stage which accommodates not only a model for effective learning transfer or behavioural change, but also provides clarity in how this transfer or change will be assessed and evaluated.

A key question is the cause of these playtimes which, whilst noting that they were vastly in excess of typical static website visit durations or direct messaging, were still lower than might be expected for a game in the entertainment MMORPG genre, and the game did not maintain a critical mass of players beyond the advertising campaign (Annex I) probably due to the social elements of the game being curtailed. Surveys of player responses (5.3.5) coupled with qualitative experiences suggest that the general perception of Code of Everand by players was not a negative one: they enjoyed many aspects of the game, but perceived it as a single-session (5.1.6) and largely single-player (5.2.6) experience. Qualitative work noted some usability issues, highlighting that text-based approaches to conveying information were often met by children’s expectations of audio and spoken dialogue. Games may have the capacity to motivate children to develop their literacy and numeracy skills provided sufficient desire exists to ‘beat’ the game, but this challenge may lead to frustration or disinterest for children with lower skill levels, in-line with flow theories (Cziksentmihalyi, 1997). Though confirming and exploring this in more depth remains beyond the findings of this report, gaming preferences are certainly linked to demography
(5.1.1) and the need remains for an understanding of how best to balance the perceived challenge of a serious game so as to attract and retain its key target audience.

Usability concerns are difficult to isolate as sufficiently severe or problematic to singularly explain players’ limited time in the world of Everand. A more significant consideration may be that the social element in Code of Everand was difficult to support whilst adhering to core policy principles surrounding online communication between children. Both quantitative (5.3.4) and qualitative (5.2.6) studies suggested communication was limited to a small minority of players. Established theories of MMO game design (Bartle, 2005) note the importance of this interaction in sustaining a player-base and it is reasonable to conclude the difficulty in supporting this aspect had a significant impact on player retention. The entertainment gaming industry has the capacity to create high-fidelity and highly interactive games without the constraints of needing to embed pedagogic content, and therefore competing for screen-time over long periods is an extremely challenging task.

Taking this consideration one step further, our survey results did show that a significant proportion of children (over 50% of males) play adult-rated games. Whilst this is perhaps not surprising, given the widely cited attitudes to gaming amongst both children and parents (Pratchett, 2005), it does imply serious game developers should pay reference to the gaming market as a whole when attempting to create titles for children, else risk a game being perceived as too ‘childish’. The uptake of Code of Everand showed 9-10 year olds as more responsive than 14-15 year olds (5.1.4), and though the visual style of Code of Everand was not specifically child-oriented, it can be seen as significantly less graphic and mature in tone than 9-15 year olds leisure game of choice at the time of survey, Call of Duty. This does not, of course, necessarily imply serious games must be Call of Duty clones to reach this audience: again the player survey as well as other studies (ISFE, 2010) have shown receptiveness to a wide range of titles. However certain elements, such as the use of child avatars, should consider children are frequently playing adult avatars in entertainment games and such aspects can alter their expectations from a game.

In summary, Code of Everand shows that the large-scale deployment of a game can attract and retain a sizable audience for a period well in excess of a more static web-based intervention, or television advert. By avoiding a more direct approach to conveying the road safety message, Code of Everand follows widely accepted best practice approaches for serious games in putting the gameplay before the educational or behavioural aspects (Zyda, 2005). However, it also demonstrates the need for careful and structured pedagogic design which reflects on the typical playtimes of players; a factor which can be difficult to anticipate prior to launch. Future research into design frameworks and pedagogic models will no doubt support the creation of games able to convey outcomes within a short space of time - provided these outcomes are realistically defined - and through examples such as Code of Everand, the potential for serious gaming to reach large audiences is clearly shown.
6.4 Summary

Through *Code of Everand*, the THINK! Campaign explored new territory; both in the suitability of a game to reach a young audience and the method by which a game-based approach may induce meaningful changes in the road safety habits of players. *Code of Everand* adopts the widely-held view of best practice for serious games, that gameplay and engagement must precede instruction (Zyda, 2005). The choice of gaming to reach this audience was validated on several levels by this research programme: both through its high-uptake as an opt-in programme with no extrinsic motivation placed on children to play it, the comparative length of time they experienced the intervention as opposed to a web-site or similar resource and the positive attitudes of players towards serious games. The ambition of the game to provide long-term online gaming experience for children, however, was shown to be a challenging one to realise, particularly when, as illustrated by our national survey, many 9-13 year olds are conversant with adult games such as the PEGI-18 *Call of Duty*.

A behavioural model at the core of *Code of Everand* was identified as a form of analogical transfer (5.2). Yet analogical transfer is not the only way *Code of Everand* may have had impact on its target audience: a potential exists for very short interactions to stimulate some form of discourse and subsequent change, for example a child going to a parent, friend or teacher to discuss the purpose of the game. This is not to say a prolonged exposure to *Code of Everand* is required for a behavioural outcome. However, under the model identified in Section 5.2, greater exposure time would lead to increased potential for change. In addition to this formalised model, a far less structured and wider impact could be suggested, though such impact is difficult to measure and thus validate.

Looking at the intervention period of 30-90 minutes, this report does evidence a shift in the top-of-mind of road safety amongst older players (12-15), together with player survey results that demonstrate safer self-reported behaviour in comparison to a national baseline. The results of this study provide some evidence of positive impact across a wide sample of 1,000 players. Taken alongside qualitative findings, a key suggestion for future game-based learning interventions is that they must carefully consider the amount of contact time they can reasonably expect to obtain with a young audience and use this time carefully to deliver their desired outcomes. Qualitative work demonstrates the particular challenges in analogical transfer as a model for a game-based approach, for example the ease with which activities can deviate from the analogy, or prove contradictory. New interventions must seek to capitalize on the benefits of game-based approaches demonstrated through the reach of *Code of Everand*, whilst advancing underlying models for change in line with both anticipated and measured exposure times.
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Annex I – Timeline

Promotion through online search and display advertising on child-oriented sites

First burst of TV advertising supported by paid search

Second burst of TV advertising supported by paid search

National survey undertaken

Player survey and qualitative work undertaken Feb-Mar-11
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