Supporting Improvised Games for Young People in Public Spaces

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Abstract

Researchers looking at technologically mediated play and games have explored how games can be taken away from the computer screen and played in outdoor spaces. This has resulted in new pervasive games that benefit from the opportunities for rich social and physical interaction in new mobile contexts. However, we have only just begun to explore these opportunities; game designs should bring young people together in these new contexts in play that is appropriate, meaningful, and can be enjoyed on their own mobile devices.

The research in this thesis explores how game designers and interaction designers can design more playful mobile games for young people that can be played together in public spaces. This work draws upon a research through design approach that has been informed by the researcher's own practice of game design and working co-creatively with custodians of public spaces. The contributions are based on the analysis of empirical data collected from two case studies in a community library and a country house, while additionally drawing upon three further game designs made in collaborations with other partners.

This work contributes a game design framework that provides an approach, a step by step method, guidelines and a software library for making mobile games with more open, spontaneous, and improvised styles of play. The mobile games are designed with and based on a simplistic game system that presents digital playing cards to provide the game structure and bound play, while the mobile device is also used to configure the play space and sustain play. The intention is to provide designers with a practical and evidence-based approach to designing digital games for new mobile contexts. This work will appeal to game designers who are motivated by an interest in play and playfulness that will resonate with our childhood memories of play.

Selected Publications

I. Wood, M., **Wood, G.** and Balaam, M. (2017) 'Sex Talk', in *Proceedings of the 2017 Conference on Interaction Design and Children - IDC '17*. ACM, pp. 137–147. doi: 10.1145/3078072.3079747.

II. Morrissey, K., **Wood, G.**, Green, D., Pantidi, N. and McCarthy, J. (2016) '"I'm a rambler, I'm a gambler, I'm a long way from home'', in *Proceedings of the 2016 ACM Conference on Designing Interactive Systems - DIS '16*, New York, USA: ACM, pp. 1008–1020. doi: 10.1145/2901790.2901798.

III. Wood, M., **Wood, G**. and Balaam, M. (2015) 'Talk About Sex', in *Proceedings of the 2015 Annual Symposium on Computer-Human Interaction in Play - CHI PLAY '15*. ACM, pp. 795–798. doi: 10.1145/2793107.2810270.

IV. Marshall, K., **Wood, G.**, Read, J. C., Yarosh, S. (Lana), Balaam, M. and Lee, J.-J. (2015) 'Supporting Children to Engage in Play for Wellbeing', in *Proceedings of the 33rd Annual ACM Conference Extended Abstracts on Human Factors in Computing Systems - CHI EA '15*. ACM, pp. 2445–2448. doi: 10.1145/2702613.2702658.

V. **Wood, G.**, Anderson, L., Clarke, A., Wright, P. C., Vines, J., Balaam, M., Taylor, N., Smith, T., Crivellaro, C., Mensah, J., Limon, H. and Challis, J. (2014) 'The dept. of hidden stories', in *Proceedings of the 32nd annual ACM conference on Human factors in computing systems - CHI '14*. ACM, pp. 1885–1894. doi: 10.1145/2556288.2557034.

VI. Garner, J., **Wood, G.**, Danilovic, S., Hammer, J. and Mueller, F. (2014) 'Intangle', in *Proceedings of the first ACM SIGCHI annual symposium on Computer-human interaction in play - CHI PLAY '14*. ACM, pp. 413–414. doi: 10.1145/2658537.2661306.

VII. Garner, J. and **Wood, G.** (2014) 'I-dentity: Concealing Movement Representation Associations in Games', *CHI '14 Extended Abstracts on Human Factors in Computing Systems*, pp. 285–288. doi: 10.1145/2559206.2580102.

VIII. Garner, J., **Wood, G**., Pijnappel, S., Murer, M. and Mueller, F. (2014) 'i-dentity: innominate representation as engaging movement game element', in *Proceedings of the extended abstracts of the 32nd annual ACM conference on Human factors in computing systems - CHI EA '14*. ACM, pp. 375–378. doi: 10.1145/2559206.2574812.

IX. Garner, J., **Wood, G.**, Pijnappel, S., Murer, M. and Mueller, F. 'Floyd' (2013) 'Combining moving bodies with digital elements', *Proceedings of The 9th Australasian Conference on Interactive Entertainment Matters of Life and Death - IE '13*, pp. 1–10. doi: 10.1145/2513002.2513014.

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Joining this program was opportunity to see what we might learn from creating new game designs for young people in new mobile contexts. The work was carried out over four years where I was fortunate enough to publish with other academics, as well as working with other research institutes and labs, including an internship at Microsoft Research, Cambridge, UK.

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1 Introduction

1.1 Introduction

This thesis is principally concerned with designing computer games on mobile devices for young people to play together in public spaces. This research is situated within the broad area of pervasive mobile gaming research, where playing games is no longer about players being behind a computer screen in the home and is instead about playing games in the "real-world" (Benford, Magerkurth and Ljungstrand, 2005; Bichard and Waern, 2008; Ejsing-Duun, 2011).

Mobile devices are now everywhere, for the first-time in 2016, they overtook desktop computers as the most popular method of accessing information, and remain an integral part of the lives of young people (Murphy, 2016). However, despite this widespread usage of mobile devices and the associated rise in mobile gaming (Orlando, 2014), young people in contrast to older generations, do not spend as much time playing out of doors in industrialized societies (Soute, et al. 2009) - with the average young British adolescent spending six hours a day of screen time (Sigman, 2012). This has also coincided with the loss of public places where young people can play, as large areas of cities in the UK are redeveloped with the land being handed from public to private hands - these new owners have often repurposed the space for business such as retail parks, which has restricted how young people use these spaces (Vasagar, 2012). This proliferation of modern technologies, together with the loss of access to public space has meant that young people have fallen into playing indoors instead of playing outdoors – previously identified by (Lester and Russell, 2008). These changes can be damaging to the way young people relate to the social, physical and cultural spaces of our environment and how they form relationships with each other (Lentini and Decortis, 2010).

These problems have persisted to this time when computer games are going through change. In particular, the popularity of mobile gaming has increased massively; there are new exciting genres of mobile games (Heintz and Law, 2015) and the number and quality of games created by independent games companies is on the rise (Mirza-Babaei, Moosajee and Drenikow, 2016). Game jams are becoming increasingly popular as a way of democratising the making of computer games (Goddard, Byrne and Mueller, 2014) which is changing both the motivation for making games and what designers can make together. Social games have also seen a meteoric growth which is helping to change the demographic of computer game

players from those players with high literacy in games to those who are content playing opportunistically on personal devices (Kirman, 2010). Indeed, mobile devices and also mobile technologies are now being recognized for their capacity to place gaming experiences in the real world. There are now new genres of games, like Head Up Games (Soute, et al. 2009) which use technology in outdoor play activities and get their name from the minimal use of screen (hence Head Up Games). These examples use mobile devices to support play, and have potential to intervene in our sedentary lifestyles, and connect us meaningfully with both the spaces and people around us. Importantly, developing these experiences is no longer solely the domain of the researcher, and new technology is empowering artists, game designers, service providers, big business and educators to explore new experiences which have begun to blur the boundaries between the physical spaces of the real world and digital spaces (Flintham, 2009). Nowhere else is this more apparent than in the hugely popular Pokémon Go, a free-to-play location-based augmented reality game developed by Niantic. In Pokémon Go players explore the real-world looking for creatures called Pokémon which appear on the screen as if they were at the same real-world location as the player. Once caught, these Pokémon can be trained and battled with other Pokémon at training gyms, which are placed at popular landmarks. Pokémon Go attracted 65 million users in its first week last July and has largely succeeded in encouraging positive physical and social play in public spaces *(Tong* et al., 2017). However, despite the game maker's huge resources (it was developed by Niantic Inc. a company which was originally formed as Niantic Labs - an internal startup within Google), the popularity of Pokémon Go might not be sustainable as it has lost players since its highly successful first year (Humphery-Jenner, 2016). It also shows the inherent problems with playing games in the environments around us; Pokémon Go players have reported a litany of problems, including personal injury, trespass, and Niantic Inc. have even received accusations of inappropriateness in respect to where Pokémon can be found (Velloso, Eduardo, 2016).

Researchers in Human Computer Interaction (HCI) have been interested in designing for play and playfulness for some time. These interests started with researchers looking for innovative ways to support the design of interactive technology as it moved out of the workplace and into our spare time and social lives outside the office. Researchers created new design approaches such as experience-centered design (Blythe et al., 2005) which was associated with a so-called "third wave of computing" that moved HCI research beyond its practical and tool oriented beginnings. These approaches have been able to facilitate researchers in exploring

more humanistic digital technologies that were able to enhance lived experience and better able speak to 'Homo Ludens' (Gaver, 2002) where pleasure and engagement were placed above the utilitarian properties like performance and efficiency. More recently, the body of work by Benford *et al* (2013) has looked at practice, studies and theories from working with performing artists in the wild. This includes Blast Theory, who's touring art games has seen games curated and weaved into our cityscapes and public spaces as they engage players in new social experiences. These games require carefully crafted rules, management and orchestration in order to engage players with their environment, something that is also addressed in "Reality is broken" (McGonigal, 2011) which positions the real world as a digital playground with "infinite affordances" that can be engaged and played with through game design.

However, despite the interest in play and gaming in the real world we still do not have all the tools to create practical and accessible game designs that might better speak to both the games designers and players who will enjoy digitally mediated physical and social play. Where the HCI community has created different design platforms to support more playful experiences, they have been created to support the ideation and critique of new designs, for example, the Mixed Reality Game Cards (Wetzel, Rodden and Benford, 2016) are a deck of 93 illustrated cards with design opportunities, questions and challenges that can be used to support making mixed reality games. Comparably, the Playful Experience Cards (PLEX)(Lucero and Arrasvuori, 2013) are based on different characteristics of play (think characteristics like imagination and discovery). These can be used in the design of more playful digital prototypes. There are also frameworks which have also looked to provide more technological solutions, for example, FRAP (Tutzschke and Zukunft, 2009) provides a comprehensive software architectural solution which responds to the challenge of creating games in hybrid spaces: new imaginary spaces that exist when digital worlds are placed over the real world. This need for new pervasive platforms has been identified by the CHI pervasive play workshop (Ahn et al., 2016). This workshop set a clear agenda for pervasive play research, calling for a wider community with common goals – in particular, highlighting the need for the creation of new design frameworks. Meaningfully, the authors created this workshop with the title pervasive play, a hint perhaps, not to fall into the trap of just making "traditional" games in new contexts.

The work in this thesis is intentionally centered around digital games and play for young people. Young people are a particularly vulnerable group having lost access to important outdoor spaces and the opportunities for play that previous generations cherished. They are also an expert of their own experiences: they are both digital natives and have not yet forgotten how to play. Moreover, supporting play will be beneficial for all children and their wellbeing (Marshall et al., 2014). Children up to early teens are still developing and will benefit from games that encourage both physical and social play. It is also important to encourage them to experience more positive than negative experiences, and play will help build resilience – the capacity for children to thrive over adversity and environment stress (Lester and Russell, 2008). With day-to-day life being increasingly technologically mediated and contributing to the further disembodiment of young people with the world (Lentini and Decortis, 2010), they are an ideal group for design efforts.

In response to these challenges and opportunities, this research explores how games designers can be better supported to create new designs for young people in mobile contexts that consider the importance of play.

1.2 Research Aims

The introduction has described the interest from the HCI research community in games and play, and why it might be interesting to design for young people in public spaces. With this in mind the research explores the following questions:

1.2.1 How can we support playfulness more explicitly in our game designs?

Prior work in game design has talked about the importance of play and playfulness. Researchers have discussed how social games can support emergent play and playfulness (Kirman, 2010), while elsewhere in HCI more playful perspectives and motivations for design have been used to support social play and relationships in the family home (Lindley, Harper and Sellen, 2010). One particularly useful lens of play has been to look at how games can be positioned on a sliding scale between playful and gameful experiences which was first discussed by Caillois (1961). Caillois' continuum has been part used to inspire the PLEX Cards (Lucero and Arrasvuori, 2013) which can be used for ideation. The continuum has also been applied in investigating the properties (e.g. rules) of game jams to facilitate more constructive forms of play and in learning how to steer the outputs from these activities (Goddard, Byrne and Mueller, 2014).

It can also be useful to look at how characteristics and categorizations of play can be drawn from existing literature and applied to current games, for example, Verenikina & Harris (2003) argue that we should create designs that consider the importance of the developmental role of play. Designing with different perspectives of play in mind will likely challenge the practice of making games for some designers, as well as help identify the appropriate types of play to support for young people. This latter point, raises a practical question: as games designers, what concrete characteristics of play should we look to place in our game designs for these new contexts and young people, and how can this be achieved?

1.2.2 What game designs should we create for young people and in which contexts?

Pervasive computing and mobile gaming has been around for a while, but there still remain few examples of popular mobile games that are designed for public spaces and specifically young people. One of the biggest problems around the creation of games designs in these new contexts has been where to start, and designers face the problem of what to make and why. In the past, game designers were more or less content with creating games for console systems, desktop PCs, and the casual mobile gamer. This was changed with the runaway success of Pokémon Go which showed how games in the real world could not only be fun, but also highly profitable. However, designing pervasive games is difficult; pervasive games present difficult challenges – from a technical perspective the game designer has to deal with mobile phone connectivity and available coverage, while from a research point of view, the games are methodologically complex, for example, games in the real world must ensure the well-being of players which might mean carefully orchestrating the play. However, games designers need not imagine games in the vein of the recent successes. As games designers, we should be asking what are the other options for games designs that will motivate and inspire players? For example, the game J.S Joust (Wilson, 2012) sees players battle in a digital form of "tag", where brightly lit PlayStation Move controllers must be knocked out of hands by players to win a round. Elsewhere, in the game *Bounden* (Adriaan de Jongh, 2014), players must synchronize their movement together in this carefully choreographed and whimsical dance game. These two games have created compelling gameplay based on the idea of co-located play in the real world. Not only can these games be played in public, they have a spectator interface that draw audiences wherever they are placed, and these are games that appeal to the younger age group that seek thrills and across different demographics of game players.

1.2.3 What can we do to help game designers create their own mobile game designs?

In order to create game designs for the real world, it is apparent that game designers need directions to look along, design guidelines and design tools. To this end, there have been recent advances in games programming tools which are valuable, for example, the Unity games engine has made developing games much easier through its cross-platform development support, community support and large collection of third party software components and media assets. There are also third-party libraries, such as Thomas Perl's PS Move API (Perl, 2010) which has helped game designers support innovative social and physical play, such as the game *Scared Harvest* (Kirman and Feltwell, 2015) which was built in the Global Game Jam 2015 (GGJ 2015).

However, we are still short of choice for complete game design frameworks for pervasive games. Pervasive game designs frameworks should include an overall approach, a step by step method, guidelines, design patterns and usable software that can help game designers with exploratory development. Design exemplars as part of a research through design approach (Zimmerman et al. 2007) can be used to illustrate what these game designs might look like and what can be achieved. These exemplars can help bridge between the game designer and people that represent our public spaces, while providing software examples that can be built and deployed quickly which will enable game designers to hit the ground running.

1.3 Research Approach and Limitations

This work in this thesis began in October 2012, and finished in March 2017, with a three-month break for an internship at Microsoft Research, Cambridge. The research was conducted under The Creative Exchange project at Newcastle University, a project that brought together pioneering companies and researchers in studentships that would explore the potential of the 'digital public space'. The idea of the digital public space was that new innovative technologies could enable anyone, anywhere, and at any time, to access, explore and make digital content. The Creative Exchange provided this project with the opportunity to work with custodians and stakeholders of public spaces with a view to creating new game designs, while from a personal perspective, it was motivated by a need to approach game design more critically around formative work in play, and an interest in developing alternative tools for the games research community and indie game designers.

The work presented in this thesis looked to bring those people, spaces and interests together, driven by the perspective of the author's practice and background in working as a game designer. Correspondingly, the work belongs to the research through design tradition (Frayling, 1993; Zimmerman, Forlizzi and Evenson, 2007; Gaver, 2012) in that, the main research activity has been concerned with creating new digital prototypes through this design practice in order to generate new knowledge. To understand, why it is appropriate to frame this work as research through design, or perhaps more appropriately, research through game design, it is useful to visit the origin of the term research through design, and how this was brought into Human Computer Interaction.

Research Through Design or RTD, is a well establish field with its own conference since RTD 2013. The origin of the name RTD was introduced over twenty years ago when Frayling (1993) analysed how artists conducted research at the Royal College of Art, and specifically whether research was "into, through or for art". In relating research "through" design to teaching art degrees at his college, Frayling (1993) described the importance of research into the materials used in design, how the development work was able to push the current boundaries of the practice, and how these steps were formalized in the artist's research diaries and contextualized in their final reports. Frayling (1993) also described the importance of being able to communicate what was learnt in order to separate research through design from how reference materials might be used by the artist: *"the diary and report are there to communicate the results, separating research from the gathering of reference materials."*.

Research Through Design has been increasingly applied to interaction design work within Human Computer Interaction where it can be seen as a resource for the production of new knowledge. The application of RTD in this thesis is appropriate for a number of reasons. RTD can be applied to "wicked problems" since the artifacts themselves represent the designers best efforts to make the right thing: a product that transforms the world from its current state to a preferred state (Zimmerman, Forlizzi and Evenson, 2007). These authors also describe how the research artifact can be a conduit between the research/practice barrier of the research community and the practice community (see Figure 1).

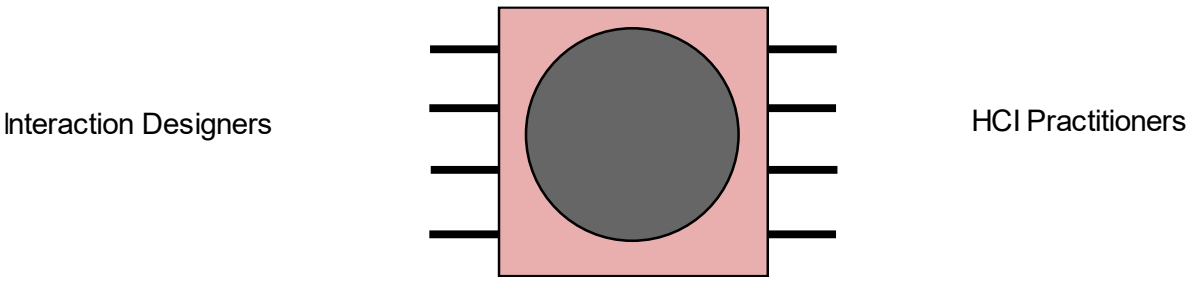

Figure 1. Redrawn detail from part of the model in Zimmerman, Forlizzi, et al. (2007) which positions the research artefact as a conduit between researchers from the two communities

This relationship is particularly important in this thesis work as successful game design is often judged by the playable game – the game being the artifact which is produced through the design efforts. Resulting game designs can also be played by the research community which allows researchers to make their own "hands on" understanding through play.
The value of the research artifact is also underlined by Gaver (2012) who cautions that the generative nature of research through design can mean that theories can be provisional and contingent because they are centred around a particular instance of design – something that can limit the extensibility and verifiability of the research. Gaver (2012) proposes using "annotated portfolios" to present a set of design exemplars which can be compared and contrasted together to contribute a better understanding of the design space – where each design exemplar occupies a single point in the wider design space. In this thesis work, the games that have been developed are described are single instances in the wider design space of pervasive games. However, this thesis work looks across these different game designs in detail in order to build a better picture of what works in this domain.

Zimmerman, Forlizzi, et al. (2007) formalise their RTD model by providing a set of four lens (or criteria) to evaluate the contribution to interaction design research. These criteria are *process*, *invention*, *relevance*, and *extensibility*. In short, the authors explain that the research *process* can be evaluated by the explanation of the rationale behind choices made during design; the *invention* is the novelty of the new work, compared to previous efforts, and how it advances the state of the art; the work should also have *relevance*, in that, the design should help move the world toward a preferred state, and researchers need to provide a strong argument for why this preferred state is desirable; lastly *extensible* work should allow others to build upon it, allowing the community to leverage both the research process and design artifact in their own research.

The criteria of *relevance*, *process*, *invention* and *extensibility* can be applied to the contribution of the work in this thesis. The related work in the next chapter contributes to why this research is *relevant* – it synthesizes the important work in this domain, explains why exploring game design in mobile contexts for young people is valuable, and identifies the significant gaps in knowledge in this area. In the remaining thesis, the game design *process* is described in detail, which includes the provenance of ideas to explain how ideas around play are important because they eventually translate into actual gameplay. It then shows how each of the games worked in their particular instances. In these descriptions, it was important to relate the features back to design decisions taken in making the games, and the actual experience of playing the game – the gameplay. Significantly, the game designs are not the only digital output of the work, the work also necessitated the *invention* of new software tools and changes to existing tools. The software tools are therefore shaped across all the making in this work, influenced by both a games design practice, personal choice, the different mobile contexts, and particularly the first research question, which looked to embed playfulness more explicitly in the designs. Therefore, the discussions of these game design tools in this work aim to communicate the learning embodied in these design tools and present them as an *extensible* resource for games designers.

It is important to note, that the work for this thesis was undertaken in a research lab, and it was natural that a games designer would be best positioned in the role of research developer, alongside researching the primary work for the thesis. Rather than be to the detriment of the central work in this thesis, being involved in other projects was an opportunity to apply an interest in play and consolidate the game design tools so that they could be applied to other research work. Similarly, to the game design work, these non-game projects were influential in shaping the tools to make them more effective in delivering digital apps. This helped ensure that they were not too rigid to be used in different types of prototypes for HCI research – albeit ones which had some element of playfulness or used card-based design. These other projects included: *Magic Land* (Pykhtina et al., 2012) - a digital prototype that promote children's emotional well-being in play therapy; a set of demos for *Expressy* (Wilkinson et al., 2016) - an app that uses a wrist-worn inertial measurement unit to add expressiveness to touch-based interactions; *Swaythe Band* (Morrissey et al., 2016) - a digital prototype designed to encourage people in a care home to enjoy music sessions together, and in making the

software visuals for *Eye Resonator* - a dream-like graphical interactive installation by Brigitta Zics[1] that engages viewers by responding to their eye movements.

The main limitation of this work is that it has been focused around the actual act of game design. For example, the case studies and game designs which are included in this thesis, do not examine how the games have changed the environment they have been deployed in i.e. how they have affected the practice of the stakeholders, or changed the players (other than assessing how much players enjoyed the experience at the time of playing the games). The game designs have also been presented in this thesis from the perspective of a games designer, which is just one of the many perspectives across the collaborations which has included sociologists, interaction designers and domain experts. One benefit of using a research through design approach is that it has permitted this work to talk about the knowledge generated from this games design perspective and therefore knowledge that is valuable to games designers. For the other unique and important perspectives, the papers provided on the Selected Publications page should be visited. These include the game *Talk About Sex* (Wood, Wood and Balaam, 2017) which describes the application of computer games to facilitate talk among young people about sex and over a longitudinal study, while the papers on the game *i-dentity* (Garner et al., 2013) show how games can play with different representations of movement.

1.4 Thesis Structure

This chapter introduced the context of this thesis, and the motivation for creating pervasive games for young people on mobile devices. It outlined the research approach and limitations, and how working as research developer in a research lab for four years, has shaped this approach around the provision of mobile technology, and how in turn, this shaped the design of these digital games and the design tools.

This thesis has three distinct parts – the first part, looks at the characteristics of play through the important literature. These perspectives are then used to look at related work in playful design and pervasive game design across academic research, indie games and mobile games. The second part presents an account of creating and deploying mobile games for young people in public spaces and the lessons from this work. The last part, contributes a game

[1] http://www.brigittazics.com/

design framework and online software tools that draws upon these experiences and describes how the framework can be applied.

Chapter 2 reviews the related work. It begins with the characteristics and categories of play that will be interesting to game designers, drawing upon classical and modern of theories of play. These are used to foreground the characteristics of play that will be appropriate for games in mobile contexts, which this thesis argues are more *spontaneous, open, and improvised* forms of play. It looks at the work in pervasive game research and importantly the work that has a specific interest in play. The literature review then draws comparisons between these game designs and the playful approaches used in HCI research and interaction design. This is used to examine the design frameworks that have been used to create playful experiences and pervasive game designs. Lastly, it looks at game design frameworks that will help designers make actual new game designs and describes what any new frameworks should include.

Chapter 3 describes the first case study – the Department of Hidden Stories (*DoHS*). *DoHS* is a mobile game developed to encourage young people to engage with books in public libraries through playful digital storytelling. *DoHS* introduces the use of digital playing cards to this thesis which are used in the mobile game to initiate playful interactions around the mobile device. In *DoHS* these digital playing cards are used to support children in the task of writing stories alongside traditional writing materials and real books from the library. The outwardly simplistic game dynamic of prompting play with cards is shown to be appropriate. It helped support child led creativity and promoted emergent gameplay as children subverted the game to play together more closely. This chapter describes how the mobile phone emerged as being on the periphery to the children's play which was instead centered on the books, the stories they created and exploration of the wider library space.

Chapter 4 describes the second case study: *The Wild Man Game*. *The Wild Man Game* is a mobile phone app that encourages visitors to play together as they visit a country hall. The game was created in collaboration with staff from the heritage site and an interdisciplinary design team. The game featured a Wild Man that was present in the architecture of the site and its history. This Wild Man was used to theme gameplay that intertwined the existing play that had been observed at the hall, the stories associated with the fiction and its physical space. This game builds on the same card-based paradigm as *DoHS* in using prompts to

structure the game and initiate play. In contrast, the *Wild Man Game* is programmatically more complex as it additionally explores the ability of the mobile device to sustain play through different digital interactions without completely leaving the paradigm of digital playing cards. This chapter describes how thinking about the game in terms of cards made the structure of the game clear to the designers from an early stage, allowing the design team to alter the wording to better present the cultural meaning of the Wild Man in the game and shape the games themselves. The card-based paradigm and its inherent simplicity also supported more open and improvised forms of play which encouraged visitors to play together, entwining the physical space and the character of the Wild Man into their play.

Chapter 5 describes two further game designs: *i-dentity* and *Intangle.* These games were created in collaboration with other partners at game jams and are described in these chapters to further explore games that have *open, spontaneous* and *improvised* forms of play.

i-dentity is a multi-player movement-based game for 3 to 8 players which was inspired by traditional party and playground games. It is used in this chapter to describe how games can support more explicit ideas of play and playfulness, and how this led to different player interaction patterns around synchronised play.

Intangle is a game that was designed to encourage young people to reflect on bodily contact in physical games. It is used in this chapter to look at how the games design process for the games in this thesis benefited from card-based designed and how this led to a player interaction pattern for turn based play.

i-dentity and *Intangle* differ from the previous games that were created around culturally important spaces. Instead these games are interesting because they can be applied to youth work. This chapter begins by discussing youth work and how it is delivered in publics spaces where young people meet together and “hang out”. In this mobile context, engaging the young people on their own level is important and play is regularly used as an ice-breaking and diversionary activity.

These two games complement the learning from the two case studies. This chapter describes how card-based design can be used to quickly iterate gameplay and contributes new player

interaction patterns from the design of these games. In addition, *Intangle* illustrates how these games can be used to explore more serious game topics.

Chapter 6 describes a game design framework that can be used to create games for young people in public spaces. The design framework is the main contribution from this thesis work. It describes how the game design process works i.e. how the games designers can create a game using the framework, and also details the software side of the framework. This describes the game engine that was used for designs: why it is an important part of the overall approach and contribution of this work, how the software can be used, and how it might be extended.

Chapter 7 describes the most recent game design *Talk About Sex*. *Talk About Sex* is played on mobile phones and uses game cards with playful prompts in order to get players to talk about sex. The game was created in a design exercise led by the author, in collaboration with an interaction designer who focuses on designing for digital health and wellbeing, and a sex and sexuality researcher experienced in working with young people. This game is used as an example to illustrate how the game design framework can be used.

Chapter 8 presents the conclusions for the thesis work, beginning with looking at how each of the research questions have been addressed. This is followed by a discussion from a practice-led perspective that explains why creating individual game designs around improvisation, the game design framework, and the associated tools will interest games designers. It reflects on how the game design framework has been developed in response to working in a collaborative research environment and, pragmatically, how this has worked as a research through design project. The thesis concludes with the future work and how the software side of the framework is finding some traction in open source development and in student projects.

1.5 Contribution

The main contribution of the thesis is a game design framework which can be used to make improvised games for young people in public spaces. The framework packages together knowledge that has been generated in research through the design of five different games.

The game design framework provides a series of steps to making games in these new mobile contexts, guidelines that describe what is important when making these games, game design

patterns which illustrate different player configurations, a guide to how the framework can be applied and a complete software resource for making these games which is available online.

This work is evidenced through two main case studies *DoHS* and the *Wild Man Game* which are used to show how the design framework and guidelines were generated. Additionally, the games *i-dentity* and *intangle* are used to describe different play patterns that can be used in these improvised games, and also provide practical tools for exploring improvised play.

Lastly, the game Talk About Sex provides a working example of how this framework can be applied to a new mobile context in exploring how to get young people to talk about sex. Together, these five games present working examples of how we can make improvised games for young people and which contexts they can be applied.

2 Related Work

2.1 A Background to Play

The introduction describes the HCI community's interest in designing digital technology for play and playfulness in mobile contexts. It explains the context of this work and why thinking about the characteristics of play might provide an interesting provocation for games designers. Accordingly, this chapter reviews the literature and design efforts which have explored play and playfulness and how this might be applied to game design. In particular, this chapter focuses on play for young people, since this group are facing environment stress. Games are opportunity to speak to them as digital natives, to draw upon their own expertise in play, as something that they already enjoy, and to support their well-being through play which is appropriate for their social and physical development.

Where HCI researchers have reviewed and used the literature on play, the work has often assumed a *common core approach* which has looked at the existing definitions of play and games before synthesizing new ones (Arjoranta, 2009). In order to avoid what these authors describe as the *language games* associated with creating new definitions, the work acknowledges there is a distinction between games and play, and the work is framed against the relationships between games and play described by Salen & Zimmerman (2003).

Salen & Zimmerman (2003) describe two possible relationships between games and play as they take place in the real world. In a first step the authors describe play as the larger design space, with games the smaller subset which are given more formalised rules. In a second more conceptual relationship, the authors describe the play that can be enjoyed within a gaming experience. In this thesis, both these views are useful as this work looks to (1) change how computer games can be designed in order to expand gaming experiences into the wider design space of play, and (2) support certain characteristics of play more explicitly in game designs.

To explain this further, games can be viewed as one form of play, for example, playing a computer game might involve picking up your smart phone and favourite game, for example, trying to survive a further ten seconds in Terry Cavanagh's Super Hexagon. In contrast, play can be anything playful, from trying to flip beer mats over in your hand in a pub, to throwing a stick for your dog. Meaningfully, it is possible to create new games that provide new experiences and in doing so, the possibilities of what play can mean in terms of computer

games expands outwardly into the bigger design space of play. Significantly, Salen & Zimmerman (2003) describe that playful elements can be found in games. This is succinctly explained in (Kirman, 2010) who discusses the freeform play that can be enjoyed in "sandbox" games like Grand Theft Auto and The Sims where players enjoy messing around for their own amusement (regardless of game objectives). Correspondingly, game designers can think about what sort of play might be "designed for" and make this an aim of game design, for example, we might think about playful "mimicry" and how games might support this more explicitly.

It is therefore important to think about what sort of play should be designed for, especially as designing for play is opportunity to support the enhance the wellbeing of young people (Marshall & Wood 2015). The literature on play provides a good starting point for this endeavor and Verenikina & Harris (2003) are one of many authors who look across the literature – examining the classical, modern and social-cultural theories of play. Verenikina & Harris (2003) provide useful suggestions to where efforts should be directed, arguing that there is a *lack of focus on digital gaming for use as play per se*. In looking at classical theories they describe the need of children to spend energy through physical play and the importance of pretend, make-believe and imaginative play. In looking at more modern theories of play they use Piaget's staged-based theory to highlight the importance of symbolic play in the development of abstract thinking. In describing Vygotsky, they describe how toys are used with gestures which can symbolize what a child is trying to communicate, and how this will often represent a child's understanding of the social and cultural setting. Verenikina & Harris (2003) concludes with a summary of theories and provide general characteristics of play that should be considered in our games. This is quoted verbatim below.

• *Play is a spontaneous, self-initiated and self-regulated activity. Does this computer game allow children to freely engage in play? Does it provide a freedom of choice?*
• *Play includes a dimension of pretend. Does this computer game enable children acting in an imaginary, "as if" situation?*
• *Children are actively involved in creating their play and are in control of it. Does this computer game allow children to create their own scenarios, rules and characters of the play"* (Verenikina & Harris 2003).

The paper by Verenikina & Harris (2003) and those general characteristics is important for the work in this thesis. However, it has also been useful to visit other definitive work in play that has been applied to digital designs. For example, Huizinga's (1949) account of play in *Homo Ludens* has been widely drawn upon in HCI discussions about play e.g. (Salen & Zimmerman 2003; Lindley et al. 2010; Segura 2016). Huizinga, argues that play must be voluntary, it can be enjoyed for the sake of play itself, it is compelling in every sense, it is not serious, it needs rules that structure its activity, and exists within our normal existence of life, and should be understood as being separate from everyday life. Importantly, Huizinga's definition describes play as something that is clearly delimited from normal life – using, the now popular term - the "magic circle", a concept that describes the place were play happens, and anything inside this circle of play is sacred to this activity of play. Huizinga's concept of the magic circle was first applied to games design by Salen & Zimmerman (2003) where it can delimit the 'reality' of play in computer games. This reality is created when the game is run, and anything entering the space of the game is given meaning according within the context of the game. The magic circle has received some criticism, but has provided a useful tool for games design (Goddard, Garner and Jensen, 2016), and likewise, in this body of work the concept of the magic circle has allowed the designs to be considered with respect to their boundaries of play that separate them from activities in the real world. In the discussion of pervasive games later we see how games can blur the edge of this magic circle, blurring the boundaries of the game and real world, for example, players might not know what part of the game is, and what is not. In the work in this thesis, the magic circle is viewed more closely to Huizinga's definition where play is something worthy, recognisable and distinct from normality.

Roger Caillois' (1961) sociological account of play reinforces and builds on Huizinga's play, in recognising how play has a fundamental role in the development of both human nature and society. Caillois argues that play can better understood by categorizing different experiences of play which are defined through four key categories and a continuum. The four categories *agon*, *alea*, *mimicry* and *ilinx* are described below.

- *Agon* involves competition e.g. the object in games such as chess is to beat the opponent through contest.
- *Alea* are games of chance such as the card game blackjack which is played in gambling casinos. These games are not just about waiting for an otherwise inevitable

outcome. Instead, they are described as having space for play around the game itself such as the ritual adopted by gamblers where they might say something that might sway their luck or hold a lucky item during play.

- *Mimicry* involves the player using their imagination as they take part in 'make believe' play, role-play and where parts of the play activity are improvised.
- *Ilinx* comes from the Greek word for *whirlpool*. These are games that change the normal perception of reality, for example, the feeling of vertigo can be created in play (imagine spinning wildly on a roundabout in a playground).

Although these categories are broad, they can be used to frame and think about what sort of play might be supported in our game designs. There is also an inherent flexibility; play can fall into one category but does not have to e.g. break dancing might be considered through the categories of *agon* and *ilinx*. Games can also reside in a single category e.g. *Parkour* (or free running) could be categorized by the experience of *ilinx* alone. The category *mimicry* should challenge games designers to think about games that might involve improvised play alone. Such games, would exercise the imagination and might allow players to react to real world changes – since improvised play is spontaneous and unprepared.

Importantly, for the work in this thesis, Caillois describes games and play on a continuum that describes whether it is more playful (or *paidic*) or more gameful (or *ludic*). Playful games are typified by games that allow self-expression, free-form and improvised play, and can be associated with those experiences from childhood where play is more spontaneous. For example, the game Hide-and-seek is a playful game with malleable rules. It can be played in many ways, with different numbers of players hiding, or seeking, and even the number to count down from, can be decided in the moment. In contrast, gameful games have rigid rule structures and can be typified by games such as boxing and chess where straying from the strict rules is not allowed. For the research in this thesis, Caillois' continuum of play provides a useful lens for our digital designs. As a game designer, this continuum provides a powerful provocation: how can we make our games more playful? How can the player be encouraged to be more spontaneous, use improvisation, and find enough room to play the game in the way they want to play? Correspondingly, Caillois' scale has been used elsewhere to critique existing games by their position on this continuum, for example, in asking whether games use more structured play with rules, or facilitate more unstructured and open-ended play (Kirman, 2010).

Caillois' and Huizinga's sociological perspectives in play are useful; they help frame the play in our designs and motivate game designers to adopt more playful perspectives. However, they do not explain why, or even how we play. In order, to explore these questions looking at the developmental theories of play can provide insights to what should be supporting in our designs, and what values of play are appropriate for the mobile contexts.

Piaget (1962)'s developmental theories of play resulted from detailed observations of children. Piaget described different stages of play which are characterized by mastery play, symbolic play and structured play with rules. Mastery play can involve repeating activities which allow children to become better at a given challenge. In symbolic play children are able to use objects, actions and ideas to represent other objects, actions and ideas. Finally, in play with rules, children operate at a level of playing ability where they can follow a game where rules are imposed on players. This latter stage is important as it describes children's games where players will follow the logic of the game. This logic is determined by the rules and structures the game. The logic of games (or game logic) is central to the design of computer games and also imposes a structure. Of course, Piaget is describing play and in play children can only follow the structures present in the game, because play cannot be imposed. Significantly for the work in this thesis, Piaget observed this last category in looking at young teens and this is the age when children should be able to understand and play with the rules of a computer games. This means that games can be designed with a basic structure and the young players might be expected to take the rules as a starting point and look to appropriate and bend the rules as they want.

Parten's sociological account of play (Parten, 1933) also referred to different stages. Parten created six stages of play, which contributed toward the cognitive, physical, emotional and social development of children. These are:

- *Unoccupied* play where children are not engaged in play.
- *Solitary* play where the child is playing alone.
- *On looking* where children observe other children around them and join in conversation.
- *Parallel play* where children copy and mimic other children around, but alongside rather than together.

- *Associative* sees young people beginning to play with others and developing friendships, which may end up in playing together;
- *Cooperative* play of young people sees them play together with shared aims.

The latter two stages of play can be recognised in computer games. For example, games played in the social living room like Nintendo's Mario Karts might encourage associative play, while games are often played over the internet in cooperative play. Importantly, all the stages map to configurations of play that can be found in computer games. However, it is worth noting that there has been little exploration in computer games that support parallel play and Parten's work illustrates how these patterns of play can be seen with young people.

Lev Vygotsky (1977) also recognised the value of playing with others. He argued that cognitive development was linked to social and cultural factors. Vygotsky believed that learning happened primarily through language and therefore was driven through social interaction with others. Vygotsky recognised play for its importance in development, emphasizing the need for role-playing and imaginative play where children create dialogues with themselves and others. Therefore, creating designs around social play and interaction between young people requires them to communicate through language, which supports cognitive development. Vygotsky theorized about a zone of proximal development that can be used to visualize tasks that a learner can achieve normally and those tasks that are out of reach. In this *zone*, young people could attain new skills by working in parallel and together with older children or adults, and these skills will remain after the play was finished. In respect to those characteristics of play recommended by Verenikina & Harris (2003), it is easy to imagine how games (such as those around mimicry) might more directly encourage children to work with and copy others.

The 'Grasshopper: Games, Life and Utopia' by Suits & Hurka (2005) uses Aesop's fable - *The Grasshopper and the Ant* to argue why we should be playing more. In the original fable, the hungry grasshopper begs for food from the ant when winter comes because he has been improvident. In Suits' retelling, the grasshopper talks to the ant, and slowly brings them around to their way of thinking, which is that grasshoppers enjoy more rewarding and happier lives by placing play above all else. Suits uses the conversation between the characters to both define and defend a new definition of games. In his parable, he argues games are an intrinsically valuable activity which should be placed above everything, and in doing so

suggests how people can live better lives. Suits provides a useful definition where "games are a voluntary attempt to overcome unnecessary obstacles" (Suits & Hurka 2005: 36). In explaining this definition Suit's describes four components that are necessary for this game, being: 1) a goal, 2) the means of achieving the goal 3) constituent rules of the game, 4) and the lusory attitude. The lusory attitude describes how players must adopt a mindset where they are willing to adopt the constituent rules of the games. For example, in the childhood game tag, a player might be tagged, and become "it!". They might then immediately turn around and touch the tagging player. However, this would be unfair. Significantly, playing a game requires a magic circle of play where the acceptance of the constituent rules of the game serves a higher purpose of play. Suits' definition seemingly avoids the language games described (Arjoranta, 2009) providing four important components which can be used to structure game designs. In his definition, it is significant that goals do not require competition or contest which are less important in the *paidic* end of the continuum of games.

Relatedly, Polaine (2010) borrows the expression "invitation to play" to describe the attitude users adopt when engaging with playful public art installations. Through case studies, Polaine draws upon the concept of affordances to present interfaces that allow the viewers to find it easy to "get it". He hints, that one of the ways of eliciting a positive emotional response from users, and therefore a good "invitation to play" it is to get rid of the interface entirely. In applying this notion to computer games, this should remind game designers to appeal to players without high gaming literacy and provide an accessible interface that can be easily picked up.

Work in HCI has used these definitions of play and games as a provocation for design, for example, Lindley (2010) uses "defining characteristics of play" as a starting point for design in a household messenger, referencing Caillois' continuum that runs from *"turbulence and impulsivity (paidia)"* to *"taking of delight in challenge (ludus)"*. Thinking about particular characteristics of play is not a common way of framing computer games design e.g. games designers often think in broad terms of genre, gaming patterns e.g. (Davidsson, Peitz and Björk, 2004) and game mechanics, as defined (Hunicke, LeBlanc and Zubek, 2004). However, thinking about the characteristics of play and capturing elements of children's play and games will lead to a different style of experience than that of traditional computer games, such as those games seen in outdoor play in Soute, Markopoulos, et al. (2009). Therefore, game designers might look for characteristics which will be appropriate for mobile contexts,

such as those that forefront the end of the Caillois' continuum with more open, spontaneous, and improvised play. However, as a final note when thinking about these definitions of play, Koster (2013) warns, that drawing upon these definitions of games and play does not *"help designers find "fun" though"*.

2.2 Pervasive Games and the Role of Space in Play

The thesis introduction describes how The Creative Exchange project was motivated by the opportunity to explore a new "digital public space" where anyone, anywhere, anytime can access, explore and create with digital content. For the work in this thesis, the digital public space is somewhere that game designs could be used to connect players to one another and the real world through play – a purpose that is synergetic with the aim of pervasive games. This section continues with a look at pervasive games and its sub-genres, and how these games relate to the previous discussions of play and the opportunity to design for young people and play.

Pervasive games cover a wide breadth of experiences that support play in the real world, with gaming sub-genres that include location-aware gaming, exertion games, movement games, smart toys, affective games, augmented reality games (Magerkurth et al., 2005) and site-specific games (Kristiansen, 2009). Pervasive games are an exciting idea from a commercial viewpoint as games can leverage online connectivity to include real locations and activities. Likewise, they are interesting for research because of the technical and human challenges arising from creating designs for the real world (Benford, Magerkurth and Ljungstrand, 2005).

In 1988 Mark Weiser coined the term ubiquitous computing to describe the new age of calm technology, an age where technology is receding into the background of people's lives. The development of these ubiquitous devices meant that games could experimented with new exciting technologies which created interest in studying the phenomenon of ubiquitous game design and ubiquitous gameplay (Kristiansen, 2009). Montola et al. (2009) explains that around this time, *Killer: The Game of Assassination* was being played on college campus'. The game involved players taking on the role of undercover assassins who could use toy weapons and their imagination to kill other players. It could be played at any time and any place, and as such mixed the real-world and fiction. These new games influenced their

technologically-mediated successors: they were as much about making the real-world part of a game, as playing games in the real-world.

As described the magic circle can be applied to computer games, and pervasive games can consciously exploit the ambiguity of the edge of the magic circle – blurring the boundaries between the real world and those of the computer game world. More "traditional" computer games are played in certain spaces at certain times by certain players, whereas pervasive games challenged this notion expanding games into the real world both *spatially*, *socially* and *temporally* (Montola, 2005).

Spatial expansion: In pervasive games the magic circle of play is no longer limited to playing behind a desktop screen. Instead, the real world can become the gaming board in such a way that the physical attributes of the real world become wrapped up and tied to the game world. For example, in the game Savanah (Benford, Rowland, et al., 2005) the school playing field becomes the hunting ground for a pride of lions as children work together to survive in the wilderness.

Social expansion: Pervasive games like the game *Killer* can expand into the real world, such that people who were not originally playing the game become wrapped up in the play themselves. Montola (2005) describes how social expansion can be handled in different ways e.g. gameplay can be indifferent to interaction with the audience, or in the other extreme, gameplay can be created with a spectator interface in mind. In the latter, it is even possible that players on this borderline might not realize that they are participating a game, something that problematizes Huizinga's notion of voluntary play. Social expansion is provocative, and games might seek to expand socially, since it might encourage emergent play. However, social expansion might be avoided in order to create games that respect the magic circle and keep this space sacred.

Temporal expansion: Pervasive games can be played across days, weeks and even months. For example, in the multiplayer-game *Feeding Yoshi*, players have to find virtual creatures or *Yoshis* and accompanying seeds which can be sown at plantations around the players' own cities to feed the Yoshi (Bell et al., 2006). In the study by the authors – universities were pitched against each other and winning teams were those who were dedicated to the gameplay. This temporal expansion benefited players who had more opportunity to play e.g.

those with jobs that allowed them to move around a little more freely. In this way, the temporarily expanded game made demands on the players own time, resulting in a tension between gameplay and the players own lives.

There are many ways that pervasive games can expand the magic circle of play and this is one reason that Montola et al. (2009) argues that pervasive games might be tackled from a perspective of *paidia* in order to provide the flexibility to react to situations in the real world. For example, in gameful games like chess, rules are explicit and unnegotiable, whereas games like *Killer* have a few formalised rules but also require rules to be made and negotiated by players, which become a product of the social and physical mobile contexts.

Benford et al. (2013) describes a series of games created with the touring art group Blast Theory. These games began with the exploration of collaborative virtual environments in the game *Desert Rain,* which used behind the scenes management to structure and ensure delivery of the pieces fitted with the narrative. These touring art games enabled the authors to explore more performance-led approaches where artists will draw upon their own practices to curate their works of art. Importantly, the artists' configurations and hands-on approach, enable these games to have rich adaptability to changes in the real world and accommodate player initiative. Furthermore, these approaches allow these games to be mapped to different spaces e.g. from interweaving geographical barriers such as the border between a fence and a road in *CYSMN?* (Benford et al., 2006) to utilising an open playing field where children imagine hunting as a pride of lions in the game *Savannah* (Benford, Rowland, et al., 2005). In contrast, Reid (2008) manages to avoid this level of hands-on management, in *designing for coincidence*. As such, the author must pre-empt all possibilities of what might happen in the space across different coincidences which include: natural coincidence e.g. what happens if it rains; social coincidence e.g. meeting someone real that fits with the game world; and feigned coincidence, where something is introduced intentionally into the real world. This approach is fascinating as eventualities must be carefully thought out, and as such requires a detailed understanding of the nuances of the space that is rarely evident in pervasive game design.

In writing about the contexts in this thesis, the writing draws upon Harrison & Dourish (1996) who provide a language for researchers to explore our experiences with space, in their research in computer-supported cooperative work (CSCW). They describe how the terms [space and place] differ from one another where *"space is the opportunity; place is the*

(understood) reality.". In exploring real world places, people can develop a "sense of place" – a term used to describe someone's personal understanding of the surroundings; notions that are explored in Lentini & Decortis (2010) who define the human experience of space and place as a complex phenomenon which includes geographical, sensorial, social and interpersonal dimensions. These authors, describe how modern technologies have disembodied our exploration of the real-world spaces and suggests playful designs can be used to address these problems. They highlight the value of physical play through its ability to allow young people to practice their abilities in the physical world. A particular compelling part of this work, is how children are encouraged to use a camera to closely examine the colour, texture and feel of the space which they are able to share with other young people. Importantly, these pervasive experiences mediate exploration of the outdoor environment through more self-directed play to re-place [space].

2.3 Pervasive Games on Mobile Phones

Mobile phones are the most widespread pervasive digital platform and designing for these devices is important because of their prominence in young people's lives as a way of accessing data (Murphy, 2016). As hardware, they are ideal for pervasive gaming because they have powerful sensors which offer contextual awareness of what the player is doing, as well as connectivity allowing them access real world information, and connect to other mobile devices. However, pervasive games on mobile phones have received criticism. For example, the authors (Reid, 2008; Soute, Kaptein and Markopoulos, 2009; Conor Linehan, Bull and Kirman, 2013) have commented that many pervasive games are location aware applications that have not drawn upon the unique aspects of the space. Where games have managed to exploit the social and physical affordances of different spaces, such as airport security in *Blowtooth* (Kirman, Linehan and Lawson, 2012) and the expected quiet space of a library in *Bollocks!* (Conor Linehan, Bull and Kirman, 2013), this has led to unique gaming experiences. These two games are examples are particularly interesting because they encourage more spontaneous forms of play in environments that do not lend themselves to "fun" behaviour. However, it is worth noting that mobile games have been critiqued because they encourage screen fixation where users are reliant on the screens. This has been highlighted as a problem in the development of pervasive games (Soute, Markopoulos and Magielse, 2010) and in the exploration of cultural heritage (Coenen, Mostmans and Naessens, 2013) where it is more important to direct people's attention to the space.

Pervasive games for young people have also been focused on bringing games back to the classroom, for example, *REXplorer* (Ballagas et al., 2007) is a pervasive spell-casting game. *REXplorer* was designed for tourists and to make learning history fun in Regensburg, Germany. The game used rented mobile devices since the gesture recognition and location detection, at the time, could only be done with specialist hardware. In contrast, *MuseUs* (Coenen, Mostmans and Naessens, 2013) was designed so that players can walk around a museum without loan equipment, as they create a "personal exposition" of collected artworks on their own mobile device. *MuseUs* is also interesting because it provides more open play i.e. users can choose their own route around the museum as they make their own digital representation of the exhibition. In moving away from the screen altogether, *Explore!* (Ardito et al., 2012) was designed to enrich archaeological parks through the use of contextual sounds and mobile technology. This experience uses a mobile device and tackles the important issue of "screen fixation" through the use of spoken audio which guides the users around the park.

Viking Ghost Hunt (VGH) (Carrigy et al., 2010) is a location-aware mobile phone game, based on a Gothic ghost story set in Viking Dublin. The authors describe how it was necessary to preserve the magic circle of play since the player was encouraged to make-believe that they are a paranormal investigator which must persist at all times in the game. This game is one of few examples that uses imaginative play and the game attempts to keep the players engrossed in the experience in different locations in the city. It is in this roleplay that the authors have spent considerable effort in achieving "realism", and mobile phones are given to players dressed as a radar and frequency scanner for ghosts.

2.4 What are the alternatives

Head Up Games (HUGSs) by Soute, Markopoulos, et al. (2009) provides some key insights for this thesis work. The authors describe the problems with existing mobile games design and the opportunities for alternatives which can *"liberate players from attending screen* based interactions". Meaningfully, HUGs are inspired by childhood and traditional play - which supports the benefits of outdoor play and the authors describe that their design focus was on social and physical play, fun, and flexible and adaptable rules. HUGs are illustrated by the authors with some of the compelling rules created by children e.g. ''once you are caught you are out'' / ''once caught you can be set free by a team mate''. These rules are inspiring because they show how elements of their designs allow player to adapt the rules beyond what has been formalised in the system and these rules are clearly varied enough to even change

direction. Soute, Markopoulos, et al. (2009) open the way to creating new experiences with location, explaining that network infrastructure at this time was restrictive both in playing area, coverage and bulkiness. It now possible to tackle the infrastructure without the problem of bulky hardware, for example, small Low Energy Bluetooth devices can be installed anywhere (think inside walls or the top of shelves in public buildings) and detected from phones. This also allows games to employ seamful design (Chalmers et al., 2005) where issues of coverage might be seen as a "resource". For example, network devices might be positioned so that players can move out of the range of signal coverage – this might be used to allow players to hide from the game. Lastly, these authors suggest that future games might explore richer sensory experiences, fantasy elements, and employ reward structures. HUGs occupy are interesting because they occupy a novel space in pervasive game design, in that they use co-located play with rich face-to-face interaction. Such rich co-located play can be also seen in other digital play that has drawn from more traditional games and play.

The New Games Movement was setup to encourage people to enjoy playing games together in the US in the 60s and 70s. This movement emerged against the backdrop of civil unrest and the Vietnam war with the idea that it could encourage people to play non-competitive and friendly games together. These games are interesting because they have also been inspired by the traditional games and play but pushed to *remediate* new forms of these games. One of the influential advocates of the New Games Movement is Bernie DeKoven - a 'FUNcoach' who has written on the experience of playing. The Well-Played Game (De Koven, 2013) is the definitive text for looking at how people might play better together. It has an almost single-minded approach toward play, where it is rightly placed in front of all other pursuits and activities. From the perspective of a games designer, this book explains why we should be privileging play in our designs. Meaningfully, De Koven (2013) provides new ways to think about how we play together (with the associations of playfulness and more self-expression) to games (with their formalized rule systems) – explaining what should be important in games. De Koven (2013) helps the reader find their own understanding of the *well-played game*, something that is almost ineffable, but as De Koven (2013) describes, *"once we find the game that we can play well together, we'll all know what it is"*. As such this book encourages fun over competition (though they are not mutually exclusive), and discusses the limits of player behaviour and games, for example, going as far as asking what makes a well-timed cheat.

Indie games (or independent video games) challenge the way we think about game design, and particularly around play and 'playfulness'. There are exemplar indie games that show how game designs can work in public spaces in replacement of more locative pervasive games. These are perhaps viewable as more *procedural pervasive games*, albeit ones that leave space for play. For example, B.U.T.T.O.N (Wilson, 2011) is a multi-player console game where co-located players compete with each other following a series of onscreen commands. These commands can be prompts such as "do five pushups", "turn around", or "close your eyes". These commands are intended to occupy players before commands are given which will remove one of the players, or find the winner of the game e.g. "Last player whose button is pressed loses". B.U.T.T.O.N was designed to create engaging situated play in the "living room", and one reason for its compelling play is that players look for new ways to interpret the instructions - dealing with the ambiguity of what is, and is not allowed. Wilson (2011) unpacks these new folk styled games, writing how these hybrid analog-digital game forms should deserve our attention. He argues that making intentionally "broken" or otherwise incomplete games will enable distinctly self-motivated play and often result in new collaborative forms of play. For the work in this thesis, the absence of formalized rules is certainly interesting - because the game does not understand the context, it must only respond to when a button is pressed, or otherwise, as he explains, *"even if the rules were clear, the game wouldn't be able to enforce them"*. However, the game B.U.T.T.O.N might not make sense in a more pervasive context and it does not need a public space to be fun. Significantly, Wilson (2012) describes two card games – the *Collectable Business Card Game (CBCG)* and *Fuck You Its Art (FYIA)* which have provided hints into creating more minimalist games. Both these games are analogue and card games, but *FYIA* is perhaps more intriguing with view to the minimalist game design that might suit the characteristics of play this thesis is interested in. The game encourages players to "flim-flam" about whether certain hypothetical games depicted on a playing card can be considered "Art". (Wilson, 2012) describes how *FYIA* can be understood as a convenient "alibi" for making silly and creative performances, and it appears the game is dependent on the social context. Importantly, Wilson (2012) uses the term "simplistic game system" to describe the simplicity of the game, which is used throughout to describe the new "simple" digital games.

Wilson (2011) concludes that the essence of these games is framing them the right way - since a comparable set of commands followed individually may not be fun to play, but might be enjoyed as part of a bigger playful experience. In this way, he talks about the game design

being more about the mood and setting and instilling the players the appropriate "spirit" (elsewhere in this work, this "spirit" is referred to as a lusory attitude).

2.5 The Importance of Ambiguity

Ambiguity can be a useful resource in digital design and its use in games can be linked with more open and emergent play (like that seen in B.U.T.T.O.N). In the paper, 'Ambiguity as a resource for design', Gaver et al. (2003) describes three types of ambiguity that can be used in design. These are ambiguity of information, ambiguity of context and the ambiguity of relationship.

Ambiguity of information requires us to make our own interpretation of incomplete information (Ibid.). For example, Salen and Zimmerman (2003) describe the value of ambiguity in the engaging social drama that is present in the party game *Mafia*, where the engagement results from the ambiguity and uncertainty around who is playing which role, as players attempt to identify the killer: we do not have enough information from the outset to know which person has the role of the killer.

Ambiguity of context requires us to interpret seemingly incompatible frames of reference Gaver et al. (2003). The authors of the paper give the example of Duchamp's Fountain – an artwork where an *objet trouve* (or the "found object") of a urinal is repositioned *in-contextually*, to provoke reflection from people viewing the piece.

Ambiguity of relationship asks us to project our own personal experiences and points of view onto new situations Gaver et al. (2003). For example, the previous discussed game design *Blowtooth* (Kirman, Linehan and Lawson, 2012) asks us to reconsider our relationship with the security at airports. After playing *Blowtooth*, its participants did not necessarily think of airport security as something imposing and hostile, but rather as opportunity for fun.

2.6 Designing for Improvisation

The prior work in this section has described different characteristics of play that are appropriate and how pervasive games might be tackled – both with a more *paidic* point of view and through creating procedural pervasive games that benefit from co-located play and rich face-to-face interaction. In thinking about designing with these characteristics such as more *open, spontaneous,* and *improvised* styles of play, it is possible to imagine how the

resulting game design and gameplay will be markedly different. In these games the onus of play will be placed more firmly on the player, and the rules of the game might expand beyond those that have been formalised in the game logic. From the perspective of a game designer, games that result in improvised play are exciting, since they will likely include emergent play from the start. However, improvisation has been little used in gaming, instead being something normally associated with music and artistic performance. For example, (Hook, 2013) describes the importance of improvisation, in the spontaneous variation across live performances which included VJing (the work of visual jockeys – as opposed to DJs) . In his writing, he explains how improvisation places an emphasis on the creative process and can therefore, introduce creativity as a primary element of the audience's experience, where it was once absent, and quoting (Sawyer, 2000), describes how a performer enters into a dialogue with elements of the environment (e.g. other performers or their materials) in order to bring about the resulting performance. This explanation is tantilising for a game designer as the analogous player, can become the performer in this relationship, and draw upon the elements from the game location themselves. This form of improvisation is present in live-action role-playing games, although it is part attributed to the games-master. These games-masters can react to player improvisations, intervene in problems caused by the real world and create the illusion of an unlimited game world. A successful games master can create richer and more coherent experiences through the game narrative. They can adjust gameplay, changing pace, solving conflicts, negotiating and merging playing styles and discourage unwanted behavior (Jonsson and Waern, 2008).

There are also insights to be gained by looking outside pervasive games at more technological-mediated designs for play and playfulness. HCI has a rich history of digital designs that have explore playful interaction in their interfaces. These designs have an association with the third wave of computing, where there has been an intention to challenge the assumptions that were made originally to design more efficient tools. As such these designs are intended to appeal to Homo Ludens (Gaver, 2002) and afford play through the application of conceptual design resources, such as ambiguity (Gaver, Beaver and Benford, 2003).

The Talking Memory Box is a playful artifact that allows young people to attach stories to objects. The design was based on a cultural computing artefact called the *Family Hedge* (Marshall et al., 2013) that bridged different generations in a household where a family lived

together under one roof. In the most recent realisation, the interaction design was simplified to the extreme with a view to facilitating more playful interactions. The result was a design that had a conceptually simplistic interface and that could be quickly mastered by the young people playing with the device. *The Talking Memory Box* used "playing cards" which presented simple atomic actions. This meant one playing card would perform on action, so that it might be viewed as playful prompt. For example, the record card could be placed on the box to capture the audio, the play card would just play it back, while the joker card would affect the recorded sound during playback giving the young people using the device the ability to change the pitch of their voice. As such this design was inherently playful. Even though the device had basic rules – cards can be placed on the surface and they have one of these functions e.g. play / record / stop, the number of different possible operations and uses for the device are seemingly endless. *The Talking Memory Box* (see Figure 2) illustrates how single atomic actions could result in complex and layered interactions – the design philosophy being to *keep it simple*.

Figure 2. Card-based interaction on the Talking Memory Box

2.7 Design Frameworks for Pervasive Play

There are a number of publications that have argued for new design frameworks to support the design of pervasive play e.g. (Kort & Ijsselsteijn 2008;Tutzschke & Zukunft 2009). This call for design frameworks was reiterated by the recent workshop at CHI 2016 (Ahn et al., 2016) which brought researchers and academics together to explore pervasive play, the challenges and the opportunities for research. The CHI 2016 call was important; research in pervasive play is difficult - design is challenging from both methodological and a technological point of view. For example, Wetzel et al. (2016) describes how there is an imbalanced playing field as different stakeholders will have different skills, for example, there are technological experts who understand sensors, games designers who will have the skills to make game mechanics, and content designers and location experts who know the domain. In order to tackle these problems Wetzel et al. (2016) proposed the *Mixed Reality Game Cards* - a deck of 93 ideation cards that includes opportunity cards, question cards and challenge cards. These design cards have been successful; The Mixed Reality Game Cards helped conceive the original idea for the game *Taphobos* in a 2-day hackathon at the University of Nottingham during the Performance and Games Workshop in 2014. *Taphobos* was created with its design team playing with a large cardboard box during design. This design process was playful and the current prototype sees players escape from a claustrophobic real life coffin in this novel game (Brown, 2015).

Design cards like PLEX (Lucero and Arrasvuori, 2013) and the Mixed Reality Game Cards Wetzel et al. (2016) encourage playful design thinking. The PLEX framework (Lucero et al., 2014) emphasises the role of playfulness with a view to creating and examining digital technologies which are more pleasurable to use. PLEX extended an earlier theoretical work that looked at three different interactive artworks in order to draw out pleasurable categories that designers should consider. PLEX presents a pack of 22 design cards that include such experiences as competition, challenge and even eroticism. PLEX cards present largely positive notions of play (notable exceptions subversion, suffering and cruelty). However, the authors suggest there is also room for more negative ones to join those, such as shame and tragedy that might provide interesting provocations for imaginative and creative play – where the play here is the “spontaneous enjoyment arising from an action” (Lucero and Arrasvuori, 2013). In addition, their characteristics of play were extended through an analysis of play engendered by console-styled video games, which complement the characteristics from the more paidic end of the continuum.

Comparably, there is also The Deck of Lenses (Schell, 2013) which uses illustrated cards to describe 113 unique "card lens" which include "The Toy", "The Player", "Problem Solving", to name but a few. This tool can even be downloaded as an app which contributes to this being both a charming and useful tool for game design. In contrast to Wetzel et al.'s (2016) *Mixed Reality Game Cards*, these lens are best positioned to help further develop or critique a pre-existing idea, rather than be used for ideation.

The use of design cards in making games is distinct from design patterns and guidelines in that they all foster playful and collaborative design activities. Importantly, these difficult card-based approaches illustrate the value of involving the stakeholders at all stages where everyone has an equal opportunity to contribute to the game design. These frameworks also show the power of designing around different characteristics and phenomena, and significantly these can be used alongside more technical frameworks in pervasive play.

Frameworks for pervasive play can also help game designers and interaction designers overcome technical difficulties which include dealing with the different capabilities of mobile platforms and the need to handle network connectivity in the real world. These challengers can mean that the time-to-market is long and the cost of exploration is high (Tutzschke and Zukunft, 2009). This is part of the reason that pervasive games have often been created with bespoke technologies and architectures for predefined contexts and gameplay e.g. *Human Pac Man* (Cheok et al., 2004). In other examples, researchers have explored how to make reusable design frameworks e.g. *FRAP* (Tutzschke and Zukunft, 2009) and MAR (Mobile Augmented Reality) (Kuikkaniemi et al., 2006). These platforms were primarily designed for context-aware experiences – where the design framework supports location tracking combined with interesting game logic and gameplay which responds to the players' location. For this reason, *FRAP* is illustrated through the metaphor of capture the flag where different digital playing zones are mapped onto the physical world. *MAR* is illustrated through the classic board game *Scotland Yard* demonstrating its ability to use both 2D-tag and GPS in interesting gameplay.

Contrastingly, the *Player Space Director (PSD)* (Hwang et al., 2012) provides a mobile platform for building pervasive games. The authors argue how games need to leverage contextual interactions from the real world, for example, its games can interpret whether someone is walking, running or even making a punching gesture, and bio-signals add exciting

game inputs. In order to achieve this, *PSD* requires external sensors such as wearable and on-body sensors, space-embedded sensors and smart devices. The *PSD* software makes sense of the different data streams through its available algorithms e.g. machine learning and gesture recognition and makes these accessible to the game designer. *PSD* was illustrated through several games: *ULifeAvatar* is a life style pervasive game that presents an ever-changing avatar of the player based on real word data. In contrast, players of *U-Theater* can interact with a big screen through jumping, reaching out and waving etc., and *Swan Boat* provides an exciting experience for runners on an otherwise tedious treadmill. *PSD* is comprehensive but is not specifically oriented toward any game style – which is part of its appeal.

There are also design frameworks which have direct relevance to the mobile technology carried by young people. For example, Benford, Schnadelbach, et al.'s (2005), "expected, sensed, and desired" framework can be used for designing sensing-based interaction. This framework encourages designers to compare *expected physical movements with those that can be sensed by a computer system and those that are desired by a particular application*. This framework is useful when designing for mobile devices since it helps designers find new functionality and get the most utility from our existing devices. This framework has also been applied to movement based games, in the design of *Oriboo*, a movement-based game platform for children (Segura, 2016). In this work, Segura describes a dance game where certain movements cannot be *sensed* accurately by the machine with the current state of the art sensors. However, the author describes how the "expected, sensed, and desired" framework opens up new possibilities for judging the gameplay in novel ways, for example, interaction designers might *examine qualities of the desired movements, rather than looking solely at a categorization of the movement,* while also opening up the possibility for the players themselves to step in and become part of the game logic by judging the play themselves.

2.8 Summary

This related work chapter has reviewed theories of games and play and how these have motivated design efforts in pervasive games. Where pervasive games have been created with play in mind, they have clearly benefited by forefronting physical play and social play which can foster rich face-to-face interactions between players e.g. Soute, Markopoulos and Magielse (2009). Importantly, pervasive games can be designed with the *paidic* stance suggested by Montola (2005) who argues that the more playful end of the continuum might allow players more freedom for expression. Moreover, games can be designed to support play

more explicitly (Kirman, 2010) and also specific characteristics of play, like the more improvised, open and spontaneous forms of play that are important for the development of young people (Verenikina & Harris 2003). These particular characteristics are underexplored in game design, and yet may encourage emergent play, and allow designers to draw upon more traditional forms of play for inspiration such as the games seen in Soute, Markopoulos, et al. (2009).

Designing with a more *paidic* mindset and more improvised forms of play will likely help use the underused affordances and unique characteristics of the context suggested by Reid (2008), as well as better hook into the "infinite affordances" present from gaming in the real world (McGonigal, 2011). However, the touring art games that mix players on a city street with online players e.g. CYSMN (Benford et al., 2006) demonstrate the value of carefully configuring and managing games which helps them adapt to real world changes and events. This presents a challenge in game design of how to create appropriate content that can played by the young people without real time curation by the designers. However, rather than expand the magic circle across those dimensions described by Montola (2005), there is room for procedural pervasive games which can be played in public spaces (albeit ones that carefully structure the game so as to afford play within) .

(Goddard, Garner and Jensen, 2016) describe how co-located games can create portable magic circles which can facilitate social play and benefit from providing a space for play. This co-located play can be found in the compelling Head-Up Games (Soute, Markopoulos and Magielse, 2010) which draws upon more traditional games and play that might be familiar from our childhood. HUGs might be compared to other exemplar mobile games like *Bounden,* and *J.S. Joust* (Wilson, 2012) which have compelling and engaging play that can be enjoyed in outdoor spaces by players. However, games are irreducible and complex systems (Goddard, Garner and Jensen, 2016) and these last two remain standalone exemplars of creativity and inspired game design.

Instead, design efforts might be inspired by those simplistic games systems described in the games *CBCG* and *FYIA* (Wilson, 2011). These are typical of card-based systems that draw upon simple game mechanics that allow players to lead the play and benefit from play that is synonymous with the more paidic end of Caillois' continuum. Therefore, we might look to create co-located play around this paradigm of simplistic games systems in order to create

flexible game designs that can draw upon places, relationships, and technologies and use these as platforms for gameplay. In applying the work on play we can further see how there are opportunities in particular configurations of players that will support co-located play both in structuring where the play happens and how players interact with one another.

Importantly, the prior work calls for the development of design frameworks which can be created for this particular design space. In applying research through design to this work, it is important to provide a conceptual underpinning, a repeatable step-by-step process to design, guidelines that will help ensure that the work is relevant, and tools must be extensible, in that they will allow game designers to build on these simplistic game systems and ready-made game patterns.

3 Department of Hidden Stories

"Polar bears are like the shizzle.", Harry, aged 10.

This chapter describes the first case study - the Department of Hidden Stories (*DoHS*). This case study provided an opportunity to work in the *unplayful* space of a community library. The research in this study was supported by creative writers, interaction designers and teachers from a local school who acted as the gatekeepers to a class of 8 to 10-year-old children. The work resulted in the design of a mobile phone game (see Figure 3) that encouraged children to explore the library space and write their own fictional stories based upon the content of books they found. The game achieved this by using digital playing cards which prompted children to capture their stories on a mobile phone and tag them onto books. By scanning a book's barcode children visiting the library were also able to access stories that were created earlier by others. In doing so the mobile game supported children in new exploration and browsing activities in libraries and provided innovative ways of linking physical books with child-generated digital content.

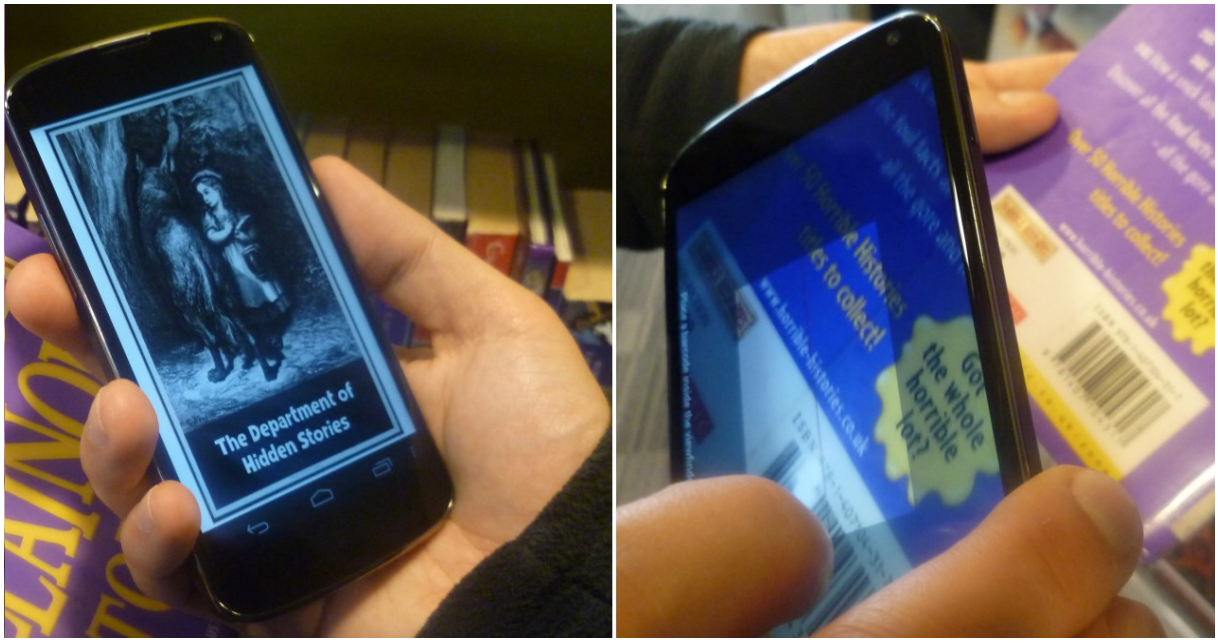

Figure 3. The Department of Hidden Stories Mobile Phone Game

Libraries have previously been criticized as not particularly engaging spaces for young children to visit and explore books, and it is perhaps not a surprise that there has been a decline in children reading for enjoyment (Eriksson, 2007). Where digital technologies could

provide an interesting hook for children in libraries, it is apparent there is a clear disconnection between the provision of ICT and the core resource of books. The use of digital technologies in relation to books is limited to search systems, providing links to book review sites and self-service loan services that have limited potential in terms of engaging children. Nevertheless, libraries are still considered important places for children and the significance of the library as a lifelong learning resource for children is emphasised in the UK through regular school organised library visits between the ages of 5–12.

In response, *DoHS* shows how technologically-mediated play can facilitate children's engagement with the space of the local library and its books. This case study takes a pragmatic focus on the potential benefits such systems may have on learning, instead arguing that books can be enjoyed as part of *"play for play's sake"* (Rodriguez, 2006), where there is value in simply engaging children with libraries and books. This approach is appropriate, since playfulness is a core attribute to learning storytelling (Cassell and Ryokai, 2001; Åkerman and Puikkonen, 2011) and learning how to tell stories is fundamental to the development of a child's literacy (Göttel, 2011).

This chapter describes the iterative design process that lead to the creation of *DoHS* through three key stages:

(1) collaborative design workshops between the researcher and supporting colleagues, the teachers and creative writers, resulting in a set of simple card-based playful activities and associated rules for children engaging with books in libraries.

(2) the piloting of two card-based games with a group of twenty children aged between 8 to 10 years.

(3) the deployment and evaluation of the digital *DoHS* game that incorporated insights from these two research activities.

This work has been used to contribute a series of insights on how mobile games can support playful interactions – with an emphasis on pushing characteristics of play highlighted in the related work section – play that is more *open, spontaneous, and improvised*. The evaluation of

the game also shows how a more minimal structure for mobile apps can still achieve serious aims, such as getting children to interact with real books.

3.1 Background: Benjamin Road Library

The context for the mobile phone game was centred on Benjamin Road Library, a state-funded public library located in the inner-city suburbs of Gateshead in the north of England. The library has a large number of fiction and non-fiction books, DVDs, adult-reading comics, music on CDs, as well as a smaller selection of children's books catering for ages from 3 upwards. Benjamin Road is located in one of the city's poorest and ethnically diverse conurbations and provides access to a number of core services for local residents. One half of the building is dedicated to services provided by the local social housing provider. The tenants who were coming to the library for housing related services would arrive at the entrance to the library, take a ticket from an electronic dispenser, and wait in a large seating area until their number is called out. It is not uncommon for large families to arrive together and wait until it is their time to go to the counter. The bustling noise of people talking to one another and the occasional calling out of "*can number 123 please come to counter 3"* stands in stark contrast with public conceptions of the quiet library space. ICT provision has become important to public libraries over the last decades and this is also true for Benjamin Road. It has 20 PCs which can be booked an hour at a time by members of the public. In the researcher's visits to the library these machines were observed in intensive use. Library staff would also run courses each day using these machines, such as curriculum vitae sessions for the unemployed, or lessons on how to use word processing software for the first time. The library has recently installed a self-service loan kiosk, albeit used rarely, with many preferring to visit the manned desk. The city's libraries had also just released an iPhone, iPad or iPod Touch app[2] that allowed people to search and request bookings for books and other services.

The initial insights for this case study were formed from a series of visits to Benjamin Road and other community libraries: Newcastle City Library and Central Library, Middlesbrough. In addition, the author observed and participated in creative writing sessions organised by schools and libraries for children and a further workshop on drawing cartoons with Dean Wilkinson (a writer for TV, radio, console games and stage), organised as part of the Middlesbrough literature festival. However, even though these explorations introduced the

[2] Newcastle Libraries, By SOLUS UK Ltd, https://itunes.apple.com/gb/app/newcastle-libraries/id589003285

author to very different library spaces and activities, it was clear that the technology available in most libraries was limited to the use of the bookable desktop PCs. Typically, these would be used for a range of activities by library users, from general web browsing and searching for new jobs, to basic word processing. What was notable being the large number of young people (mostly teenagers) observed across libraries using these public computers to access social media (e.g. Facebook) and play free games online (e.g. MiniClip[3] which provides free online games, and ebaumsworld[4] which features funny videos and pictures). Those young people visiting the library to use the PCs would rarely visit the book section. Indeed, for the most part it appeared that computers were not used to directly engage with books at all. It was clear that in the specific context of Benjamin Road there was a distinct disconnect between the role that technology played and the children's section—the computers used adult seating, they default to book services such as in-house library book search and were situated away from the children's library.

It became apparent in these initial visits, that while play and gaming seemed to be valued in terms of the use of ICT in the library, visiting school children would neglect play as a means of exploring the space of the library. The meetings with library staff and school staff highlighted how visits to the library would be orientated around finding information from books that relates to specific elements of the national curriculum. Therefore, at an early stage in the engagement with Benjamin Road it was apparent that play would have an important role in these visits and their associated activities to provide new ways for school children to interact with books, seek information and engage with the library.

3.2 Play and Storytelling

The related work in Chapter 2 describes characteristics of play that this thesis argues will be appropriate for young people, and accordingly, the context of the library is apt for more open, imaginative and more expressive styles of play. These characteristics of play are important in creative writing and valued as core components of telling stories (Cassell and Ryokai, 2001), with storytelling itself being seen as an inherently playful activity (Garzotto and Forfori, 2006; Åkerman and Puikkonen, 2011). In addition, the activity of telling stories through play

[3] Miniclip, http://www.miniclip.com/games/en/

[4] http://www.ebaumsworld.com/

can attract young people who lack confidence in their reading and writing and can help engage the imagination in children (Göttel, 2011).

To date, a number of systems have explored the design of engaging interfaces to encourage children to form stories and narratives in novel ways. In *Picture This!* (Vaucelle and Ishii, 2008) augmented toys are used to support children as they direct their own film narrative, Likewise, StoryMat (Cassell and Ryokai, 2001) allows a child to move freely around an embroidered blanket as they record and recall oral narratives with physical tangibles. Pogo (Decortis and Rizzo, 2002) and StoryRoom (Montemayor et al., 2004) are aimed at young children (5-6 and 6-8). These systems encourage children to play with tangible objects providing audio and visual cues as to how they should be used. Finally, there are examples of in-situ digital storytelling systems, such as Mobile Stories (Guetmi et al., 2015) and TellTable (Cao et al., 2010) where children explore the immediate environment as part of the creative process. Nevertheless, while TellTable was deployed in a children's library, this space was chosen as appropriate for children targeted by the deployment given it was a lively place, full of toys (Cao et al., 2010). TellTable as such did not emphasise the child's use of the library or engagement with books.

During the *Interactive Children's Library Projec*t Eriksson (2007) explored similar challenges to those faced at Benjamin Road, in looking to exploit the existing physical materials in new engaging ways, and using . In the design of bibPhone (Lykke-olesen and Nielsen, 2007) created a bespoke artefact to allow spoken stories to be added as a new digital layer in the children's library and that children enjoyed listening to what others had recorded on the books. However, they concede that children were reluctant to make their own recordings. In contrast, StorySurfer (Lykke-olesen and Nielsen, 2007) encouraged children aged 7 and 8 to search for books by using physical play with tangible blocks in an installation that made the children think about the books they wanted to find. In contrast to bibPhone the emphasis of this study was on play within a bespoke installation which was left in the library to be used.

This prior work reveals that digital technology can provide opportunities to facilitate creative play within the physical space of the library, as well as supporting children in searching the specific resources that a library holds. *DoHS* extends this work by creating a structured

activity around writing and browsing stories, where they can use actual books in the library to feed their stories, while leaving them enough space to imagine.

3.3 Design Process

An initial exploratory workshop was used at Benjamin Road to begin exploring the potential of linking play and storytelling together in a library-based game. The participants were the author, two computer scientists, a creative play practitioner, an interaction designer, creative writers, an English teacher, a children's book author, and a member of library staff. The primary aim of the workshop was to develop a common understanding across the team about the potential for using games that might engage children in reading and writing. To this end, the work in this space began with the involvement of a creative play practitioner who helped create a structured card-based exercise that would challenge the notion of what a game could be, and initiate wider thinking about play. The workshop participants moved onto different tables and were presented with playing cards which were dealt randomly to tables. These playing cards posed questions that then engendered conversation around the subject of games, play and even the dichotomy they can represent. The cards included:

- How do we create games that do not have one right answer?
- List 5 player experience goals.
- List 5 games and in one sentence per game describe the object of each game.
- List ten games you played as a child: briefly describe what was compelling about each of those games.
- Write down what you don't like about a game you have played: what did the designer miss out on?
- Name 3 games you find particularly challenging and describe why.

A further set of playing cards were used to provoke more open-ended discussion. These were:

- Advocate for the player.
- Games are puzzles.
- Define a puzzle.
- Resources.

These card-based exercises moved the design team away from possible preconceptions about games, such as games being about contest and competition (Salen and Zimmerman, 2003), something maybe more synonymous with "traditional" computer games. Subsequently, the design team discussed more creative endeavors that can be accomplished in games if the emphasis is on making. One example was the reconstruction of Heron Corn Mill, created through acts of community building in *Minecraft* (*Adam Clarke of commonpeople.tv was one of the creative play practitioners in attendance*).

In the afternoon of the workshop the team split working in three small groups and used 'experience prototyping' (Buchenau and Suri, 2000) to act out some basic games in the library. Each group used blank playing cards to make basic prompts that initiated playful interactions with the library's book collection. The blank coloured cards were likened to *Community Chest* and *Chance* decks of cards from the board game Monopoly, described (Orbanes 2006). This led to interesting conversations about Monopoly; participants commented that it was a broken game – not particularly reliant on skill and more about the luck of the dice throw on the first time around the board. Several participants mentioned how it was no fun to play when one player was monopolizing the board. For the author, the playing cards from Monopoly were especially interesting; they could change the fortune of the game quickly and were associated with genuine apprehension e.g. the anxiety of being given a Community Chest - *You are assessed for street repairs […] card*, rather than the welcome - *You have won a crossword competition, Chance card*. After prototyping and iterating some playful prompts, the groups reconvened to share ideas. Through further discussion and iteration, three approaches for the content of the game prompts were selected to take forward:

Finding books with specific qualities. A common approach was prompting players to find a book using simple criteria, such as retrieving a book that used a specific colour. This encouraged exploration of the library through a form of "treasure hunt". The envisioned use here was that child players would be encouraged to seek and touch books, even if this was just reading the cover, flicking through the pages, or reading the *back blurb* on the rear of the book.

Playing cards with characters, objects and places. A popular approach was also for games to start by dealing a random character which was illustrated on the playing card. This character

would take the role of the protagonist in the story. After this, a further set of playing cards described an assortment of objects e.g. sword, ship in a bottle, horn, and flat. A second set contained places e.g. an island, mountain or castle. These playing cards borrowed from the board game Cluedo (think about a weapon and then a location in the house i.e. dining room). The purpose of these cards would be to provide the starting elements of a story, where books would be used to situate the characters, objects and places.

Stories with fortunate and unfortunate events. One group added another set of playing cards that introduced unfortunate or fortunate events to the story. The cards themselves did not describe what the fortunate or unfortunate event was, since these were just prompts —instead, it was down to the player to find a book to inspire their own story about this change in fortune. For example, a player might start by describing a farmer living by a river. The player could be then given an 'unfortunate event' card. From browsing the library, the child could find a book that would support this unfortunate event. A book on volcanoes would inspire them to write how a terrible fire engulfs the farmer's land. Next, they might be dealt a 'fortunate event' card and inspired by a book on firefighting to write how their character uses the water from the river to fight the fire, and so forth. It was considered that these prompts would inspire the child players to collect multiple books in developing a story, winding through a series of changing fortunes. In doing so, the actions might challenge the players to solve a series of impromptu problems for a character through creative writing.

3.4 Card-based Playful Storytelling Games

Following this exploratory workshop, the design processes involved integrating the identified prompts into an initial card-based playful storytelling game. This game was to be piloted with groups of children aged 8 to 10 years on an upcoming school visit to Benjamin Road Library.

Reflecting upon the participants own experiences of enjoyment playing these games, it was decided that the pilot should include a short initial activity that would act as a 'warm up' to familiarise the children with the library and the facilitators before beginning the main activity. This game reflected the *finding books with specific qualities* rule, asking children to randomly choose a card from a pack of *object playing cards*. The game then prompted them to find a related book. The children were told that there was no right and wrong answer, but they would be asked to explain their choice to the other children on their table. This initial exercise would last for 10 to 20 minutes before the children played the main game.

The second game introduced the children to the idea of writing new stories based on inspiration from books. Building on the games developed at the initial workshop, this game comprised of a set of *character cards* and a set of *fortunately and unfortunately cards*. Characters included a doctor, pilot, captain and animals such as a polar bear, which were illustrated on the front of each card.

Having a protagonist character was deemed to be particularly important since it can be the persona through which a player exerts themselves into the imaginary world of the game. To focus each child on developing this starting character, a narrative was suggested where the character had become lost from the library and could only be saved by writing them into a new story. The instructions on how to select a character card were left deliberately ambiguous. This meant the children could choose randomly, pick one particular character over another, or even swap their selection with another child.

Once a child had selected a character, they were prompted: *"Where does your character's story begin? Go to the bookshelves and choose a book where your story starts…"* The intent here was that the first book they retrieved from the library would help define the 'qualities' for the beginning of their story, such as describing a particular place or location. Again, this prompt was intentionally open so as to encourage the child to freely explore their own ideas. Once they had made their selection the children would return to their table to begin writing their story. For this workshop, the tables were completely covered in paper, so the children's stories could take up as much room as they wanted. A variety of pens and crayons were provided so stories could be created with as much freedom and expression as possible.

Having started writing their story the children would be given a randomly chosen fortunate or unfortunate event card to continue their story and select another book. The game would continue like this with a succession of fortunate and unfortunate events encouraging the child to return to the library space and come into contact with more books. In order to support different learning styles and relax constraints as much as possible, the children were not limited to the number of cards children they could take, or how much room they could use on the tables. However, the children were warned 10 minutes before the game ended to allow them time to complete their stories. After this the children reviewed all the stories together.

3.5 Ethics

It was important in the *DoHS* project to ensure that the work with children was ethical. This was achieved through a number of different means which included: obtaining university ethics, ensuring that participants provided informed consent, running the study in the wild with the participants welfare in mind, and storing and analysing data appropriately. These points are detailed below.

Prior to the work commencing at Benjamin Road, the project was approved with the faculty ethics committee through a preliminary ethics and full ethics application. The full ethics application covers most aspects of how a study is run (see 10.1.1 and 10.1.2)

All the researchers working directly with the children required the equivalent of Disclosure and Barring checks (or DBS checks). DBS checks are part of a government system to prevent unsuitable people from working with vulnerable groups which includes children. In its application in this project it provided parents, teachers and library staff with clarity about the backgrounds of researchers. The project also followed a lone working policy where children were always with teachers and accompanied in the library space. This was especially important as the library hosted a number of council services which meant that there were strangers present in the space where the game was played.

The parents were given consent forms before the workshops which asked their permission to allow their children to participate. These consent forms included a study information sheet which detailed why the research was being conducted and what would be expected from the children. These were given back to the researchers by the teachers on the day of the workshops. In addition, children were given opportunity at the start and end of the workshop to ask their own questions about the work and the expectations.

Photos of the stories and audio data from the study were collected and stored on a secure server at the University using the ownCloud software which ensured the data stayed in the UK. Group numbers and pseudonyms were used to label the boys and girls in each group. These pseudonyms were created to help transcribe the audio and did not identify the children using their real names. In addition, the name of the school and library were annoymised for publication. Lastly, any photos taken during the workshop that included the child's faces were

deleted and not considered for publication. The thesis and associated publication only include photographs of the stories created by the children.

3.6 Pilot Study

To test out these initial games two workshops were held at Benjamin Road Library with a total of twenty 8 to 10-year-old school children who represented a wide range of literacy proficiency. The workshops were organised as part of their normal visits that occurred during their English classes. Two teaching assistants accompanied each group, while the academic members supporting the author acted as facilitators. The workshop itself was held in a meeting room in the library, with the discussions on each table audio recorded and the stories documented with photographs. An additional researcher stayed in the library to make observations of the children's interactions with books and the library space in general. After each workshop the researchers shared their immediate observations and insights before revisiting the game design. This revealed a number of insights regarding how the children engaged with the game that could be taken forward in the design of a digital tool:

Keeping a physical drawing space: As children created their stories on paper they used large surface areas and drew boundaries around their work to differentiate it from the stories of others. They creatively used colour, different sizes of text and incorporated drawings into their stories. Digital storytelling systems, like *Tell Table* (Cao et al., 2010), often use the convention of a digital canvas to allow drawing, writing and the import of media. It was clear here however that there would be value in using these traditional writing materials as part of the digital game.

Enabling darker themes: The use of character cards such as vampires, soldiers, etc. gave children the permissiveness to express stories without fear of being told off. In particular, it provided assurance that they could explore darker themes, which are important in childhood play since it lets children express real life events that may not be positive (Pykhtina et al., 2012).

Swapping and sticking with characters: The conversations about playing cards led to inevitable comparisons with collectable games such as the original Pokémon trading cards. Likewise, the children in the workshop were allowed to exchange their cards. This led to delight in swapping their characters with one another as they compared the merits of each

card before, typically, returning to their original choice. This suggested an interesting design twist: what would happen if the character was not allowed to be swapped, and whether this would impact on engagement.

3.7 Department of Hidden Stories

DoHS was designed as a two-part mobile game (see Figure 4), based upon the pilot study.

Figure 4. The Department of Hidden Story Game. (a) Title screen, (b) A prompt to scan the barcode of a book, (c) Generating a random event, (d) A prompt to take a photo of the page

The mobile game allowed children to create a digital archive in the library which was held securely online indexed by each book's ISBN number on an online MySQL database which could also be maintained from a website running PHP. The game also included specific time-based interactions to provide additional prompts to the child, while allowing control of the game's progression meaning that the children could not skip tasks. These features would have been difficult to support in a non-digital card game, and responded to a number of observations from the pilot study where the children relied heavily on the facilitating researchers to prompt them at certain stages in the game.

In order to create these game features *DoHS* was implemented as an Android OS app connecting to a remote server. *DoHS* was designed to work on any touchscreen Android device, although at the time, it was created using the Google Nexus 4 mobile phones running the Android Jelly Bean operating system. The app presented two interaction modes: *create mode* and *discover mode*. Both interaction modes of the app used the skeuomorphism of stacked playing cards, with each transition indicated by curling the corner of the touchscreen.

This would allow children to navigate the prompts using an intuitive interaction of turning over the next card. Children were able to switch between modes freely, although for the purposes of the study these were treated as separate aspects of the game.

3.7.1 Create mode

In the create mode children are guided in the creation of stories through step-by-step instructions that are delivered on a set of successive playing-cards (see Figure 4). As per the card-based game, create mode starts by asking the child to help a character, who is lost in the library. This character is chosen randomly from 23 pre-assigned characters in the system. Next, the child is prompted to find and bring back a book from the library where their character's story may begin. At this stage, they are asked to start writing and drawing the beginnings of their story using physical materials. Initially, it was envisaged that *DoHS* would contain a 'virtual canvas' that would allow players to enter text and make drawings either on a hand-held device or on a digital tabletop or surface. However, as noted it was evident from the pilot study that the children valued having a large, physical canvas on which to develop their stories. Therefore, rather than restricting the children to interacting with the small screen of a phone in constructing their story, the game supported the capturing and sharing of these handwritten and drawn stories. Keeping the paper canvas also made the technology more reliable and achievable, which was important given the scalable vision of *DoHS*.
Once a child felt they had written enough to start their story, they can move on to the next stage of create mode. At this point *DoHS* asks them to scan the book's barcode and then capture the start of their story using the phone's camera. The image is associated with the book scanned.

DoHS then changes the fortune that the story should follow. The device's accelerometer was used to allow the child to shake a virtual dice to reveal either a fortunate or unfortunate turn of events. The digital cards did not need to give the children the ability to throw virtual dice, since a fortunate or unfortunate event could have been chosen randomly and just revealed as the cards were turned over. However, asking children to shake the dice, stressed the importance of these events as something that would shape their story, it also provided a brief respite from writing the story and this novel interaction encouraged them to pick up the phone, cementing the importance of keeping the phone near them, as they went through the story writing task. The child is then asked to find a new book to inspire this event and repeat the process of writing, drawing and capturing from the previous stage. This process continues

iteratively until the child is given 10-minute advance warning to complete their story. The game also gauges the activity of the child by looking at the last touch event and movement of the phone, which it detects through the motion sensors. If the phone has not been "used" for three minutes then the game awards the child a random object, which they can either use as inspiration and write into their story or ignore if they wish. This would have the effect of bringing the child back onto the mobile phone.

3.7.2 Discover mode

Discover mode allows children to hunt for hidden stories created by other players and hidden in books around the library. *DoHS* prompts children to scan a book and in return displays the corresponding story segment that has been 'hidden' inside that book. By turning to the next digital playing card in the app, the child can see the books where other parts of the story are hidden and can be unlocked.

3.8 The Study

DoHS was deployed in Benjamin Road Library in two further workshops with the same 20 children who had participated in the pilot study. As before, the children were accompanied by teaching staff. The voice dictation facility e.g. the Sound Recorder App, was used on each mobile phone as a way of documenting audio from the workshop, which enabled the capture of the children's conversations both in the workshop room and in the library space itself. This was supplemented by field notes from each researcher detailing interactions between children, teachers and facilitators as well as the children's use of the library space. *DoHS* also logged interactions about the books for later analysis. e.g. number of books scanned, the ISBN number and title of the book.

Over the course of the two 2-hour workshops, the twenty children collected 109 books. The books chosen by them to incorporate into their stories were diverse, ranging from non-fiction such as books on the geography of Asia, to fiction such as *Alice in Wonderland* and *Dracula*. The relative freedom given to the children's explorations of the library also meant that there were instances where children picked books from the adult section, much to the bemusement and occasional concern of the teachers. 10 of the 109 books collected in total were used by both of the workshop groups.

To understand how the experience of creating stories and discovering books unfolded through playing *DoHS*, an inductive thematic analysis (Braun and Clarke, 2006) was performed on the research data gathered from the workshop. This involved the author repeatedly listening to 10 different voice recorders from the workshop and transcribing this data. In the accompanying CHI publication, a lab colleague helped draw out codes from the workshop. The first set of themes included codes such as *admin* which were put to the side. There were also examples of emotion e.g. *cruelty* and *humour,* which reflected details within the children's written stories. Through coder discussions with the colleague, the latter codes were grouped under the theme of 'self-expression', allowing a look at the wider picture of what was happening in the context of the library.

For inclusion in this thesis, the data was revisited in order to focus more heavily on how children enjoyed playing the game and highlight how children worked together. This is evidenced in the theme "Fun", the additional theme 'Playing together', and the themes 'Browsing the shelves', and 'Incorporating Books into Stories' are joined together.

The activities of the children are represented through seven overarching themes: 1) *Fun*; 2) *Browsing the shelves and incorporating books into stories*; 4) *Structuring stories*; 5) *Following and subverting rules*; 6) *Playing together* and 7) *Self-expression*. These are described in the following sections. Facilitating researchers are labelled 'FT', teaching assistant or teacher as 'TA', and the children's names have been annoymised.

3.8.1 Fun

Children enjoyed playing the game and several even played into the breaks out of choice. Throughout the day there was general excitement, teasing, e.g. humorous threats from children that they would write a story about a friend, and shouts of surprise and victory were often heard, e.g. *"Woah. What book is that?"* [Ryan]. There was also mock frustration when being given a fortunately card, when they wanted unfortunately e.g. sounds of *"Ugh"* [Alicia] and *"Oh come on… Ugh"* [Amber] were also heard. The interactions themselves were also source for fun. e.g. giggling when being asked to stand on a chair, and having to shake the phone to select the changing events, e.g. *"I really liked the unfortunately, fortunately thing"* [Cloe]. One child was seen by a researcher proudly copyrighted the work:

FT: *"Are you copyrighting it?"*.

Harry: *"Yeah"*.

At the end of the workshop, there were excited cries of *"whoahs"*, and *"whoah! Whoah!"* when the children found an interesting book in the discovery stage. There was also interest in playing the game again. Jack was one of the children who asked, *"was it was in the App Store?"*, and another asking, *"Are we going to come back again?"* [Kelly].

3.8.2 Browsing the shelves and incorporating books into stories

One goal of create mode was to support the children in exploring the resources of the library without direct facilitation from the research team or teaching staff. The vast majority of the children felt immediately comfortable leaving the confines of the workshop room and exploring the shelves for books within which their character might 'live'. Upon arriving in the library space, it was clear that the children had very different approaches for searching for books to begin their character's story.

After establishing their characters, a group of boys immediately ran through the library in search for specific types of books that they wanted to support the start of their story (in this case, Dracula for their vampiric character who began life as a doctor). Their interactions with the shelves were short, focused and chaotic - they had a strong sense of what type of book they were looking for and left as soon as they found it. Other children responded more cautiously to these initial explorations around the bookshelves. Cloe struggled to find a book about Terry, her 'fierce' tiger.

Cloe: *"Miss, I can't find a book with a tiger in."*.

FT: *"You are looking for a book with a tiger in it?"*.

Cloe: *"Yes"*.

FT: *"Where, have you looked, except this section? Where might a book with tigers be?*

Cloe: *"Animal section"*.

A facilitator helps her find the animal section and a book on wildlife that contain tigers – while also meeting another child and facilitating researcher looking for a similar book *(see Amber's story below)*. Like the boys before, Cloe, had a strong sense of what they wanted to find.

Along with diversity in browsing behaviour, there were also a number of critical differences in how children incorporated found material resources into their stories. Some children were inspired by imagery on covers or inside the book, while others used only the title of the book, or were inspired by the names of the book's characters.

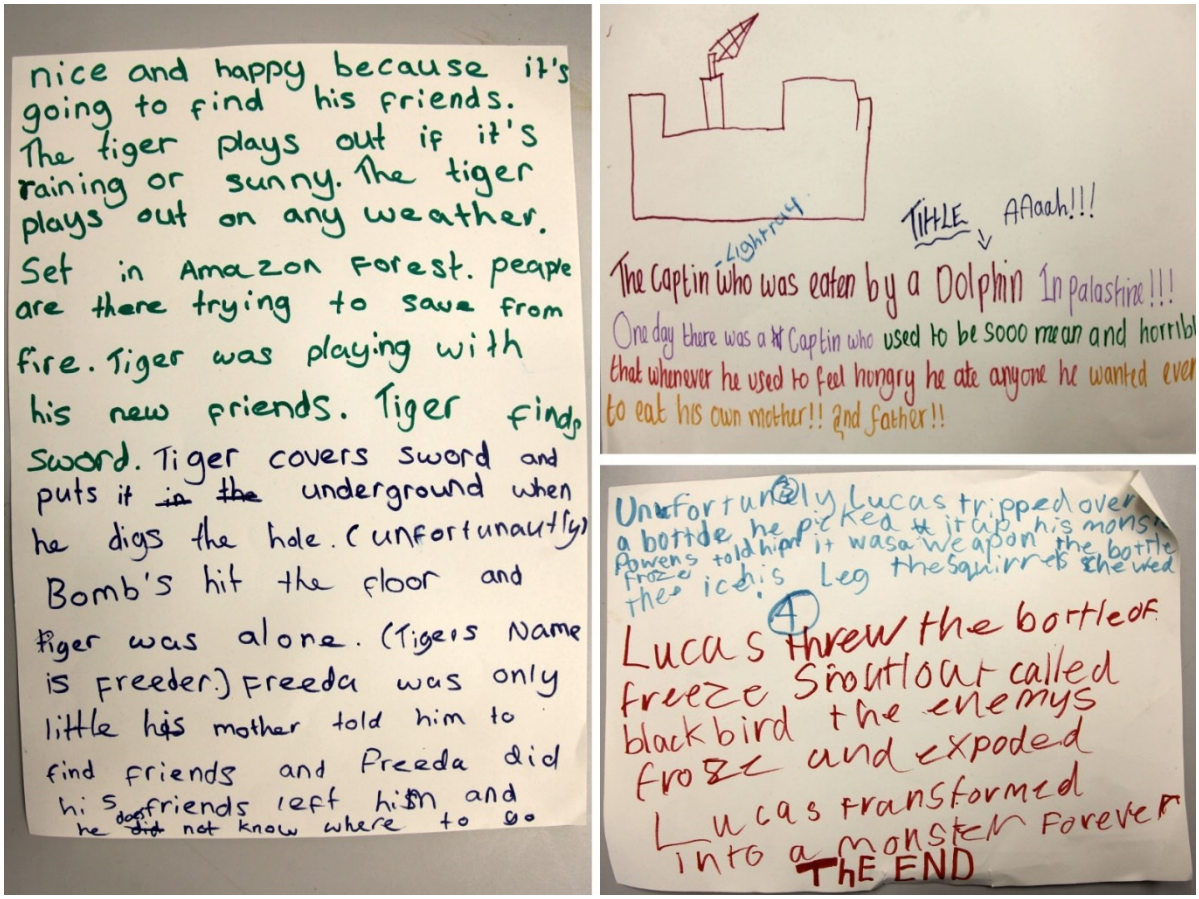

Figure 5. Various children's stories. (a) Tiger hides sword (b) Different coloured pens (c) The end

Another tiger named Freeda was created by Amber. Amber started by browsing for a book that would allow her to define the character. She was very deliberate in identifying a book, and although the nearby teachers made several suggestions, she avoided taking their advice and picked up a non-fiction book on Asia: *"They will show me how to colour in a tiger."*. On returning to the table, she continued to develop Freeda which led to a conversation with a researcher who mistakenly suggested that a tiger should be fierce and eat zebras. They were appalled by this idea and told the author decidedly that: *"They don't eat zebras"*. However, they were happy to continue her story setting the scene that described a friendly and social tiger, e.g. *"[Freeda] was nice and happy because it's going to find his friends. The tiger plays out if it raining or sunny."* Later, after starting with this positive scene, the child received an

unfortunate event. Reflecting on the pictures of lone Tiger's in the Asia book, she asks for confirmation from a nearby researcher: *"Something about being lonely.* […] *I'm wondering if the tiger can have a friend that can maybe run away."* When she returns from browsing, she has found a book titled *"Slavery: from Africa to the Americas."* When asked why she had picked this booked, she explained: *"if you were a slave, you would be very lonely."*.

Amber's story is typical of how some children responded to the some of the immediate qualities of the books or the rich imagery discovered inside. Others, borrowed ideas from the actual text after reading some content. Another child wrote a supernatural story about an evil doctor surrounded by his evil minions. They returned from browsing with a book about a black hole, explaining to a researcher why they chose this book:

Harry: *In a black hole. A doctor went to see to it. Then some creatures from the black hole entered. If they come near you, you can get a rash.*
FT: *Why did you choose this book?*
Harry: *Because I don't know about black holes, so I picked up a book about black holes and read the blurb, and it's full of good ideas.*
The browsing activities in the create mode were often jovial and vociferous with children talking together as they walked through the library. However, it was during discovery mode, when the children searched for books in ways that might be considered particularly unfitting of traditional library etiquette. To ensure as little disruption was caused to the library as possible, rather than return the books children used in their stories to the shelves, a temporary library shelf was formed in the room where the workshop was held. At the end of the workshop the children were prompted to use discovery mode to explore these books and find where stories were hidden. This part of the workshop caused the most excitement and there were cries from the children, such as "*whoah! Whoah!"* in response to finding a story. In this activity children were seen browsing the books randomly after an initial enthusiastic charge toward the shelves, as they dashed to get hold of anything that took their fancy. In this stage one child reads aloud the prompt, "*Congratulations you have unlocked a page of a hidden story. Look, I found something. It's told me congratulations. Look I have!*", "*Oh coooool. Dracula... I've got yours!*" [Amber].

In one case the children discovered "Phenomenology of Perception". This book revealed some captures of the workshop room and the book itself, which had been brought to test the

software after setting up the phones. This book caused real excitement as children realised they had found something secret and had got the better of the adults.

3.8.3 Structuring stories

Although the create mode provided specific prompts and activities for children to undertake in writing their stories, the ways in which the stories themselves could be structured was still chosen by the children. Children formed their own approaches to the creation of the narrative and structure of the stories. Watt's (2010) story structure describes eight key story points such as 1) Stasis, 2) Trigger, 3) The quest, 4) Surprise, 5) Critical choice, 6) Climax, 7) Reversal and 8) Resolution. In the children's stories, these key points can be identified, for example, Cloe begins her story with an example of stasis, (or status quo): *"It all started with fright. In India, there was a tiger called Terry, was a fierce one. He was king of the jungle. He was a good hunter."* The stasis in the children's stories in our study is often followed by a trigger that sparks off the story. In this, the trigger is the bad health of the Tiger, and this bad fortune is compounded by heavy rain: *"[…] but one day wasn't in shape, he was feeling awful"*, and *"Suddenly it was raining so much".* Such key points were often planned ahead of time, another pointed to a book exclaiming, *"That's going to be in the middle"* [Harry].

There were clear examples of climax: *"The next week it was the day, the big day, it was world war 6".* Following this, the story ended with some finality: *"Dan daan daaan! It is Kevin the solider! He got £50 million pounds and he was The King!!!",* while another child explained how their story would end, *"It feels better with a fortunate ending"* [Jack].

3.8.4 Following and subverting the rules

As noted, the level of independence afforded by the create mode differed from child to child. Although none of the children appeared to struggle to act independently in creating their stories at one stage or another, it was clear that many were concerned about following the 'rules' of the game. Some were unsure of what the 'right' or 'wrong' way of starting their story would be, despite assurances from the researchers that there was no right or wrong. Some of the children felt that being free to write anything was a misunderstanding, or an elaborate trick being played by their teachers and the researchers. They needed to know they were doing the "right" thing, that their story's direction and meaning was ok and made sense. They also needed assurance that the books were the right choice for the prompts they had received, for example, Harry asks, *"Miss, I need to look for another book for fortunately*

again. It could be like… I could get the ghosts out of the house?". Indeed, on some occasions the children's concerns about playing the game correctly were affirmed further by the intervening TA's who would question their stories and unwittingly undermine children's narrative decisions.

These were instances observed of children upholding the game rules when they did not want to. In writing about the tiger Freeda, Amber was so engrossed in her story, that the programmed game logic assumed that she was stuck, since the phone had not been touched or moved for the allotted time [three minutes]. The game presented a new random object, in the hope it would help inspire her story. This object card happened to be a picture of a sword. At this point, Amber sighed and dismissed the prompt on the phone. She exclaimed to the nearest researcher that Freeda was friendly and the tiger could not possibly be interested in the sword that had just been given to her. The solution was to let her tiger decisively dispose of this unwanted object card (top-left in Figure 3a). She wrote: *"Tiger was playing with his new friends. Tiger finds sword. Tiger covers sword and puts it underground when he digs the hole."* The child then returned to telling the story as if the event had not happened. This is notable because they could have ignored the object completely and pretended it had not happened, but instead she subverted the story itself to deal with this intrusion and followed the rules.

Although most of the children followed the rules and seemed to enforce stricter rules on themselves than the game implied, there were also examples of where the 'rules' of the game were subverted, and children bent the rules to make their own decisions, for example, bringing multiple books back from the library when the game had asked for one. Unlike the card-based games, the children were asked to use the randomly assigned character given at the start of the game. Some of the children had learned through playing with the phone that closing *DoHS* and restarting it would mean receiving a different character at the start of the game. On initial observation, it appeared that those children who restarted the app did so because they disliked their initial character.

Jamie: *"I'm changing mine!"*.

FT: *"Are you trying to secretly change it by going back?"*.

Jamie: *"Yeah"*.

Jamie: *"I don't wanna be a nurse!"*.

Harry, was caught closing the app, explaining, *"We weren't cheating…!",* before trying to convince a friend,

Harry: *"I've switched it over again. Ahhhhhh a Polar Bear"*.

Alex: [Giggles].

Harry: *"I shake them. I shake them and lost the App."*, *"Awww… Damn… Re-started. It re-started. When I was using the dice, I didn't touch it!", "Polar bears are like the shizzle."*.

And in another example, a child changes her character, and another, asks how this worked:

Katie: *"I changed my character."*.

FT: *"You changed it?"*.

Hannah: *"How?! How did you change it?!"*.

There were also examples of children ignoring the event cards when it became difficult to follow them, for example, a researcher observes a child ignoring the prompt and finishing the story at the end of the workshop with a more fortunate story:

Hannah*: "Mine's unfortunate."*.

FT: *"You're not going to do unfortunately, you're just going to choose it?"*.

Hannah: *"Yeah."*.

3.8.5 Playing together

Even though *DOHS* was designed to be played alone, children played together. Children took notice of what other children were doing during the exercise (in addition to reading each other's stories at the end), and collaborated a number of different ways e.g. asking for help with interactions, offering help with the interactions, reading the instructions together, helping with spelling, sharing ideas with each other, choosing to rest at the same time as their friends and even pushing each other to cheat. Two girls also explored the same shelves together in the library, after finding out they were both struggling to find a book for the tigers to live in.

Notably, children were keen to help one another, and often helped friends understand what was expected, Harry explains, *"Then we are writing the next part of our story. Now go back*

to the children's section and find a book for the next part of the story.". They also offered specific help for each of the interactions e.g. scanning a book,

Jasmine: *"How did you scan it?"*.

Taylor: *"You just click, and go here. I just did it. Move down. Up a bit. And wait. Yeah."*.

And how to throw the dice by shaking the mobile phone,

Alicia: *"Shake it."*.

Ellie: *"What?"*.

Alicia: *"Shake the phone."*.

Children also helped each other on the small details on a story e.g. what a dinosaur might look like. One of the boys, helps his friend with spelling, while offering help when they noticed something has not worked, in one instance Harry asks, *"Shall I show you how to do it?"*. There were also examples where they prompted each other to cheat:

Jasmine: *"Do you want to swap with this?"*.

Taylor*: "Not really."*.

Jasmine: *"Go ooooooooon."*.

Taylor: *"Anon has a pilot. A fighter pilot. Where is she?"*.

Jasmine: *"She's gone. I want to change it."*.

Taylor: *"Where did you get that? Oh, ah."*.

Jasmine: *"And you can't go back."*.

The theme *Following and subverting rules* describes how children changed their characters because they did not like what they had been given. Importantly, children were restarting the game until they had the same characters as others. Two boys 'cheated' this way forcing the character to a solider, after learning that this character was available in the game from speaking to others. This was not just because of their dislike for their character cards: the *nurse* and *toymaker*, but because they wanted to work together on their stories.

Communication between children was also simpler in places, with children just mouthing, or stating what card they had been given, e.g. *"I got unfortunate."*. Alicia, was one child who spoke aloud to let everyone know her experience, *"I've got a fortunately. I got unfortunately, then fortunately, then unfortunately, the fortunately."*.

3.8.6 Self-expression

Foremost, *DoHS* supported the children in expressing themselves creatively through their interactions with their peers and the stories they created. Some would express themselves simply by giggling or laughing while writing their story. In one example, a child explains how she is getting married in her own story, as she declared while giggling: *"I want a wedding book as I'm getting married to Justin Bieber!"* Taylor. Quite often humour was driven by unfortunate events occurring to the characters within the stories. On many occasions, stories were witnessed being created where the characters would be punished in macabre story lines e.g. Kelly explains to a researcher her character is, *"Dying, again. Not dying immediately, but like dying of cancer, or something."*. The children would frequently express their humour at these stories through expressive language and theatrical laughter such as: "*hahahah.* […] *the pilot broke his back so he's in hospital!"* Hannah.

The children also expressed themselves through the ways in which they constructed their stories with the crayons and paper made available to them. As with the pilot workshop, the children quickly felt comfortable working on paper and as before used different crayons to represent aspects of their story. Three girls in one session all preferred to draw what their characters looked like to begin with when starting their stories. Others drew illustrations and added visual details to their stories as they were being created. Sometimes these appeared to be as a distraction from the game, often, however it seemed out of self-directed enjoyment. While most enjoyed writing in this way, it could be a frustrating process for those who felt less comfortable with their writing or drawing skills, e.g. one girl was frustrated, exclaiming: *"Arggh. I did it wrong. Can't draw anything"* [Hannah].

Self-expression also emerged through visceral acts of frustration when playing the game. Sometimes this frustration was born of problems with scanning books because of damaged barcodes. Elsewhere, it related to the random prompts chosen by the game. As noted above, children 'gamed' *DoHS* by finding ways to generate new characters if they disliked the initial selection the game provided. Similar concern was also felt by those who were dealt the same

event cards several times on a row. While frustrating, this led to huge cries of excitement when finally receiving the opposing card.

3.9 Discussion

The design of the *DoHS* digital game aimed to support new modes of exploring and interacting with the core resources of the public library: its books. Rather than tell children which books they should interact with, children were successfully encouraged to find new or unusual books that could inspire them to create their own stories. These same books were then to be used as a resource to discover the stories participating children had created. Public libraries are not traditionally a very playful space, and this is highlighted in the ways in which digital technologies are normally used to organise information, to act as digital archives, and to provide more efficient ways of locating books. Yet the act of reading, writing and being inspired by books can be an inherently creative and playful act (Göttel, 2011). The findings suggest that the *DoHS* game was able to encourage this creativity through appropriately scaffolding its play through its digital card-based game. This is the focus of the following discussion, noting guidelines for the next games that might also think about card-based design as a way of structuring and scaffolding play.

3.9.1 Expand the range of prompts and avoid repetition (G1)

As noted, the children browsed and searched for books in very diverse ways. However, it is clear that the decision to initiate their stories by responding to a randomly assigned character hugely influenced the beginnings of the story and the manner in which each child searched for their first books. As apparent from the themes, some children were very direct in how they searched for books to inspire their character. They would go straight to the appropriate section in the library, i.e. reference books or maps, looking for a specific book or browse books holding onto an idea of what they were looking for. The random selection of the character preloaded their tale as it made their writing prescriptive by effectively limiting their amount of free-expression. In some cases, this led to children subverting the game (by restarting the app) as they sought new creative ways of getting around this prescriptiveness. In this case, subverting the game was positive – a point a view also taken by De Koven (2013). It was a display of imagination and inherently not risk free; children did not know the repercussion to the game or what would happen if they were caught.

The character card was meant to present a suggestion only, with the makeup of the character intended to evolve in the course of the writing. However, this beginning was clearly important to the following play. Instead, it might have been appropriate to provide more assurances to the child about the activity, for example, the intro card e.g. *"remember there are not right or wrong answers, just a pen, paper and your imagination!"* might well have been expanded upon. Further cards would reinforce the idea that any story was permissible, and the player should feel free to express themselves.

The game might also change the way the characters were created, for example, by borrowing a convention from other games - a character builder. A character builder would allow the children to create a character from a much smaller granularity. This would have provided opportunity to expand the range of prompts by posing challenges to the children while still encouraging them to return to the library.

DoHS clearly influenced the ways in which children constructed their stories over time by dealing them random fortunate and unfortunate cards. The aim of providing these prompts was to leave a child to respond openly to what could be considered 'fortunate' or 'unfortunate'. However, on getting these cards there were often sighs of resignation that it was this section again, and even more when the outcome was an unfortunate event. One response to these issues might be to expand upon the range of prompts, rather than repeat prompts. Many of the children's stories followed a story arc, and a set of prompts around these features may be one way to initiate more flexible and diverse responses from children. This could be taken further and provide a child with a set of story arc elements to choose from, asking them questions such as: 'your character is surprised, tell us why'; 'a big event will happen in the future, what is it?' From here a child might build their story up in a still creative way, but more controlled. This would also serve occasions where children struggled to find inspiration for these events from books. Adding different prompts would likely provide further intrigue to the game since the players would not know what card would be revealed next.

3.9.2 Allow players to set the pace of the game themselves (G2)

The children playing the game were given as much control as possible, and this was reflected in their play. For example, some children choose to write on the paper, whereas others chose to draw on the paper, some chose to write physically large stories, while others used different

coloured pens for alternate lines of writing. Children even bought multiple books back from the library, so they did not have to go back after the next cycle of events, while others asked the teachers when they wanted to leave the workshop room to explore the wider space of the library and shelves.

When designing games card-based games we can begin by ensuring that the players realise that they have control over the pace, for example, the intro in *DoHS* advised. *"[…] Take as little or as much time as you want."*. There are also common mechanisms that designers might want to use in games designs that that will define this pace. For example, players should be expected to turn over playing cards themselves, when they are ready. This is also good practice for designing with accessibility considerations, since not everyone will read at the same speed. Even the act of turning over the card in these games can be paced by the player. Players in *DoHS* could speed through prompts by swiping quickly, or tentatively turn cards over by their edge.

Contrastingly, designers should be cautious with interfaces that introduce cards automatically. For example, when the mobile device attempted to set the pace of the game by bringing Amber, the girl with the friendly tiger, back to the on-screen game – the result was resisted, and Amber dismissed this interruption. In designing prompt-based games, designers have the ability to use timing mechanics but should recognize the child's ability to lead their play. Instead, of interrupting play, the use of the timers might be turned on its head and used to provide a timed challenge to the player e.g. a timer might give players a short amount of time to find a particular book, or they will be given a forfeit.

3.9.3 Encourage players to play alongside one another (G3)

There were also instances where pairs of children set the pace of the game together, for example, the two boys who cheated to get the solider characters continued to work together, collecting a handful of books between themselves. They then shared these books in order to work in parallel on their own stories, turning the event cards together, going to the library at the same time, and scanning each other's books, or different books at the same time. These children manually adjusted their own pace to match others, in what can be described as an example of parallel play (Vygotsky, 1977). This parallel play started at the beginning of the workshop, where character cards were automatically chosen for the players. The players, aware of alternate characters, proceeded to restart the game in order to be awarded another

character. Three separate groups of children playing chose to restart the game in order to 'subvert' the character card selection they were given in order to play together. This enabled the children to work alongside one another – and in scanning books and turning pages together, they were presented with the playing cards at the same time. However, the random sorting of character cards and fortunate and unfortunate events meant that the stories would take unexpected turns which meant telling the same stories was difficult.

In designing our games, we can choose to present the same playing cards on different mobile devices. This would mean generating random prompts in a predictable order so that two connected devices get the same cards i.e. it makes more sense for players working together to get the same playful prompts in the same order. Alternatively, the prompts need not to be exactly the same across multiple devices - providing the combination of prompts makes sense and complements the play between players,

3.9.4 Sustain play using different interfaces (G4)

A decision was taken early on to allow the children to use the tables covered in paper as the 'canvas' on which to construct their stories. This design decision was carried through to *DoHS*. Children were observed enjoying making use of this large space and developed their own ways of expressing their stories within their own, unbounded, space. Having this space external to the phone meant that the game was "bigger" than the phone – the phone was used to reveal situated prompts, the books acted as inspiration, and the space was used to construct the story laid out in front of them. As such, rather than being the centre of play, the *DoHS* game was scaffolding and supporting play around the device.

However, providing this large expressive space did raise problems for the children, and in the latter workshop impacted negatively on the experience. In *DoHS* sharing a story was based upon photographing each phase of the story as it was being created and tagging this to a book. Children had practical difficulties in using the phone's camera, in the sense, of what part of their story to capture each time: should they capture just the last bit they wrote, or the entire story? Invariably they chose to capture it all each time, meaning their images became gradually harder to read on the devices display. There are likely better ways of capturing the written and drawn data the children created than as executed in *DoHS*. Prior work has explored the use of Anoto pens (Vines et al., 2012) or the Wacom Inkling (Chiang et al., 2012) as way of translating handwritten into digital content. However, in practice these

devices are designed to work with desktop PCs, and the game would no longer be about a child taking their own mobile phone to the library. Furthermore, they would restrict the real estate of the canvas, which the children appreciated. Instead, using other digital interfaces on the mobile device, would likely fascinate and further motivate the children playing the game, for example, the game might use the microphone of the phone itself allowing the child to read the story aloud as an alternative way of capturing the story. There is also opportunity to introduce new fun interactions, such as new mechanisms for turning the pages e.g. physically turning over the phone, or adding a throw gesture, to the current shaking of the phone to "roll the dice" in the generation of fortunate and unfortunate events.

3.10 Conclusion

As with any study, there are limitations to the findings. While the children who participated in the workshops were diverse in ethnicity and literacy level, they were still limited to meeting the one class as two separate groups. This includes involving the same children in the pilot workshop and the digital *DoHS* workshop. Clearly this may have biased some of the responses from the children, who were indeed motivated to play *DoHS* after playing the pilot game. However, the intention was to support an iterative design process and not a comparative study, involving these same children engendered a sense of ownership over the design of *DoHS*, and supported them in being able to comment on what was better (or worse) in comparison to the initial card game.

While there is not an intention to over generalise the findings, this initial evaluation of *DoHS* is promising in terms of strategies for card-based games in what is argued as an "unplayful" space. Libraries and similarly schools are often considered institutions bounded by rules. Meyers (1999), for instance, describes how preteens perceive the library as somewhere they are told to be *"SHHH!",* and that *"Libraries are so-o-o-o quiet—they are creepy".* These public perceptions impact on who uses the library and indeed how it is used. Regardless of the library stating users no longer need to be quiet, this perception still widely exists, and as a result, libraries remain quiet spaces. Some of the most compelling observations of children using *DoHS* relate to how they ardently ignored adults' suggestions for potential books and storylines. Additionally, while playing along with *DoHS* they found ways to usurp its rules of play and structure. By creating a simple game based on playful principles where children are put in charge of their own spontaneous, self-controlled and creative play, a lusory attitude was encouraged where children felt free to break a number of the institutional rules (both school

and library) around them: no use of adult book sections, no running in the library, no shouting.

In conclusion, *DoHS* was able to show that given the context of a library – digital card-based games can be useful in facilitating creative and engaging play around and away from the mobile phone. In the workshops, children were observed bending the rules together and cheating, as they picked the character cards from the game that they wanted, in order to play together. However, in other examples, the rules were bent more subtly, e.g. in the vignette with the tiger and sword, the additional prompt was rejected because she did not like the violence associated with weapons. The digital card-based prompts were also surprisingly successful at giving children permission to challenge the accepted rules of the space – providing the right level to frame play without over explaining what actions were needed. In this way, the digital card-based prompts made room for the children to create and play together, while the additional interactions, such as throwing the dice, scanning books and even photographing their work, provided challenges to keep them interested in the game.

3.11 Post Reflection

DoHS illustrated how games should use digital playing cards to initiate playful interactions both on and around a device. These digital playing cards were able to support appropriate play actions in the public space of the library, although it was clear that the children would have benefited from more varied prompts and in responding to the success of the dice – different digital interactions that might combine physical actions.

DoHS was designed as single player game with the intention being that children would work on their own during a library visit. However, the children subverted the game in order to work together and alongside one another. This also hinted at the ability of using the digital technology to programmatically support the children in playing together. The parallel play observed was particularly interesting as children were able to copy each other. Digital technologies might be used to further structure these type of configurations since they are an important learning process, for example, the phones might lock and ask children to look at what their friend is doing, before encouraging them to take their turn, while their friend watches, and so on…

4 The Wild Man Game

This chapter describes the 'The Wild Man Game', a mobile phone app that encourages families to play together as they visit a country hall. The *Wild Man Game* was created with an interdisciplinary team that included HCI designer-researchers, English Heritage, a specialist in eighteenth-century culture, and an interior designer. This case study aimed to explore how digital games can change the way young people engage, and therefore relate to cultural destinations. The resulting mobile phone game encouraged visitors to play together and reflect upon the spatial and hidden characteristics of a country hall through improvised play inspired by the character of a 'Wild Man'.

This case study builds on the card-based interaction and more improvised style of play used in *DoHS* to reimagine a culturally important, but *unplayful* public space. The game intended to help the heritage organization better understand the potential of the mobile device in creating more engagement in this space. Therefore, the game was designed to use the digital playing-cards from *DoHS* to initiate playful interactions (and improvisation) – while aiming to keep players interested with new interfaces on the mobile device.

This chapter continues with a detailed description of *The Wild Man Game's* design. Through the evaluation, it describes the effectiveness of the game in encouraging play and engagement with the site using evidence from an analysis of collected data from two in-the-wild activities. The emergent themes described from the gameplay reveal interesting phenomena in the game that illustrate the different ways of playing together in the space, and how play is supported by the structure of the game and sustained by the different interactions with the mobile game, the other players and the space.

4.1 Background

There are a number of location-based games that have been used to support engagement with our cultural spaces, for example, *MuseUs* (Coenen, Mostmans and Naessens, 2013), *Explore*! (Ardito et al., 2012) and *TimeWarp* (Herbst et al., 2008) guide players around public spaces that include museums and culturally important towns. This use of interactive technology has followed a *related* trend of living history museums where visitors have been encouraged to play a more active role that includes sharing, discussing and "playing" with artifacts (Ciolfi and McLoughlin, 2012). These location-based games have often encouraged players to

explore public spaces by leading them from one point of interest to another, sometimes with the focus on examining digital collections (as in Coenen et al. 2013). This has meant that they have gameplay designed around bringing knowledge back to the classroom (as in Ardito et al. 2012), and this external motivation for playing has shaped the experience of playing these games. Location-based games have also been criticized for relatively underexploring how the player experiences the unique aspects of the spaces we visit (Reid, 2008). However, when working with the constraints of unplayful spaces we find that they necessitate invention. For example, *Shhh!* (Conor Linehan, Bull and Kirman, 2013) challenges the social rules in a library in and *Blowtooth* (Kirman, Linehan and Lawson, 2012) encourages players to smuggle virtual drugs through an airport. These games both weave the space and gameplay in novel ways. The results can be that our relationship with the spaces are challenged and might even change for the better; the players of *Blowtooth* found that the game made them more relaxed, in contrary to what was expected.

4.2 Belsay Hall

The design work for the Wild Man Game was centred on a heritage site called Belsay Hall in the North East of the UK. Belsay Hall is a cherished and culturally important destination that includes a 19th-century country hall and a mysterious sunken 'quarry garden'. The site is managed by English Heritage. English Heritage was gifted the building in a partially-damaged state and emptied of furniture, whereupon they agreed to maintain the site in a "state of benign decay" where they ensure the hall is structurally stable and safe but otherwise as they received it. The only interpretations of the site available are its guidebook, small free-standing information panels and, less frequently, events and temporary exhibitions (occasionally including interactive exhibits). As a unique local destination, the site divides opinion: children lovingly refer to it as "the place with the '*Jurassic garden'*", and yet one online review describes it as a "*dreadfully dull dud"* (see Figure 6).

The work with Belsay Hall and English Heritage was informed by a series of visits that provided opportunity to observe different family events including a Pirate weekend, an Alice in Wonderland exhibition and a Halloween festival. Many of these events featured treasure trails where families would walk around the site holding sheets of paper containing several clues, a handful of "fun" facts and a short quiz. Participating children would delight in marking their sheets using the small red plastic hole-punch that could be found in the corners of rooms (see Figure 7).

Figure 6. Belsay Hall: Quarry garden and main hall.

Figure 7. Treasure Trails: Pirate treasure trail and Halloween treasure trail

However, these treasure trails were uneventful with parents or teachers being invariably left holding its articles for the remainder of the visit. These problems where reinforced at a later time when the researcher spoke with a creative play practitioner who highlighted difficulties of taking children to Belsay Hall. In describing what they thought of the space, they talked about the particularly problematic hall: "*Probably the hall itself. From the outside, it looked really nice. There was almost a sense of expectation about going inside. And then we got inside and there wasn't anything there. It was almost a little disappointing and we were trying to find things to keep kids interested in there".*

Conversely, conversations with English Heritage revealed many charming associations, for example, Belsay Hall is linked with the mysterious Wild Man – an intriguing mythical character, who as local folklore suggests, has watched over and protected Belsay Hall and its residents for the last 500 years. The Wild Man can be found throughout the site: in carvings in the hall, on the resident family's coat of arms, in paintings and stained glass, stamped into 20th Century cutlery, and as a once lost stone statue. The rediscovery of the Wild Man statue prompted English Heritage to plan a small exhibition about the Wild Man and his association with the site, which became a key inspiration for this game design.

4.3 Design Process

The collaboration with English Heritage began with an exploratory meeting at Belsay Hall with site staff and curators looking to identify interesting design landscapes. In this meeting, play was suggested as a provocation and discussion covered the different types of play described in the literature review e.g. imaginary play, social play etc. These conversations were key to defining the work, and there onward, the stakeholders were essential in pushing play as the focus. This included conversation about the play already happening in these spaces and about what sort of play might be appropriate. The first of these meetings was also opportunity to show *i-dentity* (Garner, Wood, Pijnappel, et al., 2014) which was used as a way of illustrating that games could capture something of childhood play. This led to the participants reminiscing about childhood play and recalling their own fond memories of playing. These meetings were on site, which was used as a further opportunity to investigate the hall and explore interactive possibilities. The activities began with detailed needfinding and included presentations that used storyboards to summarise the collective ideas. These were presented along with personas (Chang et al. 2008) which were reviewed by the larger team to ensure "recognizable" visitors were held in mind.

In parallel a *living document* was created to share the ideas and build a notion of a fully formed Wild Man. This motif was used to think about play in keeping with the Wild Man, for example, games that involve creeping, taming the wildness of the Wild Man, or mimicking wild animals were suggested. In keeping with the card-based design used in the Department of Hidden Stories the author also bought the Cluedo Suspect Card Game to play with colleagues (a card-based version of the Cluedo board game). This version did not need the board and inspired one of the storyboards (see Figure 7) where clues were given to the players in each of the physical rooms – following on from the use of clues in the treasure hunt and the absence of the actual Cluedo board in this particular card game. This idea was interesting because the Cluedo board mapped almost perfectly to the house plan. However, the murderous events in Cluedo, although fictional, suggested too dark a theme for a space which everyone agreed should be remembered as a family home. Other storyboards were also created, and these are detailed in the Appendix.

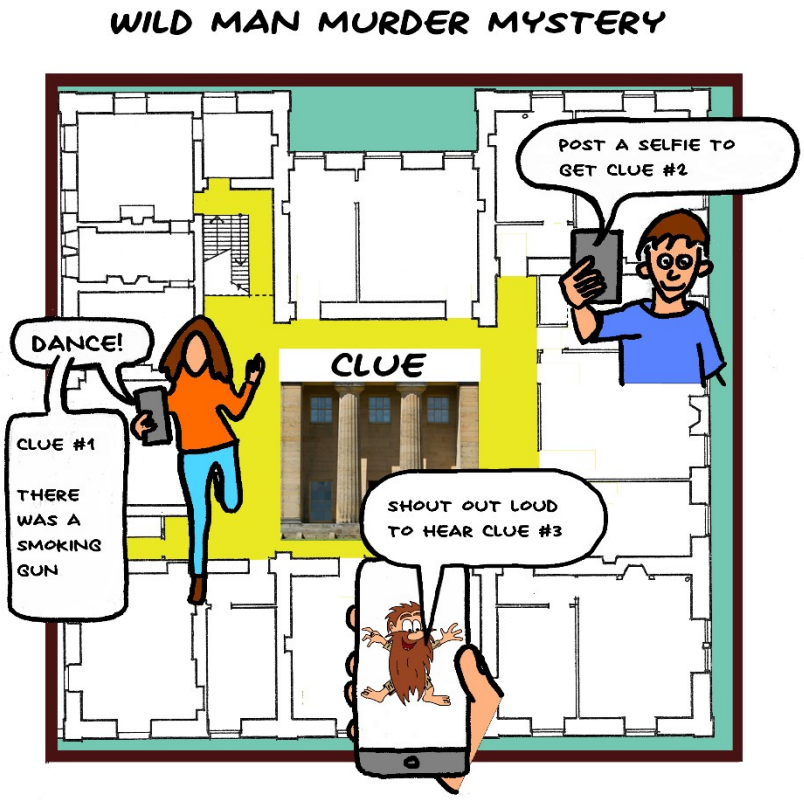

Figure 8. Storyboard: Game inspired by the Cluedo board game.

However, the idea of presenting playful prompts in each of the rooms persisted and was also given merit by the success of "50 things to do before you are 11¾" by another heritage organization - The National Trust. This promotion sought to encourage young people to try

and achieve different activities, such as *"Roll down a really big hill"*, *"Build a den"*, *"Make a mud pie"* or *"Catch a falling leaf"*. In fact, the first of these had been suggested as a game by English Heritage as they described how young children would delight in rolling down banking's on their side at another of their sites. This was the kind of play and excitement they wished to promote in the site they had described one possible view of themselves as "stuffy", in interview. Consequently, the games were thought of as activities (or challenges) which could be presented through card-based prompts to visitors when they reached a particular location. This helped the stakeholders imagine and articulate new possibilities for play that might avoid screen fixation. The last stage of design used *Mobile device design cards* (see Figure 9) which featured the different input sensors (and output devices) that can be found on mobile phones.

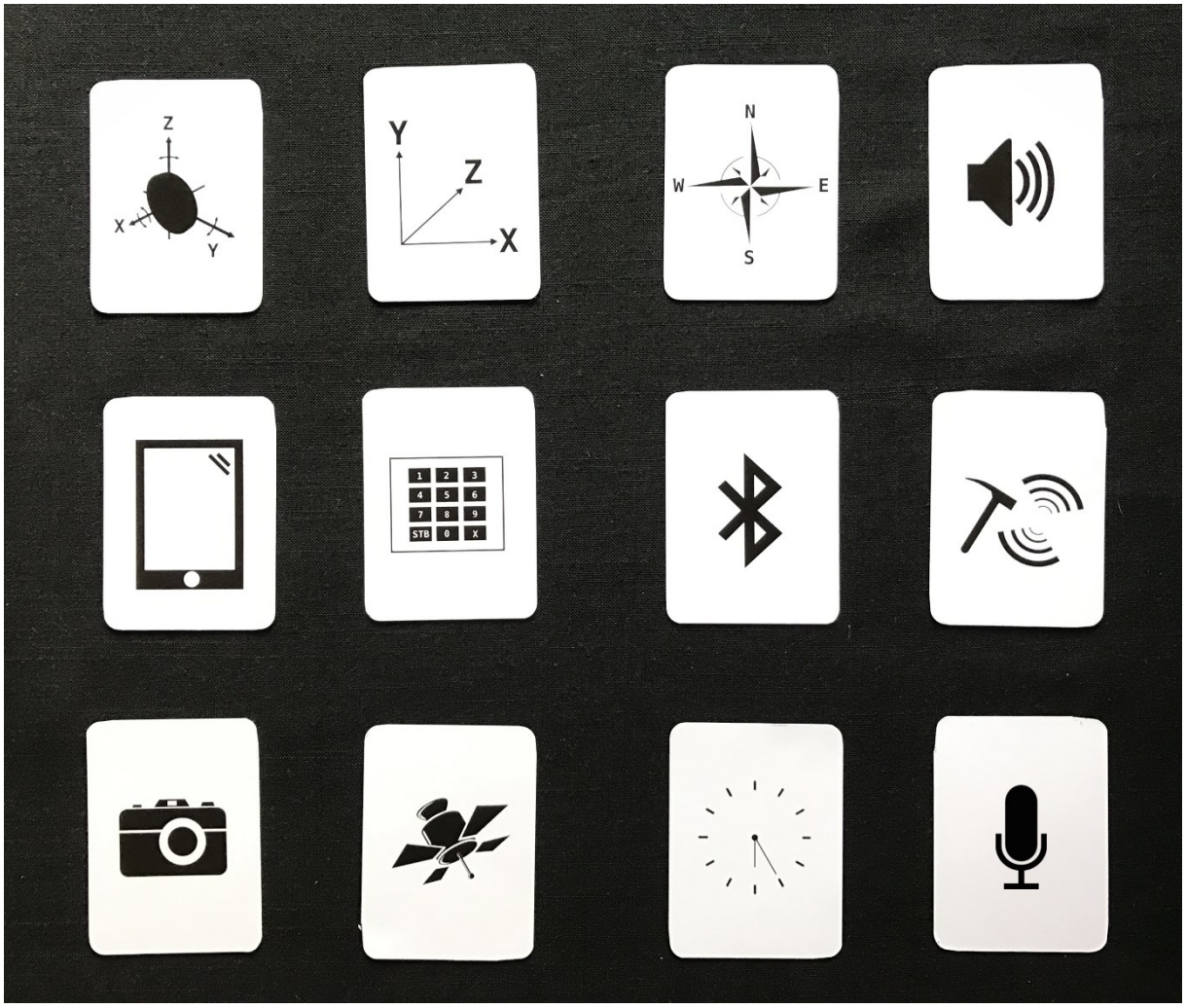

Figure 9. Mobile Device Design Cards.

These were used to translate gameplay ideas into an actual design. This avoided 'technological determinism' as ideas were more-or-less formed, and allowed the design to think about a trajectory across different interfaces (Benford et al., 2009).

The mobile app was then created through a process of iterative design, as is common in games design (Salen and Zimmerman, 2003) with further visits to Belsay Hall to refine the gameplay and playtest with staff, the research team, colleagues and friends. Through these activities, *The Wild Man Game* took shape and looked encouragingly like it would help both engage families in play together and with the space. The design rationale for the game was developed through this collaborative work and in retrospect can be expressed as four design principles. These are described below.

4.3.1 Finding a fiction which could inspire role play (D1)

To build upon previous research, it was intended that the game should draw upon a more nuanced understanding of the space than would be normally expected in pervasive game design. Indeed, Belsay Hall warrants this kind of exploration; the hall extends beyond its physical and spatial qualities to embrace the historical and mythical stories that weave through the site. The use of stories and characters in the previous case study *DoHS* reinforced how fiction could support creativity and allow the young people to form their own idea of the character, taking ownership of them through play. Correspondingly, this project drew inspiration from children's literature and its potential for engaging younger audiences with heritage. In particular, fairy tales and other literary connections with childhood ('Children of Green Knowe', 'Peter the Wild Boy', Kaspar Hauser, Mowgli and Tarzan) were considered as fictions that might fascinate young visitors. However, the Wild Man mythology remained the principal inspiration for the broad narrative structure of the game. This mythology was particularly suitable as it embodied a playful mindset with lineage dating back to early stories featuring the mischievous deities of Pan, Bacchus and Dionysius. As ritual and play have been closely associated (Huizinga, 1949) it seemed that the Wild Man was the ideal provocateur for the game and the thesis' sensitising concept of play. Consequently, this led to the development of an over-arching story to structure the game, where players would assist the Wild Man's return to Belsay Hall through completing a series of tasks that demonstrated their 'wild' abilities – expressiveness, stealth, attentiveness to their surroundings, and natural empathy.

English Heritage was keen to challenge how young people view our cultural spaces and, when discussing how young people enacted with the space, explained that "*the site itself is there for people to play, but there's nothing there to encourage people to play / we want people to be*

free within that space and [even] misbehave", and that they wanted to "*broadcast a different version of [Belsay Hall]*". The narrative suggested by the folklore of the Wild Man fitted with this idea. It would encourage people to take some liberties and challenge the *communally-held sense of appropriate behavior* (Harrison and Dourish, 1996). The game would draw upon a rich history of stories that describe the capture of half-wild children in forests and their discovery and 're-civilisation' by humanity. Games inspired by this such as creeping, or hiding away from visitors could give space for a little bit of naughtiness while gameplay would remain *in-keeping* with the space.

4.3.2 Design with the existing playful activities in mind (D2)

The game design aimed to ensure players would feel they knew how and where to play and therefore be more likely to join in the play and want to share this experience with others. To facilitate this, simple game dynamics were chosen which proved inspiring. These were based on occasional behavior that had been observed and had been relayed in conversations with the staff. For example, young people were described, "standing still on stone plinths", visitors entering the hall's cellar to enjoy "finding their 'Echo'", while "children rolling together down a banking on their sides" was recalled as an exciting example from another heritage site. Picking these origins for the game might better communicate the gameplay to ensure people had confidence to play – or a clear *"invitation to play"* (Polaine, 2010). These games also embodied a little bit of 'naughtiness' fitting with the Wild Man narrative, which further pushed the appropriate lusory attitude.

4.3.3 Design for play through and around the device (D3)

Previous work in location based games has aimed to avoid *screen fixation* in order to keep the attention of the visitor on the space (Ardito et al., 2012). Correspondingly, other genres of pervasive games have also avoided screen fixation, while encouraging face-to-face interaction e.g. Head Up Games (Soute, Markopoulos and Magielse, 2010). Similarly, the use of the screen was approached cautiously. One obvious strategy was to make use of other interaction modalities available on smart phones. Audio was used frequently which also provided better accessibility for the mobile app e.g. narrative transitions were used between games. To further lessen dependence on the screen, movement-based tasks used the phone's movement sensors and the players only needed to hear the result of their endeavors.

To get people to play together, the game needed to enable taking turns and/or working together within groups and require little 'traditional' digital gaming ability. To enable this, game rules were considered that would: encourage *self-paced play* through infrequent use of time limits; provide clear invitations to *play again*; and, allow tasks to be played *in any order*. Through these factors, it was intended to create a game that required little more than an enthusiasm to play.

English Heritage were keen to explore augmented reality (AR) as a novel and powerful way of placing digital content in the physical space. AR would not necessarily 'bind' players to the screen since interactions would naturally invite players to look *through* the device. For example, 3D models could be overlaid on the live camera view to appear at a distance and, through their animation and movement these would encourage players to look around the physical space. These early ideas were reminiscent of the throwing and augmented reality in the (later released) Pokémon GO game. However, rather than encourage the players to capture creatures, the augmented reality games were suggested as a way of bringing magical content into the space, to be watched, contemplated, but not touched, for example, imagine finding a wild deer visiting the garden.

4.3.4 Design using the physical characteristics of the site (D4)

Thinking about where to place the design cards and their associated playful prompts in the hall allowed a route to be planned. This would be the expected way of experiencing the game, or "canonical trajectory" p.53 (Benford et al., 2009). In thinking about this route, the following were particularly important:

1) travel throughout the building was maximized.
2) each element was located appropriately within spaces or rooms selected according to features of interest, acoustics and lighting (sun path, shadows) (e.g. we had discussed a game that conveyed that the Wild Man wanted to creep through the hall and hide away from visitors, which was best afforded by a route down a dank and dark corridor).
3) accessibility was considered in accordance with the Equality Act 2010 (creating a game played on a single floor of the building which would not exclude those with limited or restricted mobility, or families with younger children in buggies).

4) elements related the Wild Man to nature by making use of sightlines to the gardens, and visitors would experience the more unused parts of the hall through the locations of game taking a variety of routes between them.

The role of the interior design was key in understanding the space and the above guidelines were presented by the interior design along with a collection of images as part of a *space investigation* (see the appendix and Figure 34 to Figure 38). These were shared with the wider team, and importantly were able to hint at the gameplay which is further elaborated on in the next section. The space investigation helped exposed the unique characteristics of the space and set the scene for each game. However, hidden and unexpected details of the physical space were also uncovered by playing in the space and exploring with early prototypes that experimented with the mobile phone sensors. For example, in sampling the audio inside in the hall, the researcher noticed that the storm down pipe ran noisily with water after heavy rain. This made it apparent, that background noise could be part of the games and that it was worth using both the amplitude and frequency of noise. Relatedly, when sampling the GPS on a typically overcast day (for this region) a satellite coverage could not be reliably used to determine where players were located. This led to the experimentation with Bluetooth Low Energy (BLE) beacons that might locate the games in the space.

4.4 The Wild Man Game

The Wild Man Game is played on a smart mobile phone by families visiting Belsay Hall. The game consists of five playful experiences activated by the players' proximity to Bluetooth Low Energy (BLE) beacons hidden throughout the country hall. The beacons were used to situate the games according to the space investigation and encourage the players to explore the whole space. In this sense the beacons were a central to the core game mechanic of prompting play through spoken and written instruction, since they fixed the position of the games in the hall.

The Wild Man was voiced by a local artist-musician who narrates the game, heartening players throughout its approx. 20-minute gameplay. The Wild Man opened the game with an introduction and framed the proceeding play: *"Discover your Wild Man within, and make my presence grow strong at Belsay Hall once more! Being wild means being noisy and carefree. But it also means knowing the wild places and their creatures. You must demonstrate both to*

awaken me. Find and complete the tasks I have placed around the hall and become part of my wild family at Belsay Hall!" (Game narration)

The following sections describe the gameplay in the different games and rooms. These games begin with the narrative (or prompt) which instructs the player on how to proceed.

4.4.1 Stillness

"To know the wild, you must be still and calm your mind. Stay quiet, move slowly and the wild will reveal itself…" (Game prompt).

In this game, the players are asked to hold out the phone and move it around to see whether "the wild will reveal itself". If the players are suitably quiet and move around without quick movement, an owl will appear as if present in the room by using AR (see Figure 10).

Figure 10. Stillness Game with observed content overlaid.

In this figure, the animated content is overlaid on the picture of the room to visual the AR content as experienced by the player.

To create this AR experience, the orientation of the phone was used in the room (as determined by sensor fusion of accelerometer, magnetometer and gyroscope). The game used this orientation to position and render a lit model of an owl that was rigged and animated, using boned animations to appear more realistic as it flapped its wings. The owl model begins at a fixed distance (as seen through the screen) initially starting over the haunting garden backdrop. The phone's microphone and accelerometer are used to check if the players have remained still and silent for a period of time before the owl moves through the space. The owl then circles the room encouraging the players to follow its flight – hooting every time it turns toward the player. This encourages the players to look out into the room, and players must move together in order to share the experience.

4.4.2 Wild Mark

"To be a wild man you need a 'wild mark', a shape only visible to other wild men … hold out your phone and trace your mark in time to the drums." (Game prompt)

In this game, the players' hold the phone whose movement is translated into a glowing particle trail on the inside of a virtual sphere surrounding the player.

Figure 11. Wild mark game pictured in the library (overlaid augmented reality content created in game).

Figure 9 illustrates the gameplay using real game content created by a family member of the design team. The figure shows the glowing particle trail as seen by the players.

Players watch this pattern grow as they move, overlaid onto an AR styled view of the room from the phone's camera. This dance is made while a music with drums plays. Once the drums end, the pattern is shown in its entirety from a perspective outside the hemisphere and players are asked whether they would like to make another 'wild mark'.

Wild-Mark was partly inspired by the co-located movement-based game *Bounden* (Adriaan de Jongh, 2014) in which players are guided in a "whimsical" choreographed dance. In *Bounden* players look down upon a rendered model as they follow patterns that guide the player – imagine, a tennis ball and rotating it with your hands, as you follow the seam wind around the ball. However, in this dance game and in the heritage context, it was necessary to get players to look out into the room to appreciate the space, so this gameplay mechanic works in reverse; players can paint anywhere inside the imaginary sphere as they look outward into the space in order to ensure players avoid being fixated on the phone's display.

4.4.3 Mimicry

"To be wild you must be one with nature … can you learn the call of the quail, the cry of the peacock...?" (Game prompt)

This game begins in a room with a view of the "Jurassic Garden". Players are asked to mimic the sounds made by various animals connected with Belsay Hall, which are played by tapping pictures of animals on the screen.

Figure 12 shows *Mimicry* being played by young visitors to the heritage space. This photograph shows players standing around the device, some players lean in to view the screen and what animal is being displayed, while some are at the peripheral watching their friends' improvisations. The game works by listening to the players impressions by processing the incoming audio with a Fast Fourier Transform (FFT) to calculate the pitch of the sounds. The different animal sounds are spread out across the voice frequencies and are matched against the sampled sound to ascertain whether players were successful.

Figure 12. Mimicry game. A player watches from the periphery as other players take turns to mimic the wild animals.

4.4.4 Creep

"A wild man must be able to move quietly and remain hidden … can you creep up on me?" (Game prompt)

In this game, players are asked to move from the back of the hall to the front door of the building. In the accompanying photo (see Figure 13) taken by one of the young visitors, players are creeping down one of the corridors which has a rough floor with gravel.

As players move, the Wild Man warns them if they move too quickly or are too noisy. If players are warned more than four times they are given an option of returning to the beginning and trying again. While playing, the game evaluates how effectively the players are creeping by analyzing the amplitude of accelerometer movement and the amplitude of the real time sampled audio data. Once players have exited out the front door of the build (symbolizing the Wild Man's returned to the wild), the Wild Man congratulates them. To test whether players reach the outside, the game determines the visibility of GPS satellites and proximity to an additional beacon under the hall's front (in case of poor reception).

Figure 13. Creep game showing young players moving through the hall.

4.4.5 Wild-Selfie

"Show me your wild face … draw upon your inner wild man and make your fiercest roar. When your call is wildest I will take your picture." (Game prompt)

This game encourages players to group together as they take a unique selfie of themselves outside the hall (see Figure 14).

To create a 'wild-selfie', the device's camera captures an image once the visitor's 'roar' reaches a set volume level (with a small delay to capture players' mid-shout). The Wild Man then congratulates the players and the game notes that the picture will be saved on the phone and asks players if they would like to make another. Photographs taken 'mid-roar' are often unusual and funny and, by saving to the phone's phone roll, which was also formatted as a digital postcard, it served to invite players on social media to *"show others that [they] went Wild at Belsay Hall"*.

Figure 14. Wild Selfie game. Players are shown capturing their wildest roar.

4.5 Ethics

In the *Wild Man Game* participants were required to come to Belsay Hall to play. As with *DoHS*, it was important to ensure that the research activity in the wild was conducted with the children's wellbeing in mind. This meant that the same procedures were followed: obtaining university ethics, ensuring that participants provide informed consent, running the study in the wild with the participants welfare in mind, and storing and analysing data appropriately.

Prior to the work commencing at Belsay Hall, the project was approved with the faculty ethics committee through a full ethics application (see 10.1.5). It was unnecessary to do a preliminary one as this would have been superseded by the full ethics application (as was illustrated by the first study). Researchers working directly with the children also required the same or equivalent DBS checks. The work also followed the same lone working policy, in this case ensuring that children remained with the parents or guardian at all times when playing the game.

Consent forms (see 10.1.6) were given to participants who were recruited for the study and visitors who happened upon the game during the Wild Man exhibition. In both cases it was important that participants were able provide informed consent. This was done by taking visitors to a private room where two researchers were present to talk about the study. This was occasion to communicate what the research was about, what would be expected during the game and importantly ensure that this was understood by the participants.

The consent forms provided permission for the research team to both video record the game, take photos of the visit and record the audio from a semi-structured interview. Pseudonyms were created to help transcribe the audio and which voice belonged to whom on the audio. However, this would not identify the families in person and these pseudonyms were used in the evaluation selection of this thesis.

The description of the Wild Man Game that follows does include pictures of young people, but these have been blurred to safe-guard their identity. The last photo from this chapter (see Figure 14) was used by the university in a press release about the game.

4.6 Evaluation

The *Wild Man Game* evaluation was based on two separate data collection activities. On the first of these occasions, family groups were invited to Belsay Hall to come and play the game using a snowball recruitment technique (Braun and Clarke, 2013). After meeting researchers and handing over the pre-signed consent forms they were then led to the entrance to the hall and recorded with a video camera as they played the game.

In the second data collection activity, a special events day provided an opportunity to ask willing weekend visitors to come and play the game. These visitors began the experience by being taken into the same private room and explained the purpose of the study. However, unlike the first group they were observed rather than video recorded. In both of the data collection activities, the visitors were interviewed about their experiences immediately after the game, in an interview which lasted no more than twenty minutes. The questions for these semi-structured interviews were devised with English Heritage. Visitors were asked their opinion of interactive technology and how games using new mobile technologies could help develop the hall which was under-used by visitors. In total, 37 visitors played the games which included families, friends, older couples and a local youth group – the ages of the

fourteen children in the study ranged from 3-14 years (mean 8.7). The videos were watched several times attending to how the games were played (what they did and said, how this affected and was affected by others in the group and in the public space). This was used to finalise accurate written descriptions of the gameplay working with two other researchers, while drawing upon conversation and interaction analysis techniques (Heath and Hindmarsh, 2002) to write accurate descriptions of the game. This was then analysed with an inductive thematic analysis (Braun and Clarke, 2006).

The results of the analysis is arranged into five overarching themes. These are: F1) Playing nicely together F2), Varied formations of play F3) Performing the game to one another, and F4) Taking hold of the space. In the following, most of the examples are taken from the three different families playing the game from the first data collection activity. The first family has two mums, Lesley and Sharon and their children Andrew (16), Tom, Niamh and Sophie. The second family has Sarah (Mum) with her two children Lindsay (aged 13), Matthew (aged 8). The third family has children Rebecca (aged 11), Jennifer (11) with parents Nicola and Tony. Their respective names have been annoymised for publication, and the play is further evidenced with quotes from the interviews - matching players against interviewees.

Before looking at these themes, it is worth evidencing how the game was found to be engaging by most players, and importantly how much fun they had, even though there were initial reservations about the use of technology. To this end, the semi-structured interview began by asking visitor's opinions of heritage sites and the use of technology generally. This question illustrated how technology at heritage sites polarised participants' opinion, as either a *'cool'* application of technology or being for others: *"I think it's good because it's bringing all heritage sites into the modern age, it gives a wider range of interaction, especially for younger audiences."* (Male, 14yrs) and *"I don't like technology. I mean it has to be, but my brain and it, don't get on."* (Male, 65+yrs). "*I'm a technophobe – if I have to be honest."* (Female, 65+yrs).

Despite this split in opinion, most participants recognised the value of the game for children and families. In particular, they indicated it was well suited to children, and visitors were pleased to see children enjoying the game: *"Watching the children, it's obviously caught their imagination, and they were enjoying it."* (Woman, 65+yrs); *"It gives you great pleasure to see how excited [our grandchildren] are. They just loved it."* (Woman, 65+yrs)

Players described how *The Wild Man Game* made heritage fun and interesting, while it encouraged learning in a different way: *"It was fun, because you normally have to come and do boring things."* (Female, 12yrs); *"It was good to make you stop and take things in."* (Male, 38yrs)

Players enjoyed playing the game as it involved the playing together and being led around the space. *"It was quite nice to see everyone work together"* (Female, 44yrs). *"You know how it's like, the way things were made and set out there, makes it fun."* (Female, 13yrs). Through these former aspects, the game enabled participants' learning through bringing heritage to life. *"[the game] shows that there's a wider history and culture with the building, and not just an old place where people lived a long time ago."* (Female, 14yrs).

Players also described how they found the game fun, albeit acknowledging the challenge: [Was the creeping one hard?] *"Yeah, but it was fun."* (Female, 12yrs), and, "*I just thought it was a good end to the day – it made it really fun. Yeah it was. Really good."* (Female, 40); *"I couldn't do it. There was this good ole [local character] saying I was making too much noise."* (Female, 65+).

4.6.1 Playing nicely together [F1]

The analysis shows that the game was worth playing, but also shows the game was played together by families. For example, players enjoying the *Wild Man Game* had many conversations and exchanges which often were around how to play. This began as the players were first given the mobile phone and continued throughout the visit. For example, on arrival to the entry hall at Belsay Hall, the first family gather round to listen to the Wild Man's introduction. "*You must demonstrate both [noisiness, being in tune with nature] to awaken me".* In response, Tracy, Jon and Mary look between each other and the phone, before everyone comes closer in to look at the phone. Mary asks "*ok, what does it say?*". Andrew reads aloud "*find the rooms marked with a Wild Man on the map, or tap them for a clue".* Tracy*: "why don't you turn around and face the way we're going then, keep an eye on where we are…".* The group turns and heads into the main hall, Niamh and Sophie pointing to doorways. In this typical exchange, Andrew reads the instructions to the group and Tracy suggests how to proceed, making sure that the others think about where they are and where they are going. The players are not just picking up information and instructions from the

phone, they are checking on each other's understandings and playing together. The moments of progression often correspond with entering and leaving rooms and the beginning of games, but importantly progression is always decided socially rather than instructed by the game.

Players also encouraged each other to take their turns. For example, in the first group playing *Wild Mark*: Jon, suggests *"someone have a go"*, giving the phone to Mary. Tracy and Mary clamour to get the phone to make their own marks *"let me!... do a big circle"* [Mary]. Mary, is given the phone, *"we'll follow you then, do it together, right start again Mary…"* [Tracy].

And in the second group: *"Can we do that one?"*, as Lindsay leans in and taps the peacock button, the peacock sound clip is played, Lindsay smiles and carries on fiddling with her own phone. Lindsay and Matthew look at each other, Sarah muttering something. *"You've got to try it"*, Sarah says to Lindsay, tapping the peacock button again and smiling at her daughter.

And third: Rebecca says, *"I've done two, so now my sister".* Although, sometimes players had to ask, although these requests were always made politely e.g.

[Lindsay]: *"right, ok, can I?"*.
[Sarah]: *"have another go"*.
[Lindsay]: *"make another?"*.
[Sarah]: *"yeah, go on"*.

When games did not work out to their satisfaction they made their own coping strategies (e.g. playing an individual game again and taking more care). Since the app has no 'game over' screen, the players also decide together when play is over, as "ending together" is particularly important. In another gameplay description, there is a difference of opinion of what to do next:

Sophie is holding the phone with Andrew, Mary and Tracy around her looking on. Niamh has moved on to look into the next room (Mimicry location), Jon is catching up, then they both move in to look at the game.

Andrew: "Really, really, we have to be really quiet now". Sophie: "Yeah, but look". Andrew [pointing to the next room along, the Creep start point]: "Here, but it's…" Tracy: "We're

not in that room". Mary: "That's the one, ok, so we're in the wrong room". Niamh: "Which room is it?" Sophie is frustrated: "It's somewhere". The group heads back through the main hall to the Old Library, except Jon who goes via the SW room. Niamh: "I think, oh! I know, I know". Tracy: "Is that the room that you two went in earlier?"

Andrew wants the group to play *Creep* again whereas Sophie has found somewhere else for them to go. On entering the library, everyone walks to the NE corner door, loosely together, to find it locked and an exchange results in Mary, Niamh and Andrew heading back the way they came. Andrew and Tracy then have differences over which game to attempt next, the group stays together regardless, and Sophie shows her delight at finding the *Stillness* game:

The group gathers around the map on the phone and re-align their position to the map ("oh it's that way round"). Realising they have found a new game (Stillness), Sophie is relieved and bounces a step forward with the phone held aloft: "go!"

These examples further underline how the game is played together. The move to the next game gives the opportunity to move on - allowing Sophie to get past her earlier frustration as they find another game to play.

4.6.2 Varied Formations of Play [F2]

The families often read the game prompts aloud in order to fold-in their members. This helps playing families decide what is needed and what they are going to do. Characteristically, the families may expand and disperse as they enter a new room, then gather as they read instructions, often letting the next player (or a different player) in the group read the prompt, then they will spread out to play, gather to inspect results, and so on. Reoccurring formations of players were observed, for example, one person holds the phone, some players gather in close and some stay on the periphery. During play, the younger group members often share holding the phone with each other while the adults watch over their shoulders. Foremost, these formations are created to ensure everyone is included. In the following description, the first family is playing *Stillness. Stillness* requires players to move as they explore the room in order to find the augmented reality owl. This means the group has to consciously position themselves to allow movement while sharing the view of the screen.

Sophie holds the phone with Niamh close by her side. Everyone else is stood behind them crowding close to watch the screen. Without speaking, Sophie and Niamh move slowly forward and round watching the phone all the time. The others watch and begin to follow, but then Andrew steps aside and Mary, Tracy and Jon step back to let Sophie and Niamh circle slowly forwards. Everyone is quiet with occasional glances around the room, then back to the two girls, Andrew craning his neck around them to see what is happening on the phone, Jon moving back and next to Andrew to see the phone. After half a turn, the phone plays an owl hoot sound. Mary: "what's that?" Both Tracy and Mary who, up to now, had not been able to see the phone screen, come close and peer at the screen. "Woah!" Niamh exclaims, seeing the owl on screen, and is immediately shushed by Sophie.

There are also different formations of play that were unexpected. In the second data collection activity, two grandparents allow their grandson to follow the augmented reality owl in *Stillness* around the entire house avoiding playing all but *Creep.* The family talk about this experience in the interview, clearly excited about an invisible and *"cooooolllll"* owl their grandson begins, *"you couldn't see it on the other bits – because it was invisible.",* then describes how *"the owl was coming into the phone".* Even though this was not how the game intended to be experienced, the grandparents seemed happy with the owl as the guide, speculating that being quiet was to encourage the players to move from room to room. They added, *"it gave us a purpose going from room to room, you had to go at a certain speed".* In another example reported below, there is a description of a game where the mums leave the family group behind in order to look after the front door. These two examples illustrate how formations varied, with individuals finding their own roles.

4.6.3 Performing the game to each other [F3]

Much of what the group does during the game can be regarded as a *performance* and are acted out in such a way that others will see them being performed e.g. for example when leading a group, players take exaggerated pantomime steps which can be clearly seen by the others. The players' performances are also shaped by the presence of other visitors in the vicinity and sometimes an artful display is made, as-if for other visitors, yet targeted to the group members. The overall theme of the Wild Man of course encourages acted-out displays of wildness, both in individual games, and as a general feature of the play. In these respects, the game as an opportunity to perform, as illustrated in this description from the video of family one playing *Creep*:

Andrew leads the group out of the room with Niamh, Sophie and Mary following making exaggerated tiptoe steps. The Wild Man voice responds through the game several times: "You are too noisy…" The group look at their feet and continue on with greater emphasis on their tiptoeing, apart from Jon who walks slowly behind. As the group heads out of the room they notice other visitors talking in the main hall. Tracy: "how are we going to get past the people if they are talking? shall I ask them to be quiet?" Tracy laughs quietly. Another "… too noisy..." sound clip is played, and the group hover by the doorway, Andrew putting his finger to his mouth and Sophie her hand over hers.

The players tiptoe, shush each other, and put fingers and hands to their mouths. As they re-attempt *Creep* three more times, they gesture and perform with increasing exaggeration, all the while looking at each other, smiling and suppressing laughter. Such performance both demonstrates a game strategy *for* others, but also stresses that they are 'playing the game' – doing what seems to be required to accomplish the game. However, this performance is not only for the others in the group, it is also observed and affected by other visitors in the space. With this group, the other visitors' impact on their performance is reflected in an increasing frustration (Jon: "it's the people out there", Mary: "ah, what!") and determination (Tracy: "come on, perseverance!" Sophie: "[hand clap] come on, guys!"). During another game described from the video below, other visitors have a noticeable effect on the teenage daughter's performance during *Mimicry*. At first, she shows interest in the task ("can we do that one [peacock]") and is embarrassed upon hearing the cry that must be mimicked ("oh my god!"). She shows this embarrassment very openly - turning and walking into the room and back, smiling, hand over mouth but joins in with her mother's subsequent peacock attempts anyway. The mother successfully mimics the peacock and moves on to the cat noise, with her daughter continuing to show her embarrassment.

The mum attempts to mimic the "meow". Lindsay is fiddling with her phone but then stops, raises her arms and meows loudly, stepping away into the room. Mother reads out: "Right, that was a little bit high" and taps the cat button again. Lindsay asks, "What we doing?" Mother attempts: "meow". The son is looking at the phone and taps the cat button once more. Mother: "Meow". Other visitors enter the room. Daughter tries quietly: "Meow". Mother: "That was a little low... don't think we got that right, try this one..." Daughter whispers: "I

can't do it" and glances at the other visitors. Mother tries a lower-pitched meow, failing again, "That was a little low, try and do it..." trying a low-pitched meow, again. "Oh, my god!" Daughter whispers, turning away from her mother and brother, stepping into the room playing with her phone as her mother tries the cat call again. "A little too high for his ears". The mum reads aloud, "you try" (to her daughter). Mother tries the cat once more, looking at her daughter, who giggles but then makes her own catcall that, this time, succeeds. Daughter: "Yes! Thanks to me!" She raises her arms and dances on the spot.

The daughter's performance is less demonstrative once other visitors enter the room. Her participation is subdued, whispered with the potential for embarrassment greatly increased. Clearly, the presence of others changes her performance of the game in a way that makes it hard to complete. However, in a sense, this only contributes to her pleasure and overt display when she completes the game, congratulating herself and performing a little dance.

4.6.4 Taking hold of the space [F4]

In performing the game, the space became a stage for improvisation (as in F3), but the players also demonstrated it was their stage. Players gained a tacit understanding of the space by playing the game – they demonstrate that they can locate individual games using the barest glance at the map, remembering places they had already visited, suggesting alternative routes based on a previous game and placing the rooms geographically e.g. players talked about rooms as the most northerly etc. Another group paid particular attention to the map's photo clues, for example, exclaiming out loud when they matched a particular view out of a window to those given in the game.

Players also appropriated features of the space in playing the game and wrapped them into their own play. In their first attempts at *Creep,* the first family decides that their failure is due to the background noise of other visitors, Jon remarks in play, "*it's that stupid guy upstairs!*" and Tracy suggests a plan "*so, I'm going to go and stand guard by the front door and [laughing] tell everyone to go away.*" Although initially in jest, they carry out this plan believing they are unobserved; a researcher watches from a doorways and videos from his phone since the main video camera is following the children.

The two mums stand by the large front door. They are waiting for the children to reach the front of the hall. The mums look at one another – seemingly un-phased that the researcher is

present. One gestures at the front door, and the other raises her hand to her mouth - accompanied by a "Tee-Hee". The two, stand vigil over the front door with mischievous expressions watching the banners and waiting for the children".

This action by the mums was, in part, to prevent people entering the hall but also because they noticed that with the doors open, the wind blew the exhibition banners and caused them to clatter noisily against the wall. This caused the children to fail at the *Creep* game as the phone had picked up this sound and instructed the players to go back to the beginning. While playing, the same children head down the corridor making their way to the front of the hall. During this game the children were really focused on the environment – particularly the floor. The floor here is an uneven stone floor which has an odd crunch as it is walked over. The narrow doorways also need to be negotiated carefully if walking together positioned around the phone. In this way, the game makes strong connections with the space and causes players to experience it in new ways, being sensitive to features that they might not typically engage with. While in many publicly accessible buildings, people might visit with hushed voices, slow movement, looking but not touching. However, their actions here are in clear opposition to the context and the *communally-held sense of appropriate behavior* (Harrison and Dourish, 1996).

As well as the layout and texture of the space, players also thought about more complex notions of space. While playing *Creep* the dad from the second family remembered that the Wild Man is near the entrance and will see down the middle of the hall. The dad says, *"He'll see down"* (meaning the Wild Man), and adds, *"So we should walk around"*. The two girls and mum then follow their dad's suggestion carefully sticking to the left-hand side of the corridor, so they cannot be seen.

4.7 Discussion

The analysis of the visitors' gameplay and the semi-structured interviews show that they enjoyed playing the game together. But the gameplay analysis (F1-F4) also enables an examination of the earlier design rational, questioning how the game encouraged visitors to play together. The following section summarizes this as a set of actionable guidelines.

4.7.1 Design for play that is relatable and will make sense (G5)

The *Wild Man Game* was inspired by both fictional stories and existing play observed in the space of Belsay Hall. In the workshop, the design team reminisced over traditional and childhood memories of play, relating these to play that had been observed happening in the country house, such as running around, creeping from room to room, being *still as statues*, pretending and sometimes actually sneaking into "out of bounds" places, and creating "echoes" in the basement of the house. There were also discussions around outdoor play, with one of the heritage staff describing the delight young people have rolling down a grass banking (note: an activity in the National Trust's paper guide *"50 things to do before you're 11 ¾*" was "Roll down a really big hill"). This play was then related to the Wild Man - a figure that embodies play across different cultures (think ritualistic dance, and being attuned to nature etc.) and is also present in stories that young people will find familiar such as The Children of Green Knowe etc.

Creep was by far the most engaging game, to the point where children pleaded with their parents to replay *Creep* to try their own more difficult paths. *Wild-Selfie* and *Mimicry* were also successful, even encouraging players to copy and tease each other outside the game (F3). These successful games were similar to activities we had observed, or were reminiscent of more traditional play. For example, *Creep* resembles 'Hide and Seek,' *Mimicry* resembles 'copycat' games, *Stillness* resonates with observations of children 'being statues' on empty plinths at Belsay Hall and with childhood games such as 'musical statues'. The *Wild-Selfie* is just that (a 'selfie' gone wild). From this perspective, *Wild Mark* was less successful as it presented an activity that was unfamiliar to participants. Familiar games, or and importantly games that were easily communicated by playful prompts with little explanation were more successful, i.e. it was enough to ask players to creep from the back of the country hall to the front door.

Designing for relatable play provides players with permissiveness to express themselves, and a confidence that they are playing the right way, since the game will make sense. For example, given the instruction to *creep* to the front of the house, players in the *Wild Man Game* knew instinctively how to sneak around and how to make this more fun. Even though the players did not know the exact underlying mechanics of the game it did not seem to matter; players enjoyed creeping across the spaces of the country house. These endeavors were decidedly theatrical with both young players and adults performing pantomime

exaggerated footsteps, as well as raising fingers to lips as if to "*ssshhh*" other players. These fun actions were performed for each other (*see Performing the game to each other)*.

4.7.2 Provide mechanisms to play nicely together (G6)

F1 provides describes how players were not just collaborating together to finish the game, but made efforts to play nicely together. Moreover, F1 to F4 evidence the different ways that players ensured that other group members got the most out of the experience. This might not be surprising since the visitors were on a day out together, and they were interested in enjoying themselves. For example, players enjoyed performing the game to each other (F3), they worked out how to best take turns (F1/F2), asked each other politely for their turn, and encouraged others to play (F1) - especially when individual players felt frustrated (F4). Lastly, the mums even ventured away from the mobile device to the front of the house to help the children succeed (F4). However, there were other ways players helped one another which were unexpected. For example, F2 describes how different players took turns to read the prompts and look after the phone outside of the actual games. The grandparents were even content to watch their grandson follow the augmented reality owl around the entire house – even though this was not how the game was intended to be played.

As game designers there are simple options that will help create these games in such a way that helps them be *played well* – using De Koven's (2013) term. For example, we should allow games to be repeated so different players have the same opportunity to play, and in providing something as simple as a mechanism to turn the cards over manually, everyone is able to see what each game involves as they are setting the pace as a group. The actions of turning over cards is also instantly recognizable and accessible to watching players, so anyone can literally reach in and move the game along or even make others aware that they are not ready to move on.

Furthermore, in designing for play around the device (D3) the mobile device becomes something that can be shared between players and players enjoy sharing the experience. AR experiences particularly challenge the players in this regard. AR is seen through the device and players must respond by moving together with others in the space.

4.7.3 Allow players to enter and leave the magic circle of play (G7)

The *Wild Man Game* created an atmosphere and a stage for play that *existed* around the mobile phone. The players were observed arranging themselves around the device, playing at the periphery and even leaving to explore other rooms – but returning to the fold (F4). There was also play inspired by the game – such as creeping around, mimicking the voice of the wild man and animals, even after the session had finished.

The principle of designing for play through and around the device (D3) meant that play could happen away from the phone. For example, play in *Creep* could equally involve moving stealthily with the phone or, as observed, attempting to reduce loud noise and other relevant interferences elsewhere (such as flapping banners in the hall) (F4). This was true even when children were a distance from the mobile device and the sensors were less effective. However, rather than provide an easier path for the players, the children enjoyed balancing their own 'theatrics' against the amount of risk taken. Players further from the phone could take bigger risks in moving more and often exaggerated their steps and were louder, whereas the children holding the phone were creeping with more care – almost nursing the mobile device. In this game, peripheral play was very noticeable – children were clearly enjoying the roleplay even when they were away from the phone because they were still caught up in the play.

The different games afforded degrees of involvement at any one time and this changed during performing for self and others, enjoying the performances (and momentary discomforts) of others (F3), and being spectator and watched (F2 and F3). The loose area around the phone enabled players to come in or out of the main play, as they saw fit. This contributed to the different formations of play – and importantly those which allowed players to vary between less and more committed roles in play. It is important to underline how that games were self-paced, and players could repeat games in any order, any numbers of times and at any time. This also removed the necessity to be constantly attending the device. The act of "ending together" described in *Playing Nicely Together (F1)* also meant that players did not worry that the game would end without them. Players were happy to come back into the fold and any tensions would often be mitigated when everything was found to be fine; players would soon be excited by the next 'thing' to discover. Thus, allowing players to return to play facilitated social repair in the game.

In thinking about how players' leave and enter the game, it is useful to revisit the concept of the magic circle. Pervasive mobile games do not have a clear magic circle. However, the contract of the magic circle in this game is clear to players (Goddard, Garner and Jensen, 2016). Play largely happens around the device and is co-located, and in this sense there is a pocket-magic circle (Ibid.) which becomes noticeable as the games start. However, in *Dance*, *Creep*, *Selfie*, and contrary to its name *Stillness* (once the owl has appeared), it is noticeable that the magic circle has become portable, moving with the mobile phone. This is most apparent in *Creep* where the magic circle is limited (in one sense) by the devices ability to pick up sound. A player may position themselves away from the device in order to have an easier time, but they may then take an intentionally careless step to create some noise as if to make their play relevant.

Significantly, in the games it has been interesting to think how players can be allowed to enter and leave the magic circle without breaking the game. This is particularly important when thinking about other games in public spaces that might accommodate a changing number of players.

4.7.4 Place stages for play (G8)

The *Wild Man Game* included five games that, although having different gameplay, all fit within an overarching narrative of the Wild Man's return to Belsay Hall (D1). This story was appropriate because it had similarities to other well-known stories e.g. Stig of the Dump, The Children of Green Knowe etc. The games suggested by these stories were also recognizable e.g. creeping, animal mimicry etc. These activities both made sense within this broad story and encouraged players to appropriate features of the site into their play (D4).

Throughout the games, players were observed performing little bits this play to and for each other (F3), and that this performance was both collective and considerate. Overall, this supports the first four design principles in showing how a careful consideration of the affordances and relationships between the stories, activities and physical characteristics associated with the site can create a 'stage' for play as a collective performance. This is perhaps an obvious insight for designing pervasive games. What is notable about the Wild Man Game, however, was that it was largely effective whilst only providing *fragments* of familiar stories and games. Indeed, it suggests this is partly why the game was effective in encouraging play. The different cards in different locations invited players to re-tell the

overarching story in their own manner and in any order. These pieces suggested new conceptions of the site, new permissible behaviours, and consequently afforded new encounters with the site. Such fragments of story and play did not cause problems. Instead, the players' transitions (in the seams of the games) involved exploration and game related talk, which set the stage for the upcoming play. The positive effects of 'just enough' hints of folk mythology allowed players to improvise their own imagined Wild Man.

The use of the BLE technology in the Wild Man Game was a key part of the game design and it was important to carefully choose where to place the prompts for play. However, there are indications that some of the games, like *Creep* for example, are compelling enough to be played in different spaces. Indeed, the young players even chose to make their own routes to make their game more difficult to play again and for longer. In designing these games, we might think how young people can place the games themselves – taking those portable magic circles of play with them, in the case of creep this would involve setting up the beginning and finishing points. However, the game need not ask the players to program this *per se*, instead they could program through demonstration i.e. playing and recording their game for others.

4.8 Conclusion

This chapter described the development of a novel digital game that encourages families to play together in a cultural heritage space which was otherwise *unplayful*. The game encouraged improvised play which entwined its stories, the space and the play already happening there. This was achieved through the sensitive matching of games with the context and through working closely with the stakeholders of the space.

The *Wild Man Game* occupies a middle ground between co-located games (such as those played around a device like digital folk games) and locative games. Foremost, the game was engaging because of how people were playing together e.g. creeping actions / mimicry are playful interactions performed for each other as much as they are performed for the game. The game also benefited from the physicality of the space; children actually come into contact with the texture of the site as they feel the walls, the crunch of the floor and listen to their own echoes.

In examining how players' move in its space and feel permitted to come back into play, the discussion had cause to revisit the concept of the magic circle and this game can be usefully

framed with a portable and pocket magic circle (Goddard, Garner and Jensen, 2016). As part of enabling this magic circle, it was necessary to allow players to come and go through a number of different mechanics, for example, players could simply walk away from the game knowing they did not have to come back, or could come back at any time (since there is no score or no judgement). In the example of the family following the owl this provided a unique adventure without following any concept of a planned canonical trajectory (Benford et al., 2009). However, the games also stretched this magic circle of play and were able to encourage *peripheral play* away from the device, where play was still framed by the game and content. As the games moved around the country hall, so did the magic circle of play, for example, in the photo of the *Creep* (see Figure 14) – the child leading the group has held up his hands as if to say – "I'm not making any noise" as children tip toed down the corridor. However, the mobile device was able to draw players back toward the proximity of the phone – given a new game, or because of the appearance of exciting content like the augmented reality owl.

To conclude, it was important to think about viewing the game design as a set of playful prompts which facilitate player improvisation through different games. Thinking about prompts also helped ensure that the games were relatable and made sense. Importantly, the play resulting from these prompts could be supported by the mobile devices sensors which help sustain the play - keeping players literally on their toes.

4.9 Post Reflection

The *Wild Man Game* was an opportunity to experiment with new digital interfaces based on the simple digital cards used in the *Department of Hidden Stories*. However, in doing so, it was easy to get carried away in the creation of new digital interfaces that might be argued as full interactive experiences in their own right. Those experiences moved away from the simple paradigm that proved successful in *DoHS*; the best games were the simplest games – which are almost written 'dares'.

Instead of using the mobile device's capabilities just to provide digital interfaces to sustain play, this game showed how we might think about using the mobile device and game mechanics to better structure the co-located play: both situating it and supporting how players might play together nicely. The games were inclusive, but how might we ensure this inclusivity in other games in public spaces and can we help support a well-played game?

5 i-dentity and intangle

This chapter draws upon the learning from the game designs *i-dentity* and *intangle* which were created in academic game jams hosted at the Computer Human Interaction (CHI) conference in 2013 and 2014. For the work in this thesis, these game jams provided an opportunity to look at how improvised games can be created and iterated rapidly and yet still result in exciting and flexible gameplay. Game jams are particularly interesting because they involve making games under constraints which often include time limits or involve making games around a theme (Goddard, Byrne and Mueller, 2014). Furthermore, attending academic game jams as opposed to non-academic game jams presents an occasion to critically reflect on these events with likeminded individuals.

The first game*, i-dentity* was created at the [Game Jam at CHI 2013] (Deen et al., 2014). This was a 48-hour game jam at the CHI conference that encouraged attendees to imagine the future of digital gaming. In order to attend this game jam, the author submitted a position paper, "A future vision of new games and game interfaces". This described how new digital sensors would enable games to better capture and represent body movement, and how this might inspire new games for young people that centred on social and physical play.

The second game*, intangle* was created at the Game Jam [4Research](Deen et al., 2014). The author's submission for this game jam was the position paper, "Game Jamming The well-played (computer) game". This argued that we should make remediated forms of traditional games and play – which can provide opportunity to experiment with game rules and boundaries, specifically looking at how we might encourage the well-played computer game (De Koven, 2013).

This chapter complements the learning from the two previous case studies around culturally important spaces, instead applying the design insights from these games and the actual game designs, to a new context of youth work. This chapter does not use the full analysis from the previous chapters to generate its findings. Instead it reflects on the game design process, the player interaction patterns that were needed to support these games, and evidences short examples of gameplay across a playtesting session with youth workers. This is used to make two contributions: (1) the two game designs serve as design exemplars for games that use improvisations. These games illustrate how games can embody more explicit concepts of

playfulness through a simplistic game system that allows fast iteration and experimentation, and (2) these games are used to contribute new player interaction patterns which can be used in games that will support more improvised play. This focus makes this chapter distinct from the full papers on *i-dentity* (Garner, Wood, Pijnappel, et al., 2014) and the extended abstract published on *Intangle* (Garner, Wood, Danilovic, et al., 2014).

This chapter continues with an introduction to this youth work context, before describing what can be learnt from *i-dentity* and *Intangle* with these contexts in mind – contexts that benefit from flexible games that can be appropriate by young people and youth workers. The summary ends with the context of youth work and describes how games that enable improvised play like *Intangle* can be appropriate for exploring more serious game topics.

5.1 Background: Bad Apples

The previous two case studies were created in the space of a library and in a cultural heritage destination. These mobile contexts provided interesting constraints for design – constraints which necessitated invention and illustrate how adopting a playful perspective for design was appropriate and worthwhile. Importantly, the work in thesis has also been informed by a third mobile context through volunteering for a youth work organisation called 'Bad Apples North East' (or Bad Apples).

Bad Apples is a Community Interest Company (CIC) whose primary concern is raising the esteem and supporting the well-being of young people in the north east of the UK. Bad Apples achieve this through engaging young people through music, dance, arts projects, and creative play. This youth work is important for the well-being of young people and particularly those who might be disaffected and find it difficult to engage positively with the wider community. For young people, these problems are part due to the availability, accessibility and affordability of social activities. This can lead young people to be involved in anti-social behaviour, underage drinking, legal highs and other risk-taking activities with their peers and older people. This behaviour is often reported by local residents, which in turn leads to the involvement of the police and the application of legal notices, such as the infamous anti-social behavior orders (ASBOs) discussed (Bradford, 2012). Any arrival of the police and other agencies introduces distrust, increases reclusive behaviour, hidden harm and promotes a negative relationship with between the young people and other parties.

Bad Apples support young people in areas in the north east of the UK by providing both detached and outreach youth work. In detached work they meet young people in the spaces that they "hang out" in order to engage with them and often at night, and in outreach work they invite the young people back to their premises to work with them. In both types of youth work, Bad Apples deliver diversionary activities that young people enjoy doing. These sessions are run by enthusiastic young people who provide positive role models and can help steer others away from negative influences and "things that they should not be doing". These sessions include pizza nights, circus skill training, computer game sessions, caged football, DJ workshops, and MC sessions where young people learn how to introduce performers and speak to the audience during live entertainment shows. In the time taken to conduct the work in this thesis, it was possible to volunteer over fifty hours with Bad Apples. This involved supporting Key Fund[5] events that help 14 to 25-year olds volunteer in social action in their community, supporting a design workshop for a skate boarding park in which young people hang out at night, delivering Scratch programming lessons, helping with circus skills, and supporting arts and crafts sessions. Volunteering has provided a background knowledge of working with youth providers and opportunity to get to know the public spaces which young people play together and consider their own.

5.2 i-dentity

5.2.1 i-dentity: The digital prototype and game

i-dentity is a movement-based game that was inspired by party games such as Follow my Leader (also known as the Copycat Game). It was created at the [Game Jam at CHI 2013](Deen et al., 2014) in collaboration with the co-organisers of the game jam: Exertion Games Lab, RMIT.

i-dentity can be played with 3-8 players and is themed around spies (and spying). In *i-dentity* players are either given the role of an interrogator, the role of the leader of the spies, or become a spy themselves. The object of the game is for the interrogator to spot the leader or "odd one out" by giving verbal instructions which are then acted out by the players. The game is played with multiple Sony PlayStation Move controllers which light up together when the leader of the spies (and the leader alone) moves. The interrogator must attempt to spot the

[5] Key Fund, http://thekeyfund.co.uk/

leader by looking for disparity between the movement of players and when the controller lights switch on and off.

The game begins after the players have nominated who will perform the role of the interrogator. The remaining players are given a controller each and the interrogator normally goes without a controller. The game then selects the other roles automatically by randomly choosing which player is the leader of the spies. This is indicated through a quick vibrate of one controller. The game now proceeds with the interrogator addressing the whole group and telling them what action to perform. In response to the commands, the group performs an action together. While the leader of the spies is moving, everyone's light turns on. When the leader is stationary everyone's lights go out. The spies in the game copy the leader's movement in an attempt to fool the interrogator (see Figure 15).

Figure 15. Players in i-dentity raise their hands in the air.

Figure 15 shows the game being played with one ringleader and three spies, who are trying to deceive the interrogator (stood furthest from the camera). In the figure, the interrogator is about to make a guess about the identity of the ringleader with help from a spectator who is offering suggestions to which player is leading the spies.

i-dentity has a single overriding rule, that the interrogator cannot address one player, for example, they are not allowed to say, *"only the person in the middle should jump"*. Speaking to one player alone would make it too easy to work out who, or who was not the leader straight away. Instead, the interrogator addresses all the spies, and works out who is the leader by closely watching the movement of the players and when the light turns on and off, for example, if some spies were to take longer to perform an action than the leader when given an action like, "wave your hands in the air", they will be moving, while their controller is not lit up. In this instance, the interrogator will be certain that those players are not the leader of the spies. The interrogator then has a chance to nominate who they think is the leader, and if they guess right, the leader and their spies are beaten, and the game can start over.

One original aspect of *i-dentity* is that spies will often enjoy exploiting the ambiguity of the prompts to make the interrogators job more difficult. e.g. if the spies were asked to wave a hand in the air, they might deliberately choose to wave the hand without the controller, or maybe wave very slowly so as to allow everyone to move together. Conversely, interrogators will push against the verbally understood rules of the game, for example, trying to come up with improvisations that are difficult for the spies to do together, such as asking the spies to write the first initial of their names in the air. These suggestions are interesting because they are a little bit of a cheat. As noted elsewhere, this little bit of cheating is fair enough, and this is allowed. However, asking the 'spy on the left' to move would pass from being a little bit of a cheat to becoming what De Koven (2013) calls being a spoilsport and the game would risk being ruined since the ringleader of the spies would be much more certain.

i-dentity encourages imaginative and often funny suggestions which means it is well suited to be played at parties where players have shared a drink together. In these occasions, improvisations such as, "pretend that you have just been shot", "play air guitar", or even "dance Gangnam style" have been used to catch out players. Interrogators have also use more strategic suggestions. For example, interrogators have tried to catch spies by purely physical means e.g. giving a command and then getting players to stop suddenly which tests the dexterity of the players and often reveals who is looking at whom (and particularly who is looking at the ringleader). Interrogators have also tried using the spies' bodies or the room against them. For example, the spies may be asked to move in such a way that compromises their ability to see what the other spies are doing e.g. an interrogator may ask spies to stand

back to back together. This hinders the ability of players to see what each other are doing (see Figure 16).

Figure 16. i-dentity. Players have been asked to stand back to back which makes it difficult to copy one another.

5.2.2 Design Process

The design process of *i-dentity* is interesting to revisit for a number of reasons. Significantly, it was decided that the game should be created around more explicit notions of play and playfulness which align with the principal approach in this thesis. Correspondingly, the game jam began with an earnest discussion on play. This discussion was both a way of sensitising the design team to play and playfulness, and to provide interesting directions to look along. In order to focus on games that might be more playful, a list of childhood games was compiled

which included the quintessential English folk games: *Sleeping Lions, Follow My Leader and What's the time Mr. Wolf?* Other welcome contributions were: *Tag, Hide & Seek*, an *egg & spoon race*, *a game of marbles*, *Musical Chairs*, and *Pass the Parcel.* The names of these games were written on *Post-It Notes* to invite shared discussion. This starting point was inspired by advocates of the New Games Movement, including De Koven (2013), who writes that designers should reconsider old playground games, and specifically, how we play together.

The game *"What's the time, Mr. Wolf?"* was chosen as the most inspiring game from the selection. This game was particularly interesting as it is played at a much slower pace in comparison to games like the thrilling J.S. Joust, yet the game was fondly remembered as spontaneous and exciting. The design began with the game jam members reenacting and playing the original child's game without technology. Players crept up on a player who had taken the role of the wolf. If the wolf turned around and spotted a moving player, the player was 'out' and removed from play. This led to an interesting insight that the original game required players to negotiate rules, otherwise the game was just broken, for example, what if the wolf turned around instantly, too frequently or identified someone as moving falsely when they were stationary? Indeed, it was apparently that the original game appeared slightly flawed if examined in light of the rules only, and the team could not even agree on how it was played. This opened up the possibility to think about a remediated version of the original game that would address these 'problems'. For example, how might an improvised game with actions provide players with the ability to explore different actions (some which might not be able to be sensed), yet still place some kind of feedback system that would somehow prove they were at fault.

In order to leverage the rich physical play from the original *"What's the time, Mr. Wolf?"*, the game jam team selected the PS3 Move controllers as mobile devices to reimagine the game. These controllers were an ideal choice: Thomas Perl's *PS Move API* (Perl, 2010) allowed experimentation with a fully networked set of devices, which could be controlled from a single laptop computer and one executable program. This meant the game need not to be rerun on separate devices every time the program was changed. In addition, changing the Move controller's lights provided a nice aesthetic, coupled with playing with accelerometers helped *technologically inspire* everyone present. Furthermore, the designers could also pick up a PS3 Move controller and walk away from the group for quiet reflection. In contrast, a

screen, mouse and keyboard might elevate the programmer to dominating the design, leaving the remaining team in the background.

What's the time, Mr. Wolf? provided the design team with the right game to explore digital play. The game was quickly changed from a game where players approached a nominated "wolf" player, to a game where the wolf would watch the other players looking to see who was moving. The game mechanic of looking for movement was married with the idea of using mimicry, and this provided a simplistic game system that was based around synchronised play. Significantly, *i-dentity* contributes a new player interaction pattern for improvised play where the device state must be copied across all the connected devices. In the game jam this configuration was quickly programmed using the PS3 Move Controllers. This meant that the design team were able to explore different improvisations, and *i-dentity* remains a game that can be used to explore actions for more improvised play and mimicry.

5.3 Using i-dentity in the context of youth work

5.3.1 Ethics

i-dentity was used in two workshops with Bad Apples where it was used to support Key Fund activities with two groups of five young people aged 12 to 16 – where one group identified as all male, and the other, female. The small study was designed to evidence how improvised games can provide a flexible and appropriate platform that could be used in diversionary activities in youth work, and to further evidence that these game designs have invention, relevance and are extensible.

As with the two other case studies – it was important that the study obtained university ethics, ensured that both participants and their parents provide informed consent, that it was run in the wild with the participants welfare in mind, and data was stored and analysed appropriately. These points are detailed below.

Prior to the work commencing at Bad Apples the project was approved with the faculty ethics committee through a full ethics application.

The study involved another researcher who required the Disclosure and Barring checks (or DBS checks). In its application in this project it provided Bad Apples with an assurance about the background of the researchers and is an important part of the working procedures at the

Bad Apples. Bad Apples also required the researchers to follow a lone working policy where children were always present with at least two researchers or a member of the Bad Apples staff.

Prior to the sessions, the parents were given consent forms which asked their permission to allow their children to participate. These consent forms included a study information sheet which detailed why the research was being conducted and what would be expected from the children. These were passed on to the researchers by the children on the day of the workshops to be legible to participate. In addition, children were given opportunity to ask Bad Apples staff and the researchers with any additional questions.

The data collected from the study was videoed and kept on a secure server at Newcastle University again using ownCloud, in preference to any Cloud based service which might keep the data stored outside the European Union (EU). In this chapter, no photos have been used of the children, even though this was permissable by the ethics. Instead, gameplay in the photos was recreated using researchers in the lab to play the games.

5.3.2 Observations

The observations discussed here are summarised from two sessions and give insights into the breadth of actions used by the players and the player interaction patterns which could be supported in *i-dentity*. The analysis was conducted by the author alone, and reports against watching the video of the sessions three times as suggested in Corbin and Strauss (2014), looking for what tactics players engaged in, what movements players performed and how the players were arranged.

The two sessions were led by a youth worker and took place in a meeting which the young people were attending as part of a Key Fund activity. The five players and youth worker enjoyed several rounds of *i-dentity* with the children taking in turns to take the role of the interrogator with the winner staying on in the majority of the rounds. The following suggestions for actions were given by the youth worker who took the lead toward the end of the session. These set of suggestions are particularly interesting because the youth worker was able to summarise some of the more successful actions from these games, as well as create their own suggestions. The actions are again typical of the kind of those that work well in these improvised games. They are both a mix of tasks that involve the body on its own, the

controller on its own, and a combination of both of these. In contrast to the previous games the suggestions were also demonstrated by the youth worker as well as being spoken to the group. The prompts included:

1. Everybody put the controller in the air now
2. Move all the way down to the floor on one knee
3. Sit on the floor with your hand in the air
4. Stand up
5. Stand on one leg and put a controller underneath your leg
6. Stand on one leg and jump up and down [hopping]
7. Do this [mimicking a hold like a statue of liberty]
8. Sit down
9. Do a "tree pose"
10. Everyone do a "star jump"
11. Sit on the floor like this with one hand up, and the other not
12. Everyone stand up, put one hand in the air and the other hand on the ground

Like the prompts in *DoHS* these actions have an important order which are used to make the game harder, for example, task 6 encourages the young players to keep standing on one leg.

The games also experimented with different play interaction patterns. In most games, one player would address the five spies. However, the game logic was quickly reprogrammed to play three spies against three spies. In this configuration the youth worker became part of the team to make numbers, and in doing so were playing at the same level as the young players.

Lastly, the game was appropriated by the youth worker with the interrogator showing how an action could be performed (see task 11). This idea was then taken further in a proceeding game where the youth worker led the group by asking the younger players to mimic their move exactly, and in doing so, they did not speak out what the actions should be, instead, relying on their demonstration alone.

5.4 Summary

i-dentity is different to the other games in this thesis as it was not created around card-based play. However, the game is played on a mobile device and is another example of the *simplistic game systems* discussed in the prior work and in this thesis. Importantly, the game requires the players to improvise both playful prompts and their responses.

i-dentity demonstrates the flexibility of games that use improvisations. The game has been used across different projects and activities in the course of this work. For example, it has been used to demonstrate sensitising concepts in the design of the *Wild Man Game* and provided inspiration for the next game *intangle*.

i-dentity illustrates how we can design games on the paidic end of Caillois' continuum, and how concrete characteristics of play can be "placed" in games (which this work suggests should be more open, spontaneous, and improvised forms of play). The game has also provided a tool for exploring improvisations and can be used by designers to get an understanding of what improvisations will work and what can be fun. It has also been used in ice breaking activities as part of a CHI'15 workshop, which looked at the value of digital play in enhancing the wellbeing of young people (Marshall & Wood 2015). In the workshop the game was used to encourage attendees to think about play and start a conversation about which characteristics might be important when designing for young people in HCI research. The game has also been used in outreach and detached settings by youth workers where it has helped introduce unacquainted young people together. In this role it has been played in a public space and at a dance school where youth workers were keen to use it to encourage young shy members of the group to get to know others. This helped the youth workers ease into serious discussions with the young people – since the young people felt they were the focus of attention in these sessions and their interests were being taken seriously.

In playing *i-dentity* with a youth worker the game was configured with different player interaction patterns which was used to test player interaction patterns are suitable for games with more improvised play. These included patterns with: (1) a single interrogator vs 5 spies; (2) pitching two opposing teams of 3 vs 3 spies against each other, where the spies would take the role of interrogators on every other turn, and (3) the game was appropriated by the creative play practitioner to allow the interrogator to move away from spoken improvisations entirely. In this game, the spies copied the patterns from watching the interrogator move without any verbal commands being given, in what might be described as more choregraphed play.

5.5 intangle

5.5.1 intangle: The digital prototype and game

intangle is a four-player movement-based created at the Game Jam [4Research](Deen et al., 2014) in collaboration with the co-organisers of the game jam: Exertion Games Lab, RMIT. *Intangle* was published as a work in progress paper for the CHI PLAY conference, where it was used to explore how game designs might deal with interpersonal bodily interactions. *Intangle* has been played in public exhibitions and the photographs in this chapter were captured in a game session at The Box in the FACT gallery Liverpool, May 2016.

Intangle is played by holding shared controllers while following "playful prompts" which encourage players to weave their bodies together. *Intangle's* prompts are a mix of differently styled playful interactions which are both displayed on a computer screen and read aloud by the game using speech synthesis. The prompts in the game include suggestions which range from touching different buttons on the controllers, to performing physical actions such as jumping together, to actions which encourage the players to come into contact with other players, for example, a prompt might ask players to place their controllers underneath another player's arms or legs. *Intangle's* full list of prompts are included below:

1. Link pinkies, with another player.
2. Everyone, jump together.
3. One player, release a button.
4. Everyone, stand on one leg.
5. Someone touching, blue controller, hold triangle button, on green controller.
6. Put white controller, in someone's pocket.
7. Relax, but keep those buttons held.
8. Link legs with another player.
9. Invert green controller.
10. Someone touching, red controller, hold circle button, on green controller.
11. Two players, cross elbows.
12. Everyone, sit down.
13. Everyone, swap controllers.
14. Everyone, lean left.
15. Everyone, stand up.
16. Everyone, stand on one leg.
17. Everyone, touch knees with another player.
18. Put blue controller, behind someone's back.
19. One player, touch blue controller, with your controller.
20. One player put controller under someone else's thigh.
21. Everyone, link arms.
22. One player, raise your hands.
23. Two players, touch butts.
24. One player, lean your head, against someone else's shoulder.

25. Everyone, strike a pose.
26. Undo last move.
27. One player, stand back to back, with another player.
28. Put one controller up someone's sleeve.
29. Touch elbows with another player.
30. Move one controller behind another controller.

In Figure 17. players are shown holding onto each other and controllers while readying to respond to the prompt, "Everyone jump together". In the figure, the players are discussing how to best jump at the same time before they attempt this action.

Figure 17. Tightly coupled players prepare to jump together

The goal of *Intangle* is for the players to play through all thirty playful prompts in the game. However, there is no set way for players to perform the actions it suggests, and there is ambiguity in how the program interprets player actions: some actions may seem sensed to the players and some actions have less clarity around how they will be interpreted. This ambiguity provides a mechanism for players to leave the game should they feel uncomfortable since there are many ways to fail, for example, players are given buttons to press and hold during the course of the improvisations. If any of these buttons are released it

ends the game. Alternatively, pressing the wrong button or even rotating a controller unnecessarily during play might be interpreted as a fail.

Successful players might try and second guess how the game is judging their actions in order to avoid failing. In doing this, they will find some playful prompts more transparent that others, for example, actions that require players to use a button on a controller are interpreted by the game pretty much as they are described. However, prompts that ask players to touch another player's body are a little more mysterious; players may not be able recognise what triggers the lose condition and therefore what or even who was responsible if the game fails.

In Figure 18, the players have just responded to the instructions, "Everyone, stand on one leg" and the following instruction, "Link pinkies, with another player". The players pictured are still carefully keeping hold of the buttons that were part of previous prompts.

Figure 18. Intangle: Players standing on one leg are prompted to "Link pinkies, with another player".

Intangle continually looks at the players' actions during the game to determine whether the game has been forfeited. If they lose the players are given the game over message, *"oh no, someone touched something they shouldn't!"*

If players avoid failure, the game moves onto the next prompt after a certain period of time has passed. This time period is setup programmatically depending on the complexity of the prompt, and the exact amount of time left during the action is not revealed. *Intangle* can be beaten by completing all game instructions which results in a win state and the message, *"congratulations, you have gone the whole way"*.

Intangle's tongue-in-cheek game endings appear to make light of what is a serious issue in games: that social and physical games can be a place where players receive unwanted attention from others in the game. For example, a player might choose to act improperly and use the game as an excuse to impinge upon someone's personal space in a physical game. In doing so they might exercise what they consider to be their own agency, but take away the agency of the other person. *Intangle* is designed both as a tool to explore this problem, but also a game which encourages players to reflect on their interactions with others both during play and when the game has finished.

5.5.2 Design Process

The game jam in the following year at the CHI conference was opportunity to build on the success of *i-dentity* and work again with one of the co-designers from the previous game jam. The game jam did not have a specific theme, so it was also a chance to think broadly about the topic of youth work and some of the issues that were important for the emotional growth of young people. One topic that was particularly resonant was "teaching boys how to respect girls". In moving away from labelling one sex or the other as "the problem" and in thinking specifically about games, this led to questioning how games might deal with a situation where a player uses a physical action to exercise their agency and in doing so, removes the agency of another player. This question was posed as being particularly serious when young people play games with bodily interaction as might happen in games that use improvisation. The following discussions centered on the classic party game *Twister* from the 60s and the traditional party game "spin the bottle". *Twister* encouraged players to contort around each other to touch coloured shapes on a play mat. The game was originally described as "sex in a box" by newspapers at the time (Mahdawi, 2016), after it was created during the sexual revolution of the 1960s. However, it was met with a furor, with major retailers refusing to stock the game and existing retailers even pulling it from the shelves because of concerns around indecency. Twister is only enjoyable and therefore only a game, when players respect each other and act appropriately. Similarly, in thinking back to more traditional play and

games, the game “spin the bottle” was identified as potentially problematic. What happens if the person pointed to by the spun bottle does not want that attention, and how might a digital game mitigate these problems?

In order to explore this problem space, a game jam team was formed with other interested attendees at the game jam. The design began with the team adopting the roles of players in the game and bodystorming play ideas. The team were given different colour playing cards to identify the game jammers as either the *red, blue, green, or yellow* player. These colours were inspired by the strong primary colours from the *Twister* board. It was decided that these would indicate which player would attempt the playful interaction on a turn, and with whom. Figure 19 below shows the team posing with the game cards during the game jam. During the game jam, the team used *lo-fi* props to experiment with the instructions on the game cards. Plastic cups, stacked together were used to simulate the accelerometers (in that they would fall if the researchers moved to quickly). The stacked cups became “g – sensors” and suggested how the game might think about the actions and sustain the play.

Figure 19. Prototyping Intangle through playful prompts on coloured playing cards.

The game cards also suggested how a future mobile device might indicate the player identity through the use of a coloured background in the screen display. Spin the bottle also provided

a hint of how the game might select who would perform an action. The game would pick a random number and then assign this to one of the colours. The red player might go first, then the yellow player, and so on. Inspired, by the original game, the player might also be given an action to follow with another player. e.g. "player with the red mobile device, hold the player with the green mobile device".

Intangle's prompts included a mix of differently styled playful interactions: some prompts intended to encourage more reflection around physical touch and intimacy i.e. two players, touch butts together. Other prompts were more ambiguous e.g. the prompt "striking a pose" leaves a lot of room for improvisation and is one of the more open prompts in the game. *Intangle* was designed to be provocative and draw upon themes of intimacy and touch. During the game jam the adage, *"give someone an inch and they will take a mile"* was used to encourage the game jam team to consider more provocative and even outrageous interactions. Subsequently, a player was asked *"to kiss another player on the cheek"* whereupon one researcher found themselves on the receiving end of what might be a really personal interaction. In this instance, everyone found the interaction humorous, although it was removed from the final thirty prompts. In this sense, it was important to set the right content, so the game could balance between being fun and providing the appropriate level of provocation. This task was helped through being able change the prompts and experiment through card-based design and bodystorming. Specifically, it allowed the design to experiment with:

- the inherent complexity of the tasks. e.g. compare "*Someone touching, red controller, hold circle button, on green controller",* with *"Put blue controller, behind someone's back"*. The second instruction is far easier to understand as it does not have any levels of indirection.
- how tasks could play with the amount of ambiguity used, for example, *"Move one controller behind another controller"*, does not make reveal the expectations of the digital device, and the program does not hint how it will evaluate success.
- improvisations that might include more than one player, which increases the chance of everyone not acting together e.g. "Everyone, link arms" will cause all the players to respond.
- the order of the cards. For example, thinking back to the affordances of playing-cards allowed the order of playing-cards to be changed. This might make the game more

difficult, for example, asking players to stand on one leg, before suggesting further improvisations would likely make the subsequence improvisations more difficult.

- the number of improvised prompts, for example, adding more prompts would increase the difficulty of the game.
- using times could limit how long players would have to react to the prompts. This could be used to make the game easier or harder.
- the decision of which player would go next, would also likely change the difficulty depending on what they were doing at that time.

5.5.3 Summary

intangle shows how the game designs in this work will benefit from an iterative design process and playtesting. For example, the use of lo-fi prototyping and bodystorming can be employed to work out what playful tasks are suitable, and the points above illustrate how much variety and adaptability there is in this format. Playtesting and fine tuning these actions (their order and so on…) is particularly important as the playful prompts need to be formalised within the programming logic. These acts of playtesting can also help explore all the different digital interfaces available (and combinations). For example, the first action asked players to use their own bodies, *"Link pinkies, with another player"*. The buttons were the next interface with the prompt, "*One player, release a button"*, and then the digital device could be used as a prop e.g. *"Everyone, strike a pose"*, then as a method of touching someone e.g. *"One player put controller under someone else's thigh"*, as an interface to touch another controller, "*One player, touch blue controller, with your controller"*, and to exchange with another interface e.g. *"Everyone, swap controllers"*. In these examples, it is interesting to consider what can be *sensed*. For example, the playful prompts which asked, *"Everyone, strike a pose",* could not be easily analysed with the mobile device. This is because different people will create different responses to one another, no doubt, with different levels of enthusiasm and imagination. In the design of movement-based co-located play, Segura (2016) applies the framework from Benford et al. (2009) to explore what can be *expected*, *sensed*, and *desired* in embodied play. In the case of striking a pose, almost any improvised responses are *desired*, but are not necessarily *expected* or *sensed*. Segura (2016) describes how these kind of interactions will allow players to expand on what can be sensed by the game logic alone, for example, players can act as judges themselves, making the game richer than might be possible through programming alone. In contrast, to tasks might be both *expected* and *sensed*. However, instead of making an absolute ruling in this sense, *Intangle* could employ

ambivalence to these *sensed* interactions, for example, when asked to jump in the air, a player might be able to invert their controller, but how should the game design respond to this movement? Game designers should think about employing ambivalence in game design. This type of "arbitrary judging" is not the norm in games – but here helps challenge the players by employing ambiguity of information. This gives the impression that that players can "play with" their improvisations – testing the limits of the rules and boundaries of the game.

In returning to the context of youth work, *Intangle* illustrates how a game can be used as a tool to explore an important issue for young people - thinking about how we treat the personal space of others with respect.

5.6 Conclusion

This chapter reflected on the games design process from two game jams and a playtesting session in the context of youth work. This is used to further evidence the extensibility of these simplistic game systems – a simple game system which can therefore be iterated quickly but equally contains inherent complexity, complexity which helps generate rich gameplay and can be deployed in a variety of contexts. In playing with the controllers in both games, these games showed how the mobile device can be used in a multitude of ways, for example, *intangle* maximised the utility of the different interfaces available through combinations of the controller and body. e.g. body vs body, controller vs. body, controller vs. controller and so on… (a cartesian-product of interfaces and body). These different interfaces are useful as these game designs are part sustained by the technology of the mobile device – and players are not only taken on a journey across different interfaces (Benford et al., 2009) but a journey which combines bodies and devices. There are also similarities in the improvisations seen across the two games, for example, the simple action of inverting the mobile device, will often happen in both of these games, an action which uses the controllers physically and that can be sensed. However, this simple action has a different meaning in each game, although importantly, it is always part of what sustains the play.

The ability of the device to sustain play is key in these games. In the design of *i-dentity*, the game was bodystormed with the controllers placed in socks so as to hide their digital utility – as such these devices were suddenly no more than an inanimate stick. Interestingly, the game could still be played without the digital augmentation as the interrogator looked closely to find out who the spies were following. However, the game was not as exciting as the digital

version. Significantly, the digital interfaces help sustain play in these games – they provide challenge, a spectator interface, and will determine how players take turns and thus what player interaction pattern is decided by the game.

The two games had distinct patterns of player interaction. *i-dentity* used game logic to copy the device states across all the mobile devices which provided a pattern interaction pattern that synchronised play. In contrast, *intangle* used game logic to sense how players over which players would respond to the playful prompts. In designing improvised games, we can choose how many players are involved, how many of these players have digital devices, and how our playful prompts should be given to each player - in terms of what player interaction pattern is programmed e.g. improvisations can be prompted at the same time across multiple devices, or the prompts might choose to be presented across the different devices one at a time, or alternatively a mixture of both.

The flexibility of these improvised games allows them to be used in different contexts. For example, in youth work they might be able to help young people get to know each other when used in ice-breaking exercise. Here, the player interaction pattern means all the young people can be digitally connected together, while the games themselves can be used to approach sensitive and even taboo topics, such as how young people might relate physically to one another.

5.7 Post Reflection

The play in *i-dentity* and *intangle* was sustained by the use of the digital devices and both of the games played with what might be sensed and how this was communicated back to the players.

In both of these games, different players had their own devices which were networked together to produce specific player interaction patterns. In *i-dentity* these mobile devices were used to synchronise the players' responses across the mobile devices which created a unique and novel game mechanic. In *intangle* the connected devices were used to challenge players to perform different actions both in turn and at the same time.

In retrospect, the ability to present playful prompts on different devices, whether this was in turn or at the same time, provided a useful game mechanism that can be used to both structure

and sustain play. For example, play can be structured by enforcing a turn order which can ensure everyone has their turn and a chance to enjoy the play. In both games, play was sustained by the continual sensing of the devices across the network which might encourages players to *play well together*.

6 Game Design Framework

6.1 The Game Design Framework

This chapter describes the game design framework which is the main contribution from this thesis work. The framework is designed to support game designers in making new improvised play experiences for young people in mobile contexts. The framework presents a game design process through step by step instructions, guidelines that describe what is important when making these games, suggestions for different configurations of game and an open source software resource which is available online.

The game design framework was developed iteratively and inductively in designing for three different contexts described in the case studies: *Department of Hidden Stories (DoHS)*, *The Wild Man Game,* and through co-designing the games *i-dentity* and *Intangle*. The design framework draws upon the learning from each of these games and packages the knowledge together as a complete approach for making new game designs. Presenting this work as a game design framework builds on work that has used design frameworks to communicate approaches (Rogers and Muller, 2006) and to contribute knowledge through the use of guidelines, methods, tools, and patterns (Barendregt et al., 2017).

The design framework in this work can be usefully examined against the criteria in Zimmerman, Forlizzi and Evenson (2007) for evaluating interaction design research within HCI. First, the game design framework can be examined by its process, which in this case is a prescriptive process where the designer is expected to follow a series of discrete steps (Rogers and Muller, 2006). Second, the game designs discussed in this work are innovative: they have resulted in the invention of novel and new gameplay in new mobile contexts that is fun, something that Koster (2004) describes as a surprisingly underrated aim of game design. Third, the games are relevant as they address the wicked problem of creating mobile games that encourage young people to play in mobile contexts. Moreover, these games will encourage game designers to move toward a preferred state of game development where game designers have further motivation and tools to create game designs in the new contexts. The tools are also designed to be extensible: they are available online from two popular Git repositories and provide accessible and simple starting points which game designers can build upon.

In the following, the game design framework is described in two sections. The first section describes how the research can be conducted: starting with ethics and then the use of design workshops (looking sideways at game jams and how the pace of game design can be increased through playtesting and experimentation). It describes the card-based design and how it can be used to structure the game, the mobile device design cards and how they can be used to sustain play, applying the design framework guidelines, and how the right player interaction patterns can be chosen for the game. The second section describes the more technical side of the framework: it describes the game engine that was used for designs, why the game engine is an important part of the overall approach (and contribution), how this software can be used and how it might be extended.

6.2 The Game Design Process

The following design process combines the different activities that have been used across this body of work which are drawn together to describe an approach to game design.

6.2.1 Ethics

Ethics should be the starting point of working with young people. The role of ethics in this work is particularly important as young people are categorised as a vulnerable population and the age groups used in the studies have been from the age of eight through to early teens. For this reason, it was important to submit full ethics for each of the studies. The ethics application in addition to good practice, includes consent forms, info sheets and where necessary risk assessment. As part of an ethical and safe approach to research, this work has followed the loan working policy of the university, ensuring that more than one or more facilitating researchers or a youth worker have been present when meeting the young people in the studies and playing the games. The mobile contexts have also required other things to be considered since the games are pervasive e.g. the presence of members of the public in *DoHS*. These additional details are included in each of the case studies (see sections 3.5 and 4.5). The ethics application, approval, and consent forms are included in the appendix (from section 10.1).

6.2.2 Needfinding

The design approach in this body of work has begun with needfinding where the key aim has been to understand all the stakeholders. The stakeholders here are not just the organisations

and individuals who own and work in the public spaces, but also the young people that play in those spaces.

Needfinding has taken place across several mobile contexts in the course of this work. This has included:

- The community library and its school children, staff, teachers and creative play practitioners in *DoHS*.
- The country house managed by a heritage organization and its owners, in the *Wild Man Game*.
- Understanding the provision of mobile youth work in *i-dentity* and *Intangle* by working with a creative play practitioner.

These mobile contexts are different and detailed needfinding is included in each chapter. Importantly, play itself can be been used as part of the approach in better understanding the needs of the all stakeholders and finding common ground. This "sensitising play" has employed playing the game *i-dentity* which is discussed as an interesting game design in its own right. Games like *i-dentity* are important as they can serve as an icebreaker in different design contexts and an artefact which can start communication and discussion between HCI practitioners and the interaction design community. In this sense *i-dentity* is a design exemplar, but also a useful tool for engagement. *i-dentity* has novelty which helps it captivate audiences wherever it is played, and when played by young people can demonstrate that adults are interested in engaging at their level.

6.2.3 Focused design workshops that use card-based design

The game designs in this work have been created in design workshops and game jams. This section will discuss how the design workshops have been conducted, while making a connection between the simplistic game designs in this work and how this might encourage faster paced development such as that seen in game jams.

The design workshops in this work have provided opportunity to create games with co-designers who have provided different perspectives. In this research, it has not just been necessary to understand these various interests and perspectives, but also to ensure there was a common interest in designing for play. To this end, the design workshops have shared a

starting point around play and have proceeded there on, forefronting play and drawing upon various HCI methods.

This work has been able to centre these initial discussions on play through different means. This has included: (1) conversations with co-designers that encourage discussion about their own recollections of childhood play, for example, where they went, what they did and the experiences they had. (2) using design cards with co-designers to tease out collective opinions on the differences between play and games, (3) steering conversation using the literature around play, for example, Caillois' continuum of play has been introduced to co-designers in order to get everyone thinking about the explicit structure in computer games, as opposed to the more freeform nature of play, and (4) games have been used to practically demonstrate how computer games might encourage more *open*, *spontaneous* and *improvised* forms of play. In these various ways, play has been used as a sensitising concept to better understand the needs of the designers and find the right ground for design.

Importantly, the workshops have been centered around card-based design and how it can be used to support improvised play. Card-based design is a part of HCI design tradition and as a method it is increasingly used in interaction design. The games described in this thesis work were either designed using this card-based design or the paradigm has contributed to the design process. In the workshop for the *Department of Hidden Stories* one of the children was asked to describe the game as it drew to a close. They replied with the following explanation of the gameplay:

"It's called the [industry of books]. And you get a card, and you find a book about it, then you get another card, and then you make a story out of it." [Anon].

This quote not only describes the overall structure of the game, but how the games are understood. Importantly, the child's summary was also said with enthusiasm – the game was fun, and the children enjoyed the workshop and writing stories. The section below continues with a description of the card-based design used in the design workshops and describes why this is an important paradigm in the design of these games.

Cards help designers to be creative and design experiences quickly: The *DoHS* workshop used card-based exercises to encourage critical reflection with the stakeholders about the

opportunities of technologically-mediated play in the space of a library. These exercises helped the workshop participants move past traditional thinking about console gaming. The paradigm of playing-cards was a useful tool in designing the digital interface; playing-cards allowed the *DoHS* workshop participants to "play" with the actions given to players, and they were changed and refined as necessary, for example, an early design suggestion was that the player might find a book of a certain colour. In this way, the cards allowed experimentation with actions that might not be immediately associated with digital gaming, effectively helping to bridge between player actions and the physical space of the library. Importantly, the use of playing cards early in the workshop led naturally to their use in the digital prototype. Keeping the same paradigm allowed the playtesting and iterative game design to be started earlier. In this sense, the pace of design can be fast as the digital game can be changed on-the-fly as in game jams.

Card-based design can benefit from using *ambiguity as a resource for design* (Gaver, Beaver and Benford, 2003). In the design stage of *DoHS*, workshop participants played with the actions on the playing-cards – changing and refining them as necessary. These refinements ensured that players would understand what was expected of them, and it was possible to change the amount of ambiguity in each case. For example, the prompt *"To let the Department of Hidden Stories know you are ready for adventure, please scan your book's barcode.",* instructed the player to scan a barcode with little room for ambiguity. This can be contrasted with more ambiguous prompts, for example, *"The dice throw has revealed that something fortunate will happen in your story. Now go to the bookshelves to choose a book to inspire a fortunate event. Then continue writing the next part of your story".* The interpretation of this playing card was decided by the children. They were in charge of deciding where the event would take the story e.g. children were able to twist *fortunate* events into *unfortunate* events because they wanted a darker outcome in their story.

In the *Wild Man Game*, the written language used in the prompts was carefully curated to better represent the space (and the current exhibition), for example, *Stillness* overlooked the garden and its prompt was changed several times to better represent the Wild Man's relationship with nature. Additionally, the written language was important to the heritage organization, for example, the language around the term Green Man (as an alternative to the Wild Man) was considered and whether the gender of the Wild Man should be removed in the name, or whether it should retain its more traditional and older spelling.

In *Intangle*, the ability to change the wording on the playing-cards enabled the game jam team to question the consequences of each improvisation; suggestions like *"holding hands", "dance together"* or *"kiss another player on the cheek"* were bodystormed. In this example, bodystorming led the latter prompt to be rejected since it might lead to inappropriate behavior in a game deployed with young people in a more serious setting.

Cards provide an extensible metaphor: Designing using cards provides an extensible metaphor for games which can lead games designers to creating new interactions. For example, thinking about the physicality of playing-cards in DoHS suggested that digital games cards could be turned over using their corners. This allowed the players to tentatively pull up the corner to peak at the next page, or turn them over quickly to commit to the next action. In another example, a digital playing-card prompted its players to throw some dice. Even though the players were able to shake the phone to throw the dice – the dice themselves were left to the imagination of the player with just the sound of the dice behind heard, even though they might have been animated on the card. Thinking about passing cards from player to player in a workshop could also help suggest how the game should be configured – how does one player indicate to the next player it is their turn?

Cards help organize content: Thinking about playing-cards can help organize the content. For example, collections of playing-cards can be thought of as a *deck of cards* which enable the whole game and its flow to be held in mind during design. In *DoHS*, thinking about all the prompts helped answer key design questions e.g. how the game might relate to the library space, what different actions in the game were possible, how might the game be more open and how might it allow the children more freedom, what should the game duration be and how many cards would be needed, whether the prompts should be written especially for children or use more adult wording, and so on. In the design of games, the act of writing out suggestions for new prompts formalized the answers to these open questions and moved the workshop and game design forward.

The design workshops have been complemented by other HCI methods as it was possible to prepare materials in-between workshops in both of the case studies. These HCI methods included storyboards, personas and living documents.

Storyboards were used in the design process of the *Wild Man Game* (see 4.3 Design Process) to ensure that there was a collective understanding of what visitors to the country hall would do in the game and to ensure that these would be enjoyable. The storyboards illustrated what the play actions might look like when experienced by players.

Personas were used to complement storyboards and validate the co-designers understanding of the users. Personas are able to clarify user descriptions and therefore help designers focus on the primary user and their behavior patterns and needs (Chang et al. 2008). For the *Wild Man Game* design workshop this helped ensure that everyone held appropriate and accurate ideas of the visitors coming to the heritage site.

Living documents (also called evergreen documents and dynamic documents) are documents that are continually edited throughout a project. Living documents were created at the earliest opportunity and were brought into design workshops, as well as forming the output from the workshops. In the *Wild Man Game* this enabled the co-designers to talk about make-up of the Wild Man and critique the use of language around the character and the play.

6.2.4 Using the mobile device design cards

Mobile devices can support different types of interactions which are not possible when using physical playing cards. For example, in *DoHS* the phone's camera enabled the children to take photos of their work and recognise the barcodes on books which allowed the stories to be associated with physical books in the library. In the *Wild Man Game*, the mobile device identified when players were in particular rooms using Bluetooth and the BLE beacons.

Importantly the mobile device was used to sustain the play e.g. the accelerometer was used to judge how well the children were sneaking as they made their way to the front of the country house in *Creep*. If the Wild Man had not monitored the creeping during the play, children would have had little challenge to keep them interested. With this in mind, the mobile device design cards (see Figure 20) were created in the second case study (see 4.3 Design Process) based on insights and the use of the mobile device's sensors in *DoHS*. The design cards represent a "taxonomy of the input devices" inspired by the framework in Benford, Schnadelbach, et al. (2005) for designing sensing-based interaction. As described by these authors, device taxonomies can help designers bridge between the idea-generation phase and what can be actually built.

The following discussion of the design cards describes how they can be used when designing a game. Importantly, the input sensors are not just used in terms of "what can be sensed", but can be used with the idea of *uncertainty* (Benford, Schnadelbach, et al. 2005) or with uses other than they were designed for. For example, the GPS was used to detect whether a player was outside (as opposed to finding out exactly where players were) and the accelerometer was used to detect how heavily they were walking (rather than used to calculate the distance walked – a more common use of the accelerometer). The cards below from left to right are: the sensor fusion cards (gyroscope, accelerometer, and compass), speaker, touch screen, buttons, BLE (Bluetooth Low Energy), vibrate, camera, GPS, timer, and microphone. The design cards are a mix of both input and output devices. For example, the mobile device's output devices include touch screen display, vibrate and speakers. Touch screens can be used for both input and output. The images were created from public domain clip art, uploaded by their respective authors from clker.com.

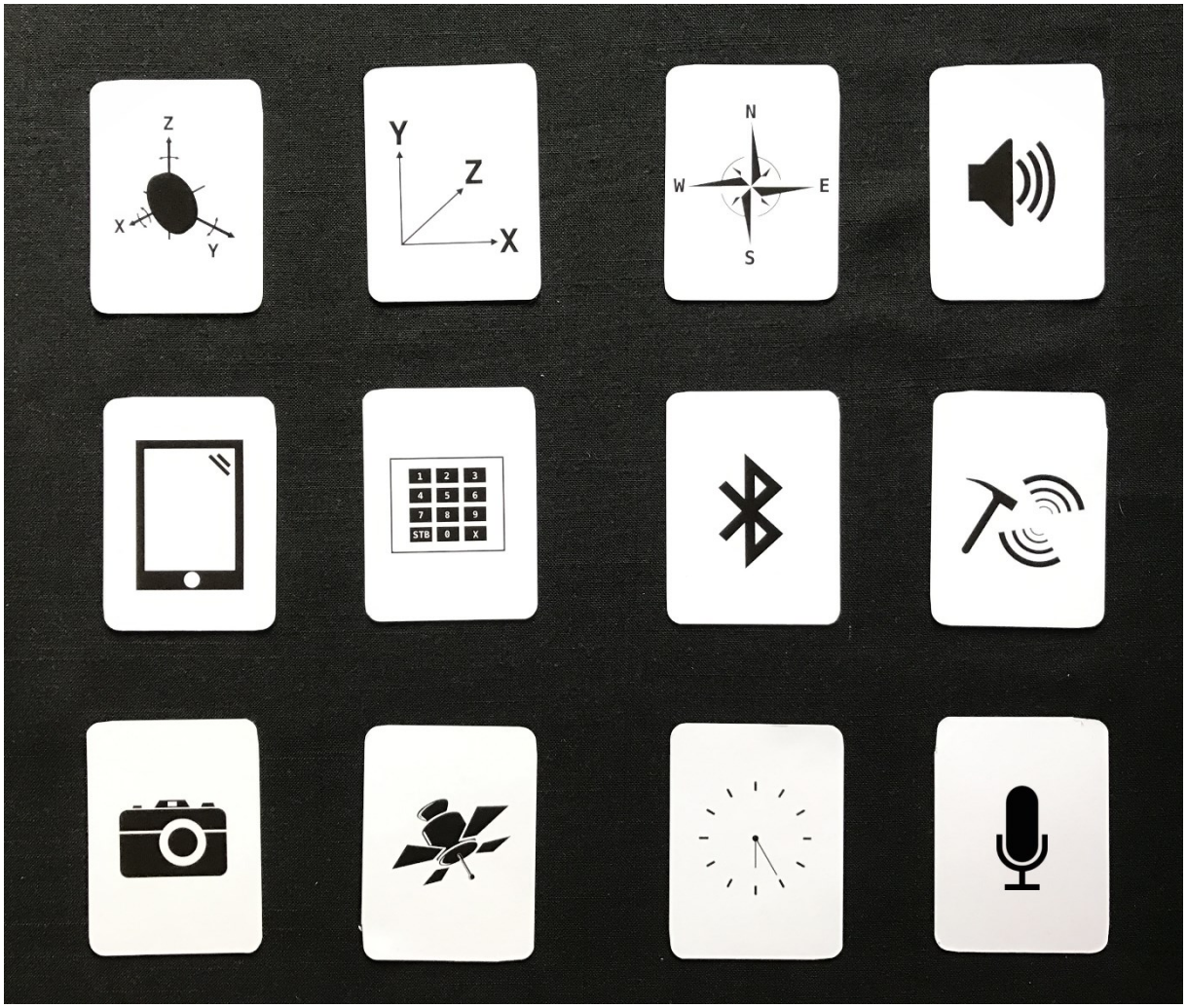

Figure 20. Mobile device design cards used in the Wild Man Game.

Sensor fusion: is a technique that combines the gyroscope, accelerometer and compass of a mobile device in order to better determine the orientation. This allows the games designer to work with a more accurate representation of the device orientation in the real world. In games where the device is held by a stationary player, sensor fusion can report how the phone is being held or moved in the hand. In the *Wild Man Game* sensor fusion was used to add augmented reality (AR) content to a playing card, making the digital card a portal into a hybrid space.

The design cards for sensor fusion can also be thought of in terms of the separate hardware – the accelerometer and compass. The accelerometer can be used to detect the magnitude, frequency and orientation of the mobile device's movement (the latter is detectable because gravity works against the accelerometer hardware on the mobile device and along three different axis). In *DOHS*, this was used as part of the mechanism to detect that the phone was not used, since the orientation would remain largely constant. The *Wild Man Game* used the accelerometer to detect the amplitude of movement of the player. A large accelerometer value was used to suggest that the players were moving heavily.

The compass can be used to determine the player's orientation and the this might coincide with the player looking toward key features of a space. These compass directions can be used to situate play such that the direction in each location has meaning. The *Wild Man Game* was able to use the compass alongside sensor fusion to situate its AR toward a particular aspect of the garden.

Vibrate: Smart phones have small motors which can make the device vibrate. These motors are designed to be partially off-balance and can be turned on for a short time by the game. Their vibration is often used in games to convey that something has happened. This is especially useful when the phone is being carried rather than held. *Pokémon G*o uses the vibration of a mobile phone to inform a walking player that there is a Pokémon nearby which can be caught. Similarly, *DOHS* used vibration to attract children's attention to the phone when the game logic perceived that the player might need help. In the *Wild Man Game,* the device vibrated in order to inform the players that they had found one of the games in a room.

Timers: Improvisations acted out by players might not be identifiable or measurable using sensors on mobile phones, as the players and the play might be happening away from the

device. As such, improvisations might not be sensed. It is therefore not possible to accurately know when players are improvising responses or have finished playing. Timers are a useful mechanism that allow the game to move on its game state without any interaction from the player. e.g. a player could be given a playful prompt and the game state will then move onto the next playful prompt after an amount of time has passed. Timers can also be used in combination with output devices to bring players back to the device after a time period has passed e.g. in *DoHS* the timer was used with the speaker and vibrate circuity to attract the children's attention if the game thought it was being ignored.

Touch interaction: Touch interaction is staple of interaction on mobile devices. In the games, touch interaction is the simplest method to navigate between one playing-card and the next. To support highly configurable touch interaction, the game engine should different between the events of *touch down*, *touch moved* and *touch up*. This allows the game logic to respond to each *touch* as different events with their own unique responses and actions. i.e. if a player is instructed to press the screen, then the game logic can detect this action as soon as a finger is placed on the screen, rather than looking at when the finger is then lifted from the screen. In *DOHS*, transitions between playing-cards were initiated when the touch was first made and subsequently dragged. This was designed to feel like turning the page of a book (or turning over a physical playing card).

Buttons: are often used to navigate menus in games. In the design of games in this work, buttons allowed the user to transition between playing-cards at their own pace. The *Wild Man Game* presented playing-cards to players once they had completed a task. The use of the buttons accommodates players that might take longer to read the contents of the card.

Global Position System (GPS): The ability to identify the physical location of the player has been central to locative games, and there are many games that use the player's location to mix the digital game world with the physical game world e.g. *Tidy City* (Wetzel, Blum and Oppermann, 2012), *Explore!* (Ardito et al., 2012) and *REXplorer* (Ballagas et al., 2007). The GPS interface to the programmer in phones does not use satellites alone, but also draws upon the WiFi and cellular networks to increase the fidelity of location tracking. In "loosely" experimenting with the GPS the mobile device reported its position approximately within 30 ft. The *Wild Man Game* applies uncertainty to the GPS functionality where a player is

identified as either indoors or outside i.e. when coverage is lost, the player can be assumed indoors.

Bluetooth (BLE): BLE is a standard for connecting short range wireless devices e.g. BLE enabled door locks, smart watches, exercise bands and locative beacons (to name a few). These locative beacons provide a different method to situate playful prompts, distinct from the GPS technologies used to situate existing pervasive games e.g. (Benford, Rowland, et al., 2005; Ballagas et al., 2007). Locative beacons like the Estimote use coin cell batteries and are small enough to be placed into the actual structure of a building, they can be used indoors, and placed in such a way that the shape of the signal can be affected by the structure – allowing the game designer to use the seamful gaming described in Chalmers et al. (2005).

Camera: A playing-card can incorporate camera functionality which will allow players to take photographs and perform vision-based computing. This latter can include recognising product bar codes, and other visual markers e.g. fiducial markers like reacTIVision (Kaltenbrunner and Bencina, 2007) and bespoke markers which can recognise markers on uneven surfaces such as those used by Almeida *et al.* (2015). In *DOHS* cameras allowed the children to photograph the stories they had created and associate them with physical books in the library by scanning the book's barcode.

Microphone: The microphone can process foreground and background noise from the mobile context. The noise can be processed by a FFT to capture the frequency of the sound and the amplitude of the noise. In *DOHS*, the microphone was used to determine the pitch of the players in *Mimicry*, and the volume of the players as they moved stealthy (or otherwise) in *Creep*.

6.2.5 Applying the game design guidelines

The game design guidelines were drawn from the analysis of the empirical evidence in the case studies which were generated in chapters 3 and 0. The guidelines are repeated below with a short reflection on why they are important and what this means for the game design.

Expand the range of prompts and avoid repetition (G1)

Improvised games can benefit from a wide range of prompts that will contribute to variation in the play. In these simplistic game systems, the addition of playing-cards and/or new

prompts are fast to implement, and exploring different improvisations is recommended. In expanding the range of prompts game designers can consider a wide variety of prompts that relate to the context. However, it is important to be mindful of keeping what Ushaw et al. (2015) describe as keeping a simple "micro game loop". This is the familiar cycle of actions a player might experience when playing a game. In expanding the range of prompts, game designs should retain a simple micro game loop, while exploring new ways to engage players through the mobile device.

Allow players to set the pace of the game themselves (G2)

As part of designing more open games that will benefit the well-being of young people, young people should be allowed to lead the play where possible (Pykhtina et al., 2012). One simple option retaining the structure of the game is to allow players to set the pace of the game themselves. This might include letting the players decide when they have completed an action or turn; allowing the player to read or hear prompts at their own speed recognises that different people read at different speeds.

Encourage players to play alongside one another (G3)

Parallel play is an under explored game mechanic. Games can support parallel play in a number of ways. For example, players can be encouraged to copy the exact actions of another player. In games in an educational setting, this might not necessarily be seen as cheating as first imagined, as De Koven (2013) explains there is a difference between a well-timed cheat - to the actions taken by a spoilsport. Furthermore, playing alongside one another does not have to be interpreted as just copying someone. Instead, games around mimicry (a type of play discussed in the related work) might allow players to complete, fill in the blanks or extend the play actions of another player.

Sustain play using different interfaces (G4)

Improvised games can be expanded by introducing new prompts and instructions. However, games should sustain the play by checking the player is performing their side of the play bargain or run the risk of boring the player – as players will quickly realise the limitations of what can be meaningfully sensed. Mobile devices have an increasing number of high fidelity sensors that can be used to analyse what the player is doing. The framework in Benford, Schnadelbach, et al. (2005) of what can be expected, sensed, and desired can be used to think about how sensors are interpreted by categorizing the actions and usefully identifying where

interactions might fall into more than one group. Segura's (2016) work which looks at movement-based co-located play also explains how players themselves can be harnessed to step in and judge play actions that devices might not be able to sense.

Design for play that is relatable and will make sense (G5)

Developmental play has an important role in childhood, and for the rest of their lives people spend time finding opportunities to play and for playing. As such, we are all an expert of our own experiences and have an innate understanding of play and what this means. These games should engage with play that is relatable – in that it can be related to these our experiences and knowledge of play i.e. game designers might think about prompts which encourage understandable actions e.g. jumping, hiding, running or standing still. Play should also make sense in the space e.g. it might draw upon stories or utilise characters or stories from the environment.

Provide mechanisms to play nicely together (G6)

The modern classic, *The Well-Played Game* by De Koven (2013) describes how people play together and how this can be something truly special. Game designers can influence how players will play together – and therefore what opportunities exist to play well together. Different types of games create different play relationships between players, for example, competitive play is distinct from cooperative play in games. There are also more complex configurations of play which allow different relationships between players, for example, in *intangle* players are given the opportunity to work together to complete a sequence of actions. However, players might deliberately make these actions more difficult than they need be, to the point where the game is intentionally sabotaged – it is neither competitive or cooperative. The game helps afford this by disguising whose actions belong to whom; when the game is lost, the game does not identify which player was at fault. Such player configurations provide opportunity for players to play together in their own ways and it is the shared (‘expression of excellence’ (De Koven's 2013) that can create the well-played game.

Allow players to enter and leave the magic circle of play (G7)

As part of creating a more open and free games we should allow the players to leave and come back to the game as they see fit. In the *Wild Man Game* this was particularly important as the families were there primarily to visit the hall and forcing players to remain in the magic circle of play would remove their agency and risk stopping them looking at things that

interested them in the hall. There are different ways to give players this freedom, for example, actions might avoid using a timer, or if games are time limited, they should allow the actions to be repeated by different players – giving players a chance to play at a later time if they were outside the immediate play space or wanted to be the driver of the game. Importantly, allowing players to leave the game also ensures that play is consensual i.e. that players do not feel forced to stay in a game where they are not comfortable. Conversely, games might take advantage of players leaving the magic circle, for example, actions might involve telling other players secrets which might create rich and unique social play.

Place stages for play (G8)

Goddard & Garner (2016) describe how games create pocket magic circles which are anchored to the co-located space where they are played. Similarly, the games in this work create pocket magic circles of play. In *DoHS* this pocket magic circle of play is brought to life when the children start the mobile phone game in the space of the library. In the *Wild Man Game,* the pocket magic circle is created as the visitors enter the hall and open the app on the mobile phone. Game designers might think about providing opportunities for play by finding specific sites within a space for these magic circles to be created. The *Wild Man Game* does this by placing stages for play around the hall through the use of the BLE beacons which anchor the different games. Importantly, when creating a stage for play, the game must also provide a clear *invitation to play* (Polaine, 2010) and in *delivering the promise of play* (Polaine, 2010), as in any game, the game must ensure the right lusory attitude is adopted (Suits, 2005).

6.2.6 Configuring the right player interaction pattern for the game

The game designs in this work used a paradigm of playing-cards or at least provide players with spoken actions. In creating these games, it was important to decide how the actions should be presented to the players, for example, players can be given actions independently, players can be given actions at the same time, or players can receive the actions in turn. These decisions have been previously considered in work on playful interaction: Fullerton, et al. (2008) described patterns of player interaction for social play around single play objects, where play objects might be imagined as something like a ball. These patterns were extended by Segura (2016) to consider the different social-spatial configurations that resulted from playing with multiple play objects where the play did not have to take place in front of a screen e.g. interactions happened when players faced away from the play object. Fullerton, et

al. (2008) suggests it is worth taking advantage of the player interaction patterns that are less frequently used as they will provide new opportunities and possibilities for game designs.

This section describes the player interaction patterns that have been observed in the games in this thesis. This section uses those player interaction patterns from the previous work, a similar style of presentation, but provides variations on these existing patterns which emerged because of the social play or were explicitly programmed in these game designs. These additional patterns include: *improvised parallel play, fully synchronised improvised play and turn-based improvised play*.

Single player improvised play

This player interaction pattern is similar to *Single Player vs. Device* (Segura, 2016) and describes single player improvised games (see Figure 21). This is the simplest player interaction pattern where players improvise actions around their own device in response to the game instructions. In *DoHS* players were tasked with creating their own stories and the mobile device supported and sustained the play. An aim of the game was to encourage the players to focus on the stories they were writing, the space of the library and its real books, rather than the mobile device. In this configuration players can get up and leave their device working either alongside the device or temporarily abandoning the device (indicated by a dotted line).

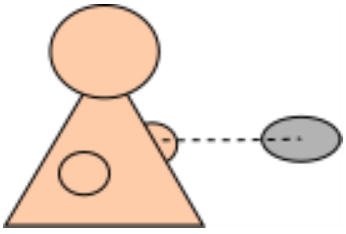

Figure 21. Single player improvised play.

Improvised play between a group

Players can improvise actions around a single play object in response to the game instructions (see Figure 22). This player interaction pattern is similar to *Multi-player vs. Device* (Ibid.). However, as in the '*Single player improvised play'* the dotted line shows how players may move away from the device to do other things or work alongside the device. In addition, multiple people may operate the device while others watch.

In *DoHS* the discovery mode allowed children to find stories hidden in the books in the library by scanning the barcodes. As there were a large number of books to look through, the children worked together to work out which books had stories. In the design of the game, sharing the device in this manner had not been considered, but was afforded by the more open design of the game.

The Wild Man Game was designed to encourage family members and friends to play together as they visited a country house. The game was designed so that one player would hold the mobile phone at one time, with the remaining players having the ability to come and go as they saw fit (see 4.3.3 Design for play through and around the device (D3)). Players also held the device between themselves or supported the hand of someone holding the device (as indicated on the right-hand side of the diagram).

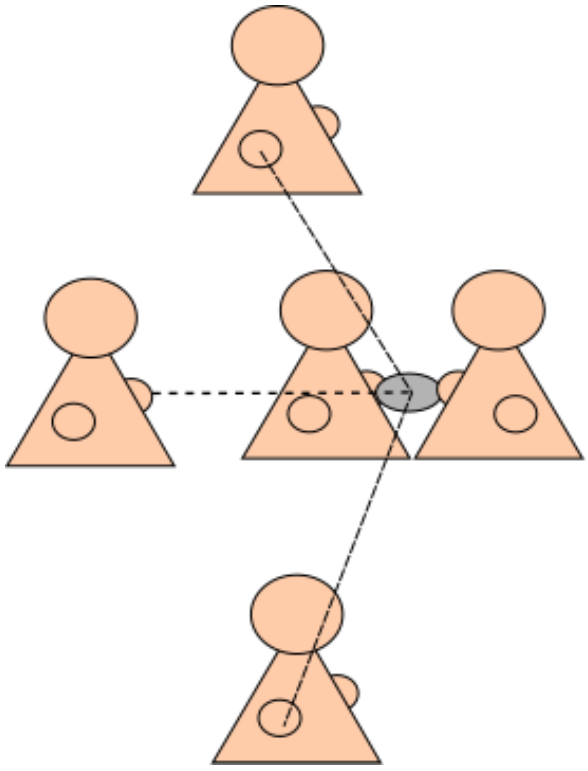

Figure 22. Improvised play between a group.

The next three interaction patterns draw upon the existing patterns described in the related work. These either detail define a new relationship between players e.g. parallel play or have added detail to the existing player interaction patterns e.g. showing how the devices are synced or additionally detailing the turn order. These interaction patterns have been created in

order to consider how game designers might create configurations specifically around the idea of well-played game described by De Koven (2013).

Improvised parallel pay

The player interaction pattern: *improvised parallel play* describes how players can choose to work together or even copy another player but play on their own devices (see Figure 23). This pattern was observed in *DoHS* where children chose to play in pairs.

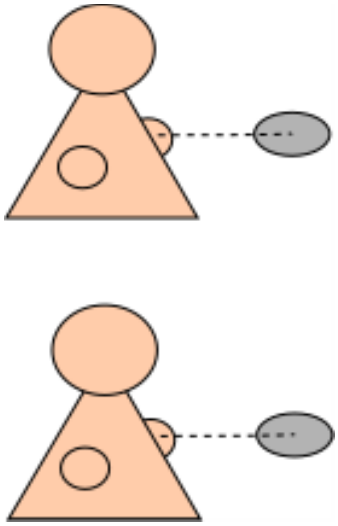

Figure 23. Improvised parallel play.

In the example of *DoHS,* children did not need copy each other wholesale and working together could mean as little as glancing at a friend's device to see where they are in a game. This could prompt one of the pair to work faster in order to catch up. Alternatively, children might decide to swap around *who* is copying *whom* – or chose to write their own stories, but share books together.

Fully synchronized improvised play

The player interaction pattern *fully synchronized improvised play* illustrates how game designs can synchronise the actions of different players (see Figure 24). This can be designed for by giving players improvisations at the same time, or by providing feedback to an improvisation across all devices simultaneously. This pattern is distinct from *improvised parallel play* as the game logic forces the synchronization of the state across multiple devices.

This player interaction pattern was seen in the *Wild Man Game* where children crept together through the country house. In this game, players theatrically copied the movements of each other, for example, walking in the same manner, following the same routes, and being quiet at

the same time. In this game, children choose to move together, which did not require multiple mobile devices. This is indicated by the exclusion of the mobile device in the bottom right hand side of Figure 24.

In contrast, the game *i-dentity* was played with multiple mobile devices which were synchronised together programmatically. Synchronised play can be found in traditional play and games that involve mimicry e.g. *Sleeping Lions, Follow My Leader, Musical Chairs, and Pass the Parcel.* In these games children follow each other's movement or the child leading the game. However, in creating these styles of games we need not synchronise the "game state" across all devices. For example, *i-dentity* has been configured for play with an interrogator vs 5 spies, or with opposing teams of 3 vs 3 spies where all the spies can be interrogators as they judge the opposing team.

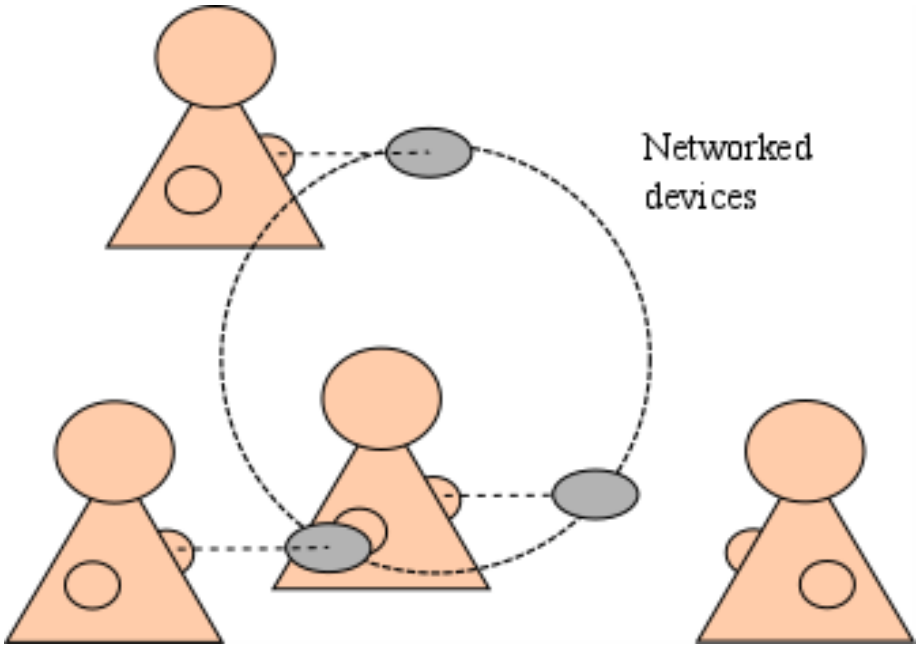

Figure 24. Fully synchronized improvised play.

Turn-based improvised play

The player interaction pattern: *turn-based improvised play* (see Figure 25) illustrates a configuration where players will take it in turns to perform improvisations. This pattern will be familiar to programmers as being an analogous to a *round-robin* configuration in network programming.

This pattern of player interaction was seen in the *Wild Man Game* where players gave everyone an opportunity to play (*see 4.6.1 Playing nicely together [F1]*). This was most evident in the dance and mimicry game where the mobile device was handed to other players after each turn; observing researchers were not be able to predict who would play next.

This pattern of player interaction was then explicitly programmed in *Intangle* which was a result of being inspired by the mechanics from the 'spin the bottle' game and the contemporary 60s game - *Twister*. The game logic would iterate through a number of prompts which were formalized in the programming. This order would appear random because of the physically close nature of the improvisations and the fact that any of the players might pick up any device. The turn taking order is further obfuscated by the random assignment of the player identity at the start of the game. i.e. player 1 might become player 2 on the next turn.

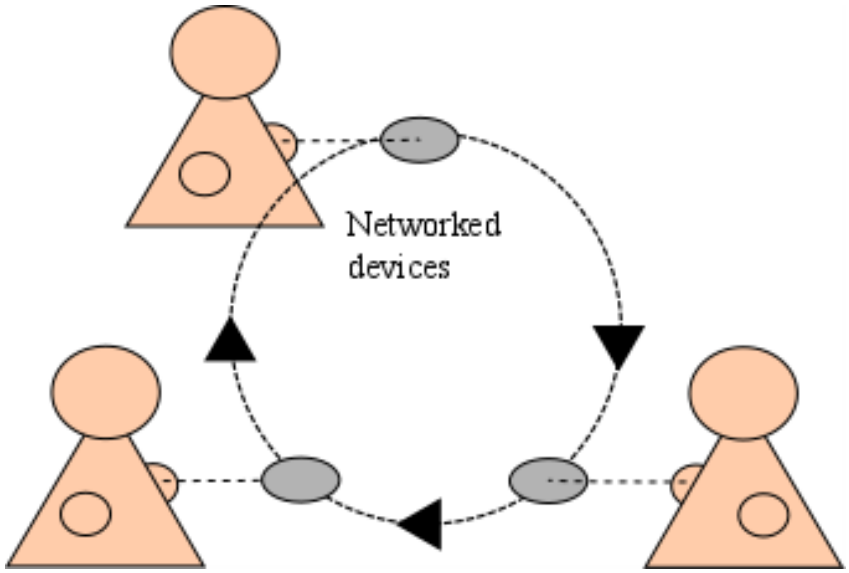

Figure 25. Turn-based improvised play.

This configuration enforces the order of play in a group i.e. one player will take their turn before passing their turn to the next player, and so on. This configuration can be used to ensure all players have an opportunity to have their go, giving everyone a chance to play and again contribute toward the "well-played game".

In designing games for young people, designers will be able to decide which pattern of player interaction is appropriate for the context. These patterns can be supported directly through programming, as in *turn-based improvised play or fully synchronised improvised play*, or

games might be designed to be more open so that player interaction patterns – such as *improvised play between a group* might happen as a consequence of social play.

6.2.7 Using state transition diagrams to communicate game design

State machines are often used in game design and there are visual scripting tools like the *Playmaker* editor which automatically generate runnable game code. State machines and their representation as state transition diagrams are particularly relevant to these *simplistic game systems* as single cards can be conveniently mapped to a single state in the game logic. Correspondingly, state transition diagrams can be closely related to the final programmed game logic. Using transition diagrams in this game design process ensures that games meet the expectations of the co-designers and can help deliver runnable prototypes earlier.

In the design of *DoHS* the state transition diagrams served several purposes. The different states were used by the design team to ensure that overall activity made sense. It also ensured that the game logic was complete i.e. that each playing card from the design stage had a digital version. The state machine also provided a quick reference to ensure that the artwork had been illustrated. The following diagrams show the flow of logic for DoHS. This begins with the diagram for the main menu (see Figure 26) followed by the Create Mode (Figure 27).

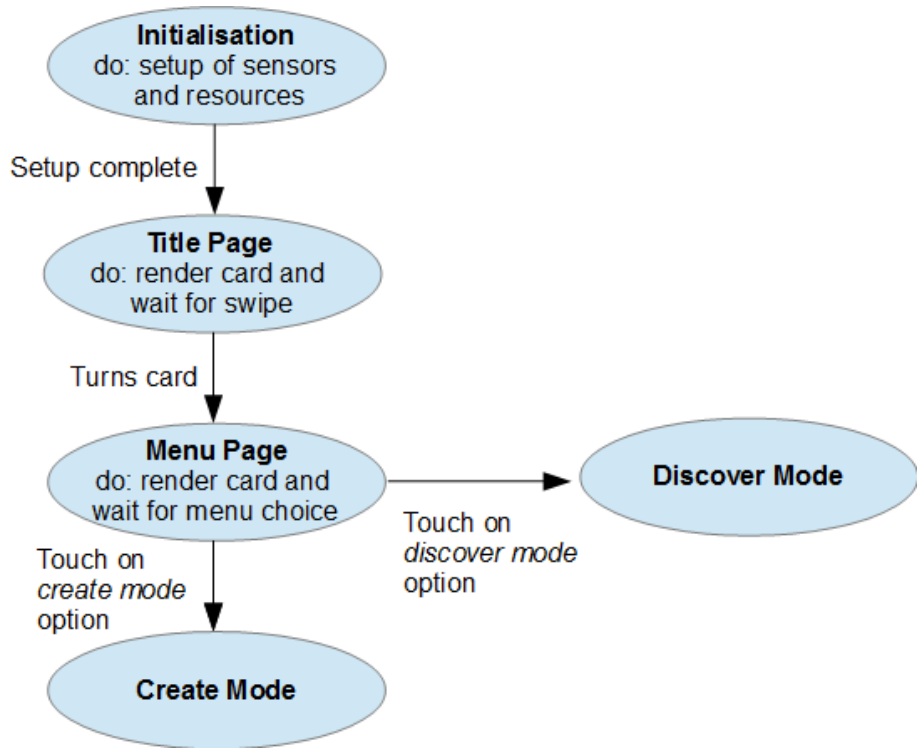

Figure 26. State Transition Diagram for DOHS' Main Menu.

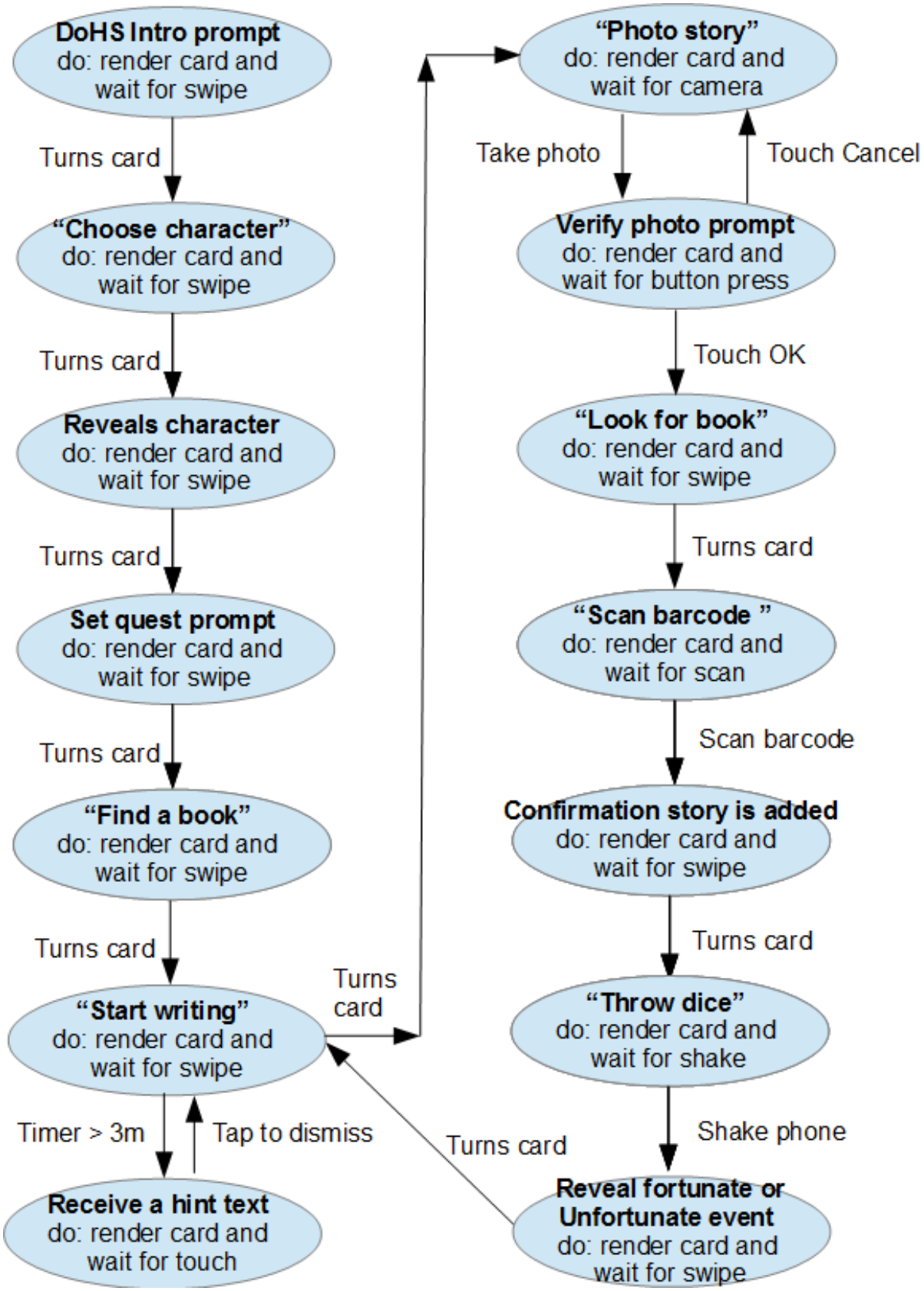

Figure 27. State Transition Diagram for DOHS' Create Mode.

The last state machine diagram details the Discover Mode (Figure 28).

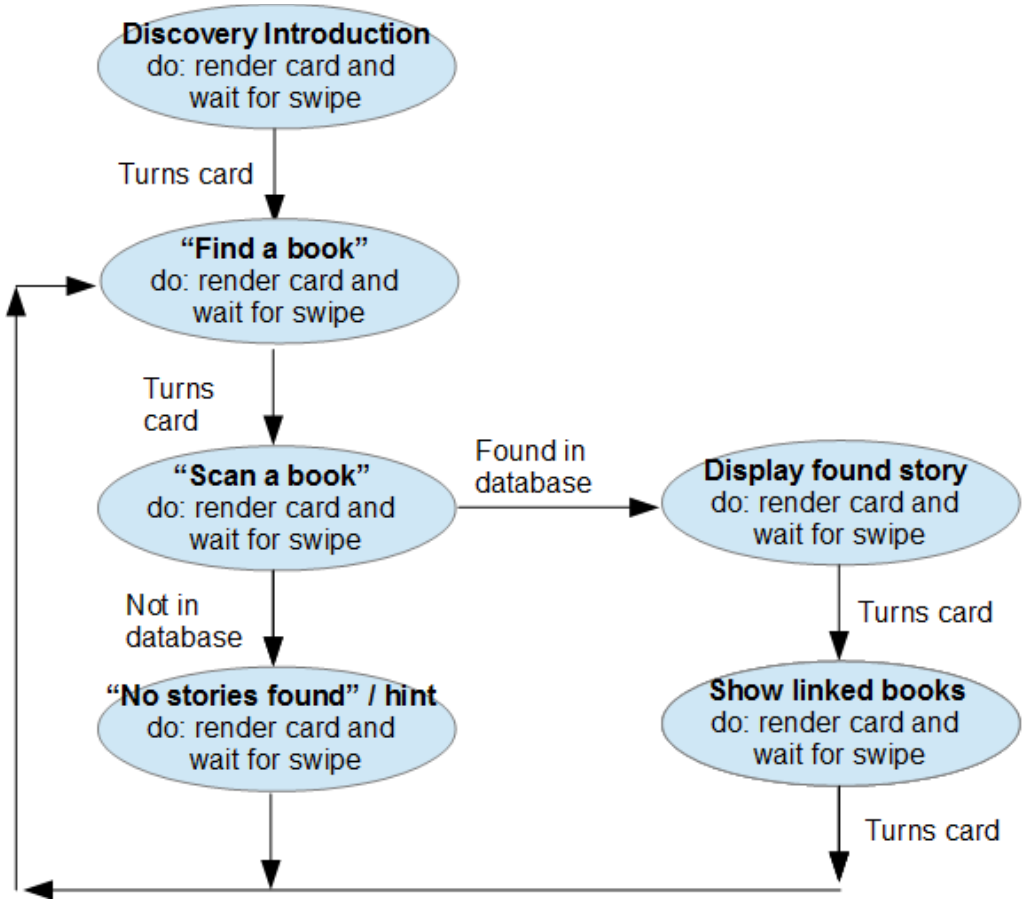

Figure 28. State Transition Diagram for DOHS' Discover Mode.

6.3 The Game Design Framework Software: DOGE

This section details the software that has been used to implement the game designs in this thesis. It describes why a game engine can be considered an important part of the contribution and approach, and how the game engine can be used by a game designer.

6.3.1 The rationale for creating a game engine

Making games typically involves a game authoring tool, and there are many examples of these tools e.g. Unity, Monogame, Unreal Engine, GarageGames Torque 2D and Game Maker. Simplistically, game designers bring these tools together with game logic and digital media to create new gaming experiences. Successful game development is tied to the efficacy of these games authoring tools – more effective tools have well documented libraries and tutorials which provide an appropriate starting point for experimentation. These game authoring tools allow games designers to spend more time on realising working prototypes

and play, rather than writing bespoke programming code to solve well understood problems (and effectively re-inventing the wheel).

There are distinct types of games authoring tools and the terms “game library”, “game framework” and “game engine” are used to describe what can be achieved with those tools. These terms are frequently used interchangeably and often imprecisely. In this work, the term game library refers to software that normally addresses a particular element of game programming, for example, the audio library Open AL is used to create sound effects in games. Game frameworks in contrast, are collections of libraries which work together to provide the minimal necessary functionality for creating a game e.g. asset loading, input, rendering and audio. Game engines provide a more complete package for creating games. This includes tools which can be used from the start to the end of the software life cycle, for example, they can help publish the games to specific platforms and also provide tutorials which can be used as a base for further work.

The game design framework contributed by this thesis work includes a games authoring tool called DOGE (or Digital Open Game Engine). DOGE is best described as a game engine because it provides a near complete solution: prescribing a particular way of working that is tailored around the game design process and the creation of the game designs in this work. The use of the game engine was formalised in this work after the experience of writing *DoHS* on Android which showed how digital playing cards could scaffold and structure the play in a public space. Although the game mechanics and the components used in *DoHS* were simplistic – it was clear that using a game engine would speed up development and place emphasis on creating the experience content rather than dealing with lower level game programming problems. DOGE itself was not built from scratch but upon on a proven set of gaming technologies which had been used in previous commercial games and research projects which included *Magic Land* (Pykhtina et al. 2012) and *Tales of I* (Wallace et al., 2012).

Ushaw et al. (2015) describe the many benefits of using an existing commercial games engine in the application of serious games for research – albeit in health research. They describe benefits which include the enhanced ability to perform iterative development, as well as showing how professionally produced art and audio assets can easily be integrated into games built in these tools. Tellingly, the authors also describe how game engines will provide the

basis of a complete gameplay experience. In this sense, the choice of games authoring platform can influence the look and feel of games. Chapter 5 has already talked about the importance of playtesting and iteration in *i-dentity* and *intangle,* and the following discussion details other advantages of using a game engine.

Simplicity: Ushaw et al. (2015) describe how the game design itself should be simple for their serious contexts – and its authors describe how the fixed and simple structure of their game examples provide a low barrier to entry for the player. In this thesis work, the micro game loop is similarly simple – in that players are given a digital playing card which suggests an action which the players respond. Sticking to the same micro level game loop is valuable and works well with what Goddard et al. (2014) refer to as 'ludic crafting' – where game designers can experiment through play (in the games in this thesis – this means experimenting with actions to find out what play actions work).

A permissive license: The Creative Exchange project was driven by making the digital accessible anywhere, anytime and for anyone, and the project intended that any source code output should be open source and published under a permissive and an appropriate license: *BSD 2-Clause License*. In contrast, other games authoring tools may have limiting commercial licenses, patents and royalties, closed-source code, or where source code is available, the license can be a copy-left license which allows people the right to freely distribute copies and modified versions of a work, but the same license must be preserved in derivative works down the line. This can result in difficulties when mixing with source code that is supplied an incompatible license.

Supporting new functionality: At the time the second case study was written, very few commercial games authoring platforms had support for the new BLE locative technologies like the Estimote beacons which were used in the *Wild Man Game*. Using a bespoke games authoring platform has allowed these technologies to be added at the same level of granularity as other sensing devices, thus keeping the level of conceptual and programming abstraction in the game engine constant.

Staying in control of development: As part of working in a collaborative research environment it has been important to stay in control of the development of software. The software for *Labella* prototype (Almeida et al. 2015), the *SwaytheBand* prototype (Morrissey et al. 2016)

and the *Expressy* interactivity demo (Wilkinson et al. 2016) can be still built using the latest versions of the game engine. Being able to control the development of this games authoring platform has ensured continuity between projects that have been spaced out over years, where in this time, other commercial games authoring platforms will have had significant architectural or license changes.

6.3.2 Downloading the game engine

The DOGE game engine can be downloaded from Bitbucket[6], *The Creative Exchange* GitHub account[7] and the DOGE[8] main repository on GitHub. For designers unfamiliar with Git distributed version control, a zip archive of the repository can be downloaded from the main repository which can be unpacked to gain access to the full content of the repository.

The current content for the game engine includes a README file that provides a small summary of the game engine and a link to its Wiki, and there is a LICENSE file containing the *BSD 2-Clause License.* The Wiki is currently being maintained online on the main branch of the GitHub repository. The Wiki details most aspects of the game engine and its use: including the aims and objectives of the project, what the different tutorials provide and how they can be built and deployed.

The game engine provides the three essential tutorials for the card-based games in this work which can be found in the folder CardBasedGames and are detailed in the Appendix.

6.3.3 What are the capabilities of the software?

The GitHub repositories contain the game engine source code and tutorials. The main tutorials relating to the games in this work are found under the folder CardBasedGames. There are also additional tutorials which show how the game engine can be used in different digital prototypes that require comprehensive 3D rendering and a further set of tutorials which show how to make games using the PlayStation Move controllers to explore improvised play.

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[6] https://bitbucket.org/GavWood/

[7] https://github.com/thecreativeexchange/

[8] https://github.com/GavWood/

The tutorials can be currently built for Windows PC, Mac OSX, iPhone, iPad and an Android port is currently in development. As the games in this thesis are built on mobile phone it is possible to build straight onto the mobile device. However, as with all game engines, the deployment of game packages to a mobile device takes a small amount of time, adding to the total time over the course of the software development life cycle. Instead, it is advantageous to build and run on a desktop machine which allows the game design team to develop and iterate the gameplay before moving onto the mobile device.

The remainder of this section describes how the game engine helps this design process. This is important to include as the tools will affect the look and feel of games (as described) and therefore a more thorough understanding of the tools will better explain the game designs.

Supporting the presentation of digital playing-cards and playful prompts: The game design framework and game designs in this body of work use a paradigm of playing-cards. Card-based activities were used in the design of *DoHS*, the *Wild Man Game* and *Intangle*. These games also use either playing-cards or prompts in the digital versions. Playing-cards have been used in many genres of computer games including: app versions of traditional card-games like *Poker* and *Solitaire*; app versions of board games e.g. *Monopoly* and *Cluedo*; card deck-building computer games e.g. *Ascension* (Gary et al., 2011); and trading card computer games e.g. *Star Wars: Card Trader* (*Star Wars: Card Trader*, 2015). This has followed a general trend in user interface design toward card-based design. The game engine helps the game designer present these cards and prompts to the players in various ways.

Text rendering is an important part of presenting the playing-cards. Text can be rendered several ways: the framework supports third party routines which can draw high resolution fonts using glyphs and text can be drawn using the game engine itself which takes its letters from a packed source image. Spoken word can be used as an alternative or in addition to presenting playing cards using graphics and text. The use of digital speech is common in pervasive games e.g. *Explore!* (Coenen, Mostmans and Naessens, 2013) and transmedia experiences such as *The Remediation of Nosferatu* (Ghellal et al., 2014). Correspondingly, the design framework supports spoken word using text-to-speech generation on platforms where there is native support, sound files in Waveform Audio File Format (WAV) and larger files can be played back as either MP3 or AAC. The sound output can also take advantage of the

surprisingly loud in-case speakers on mobile devices which are capable of filling small spaces with sound.

Transitioning between cards: The game engine tutorials provide the programmer with pre-canned transitions between cards. The simplest of these mechanisms is the straight forward replace (like with like) of one playing-card with another. Transitions might also consider gestures such as swiping the page from left to right. *DoHS* used a third-party routine to simulate the turning of paper as it curled upward with a player's touch in the corner. In the *Wild Man Game* transitions happened instantly and automatically when locations in the hall marked by Bluetooth devices were reached.

Augmenting playing-cards: The game designs in this work facilitate improvised play that can take place away from the actual mobile device. However, more complex graphics can also be used to situate action on the device or around the device. The design framework supports augmented reality and particle effects. Although, more complex rendering such as drawing 3D models with animation and sprite rendering are now a staple of computer games authoring software – the more complex graphics here are used in combination with the playing-cards which in the case of augmented reality can encourage players to look through the device at each other and the space around the device.

Asset management: Ushaw et al. (2015) describe how game authoring platforms allow easy integration of professionally produced art and audio assets which can result in a more exciting experience. In the design of *Labella* (Almeida et al., 2015) and *Talk About Sex* in the next chapter this enabled the interaction designer, games designer and graphic designer to work in parallel without waiting on one another – with graphics added when they became available.

Peer to peer networking: The games described use a peer to peer network configuration rather than a client / server architecture. This means there is a digital connection between each of the player devices. This configuration is important, as apps can join and break away from the game physically, which means that players can enter and leave the game as they wish. Building games in a peer to peer system with this connectivity in mind will also strengthen the conceptual importance of linking players.

Peer to peer networking was first used in *i-dentity* and *intangle* by using the PlayStation Move controllers and Thomas Perl's *PS Move API* (Perl, 2010). These connected Bluetooth devices can be viewed as supporting play which is analogous to connected mobile devices in a peer to peer configuration. However, playing with the PlayStation Move controllers and this configuration is practically far simpler as the game designer need only program one state machine which does not need to wait on communication with other networked devices.

6.3.4 The game and system architecture

The following diagram (see Figure 29) describes the system architecture of these games and supporting technology. It is illustrated to show the relationship between the game (its state machine and game logic) and the games authoring platform or game engine.

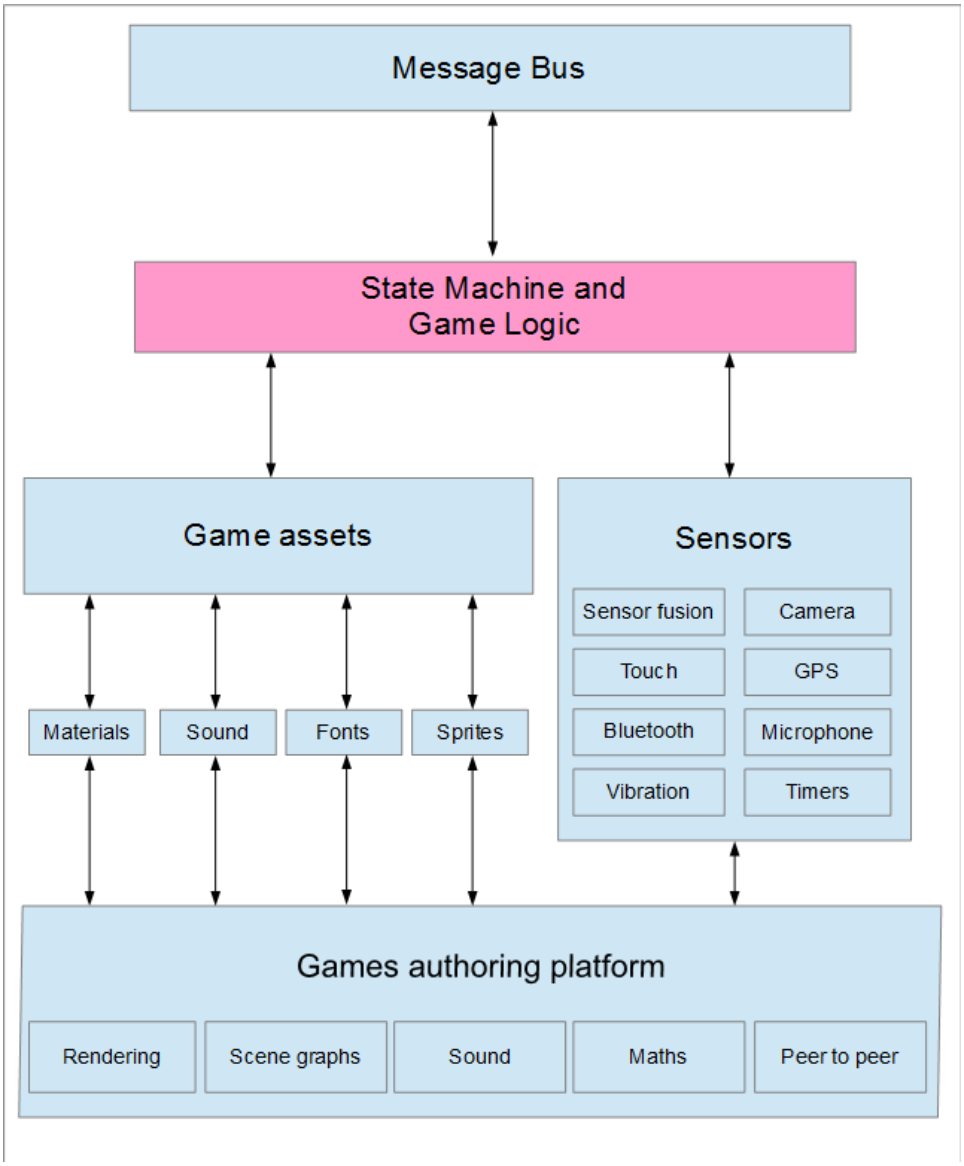


Figure 29. Game and systems architecture.

The explanation of the system architecture is included here for comparison with other game designs framework for pervasive games e.g. *Frap* (Tutzschke and Zukunft, 2009) and the framework used in *Campus Knights* (Samodelkin, Alavesa and Voroshilov, 2016). Those frameworks are built around client-server architecture where games are orchestrated from the server. In contrast, the game designs in this body of work perform the game logic on the players' own devices which is illustrated in the middle block (State machine and Game Logic).

6.4 Summary

The game design framework described in this chapter is the main contribution of this thesis and presents an approach to creating game designs in mobile contexts. The framework was creative iteratively and inductively across the game designs in this work and is examined by Zimmerman, Forlizzi, et al.'s (2007) criteria for judging research through design (see 1.3. Research Approach and Limitations).

The game design approach began by asking co-designers to think about play and specifically about the characteristics of play. Thinking about play rather than games per se (Verenikina and Harris, 2003) provided opportunity to engage in design conversations without thinking specifically about computer games which can risk bringing up some unfavorable associations. Instead, starting with, and speaking about play the approach provided occasion to discuss our own collective memories and experiences of childhood play, which are always welcome and enjoyable.

The games based upon these conversations about play have adopted a common game design pattern. This can be described as a *simplistic game system* which is based on the paradigm of playing cards and through prompting actions. This term is borrowed from Wilson (2012) who uses a "simplistic game system" to describe the structure of the games in the non-digital card games CBCG and FYIA. The game designs in this thesis can be viewed as a comparably simplistic game system as they use playing cards with simple prompts that are used to initiate play actions. In contrast to CBCG and FYIA, the game designs in this body of work can be viewed as both technologically supported and technologically sustained (Montola, Stenros and Waern, 2009) since they use the mobile phone to support and sustain activities. These simplistic game systems have proven to be practical solution for designing unique and novel games. These games often resulted in new embodied experiences, in that, they were not just

about the user and a computer system (Polaine, 2010), but experiences that entwined players together in the mobile context – the physical space and with its associations. Rather than "blending" a game with the real world, the games build upon the context to create what Huizinga's (1949) calls the "stage apart", a temporary place for play which has its own rules. Importantly, these rules here are not certain, but are a combination of what actions are given, how the players interpreted the actions and how the game responds to what can be sensed from the device.

The game designs can be viewed in terms of Salen & Zimmerman's (2003) definition of play where play is described as the free movement inside a more rigid structure. The games are able to create this rigid structure by presenting the players with different improvisations (whether these are shown on digital playing-cards, spoken by the player, or articulated by using text-to-speech algorithms). Through creating new gaming interfaces using the different interfaces on the mobile devices, the games are able to sustain the play and complement the structure of the game. The different interfaces are created from the multitude of input sensors and output devices on our mobile devices which provide this practical means to sustain this play. Thus, technological pragmatism has been appropriate in design (as opposed to technological agnosticism). Technological pragmatism is useful because it provided practical directions to explore, helped imagine new unique interactions and enabled play testing to happen early in the design.

In the creation of these structures to support play it has been useful to apply several existing theories which have helped in the design. For example, in thinking about improvisations, ambiguity has been a key resource for design (Gaver, Beaver and Benford, 2003). This has allowed the game designs to take a simplistic game system and expand the possibilities for play. There are no two games in this thesis that are the same and yet they all facilitate improvisations through the use of playful prompts in one way or another. However, as the mobile games have been used in different contexts this has also shaped both what sort of actions have been used and also how the play and players have been structured. The games use different player interaction patterns and in the creation of these games the thesis work has been able to use variations on the patterns proposed in Fullerton (2008) and Segura (2016). These playing interaction patterns are important because game designers need to program how multi-player games allow players to interact with one another and this is a key architectural decision in their design and development. These configurations not only shape

what and how we play but determine how we relate to other players – a structure which will contribute toward players enjoying De Koven's (2013) *well-played game*.

Lastly, in making new interfaces to sustain play in the game design, the thesis work has applied the work on trajectories by Benford et al. (2009) which allows the experiences of these games to be viewed as a journey across different interfaces, which in turn are based on the different sensors which can be usefully considered through the "expected", "sensed", and "desired" framework (Benford, Schnadelbach, et al., 2005).

This game design framework also provides guidelines which contribute to the design of games in this domain. These guidelines are reiterated below:

- Expand the range of prompts and avoid repetition (G1).
- Allow players to set the pace of the game themselves (G2).
- Encourage players to play alongside one another (G3).
- Sustain play using different interfaces (G4).
- Design for play that is relatable and will make sense (G5).
- Provide mechanisms to play nicely together (G6).
- Allow players to enter and leave the magic circle of play (G7).
- Place stages for play (G8).

The guidelines are intended to help guide the creation of a game as part of the design process. However, it is important to note, that games can be described as irreducible and complex systems (Goddard, Garner and Jensen, 2016) and as such, the guidelines and requirements are not necessarily a panacea to create fun and engaging games. Instead, the games design framework can be viewed as a way to create a practical digital prototype that will make it easier to explore these interesting contexts and look for actions and interactions that work.

This chapter has described how this game design framework can be applied to create new games for young people in public spaces. This framework was contributed in three parts: (1) how the research should be started and conducted (2) the design process; and (3) the architecture that supports these new game designs. In addition, the discussion has looked back over theories from related work that can be applied, as well as applying the frameworks own guidelines.

The game design framework can be used to create new games that result in improvised play for young people in their own spaces. The resultant designs from this framework are practical, minimal, flexible and fitting for the mobile context.

These game designs present a rigid structure which will encourage play that is appropriate for the mobile contexts. These games are successful because they carefully balance between supporting the play (defining the rigid structure through playing-cards and playful prompts) and sustaining the activities of the player (encouraging free movement using the mobile device and its potential for new playful interactions).

Significantly, the research through design approach described in this work has naturally moved discussion to the tools used in the game design i.e. the game engine and its architecture, where extensibility is key. However, this is one perspective on the game design process and an important limitation of this work is that game designs are viewed from this perspective (not the custodians of the public spaces) and importantly the game designs will still need to be created by a games developer or programmer. In building on this work, its apparent that the simplicity of the games lends themselves to be created by configuration alone. This might mean that future frameworks could avoid programming and allow these games to be created by the custodians of public spaces or those who work in these spaces – in extending the framework, it is possible to think of the design framework re-imagined as an online configurable tool.

7 Talk About Sex

Talk About Sex is a mobile game for two to eight players that encourages young people to talk about sex by engaging them in play on their own mobile devices with others. The game design was created across multiple design sessions and discussions in collaboration with an interaction designer who focuses on designing for digital health and wellbeing, and a sex and sexuality researcher experienced in working with young people. The game is included in this chapter as an example of how the game design framework can be applied in a different context.

This chapter begins by further discussing the context of youth work and how it part informed this game design. This is followed with a description of the game design, and how the design framework can be applied.

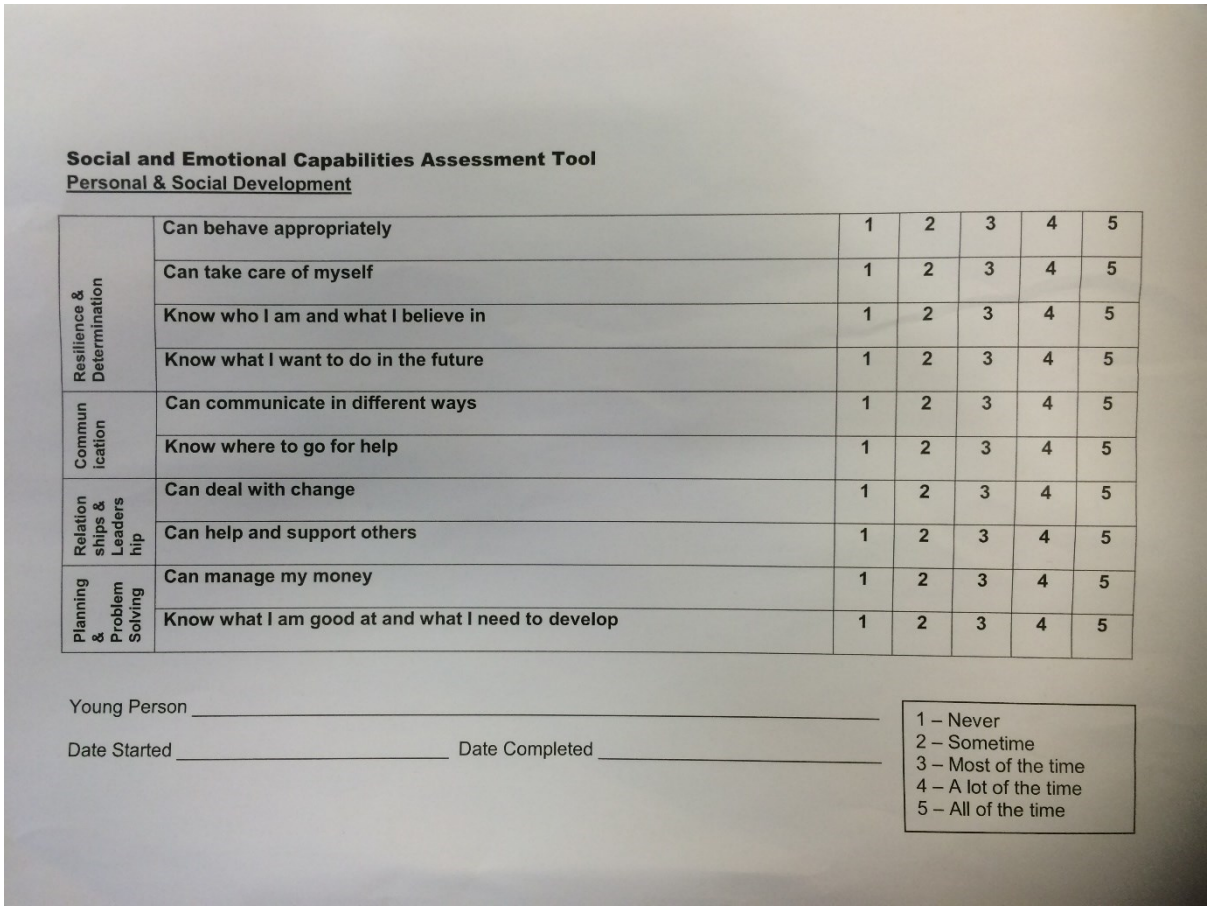
7.1 Introduction

The game design framework describes the importance of needfinding and this project was part informed by volunteering for Bad Apples North East. The discussion on youth work began in chapter 5 which describes how youth workers use diversionary activities to engage with young people. This volunteering was opportunity to talk and learn about the delivery of important services in outreach and detached work. These include social and sexual health services such as C-CARD registration which provides young people access to free condoms and sexual health advice. Other important services include:

1. Free health checks for young people.
2. Alcohol advice/support/referral.
3. Self-assessment on personal goals/achievements.
4. Outreach questionnaires.
5. Referrals to other agencies (health, social services, family support, education, training, employment opportunities).

These services support the well-being of the young people and are often delivered alongside the diversionary activities. The youth workers normally deliver these on foot in the evenings, walking between public spaces like parks and town squares. Additionally, where resources are available, youth workers have used vans or minibuses to deliver services in the spaces where

young people “hang out”. For the young people, the mobile provisions of vans and minibuses provide a nexus, shelter and a place to get hot drinks like tea and drinking chocolate. These are often used as bases to hand out paper tools such as the Emotional Capabilities Assessment tool (see Figure 30) which charts the development of important personal and social skills, such as being able to communicate effectively. Providing services in these environments is time consuming and often cold where Bad Apples are located in the north east of the UK, but always worthwhile.



Social and Emotional Capabilities Assessment Tool
Personal & Social Development

Resilience & Determination	Can behave appropriately	1	2	3	4	5
	Can take care of myself	1	2	3	4	5
	Know who I am and what I believe in	1	2	3	4	5
	Know what I want to do in the future	1	2	3	4	5
Communication	Can communicate in different ways	1	2	3	4	5
	Know where to go for help	1	2	3	4	5
Relationships & Leadership	Can deal with change	1	2	3	4	5
	Can help and support others	1	2	3	4	5
Planning & Problem Solving	Can manage my money	1	2	3	4	5
	Know what I am good at and what I need to develop	1	2	3	4	5

Young Person _____

Date Started _____ Date Completed _____

1 – Never
2 – Sometime
3 – Most of the time
4 – A lot of the time
5 – All of the time

Figure 30. An example of one of the forms used to chart progress.

Volunteering with Bad Apples highlighted a number of problems that youth workers tackle when performing detached work. These problems include engaging with new people meaningfully and keeping them interested as they take part in these services.

Digital technologies can provide an opportunity to engage young people at their own level and when used, it has proven successful, for example, Bad Apples have used artificial “Beer Goggles” and breathalysers to communicate the effects of alcohol to young people. However, youth work organisations do not necessarily have the money, time, resources or expertise to develop their own digital technologies. Nevertheless, these few existing interventions show

how digital technology has a valuable role in youth work and volunteering was opportunity to think about bringing play and these services closer together. The remainder of this chapter details the game and design of *Talk About Sex* which responds to the challenges faced in providing important health services for young people. Importantly, for this thesis, *Talk About Sex* builds on the previous work in designing for improvised play and creating games that support card-based playful interactions.

7.2 Talk About Sex Prototype

Talk About Sex (TAS) is a digital card-based game designed for two to eight players which is played on a mobile phone. The game asks players to improvise different responses to digital-playing cards written around the agenda of sex, relationships, intimacy, and even flirting, in order to encourage candid *talk about sex*.

TAS was designed to be played around a table where players are sat facing each other. Players are given actions which they perform when it is their turn to play. *TAS* uses approx. thirty playing cards with an aim of making a game last twenty minutes or more. The playing cards are written in language that is appropriate to the context, while intending to engage young people in conversation about sex, relationships, identity, intimacy and gender. The actions in the game are worded carefully against the following criteria: (1) they do not necessarily assume that players have any actual experience of the 'act of sex'; (2) the game avoids heteronormative stereotypes i.e. the game does not assume men are heterosexual and have heterosexual relationships with women; (3) the game does not presume that sex is just about the physical act. Instead, the cards express other ideas around the topic of sex, such as friendship, trust, humour and fun.

TAS presents a look and feel that loosely follows liberal movements from the 60s and 70s (see Figure 31). The aesthetic extends these clichés by using an 80s coin-up styled "number of lives" sprite in the top right-hand side of the screen and the main game screens adopt a colorful and brash style for the background of the playing-cards.

The game is played on mobile phones and the game starts when players in the same room open the app on their phone with either their Wi-Fi or Bluetooth connections turned on. Players then wait while the game automatically connects everybody's phones together. The game indicates how many players have joined the game by a row of hearts which appear one

by one as they join (see Figure 31). Once players are happy everyone is in the game, any of the connected players can touch the screen to start the round.

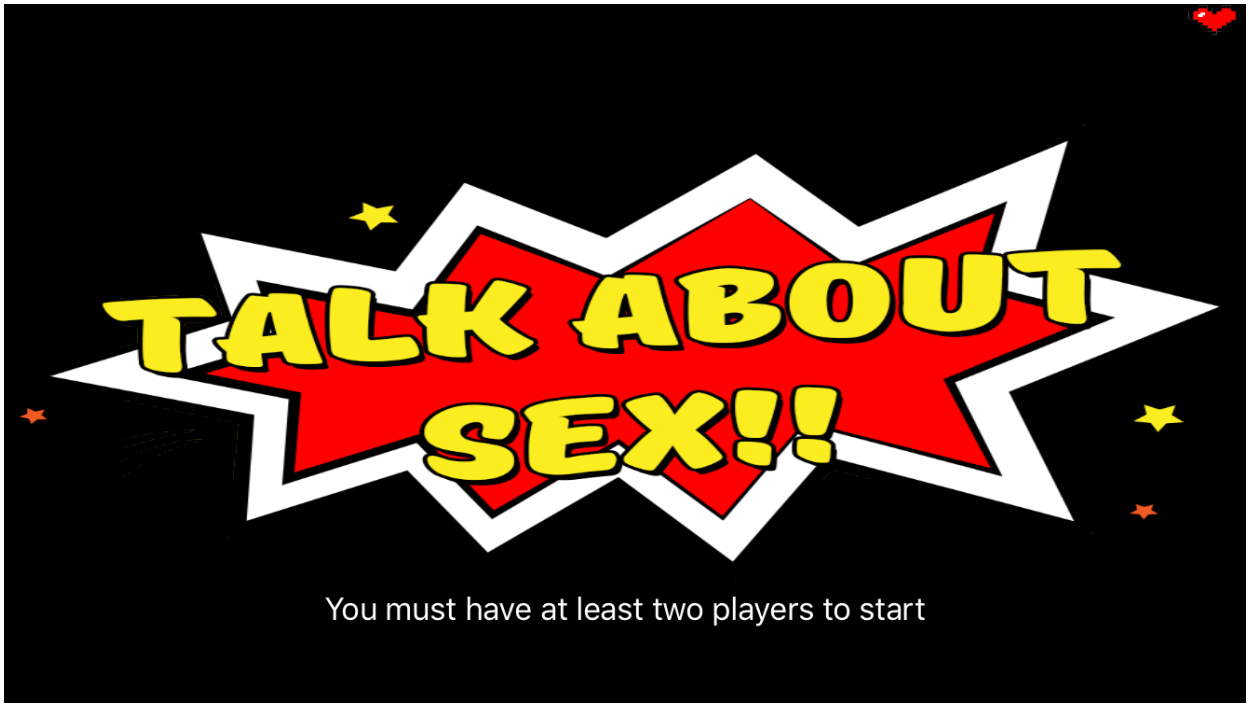


Figure 31. Talk About Sex - Title Screen

Once the round has started, the players are instructed to place all the phones face down and the game waits until this has happened. After a small delay the game plays a sound and one device vibrates to indicate that it should be picked up. The player with that notification, picks up their device. The game then presents the first of the playful prompts (task 1 to task 29) on the screen of the device from a full list that includes:

1. Blow a kiss to another player.
2. Mark on Google maps where you've had a 'moment'.
3. Take a photo of a body part.
4. Write the name of your first kiss.
5. Hold your phone and draw a love heart in the air.
6. Get everyone to leave the room - then describe a poignant or daring intimate moment to another player.
7. Draw a body part.
8. Use a Google image search to find a photo of a romantic location.
9. Shout a pet or slang name for any body part.
10. Wink at one of the other players.
11. Choose a friend(s) then place your phones in your pockets and swing together to an imaginary beat.
12. Sing, hum, or whistle your best sexy theme tune.
13. Stop playing the game. Return in one minute.
14. Choose a song from your mobile that you associate with someone or romance.
15. Draw some tickly bits on your phone.

16. Simulate a massage with your phone.
17. Read this bad sex paragraph.
18. Tilt the screen on your mobile and watch\nan imaginary sperm win the race to the egg
19. Start at one end of the group and draw a part of an intimate picture. Pass to each player and let them continue.
20. Pass this sealed condom to another player.
21. Draw something to do with sex, intimacy, or sexuality, NOW and quickly.
22. Swap phones with another player and don't give it back to them until the end of the game.
23. Draw something NOW.
24. Take someone else's phone and record a message private message for them.
25. Take a selfie on someone else's phone.
26. Hold hands with another player clasping the phone and swing your arms together.
27. Shine the light to illuminate part of your body.
28. Write a message to someone important in your life.
29. Whisper a message into someone else's ear. encourage a variety of different actions.

The prompts are revealed in order and the following prompt in the game (task 4) asks players to "Write the name of your first kiss." (see Figure 32).

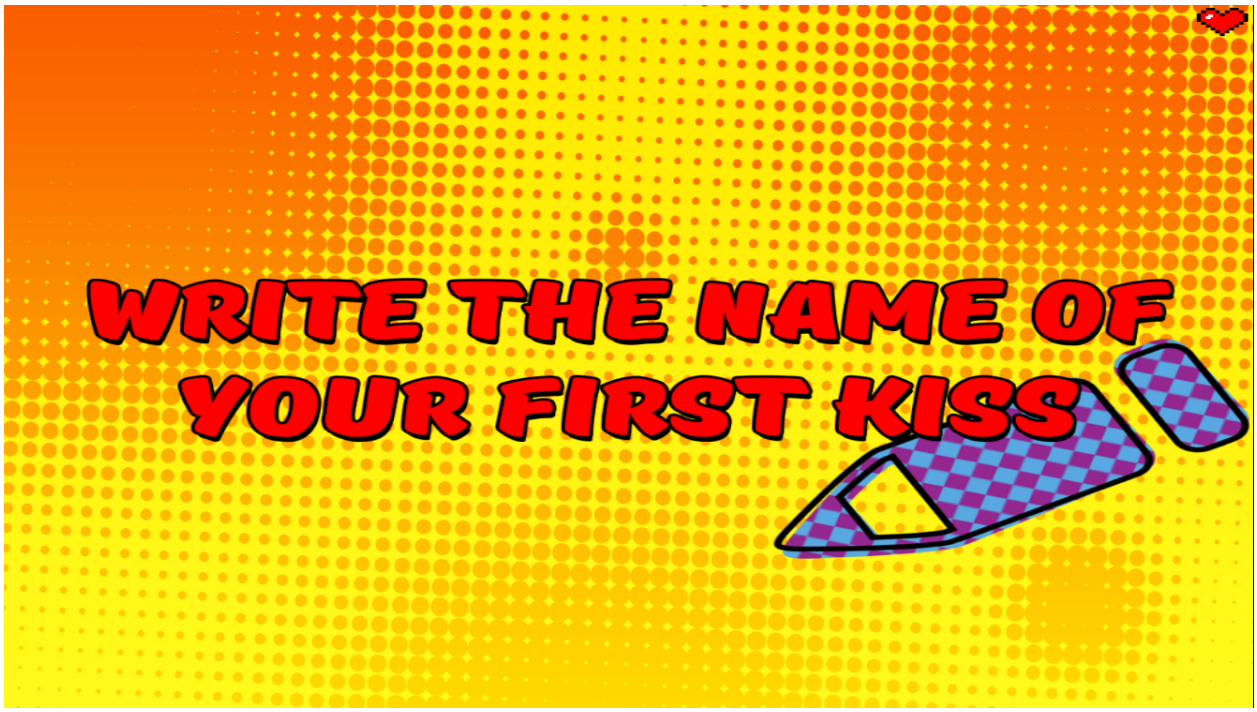


Figure 32. Talk About Sex. "Write the name of your first kiss".

This prompt is typical of the actions prompted in *Talk About Sex*; the game does not expect to be able to sense what was written and the player might respond by drawing a "?". The player can therefore choose to act out a playful prompt or choose to do nothing. Whatever they choose, they finish their turn by placing their phone "face down" back on the table. The game then waits to ensure all the players have rested their phones correctly. This player has now indicated they have taken their turn (or they have passed their turn and decided not to play). They are effectively put at the back of a queue, and the next player takes their turn, and so on.

The game follows the order that the players joined the game at the start. Once the full list of instructions has been played the game returns to the title screen and the game is ended.

7.3 The Game Design Process

Prior to starting on the initial prototype, the design team played a selection of games that could be positioned on the playful end of Caillois' scale of playfulness to gamefulness. This first step was used to "sensitise" everyone around play and to encourage conversation around more playful interactions. The games were summarised in a living document of 'interesting games' which included *Heads Up!* (DeGeneres, 2015) and *Spaceteam* (Smith, 2012). The first game, *Heads Up!* is a Charades-like party game where a player must guess the word displayed on the mobile phone that has been placed on their own forehead using the clues of their friends. This game is interesting because it makes innovative use of the accelerometer via a tipping mechanic. The player uses this mechanic to record whether they got the answer right or wrong through tilting the phone either forward or sideways. The second game, *Spaceteam* is a "cooperative shouting game" for two to eight players. In this game, players shout instructions at each other to get them to perform tasks such as toggling buttons and moving sliders on a user-interface which pretends to be a "bridge" from a sci-fi spaceship. *Spaceteam* is interesting because the instructions and controls are intentionally confusing. Thus, the actions are difficult to follow, and the enjoyment is a result of the miscommunication and mayhem between players. In addition to these two games, *i-dentity* and *intangle* which were described in chapter 5, were familiar to the co-designers and discussed as examples of games where players act out improvisations in response to prompts.

The design sessions for *TAS* began by brainstorming around these games and worked toward playable content for an initial set of prompts. The design team were given the mobile device design cards and tasked with creating ten original prompts which might encourage conversation around sex. These were provided with a hint to use the content of the cards "creatively" e.g. the camera card might be used for its LED torch rather than its camera, or the GPS might involve the Maps application (a default app found on everyone's mobile phone). The result of this initial activity, was a stack of written playing cards which could be role-played on card (as a paper prototype) with the responses bodystormed. Importantly, this activity treated the cards as a deck which were dealt out to the co-designers, one at a time, who were sat around the same table during the design sessions. Play then proceeded in a clockwise fashion with the co-designers taking turns to act out (and bodystorm) the actions.

The order of this play suggested that the player interaction pattern *turn-based improvised play* would be appropriate and was an important step in this first design session. This pattern would allow players to take a playing-card and respond to an action before allowing the next person to play, and so on.

The playing-cards used in Talk About Sex and the game can be examined through the game design guidelines. There are several versions of the playing-card deck used in the design sessions, and the deck used in the following application of the guidelines has twenty-nine playing cards, which can be compared to the thirty cards in *Intangle* (one card generated in the design sessions was a duplicate).

Expand the range of prompts and avoid repetition (G1)
In creating ten cards each, the design team created a wide range of improvisations which avoided repetition – although some cards have a close resemblance to others. The content of the cards varies from those that encourage players to move e.g. "Simulate a massage with your phone" (task 16), to those that share something personal e.g. "Use a Google image search to find a photo of a romantic location" (task 8), to cards which use humour e.g. "Read this bad sex paragraph" (task 17): *"Alexis brought me close to their neck, and I smiled as I took in the smell of their sweet aroma, once more. I let out a contented sigh as my thoughts irrevocably slipped to my Skye. What would they make of our blossoming relationship?")*. Importantly, the cards suggested a range of actions which will encourage players to improvise their own unique and original responses.

Allow players to set the pace of the game themselves (G2)
The player interaction pattern in this game was chosen so that players would take it in turns to play. This pattern structures the play so that the game is inclusive i.e. everyone gets to have a go. Since the game cannot sense the actions of the players, individual players must decide when their turn is over. This also gives players the ability to take their time in both understanding what is being asked of them and being able to spend as long as they want on their own responses. Players can place the phone down on the table when they are finished or use this mechanic to indicate they do not want to respond, or even if they do not want to share what is on the screen with others. These options allow the player to set the pace of their own responses, and the players all set the pace of the game collectively.

Encourage players to play alongside one another (G3)

As described, the player interaction pattern in this game encourages players to take turns. However, the improvisations change this configuration by involving other players in their actions, for example, the game asks players to "blow a kiss" (task 1) and "wink at one another" (task 10). These actions will direct some attention to the other players. Players are also asked more explicitly by the prompts to involve others, for example, players are asked to dance together (task 11), leave the room together (task 13), use each other's phones (task 25) and whisper a message into someone else's ear (task 29).

Sustain play using different interfaces (G4)

The mobile device cards were given to the design team to encourage varied playful prompts and to provide suggestions of how play might be sustained. In the initial play testing it was obvious that it was not necessarily important to sustain every interaction with technology, for example, "blow a kiss" (task 1) and "wink at one another" (task 10) could not be sensed. When there was opportunity to detect a response had been made e.g. "Shout a pet or slang name for any body part" (task 9), it was decided that it was not necessary to sense the interaction e.g. by capturing the volume of the captured sound. Instead, it was assumed that the players themselves would act as the judge of whether someone had actually shouted. However, some actions did need to be sustained by game logic, for example, the prompt "Write the name of your first kiss" (task 4) used touch interaction, the display, and required a small amount of programming code to enable the player to draw free hand.

Design for play that is relatable and will make sense (G5)

The actions in *Talk About Sex* were created across the design team and drew upon diverse inspirations. These included capturing the nostalgia of the 60s Twister game which asked players to enjoy awkward embraces e.g. "Hold hands with another player clasping the phone and swing your arms together" (task 26), thinking back to dares, as they were remembered from childhood parties or school e.g. "Mark on Google maps where you've had a 'moment'" (task 2), to suggesting improvisations that might be associated with performing arts or drama in schools e.g. "Hold your phone and draw a love heart in the air" (task 5), also several actions resembled some of *intangle's* prompts c.f. "Everyone, swap controllers" (card 13) with "Swap phones with another player and don't give it back to them until the end of the game" (task 22), and "kiss a player on the cheek" with "Blow a kiss to another player" (task 1).

Whatever the inspirations, the actions are relatable - they are immediately understandable and make sense. Furthermore, actions can be related to everyone's own experience, for example, in marking on Google Maps where "you have had a moment", this could mean anything from remembering the moment when you met your current partner or sharing a hug with a friend.

Provide mechanisms to play nicely together (G6)

There were a number of design decisions taken in order to encourage the young people to play nicely together. The most important decision in this regard, was the choice of a turn-based architecture which provides opportunity for everyone to have a go at performing an improvisation. This ensures play can be democratic and that no one is marginalised.

The turn taking mechanic is also the most innovate feature of *TAS*. To move to the next person, the game requires all the players to place their phones face down for 10 seconds. If one of the players lifts their phone in this time, a software timer is reset, and the timer begins again. This turn taking is a collaborative action which asks the players to continually 'buy in' to playing the game. This gives players the opportunity to leave the game should they not feel comfortable. This contributes toward play being consensual as all the players must consent to play. Similarly, players do not have to perform an improvisation and can pass a turn. This is also intended to ensure players do not feel obliged to play and will contribute to everyone having fun.

Allow players to enter and leave the magic circle of play (G7)

TAS attempted to provide as many opportunities as possible for players to enter and leave the game and the network implementation of the player interaction pattern helps achieve that goal. *TAS* uses a peer-to-peer network which means that players are only connected to the network when the game is running. Players will be added into the session when the game is opened and will leave when they close the game. Importantly, the game works around this – including or excluding this player from the group of players so that the turn taking in the game is not broken. This allows the players to enter and leave the game seamlessly without having to restart the game.

In addition, the playful prompts were explicitly written to allow players to enter and leave the game through the tasks themselves. For example, "Stop playing the game. Return in one

minute" (task 13) gives players additional opportunity to find excuses and leave the game during play.

Place stages for play (G8)

TAS was designed with the provision of youth work in mind and is playable on the mobile phones carried by young people. The peer-to-peer network configuration allows the game to be started in public spaces and does not require a WiFi or 3G connection to work. Instead the game can use Bluetooth connectivity to allow players to connect to one another without incurring any cost from the phone carrier. This enables young people to create a portable and pocket magic circle (Goddard, Garner and Jensen, 2016) (and stage for play) in the public spaces they visit.

The game also creates a literal stage for the players, in that they are tasked with creating a performance. The improvisations are designed to be exciting to watch from the perspective of players waiting for their turn and the game provides a spectator interface. For example, the playful prompt "Shout a pet or slang name for any body part" (task 9) and "Hold hands with another player clasping the phone and swing your arms together" (task 26), as well as others, will likely attract attention.

7.4 Creating the digital prototype

In the second stage of the game design, a digital prototype was created using the initial deck of cards and built upon the 'turn-based improvised play' tutorial. The player interaction pattern in this tutorial was chosen as it matched the configuration of play that was seen in the first design sessions (with the paper prototype). The tutorial provided a working and adaptable software implementation where playing-cards could be presented in-turn across networked mobile phones from the outset. This tutorial is further detailed in the Appendix and on the GitHub Wiki. In the development of *Talk About Sex* its use allowed time to be spent on other design tasks, such thinking about how to sustain the play interactions and for finessing the user interface design. e.g. the flipping action.

The software development that took place in this second stage was fast paced because the more complex aspect of the software i.e. the turn based communication was part of the template game. Instead, one of the places that the development time was spent was in the mechanics of turning over the playing cards. The card-based design sessions illustrated how

cards might be taken from a deck and then turned face up by a player to reveal the content. This mechanic came from thinking about the cards as a pack where a card is turned over in order to play. In making a digital version it was originally intended that players place their playing cards face down and "knock" twice should they want to opt out of taking that turn. This mechanic drew upon the analogy of knocking on the table to pass a turn in a game of Dominoes when a player is not able to play their domino. However, in implementing this functionality the microphone was unable to detect the knocking when the mobile phone was placed face down. In experimenting with this interaction, the phone was naturally inverted and thus presented a novel solution to the problem - that a player might simply pass by returning the phone to its original face down position. It is worth drawing attention to this mechanic because it helped sustain the play in the game, as all players needed to act together at the end of every turn to continue the play. This mechanic also typifies the iterative leaps that occur game development which come about through digital development and play-testing, and why game jams are a good model for development. Significantly, it is unlikely that this mechanic would have been created without using the game engine as a tool, and in a research through design approach. The game design framework had real value in this occasion as its software made playing around with the orientation of the phone simple to work with during development and encouraged play with the device.

There were also other interactions which came from using the game engine and its associated code base. For example, the cards that prompted players to, "Write the name of your first kiss" (task 4), "Draw a body part" (task 7), and "Draw something NOW" (task 23) allowed the user to draw with touch. This activity borrows a drawing mechanic that had previously been used in *Magic Land* (Pykhtina et al., 2012) and could be simply dropped into the game.

Ushaw et al. (2015) discussed in the software section, describes how game engines allow professionally produced art and audio assets to be added efficiently to games, which can contribute toward more polished experiences. Correspondingly, in *Talk About Sex*, a graphic designer was employed to create artwork with a 1970s aesthetic. These assets were added as they were created and iterated. Furthermore, using a game engine enabled the backgrounds to use alpha blended layers enabling the card background to be composited out of multiple images (see Figure 32).

7.5 Summary

Talk About Sex was opportunity to (1) create a third game based on the simplistic game system from *DoHS* where digital playing cards are used to initiate playful interactions around a mobile device, and (2) apply the approach and software described in the game design framework against a difficult challenge: encouraging young people to talk more openly about sex.

The development of the game was successful for a number of reasons. First, the card-based interaction provided an appropriate starting point with the mobile device design cards supporting the design team in thinking about all the affordances and the devices of the phone e.g. its camera, the accelerometer, GPS etc. Secondly, creating a game design for the provision of youth work and prototyping with the co-designers underlined how the player interaction pattern for turn-based play was the right dynamic for players. Lastly, the use of the gaming technology allowed the card-based prototype to be made into a digital version quickly which allowed the game mechanics to be refined and encouraged innovation in the form of the novel flipping mechanic.

From a game design perspective, the unique gameplay mechanic around the turn-based play remains the most interesting aspect of *Talk About Sex*. The mobile device design cards used in its design intended to encourage designers to think about a wide range of playful prompts and how the digital technology might sustain the play. However, in the digital version of the game there were few prompts that actually needed to sense how players responded. This was because certain actions e.g. “blowing a kiss” were still fun to play and watch, even if they were not sensed (and judged) by the game logic. Instead, the play was sustained in other ways: cards were given bespoke game logic to sustain their digital interactions e.g. drawing by touch; leaving the game to use other apps provided a novel interaction and the turn-based mechanic of turning over and resting mobile phones was compelling. The last of these interactions meant that the players always needed to be part of the game even when it was not their turn since they were needed to progress to the game.

In summary, the game design framework provides game designers with a starting point for creating new games through its card-based design; the use of mobile device design cards; player interaction patterns; the design guidelines, and the tutorials (which can be built and run from the outset). This starting point can be used to create games quickly for new contexts

which are both appropriate and flexible. In creating *Talk About Sex*, a research through design approach enabled a playful perspective to be adopted in the games development and draw upon tools, patterns and tutorials which were created to be extensible. This helped find a new exciting game mechanic based on flipping which contributes to making *Talk About Sex* an innovative game and unique playing experience.

7.6 Post Reflection

Talk About Sex is different from the other mobile games in this thesis as it makes use of the other apps on the mobile device (with the exception of drawing or writing onto the screen). In contrast, the previous games *DoHS* and the *Wild Man Game* sustain play through the use of the device sensors which are dealt with in the game logic. While this is novel (games do not often encourage players to switch to other apps) the game designer loses some control to what is happening is those apps, as the player must temporarily leave the *Talk About Sex* application. Whilst this is an exciting and unique gaming mechanic, it can be problematic, for example, any photos taken on the camera will be saved on the photo reel which might be of a personal and private nature outside the game. However, the game described in this chapter was a prototype and the design decision to use the other apps allowed different actions and interactions to be tested early in the games development. Games designers might therefore choose to implement their own camera app (or other app) where using default apps could be problematic or potentially sensitive.

8 Conclusion

This thesis aimed to explore how games designers might create new mobile games for young people that can be played together in public spaces. The work was initially motivated by prior work in HCI which has used characteristics and classifications of play to provide new perspectives on games design that might challenge game design thinking. From a games design perspective, it was opportunity to design games in the real world with the stakeholders of creative companies who provided interesting constraints that necessitated innovation and would lead to the creation of new games that can be played in public spaces.

These motivations were worth pursuing, games designs that are created from a more playful perspective encourage physical activity and social interaction, and can be part of supporting play that will benefit the wellbeing of young people (Marshall et al., 2015). In addition, supporting play in real world spaces can change the relationship that young people have with these spaces and who are under environmental stress from losing access to these spaces (Lester and Russell, 2008). Play will likely encourage young people to take more interest in the spaces around them, and open the way for them to become future custodians of the increasingly vanishing public spaces problematised by Vasagar (2012).

The work responds to existing academic and commercial games that have been created for public spaces. These existing games are often complex - requiring hands-on management, situated bespoke network infrastructures and bespoke devices. Instead, the work in this thesis draws upon the simplistic game systems explored by Wilson (2012) and similarly marries this with digital games primarily around improvisation which benefit from more open and spontaneous play. These games can be created on the mobile devices that young people carry around, and this same technology can be both used to structure play – in that, it can order what players are doing and how they play with others, and it can be used to sustain play, so that players will experience new unique digital interactions.

The research aims are revisited below, which are followed by a discussion of the game design framework, and game designs from a game developer's perspective i.e. how might a games designer use these research artifacts to change the way they make games. This is followed by a reflection on the approach and methods used in this body of work, the implications of the work and future work.

8.1.1 How can we support playfulness more explicitly in our game designs?

The game design in this thesis began by looking at the characteristics and categorizations of play from related work in sociology and developmental psychology and how these have been brought into HCI and game design research. This related work showed it can be useful to view games as being on a continuum from gamefulness to playfulness (Kirman, 2010) and how play is an important element of games (Salen & Zimmerman 2003). Importantly, we cannot specifically "design play" in computer games. However, it is possible to create games that support play more explicitly (Kirman, 2010) and the work in this thesis has achieved this a number of ways. Foremost, it has considered what characteristics and categorizations of play might be worth supporting. These were chosen from the literature on development play for their ability to support the well-being of young people (Marshall et al., 2014) and that they might provide interesting and otherwise different motivations and directions for our game designs. Specifically, these are games that can facilitate improvised play that is more open, and more spontaneous. These are underexplored in games - maybe because game designers do not think they are interesting, or that they provide difficult methodological challenges, for example, how can we formalise rules around players actions which have no constraints or no way of being sensed by our devices.

Significantly, choosing to design games around more improvised forms of play has allowed the work to draw upon different inspirations. This has included more traditional games and play e.g. playground games, party games, and the traditional games played by young people out of doors. These games have interesting rule sets defined by the players and similarly, the pace of the game is often changeable and set by the players. These forms of play are also more relatable in that players intrinsically understand the games and require little computer game literacy. Making games that support play more explicitly is not just restricted to the experience of playing. This also extends to the making of these games since play can be part of the design process , so that the design becomes an (*'act of play'* (Koster, 2004)). This process is repeatable and can be applied to different mobile contexts.

8.1.2 What game designs should we create for young people and in which contexts?

One of the overarching aims of this work has been to create games that young people might play on their own devices in their own spaces. These real world locations have been interesting and their constraints have functioned as a (mechanism for creativity (Hook,

2013)). Where existing pervasive games have been created for the real world they have often require hands-on management during play. This hands-on management has helped games present richer adaptability to the infinite and ever-changing real world (Jonsson and Waern, 2008). However, the game designs in this body of work, are motivated by the idea that we can create mobile game designs that have little requirement for anything other than a mobile device and an appetite to play. Consequently, the games built in this body of work have been carefully structured by setting the content through working with the stakeholders of the spaces and domain experts. This structure has been created around more improvised forms of play which itself has provided the games flexibility to adapt to the real world. The game designs also create their own portable magic circles of play in these contexts which serve to "ring fence" the play. Practically, this meant there has been less of a need to adapt to the changing conditions and events that might happen in the real world.

The games in this work can be viewed as occupying a middle ground between pervasive games and co-located games. This has meant the games have benefited from the best of both worlds. First, as pervasive games the designs have been able to make use of the unique aspects of the mobile context e.g. in designing for the library the game made use of the physical space – the libraries shelves, its books, and approaches to creative writing. Secondly, in designing for co-located play and drawing upon more traditional games and play, these games benefit from physical and social play with rich face-to-face interaction (as discussed Soute, Markopoulos, et al. 2009). Consequently, this led to looking at different player interaction patterns. These player interaction patterns are significant because different configurations can better support the play between young people and encourage them to play well together, drawing upon De Koven's (2013) notions of the "well-played game".

8.1.3 What can we do to help game designers create their own mobile game designs?

This literature review in this work describes how the literature on play has been brought into the playful approaches used in HCI research. This section forms part of an argument for the need to create a games design framework, and correspondingly, the design framework created in this work came out of a research through design approach where it has been necessary to refine and iterate software to support the process of game design. This framework has been generative, in that, it can be used to create new digital games for young people in public spaces. This games design framework intends to help game designers through providing a

games design process, guidelines for development, design exemplars, and extensible software code which game designers can use to create working prototypes from the outset.

The framework has used a common games design pattern across three different mobile contexts. In light of the studies this pattern might be considered along with other games designs patterns which have been described (Davidsson, Peitz and Björk, 2004). Importantly, the game design prompted by this work might encourage game designers to avoid what Davidsson et al. (2004) sees as: *the industry seemingly slipping into the same old tracks, and continues to make ports aging arcade games, but has a chance of utilizing this new device for what it is really worth instead of disguising old ideas in a new costume*.

Even though this abstract was as long ago as 2004, this provocative statement should still strike a chord for game designers. When games try something completely new with their core interactions, whether this is in a pervasive game such as Niantic's *Pokémon Go*, co-located party games like Warner Bros.' *Heads Up!* or an existential experience in the game *Mountain* by Double Fine Productions', the game development community learns something new. At the time of writing the top 100 games on the App store are mostly single player touch-based games that might be compared at some level to Zhou's *Flappy Bird* rather than traditional play. However, exploring how far this single pattern can be pushed, might provide game designers with motivation to try something different. Game design patterns are useful as a semi-formal tool since they provide a simple convention for describing and documenting recurrent design decisions within a given context (Kreimeier, 2002). The use of patterns can be usefully leveraged in a research through design approach where it is important to communicate the process and ensure the designs can be extensible.

The following is a game design pattern for digital card-based improvised games drawing upon the template from Davidsson et al. (2004). As such, this might be added to the 74 patterns included in that work. Note, this description retains the simplicity and brevity of the original example and relates this to the similarly short titled game design patterns in that work (see the subheading: Related game design patterns).

Game Design Pattern Name: Digital Card-based improvised games
Core definition: Uses playful prompts to initiate playful interactions around a mobile device which is either networked with other devices or is stand alone.

General definition: Players are given an instruction which prompts them to carry out an improvisation action. This can be used to engage across different contexts, different themes of play e.g. dark play and topics e.g. cultural heritage.
Example: Mimicry games like Simon Says! Players in a multiplayer game are given tasks based upon mimicry - such as standing on one leg which players are asked to copy at the same time.
Related game design patterns: social interaction, common experiences, spectators, collaborative actions, team play, multiplayer games.

This game design pattern should appeal to game designers because it has succeeded in created interesting games that look different from other games and this work has evidenced that it encourages emergent play. Game designers will also likely find the *simplistic game system* interesting in its own right without necessarily applying it to the specific contexts described in this work, for example, we can look across *Ludum Dare* and *GGJ* game jams – and we rarely see card-based games or improvised games, and similarly infrequently, pervasive games, yet - the paradigm of playing cards and game mechanics around improvisation are extensible. They will also appeal to a wide demographic of players since the game designs are relatable, will feel familiar to players and have a learning curve that does not require computer game literacy.

8.2 Reflecting on the Work, Collaborations and Research Through Design

As part of working in a collaborative research environment, having access to a game design framework, and having interests around more playful approaches and interactions, has meant that it has been natural to work on other projects, and in the role of a software developer / interaction designer. In doing this, working on projects with an approach, that is similar, or least analogous to the approach in this thesis has worked particularly well. These projects have included some of the methods used in this work, such as bodystorming, card-based design, and have used the game engine part of the game design framework which has proven valuable. Importantly, this has meant that from a research through design point of view the criteria presented in (Zimmerman, Forlizzi and Evenson, 2007) are arguably applicable. Particularly, (1) the process used; (2) the relevance of the design efforts; and (3) the extensibility of the software has been continually tested and pushed which has necessitated further work and refinement in an on-going cycle over three years.

In looking back on this work, it is useful to look at the experience of making *Swaythe Band,* which was one such collaboration and a good example of how things just worked out in this PhD work. The publication for this project is described in the related publications sections. This is included to further evidence the extensibility of the game design framework, the extensibility of the tutorials, and to also highlight the interesting playful interactions that have often emerged from and have been central to these projects.

Swaythe Band (Morrissey et al., 2016) is a digital prototype (see Figure 33) that encourages participants to sway or otherwise move to music being played by a computer system by illustrating a song's tempo using a series of sequenced (gentle) coloured light flashes to corresponds to changes in beat. *Swaythe Band* was conceived at the *Create 4 Dementia* hackathon at the Great North Museum, Newcastle-Upon-Tyne.

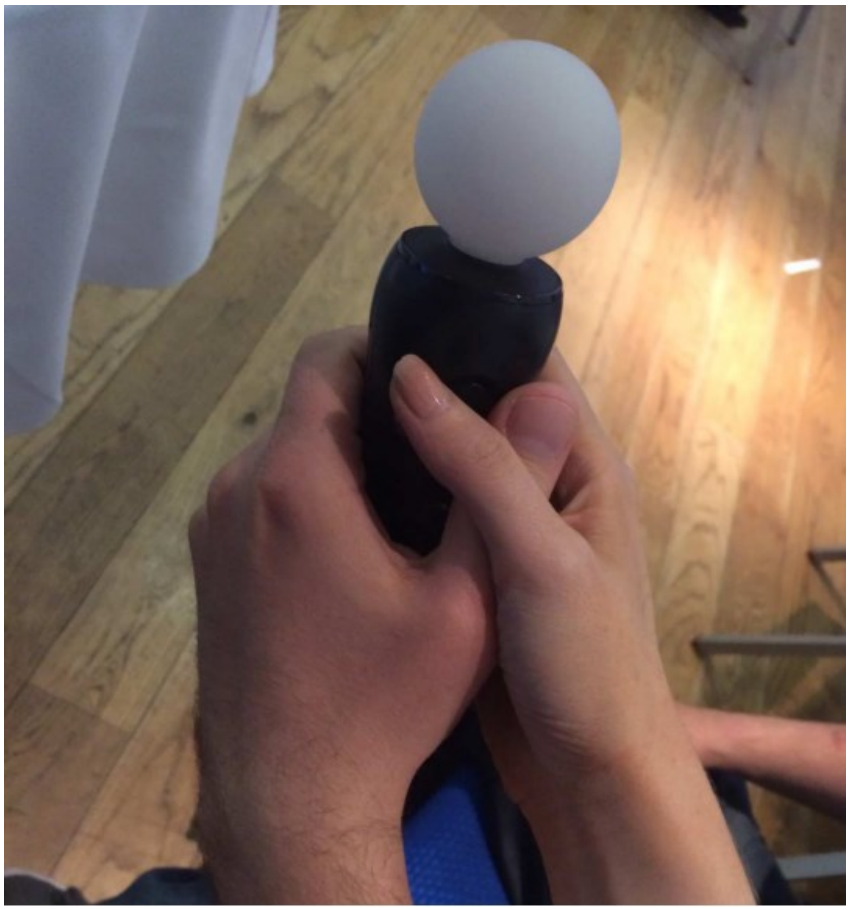


Figure 33. Holding the Swaythe Band together in the hackathon.

The hackathon brought together designers, coders, hackers, makers and researchers to share knowledge, experience, and create new digital designs for dementia. *Swaythe Band* was created with the design team "The Confabulators" with Kellie Morrissey. At the beginning of

the event, Morrissey spoke about her experience working with a group of adults in a care home. Morrissey painted a picture of the home's music sessions which immediately captivated the designers; this was a time full of emotion for the residents who were connected by a shared love of music. The hackathon was opportunity to think about digital prototypes from a more playful perspective and the synchronised player interaction model presented in the game design framework seemed perfect for this context.

The *Swaythe Band* digital prototype was designed to help participants sway to music by illustrating the tempo of the song. The PlayStation Controllers were programmed to use a different colour light on every beat synchronised across all the connected devices. In the hackathon, the controllers were used to keep time to the Shrimp Boats, a song by Jo Stafford (1951). In the design it was important to consider the aesthetics of the baton, and a rope textured handle was created which drew inspiration from the trawling nets on the 'shrimp boats'. This made them easy to hold, pleasing to look at, and soft in case they should be dropped. Correspondingly, the controller's lights changed between green, white and gold to reflect the colours of the Irish flag. *Swaythe Band* was published at DIS 2016 and has been used as a research tool across care homes in Ireland where it has been used by carers to engage the people in the care home.

8.3 Game Designs

The different game designs in this work were designed for different mobile contexts. These mobile contexts included (1) a community library; (2) the country house that was managed by a heritage organisation; and (3) in thinking about games that have a value in the provision of youth work – whether these games are used as diversionary activities for young people, or in thinking about more serious agendas such as encouraging discussion about relationships and sex.

The following are a set of short summaries of each of the games which illustrate their interesting aspects and why they are novel and unique. These intend to encourage designers to think further about the paradigms and game mechanics used in this work.

DoHS: was the first game design in this body of work and illustrated how game designers can scaffold and structure play through digital playing-cards. *DoHS* used cards to present a series of tasks to the player that were appropriate for a library, encouraging young people to create

stories using the books that were present in the space. In doing so, the digital playing-cards were able to connect young people with the physical space of the library and situate the game in the real-world space. *DoHS* benefited from being digital as the ability to scan a book by its barcode and upload stories allowed experimentation with a growing archive of stories. *DoHS* also found new ways to sustain the play by augmenting the playing-cards. For example, the young people liked the challenge provided by the random characters and shaking the dice to decide the fortune of the events.

The Wild Man Game: can be viewed by game designers as literally journey across the different mobile interfaces that can be afforded by a mobile device. *The Wild Man Game* had many subgames which maximised the use of the different sensors available on the phone, from those games that sampled the accelerometer, to using sensor fusion, to sampling the audio in real time. The game also provided a new compelling game dynamic in the form of a creeping game which might be easily implemented in different spaces and even as a standalone game. *The Wild Man Game* showed how the Bluetooth Low Energy locative beacons might be used in games design to allow mobile games to be situated in public spaces, allowing game designers and players to place a *stage for play*. The beacons are small enough for young people to carry around and could be even secreted in public spaces to allow subversive gaming in public spaces which might otherwise have no association with gaming.

Talk About Sex: is a mobile game that can be viewed as conceptual successor to *intangle*. *Talk About Sex* similarly encourages young people to reflect on a serious subject matter, albeit sex and relationships more broadly, rather than physical intimacy. *Talk About Sex* is interesting because it uses the digital playing-cards to initiate play around the device where the cards were created around strict rules. These rules ask game designers in this domain: (1) to not necessarily assume that players have any actual experience of the 'act of sex'; (2) to avoid heteronormative stereotypes i.e. the game does not assume men are heterosexual and have heterosexual relationships with women; (3) to not presume that sex is just about the physical act, but that there are more nuanced ideas around sex. Importantly, these can form good practice for any game in this domain – but these rules can also be extrapolated to other domains i.e. should our playful prompts assume players have done *x*, know *y*, or want *z*. etc.

In this game, designers will find the game mechanic for synchronising the play across different mobile devices particularly interesting. Until Warner Bros' released the mobile game

Heads-Up! – there were few examples of commercial games that used the orientation of the phone and games do not often encourage players to be able to leave the magic circle of play. Rather, this is dissuaded since many games increasingly make money from screen-time through adverts and other mechanisms. However, creating games that ask for play to be more consentful is clearly ethical and appropriate.

8.4 Future Work

The work described in this thesis has been explorative which has meant that the creation of the game design framework has been iterative and inductive over the duration of the studentship. The format of the studentship decided how the collaborations with the creative companies would work, their format, and which creative companies were available. This structure led to working with unique contexts and both the library and heritage organization provided interesting spaces and constraints. Practically, this has meant the game designs had to work across dissimilar contexts which needed software technologies that could keep up. Tellingly, the software technologies have proved extensible as they provided the right base for development, allowing fast development and using a game engine meant that the ideas were always implementable with the current technology, or at least with small changes. In addition, the online repositories are now generating some interest in the GitHub development community (both in terms of visiting traffic and email inquiries about using the game engine).

However, the software tools for this game still require programming knowledge and even though the software has been created from the "ground up" and is therefore comparatively simple, the tools are programming tools. An alternative would be to think of a game design framework as more democratic tool that might be used by custodians of public spaces rather than just games designers / programmers, for example, creating games by a website or app would make the designing these games more accessible to the point where they could be viewed as a service i.e. the games programming tool could have a graphical interface which would output a game. Such a tool, would allow the stakeholders to create their own content without needing to program the games themselves. By having a web presence these tools would also benefit from secure communication and data collection in the cloud that would allow the use of real time analysis tools e.g. Google analytics. Another interesting direction would be to create these tools by programming by demonstration. For example, a stakeholder might be able to walk into their space and illustrate by playing what a game could look like. This would also remove programming *per se* from the creation of the digital prototypes.

Finally, in thinking about scaling the system, it would be interesting to look at interweaved trajectories (Benford et al., 2009). For example, interweaved trajectories would be present when there are more than one physically co-located group. This would likely be an effect of creating a successively game (where successful means having a large user base). This would increase the incidence of people playing together in a public space. Finding multiple players in the games would remain within the carefully structured magic circle of play and retain its aloofness to what is happening in the real word.

To conclude: this thesis argues that there is room for new games that can be created around the paradigm of playing cards with game mechanics that use improvisations. These games can use a *simplistic game system* where *simple prompts can initiate playful interactions around the device*. Importantly, in designing these games, these prompts should be viewed as defining the structure of the game, while using the mobile device itself to sustain the play. Despite being minimal and simplistic, this basic game pattern, and the right player interaction patterns will create familiar, recognisable, accessible and appropriate games for our public spaces and the young people who should be able to use these spaces for play.

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10 Appendices

10.1 Ethics

The case studies in the project were submitted and accepted by the school ethics procedure for the SAgE faculty (Science, Agriculture, and Engineering) at Newcastle University.

The first preliminary ethics form is shown here for brevity. Preliminary ethics was given to the two case studies, starting with Department of Hidden Stories on 23/10/2012, the Wild Man Game on 6/3/2014 and i-dentity on 9/3/2014. Photo copies of the original forms can be obtained from Prof. Peter Wright.

10.1.1 Preliminary ethics application

As part of its assurances and compliance processes, Newcastle University ensures that all research, including student research and consultancy projects, undergo an initial ethical review before commencement. This form is used to identify higher risk projects e.g. those working with children, which like the projects in this thesis, required a full ethical review. Additional guidance can be found at:
http://www.ncl.ac.uk/res/research/ethics_governance/ethics/index.htm

SECTION 1: Applicant Details

Name of Researcher (Applicant):	Gavin Wood
Faculty & School:	SAGE / Computing Science
Email Address:	g.wood2@newcastle.ac.uk
Contact Address:	Culture Lab, King's Rd, Newcastle upon Tyne, Tyne and Wear NE1 7RU
Telephone Number:	07715370630

SECTION 2: Project Details

Project Title:	**Department of Hidden Stories**	
Has ethical approval to cover this proposal already been obtained?	**YES** ☐	**NO** ☒
If **YES**, please confirm:	**Approving Body:**	
	Reference Number:	
	Date of Approval:	

Will anyone be acting as sponsor under the NHS Research Governance Framework for Health and Social Care?	**YES** ☐	**NO** ☒
	If 'Yes' please enter the name of the sponsor:	
Do you have a NUTH reference?	**YES** ☐	**NO** ☒
	If 'Yes' please enter the reference:	

If you already have approval then you do not need to complete the rest of the form. Please go directly to the Declaration in Section 8.

SECTION 3: Animals

	YES	NO
"Does the research involve the use or observation of 'protected animals' as defined in the Animals (Scientific Procedures) Act 1986 (i.e. live vertebrates excluding man but including embryos after half way through gestation and cephalopods)?"	☐	☒

*If you answered **YES** to Section 3, you will need to submit an application to the University Ethical Review Committee, based in the Faculty of Medical Sciences.*
Please continue with the rest of the form.

SECTION 4: NHS, Health & Social Care: Facilities, Staff & Patients

	YES	NO
"Will the study involve participants recruited by virtue of being service users, their dependents, their carers or human tissues or the use of NHS & Health / Social Care Facilities or otherwise require REC approval? (If you are unsure please tick 'Yes and complete the sub-questions)	☐	☒

*If you answered **NO** to this question, please go to Section 5*
*If you answered **YES** to this question, please complete the rest of the questions below.*

Will the study involve any of the following?	YES	NO
a. Patients and users of the NHS?	☐	☒
b. Relatives or carers of patients and users of the NHS?	☐	☒
c. Foetal material, Human Tissues or IVF involving NHS patients?	☐	☒
d. The recently dead in NHS premises?	☐	☒
e. Requires the use of, or access to NHS premises of facilities (labs, clinics) or the study is a clinical trial?	☐	☒

f. Participants aged 16 or over who are unable to give informed consent e.g. people with learning disabilities. For a full list see the ***Mental Capacity Act 2005***?	☐	☒
g. Human participants (users) in a social care setting within the UK and N. Ireland?	☐	☒
h. Intergenerational studies in social care, involving adults, children, or families as research participants?	☐	☒
i. Or will the study come under the remit of GAFREC?	☐	☒

*If you answered **YES** to any of Section 4, you need to submit an application for Full Ethical Review to the appropriate external health authority ethics committee through the National Research Ethics Service (NRES) – see http://www.hra.nhs.uk/hra/ for the process.*
Please continue with the rest of the form.

SECTION 5: Human Participants in a Non-Clinical Setting

Does the research involve human participants e.g. use of questionnaires, focus groups, observation or surveys? (If you are unsure please tick 'Yes' and complete the sub-questions)	**YES** ☒	**NO** ☐

*If you answered **NO** to this question, please go to Section 6*
*If you answered **YES** to this question, please complete the rest of the questions below.*

	YES	**NO**
a. Does the study involve other vulnerable groups; as defined in ***Section 59 of the Safeguarding Vulnerable Adults Act 2006*** as those who are relatively or absolutely incapable of protecting their own interests, or those in unequal relationships e.g. your own students?	☐	☒
b. Will the study require the co-operation of a gatekeeper for initial access to the groups or individuals to be recruited e.g. students at school, members of a self-help group, or residents of a nursing home?	☒	☐
c. Will it be necessary for participants to take part in the study without their knowledge and consent e.g. covert observation of people in non-public places?	☐	☒
d. Will this study involve deliberately misleading participants in any way?	☐	☒
e. Will the study involve discussion of sensitive topics e.g. sexual activity or drug use?	☐	☒
f. Are any drugs, placebos or other substances (e.g. food substances, vitamins) to be administered to the study participants or will the study involve invasive, intrusive or potentially harmful procedures of any kind?*	☐	☒
g. Will blood or tissue samples be obtained from subjects?*	☐	☒
h. Is pain or more than mild discomfort likely to result from the study?	☐	☒
i. Could the study induce psychological stress or anxiety or cause harm or negative consequences beyond the risks encountered in normal life?	☐	☒

j. Will the study involve prolonged or repetitive testing?	☐	☒
k. Will financial inducements (other than reasonable expenses and compensation for time) be offered to participants?	☐	☒

* **Please Note**: Depending on the details of this project, this may require NHS approval. You will be given further clarification if the project is awarded. You are also advised to consult the ***JRO Policy Regarding the Participation of Volunteers in Research Projects***.

*If you have answered **YES** to any of questions in Section 5: You will need to describe more fully how you plan to deal with the ethical issues raised by your research by completing the Full Ethical Approval application form (after your project has successfully been awarded). Please continue with the rest of the form.*

SECTION 6: Data

	YES	NO
Does the research involve the usage or transfer of Sensitive personal data as defined as by the ***Data Protection Act 1998*** or data governed by statute such as the ***Official Secrets Act***, commercial contract or by convention e.g. client confidentiality? (If you are unsure please tick 'Yes' and complete the sub-questions)	☒	☐

*If you answered **NO** to this question, please go to Section 7*
*If you answered **YES** to this question, please complete the rest of the questions below.*

	YES	NO
a. Will the study involve the sharing of sensitive data outside the European Economic Area?	☐	☒
b. Will the study involve the collection or analysis of sensitive data which will be identifiable within the project outputs and could potentially cause harm?	☐	☒
c. Will the study involve the collection or analysis of personal data without explicit consent?	☐	☒
d. Will the study involve the collection or analysis of information covered by the Official Secrets Act, Terrorism Act, commercial contract or license?	☐	☒

*If you have answered **YES** to any of questions in Section 6: You will need to describe more fully how you plan to deal with the ethical issues raised by your research by completing the Full Ethical Approval application form (after your project has successfully been awarded). Please continue with the rest of the form.*

SECTION 7: Environment

	YES	NO
Will the study cause direct or indirect damage to the environment or emissions outside permissible levels or be conducted in an area of special scientific or cultural interest? (If you are unsure please tick 'Yes' and complete the sub-questions)	☐	☒

*If you answered **NO** to this question, please go to section 8*
*If you answered **YES** to this question, please complete the rest of the questions below.*

	YES	NO

a. Is the research expected to lead to emissions to land, air or water ***above*** the permissible level according to UK regulations (or local regulations in the case of non-UK research)?	☐	☒
b. Is the research expected to lead to a detrimental effect to the landscape or cultural heritage, including artefacts?	☐	☒
c. Is it expected that the research might cause harm through environmental fieldwork such as sampling or monitoring a site?	☐	☒
d. Will the research be conducted in an environmentally sensitive area or area of special scientific interest?	☐	☒

*If you have answered **YES** to any of questions in Section 7: You will need to describe more fully how you plan to deal with the ethical issues raised by your research by completing the Full Ethical Approval application form (after your project has successfully been awarded). Please continue with the rest of the form.*

SECTION 8: International Projects

	YES	NO
Will the research be conducted outside of the European Economic Area (EEA) or will it involve international collaborators outside the EEA?	☐	☒

*"If you have answered **YES** to the question in Section 8 you will need to describe more fully how you plan to deal with the ethical issues raised by your research by completing the Full Ethical Approval application form (after your project has successfully been awarded)."*

Please continue to the declaration.

SECTION 9: Declaration

I certify that the information contained in this application is accurate and that the research will be undertaken in line with all appropriate local standards and regulations.	
Name of Principal Investigator:	Peter Wright, Professor of Social Computing
Signed:	*Removed for publication*
Date:	6/3/2014

If you have any queries about this or any other ethical issue, please contact your Faculty Ethics Coordinator or appropriate Grants and Contracts team.

10.1.2 Full ethics for the Department of Hidden Stories

APPLICATION FOR ETHICAL APPROVAL OF A RESEARCH PROJECT FROM FACULTY ETHICS COMMITTEE

This application form is to be used by **STAFF** and **PGR STUDENTS** seeking ethical approval for an individual research project where preliminary ethical assessment has indicated that full ethical review is required.

A completed version of this document should be emailed to the Secretary of your appropriate Faculty Ethics Committee in the University. *Applications must be completed on this form; attachments will not be accepted other than those requested on this form. This form has been designed to be completed electronically; no handwritten applications will be accepted.*

Research must NOT begin until approval has been received from the appropriate Faculty Ethics Committee.

SECTION 1: APPLICANT DETAILS

Name of Researcher (Applicant):	Nick Taylor
Email Address:	nick.taylor@newcastle.ac.uk
Faculty & School:	SAGE / Computing Science
Contact Address:	Space 8, Culture Lab, King's Walk
Telephone Number:	0191 246 4634

SECTION 2: PROJECT DETAILS

Project Title:	The Department of Hidden Stories		
Name of Supervisor(s) (for PGR):			
Is this project:	Internally Funded ☐	Externally Funded ☒	
If externally funded, please provide the MyProjects reference number: BH			
Category of Research:	Postgraduate Research ☐	Staff Research ☒	
Is this a re-approval following a change to an existing project? (If so please attach previous form)		Yes ☐	No☒
Who has overall control for the MANAGEMENT of this research? (Please provide their name and post)		Peter Wright, Professor	
Who has DESIGNED the research? (Please provide their name and post)		Nick Taylor, Research Associate John Vines, Research Associate	
Who is CONDUCTING the research? (Please provide their name and post)		Nick Taylor, Research Associate John Vines, Research Associate	

SECTION 3: TYPE OF PROJECT

Please indicate the predominant nature of this project (mark one box only):

Questionnaire/Survey e.g. surveys of members of particular groups / organisations; mail out questionnaires, street surveys	☐
Experiments e.g. participants completing tasks under controlled conditions, use of tasks/method other than or in addition to questionnaires/surveys	☐
Observational e.g. observing how people behave in a natural setting or in a laboratory	☐
Data-based e.g. the use of official statistics where individuals could be identified	☐
Other	☒

If you answered 'Other' please provide additional details.	Workshop-style sessions. Participants will be given set tasks in a natural environment, combining interviews and observation.

SECTION 4: OUTLINE PROJECT DETAILS

Proposed date on which project or study will begin:	01-Dec-2012
Proposed date on which project or study will end:	31-Mar-2013

Project Outline & Aims:

Briefly describe the aims of this research as well as the main tasks (or tests) that participants will be required to complete or what use will be made of sensitive economic, social or personal data. This description must be in everyday language, free from jargon, technical terms or discipline-specific phrases. (No more than 700 words)

The Department of Hidden Stories is a pilot project conducted as part of the larger Creative Exchange hub. In this project, we are working with Newcastle Centre for the Literary Arts, Newcastle Libraries, Canning Street School and Adam Clarke, an independent creative learning practitioner.

The broad aim of the project is to encourage reading through the use of games. In the first instance, rather than directly promoting reading itself, we will use games involving the exploration of a library and discovery of books, with the intention that children will serendipitously encounter books that are of interest to them. Indirectly, this is intended to encourage literacy.

In collaboration with our partners, we have created a non-digital card game in which children select a set of prompts. These are subsequently used to find books in the library that match those prompts. In groups, the set of books collected will be used to create a single story that will be presented back to the rest of the group.

Findings from the use of this game will be used to inform the design of a digital version of the game based on mobile devices. Due to the nature of the design process, the precise mechanics of the digital game are not currently known, but will involve players being able to scan barcodes from books to access content and attach their own content and stories, such as text or audio recordings.

Primary school pupils aged 9 to 11 years will be observed playing both games, and feedback about the game and their current engagement with books and the library will be recorded anonymously.

SECTION 5: PROPOSED RESEARCH METHODS

Please provide an outline, in layman's terms, of the proposed research methods, including where and how data will be collected and stored (including steps that will be taken to ensure the confidentiality of personal data) and all tasks that participants will be asked to complete. Specify if the research will take place outside of the UK or in collaboration with internationally-based partners, and / or if research will take place using the internet. Present an outline of the method in a step-by-step chronological order, and avoid using jargon and technical terms as much as possible.
(No more than 700 words)

The research will be conducted through four workshops at West End Library in Newcastle. There will be two stages of the project, each comprised of two workshops. Each of the workshops will have approximately 15 participants and last two hours.

Each of these workshops will be led by either Adam Clarke, an independent creative learning practitioner with extensive experience running such workshops, or Helen Limon, a Teaching Associate and published children's author. Three other members of the research team will be present to act as facilitators.

Participants will be recruited from Canning Street School, and will include children with very low literacy and English. Participants will be from years 5 and 6, aged between 9 and 11. The workshops will take place as part of the participants' normal literacy lessons, which are conducted in the library. Their teachers will be present in these sessions.

In the first pair of workshops, participants will be broken into groups of 3-4 to play two games. In the first game, participants will select a noun and an adjective from a pack of cards, then find a book that matches this description. In the second game, participants will select cards representing objects, characters and places, and then attempt to find books that match those cards. Returning with the books, participants will talk about the books and then attempt to tell their own story inspired by them. While playing these games, participants will be encouraged to talk about their existing engagement with books and the library. Throughout,

researchers will observe how the games are played and how participants interact with books and the library.

Based on the findings of the first workshops, a mobile app will be developed to expand upon this game. In the second pair of workshops, the game will be replayed using the mobile application and participants will be able to 'attach' their stories to books using a barcode reader. Content submitted through the application will be anonymous and stored on a university server.

In all workshops, audio recordings will be made of discussions with participants. These recordings will be anonymous and stored on a password-protected server in Culture Lab, where they will only be accessible by the project team. This data will be stored for up to five years to allow for use in publications and PhD theses. The decision to delete this data will be taken by the PI (Peter Wright) in conjunction with relevant members of the research team. At this point, data will be securely deleted so as to be unretrievable (e.g. using shred).

SECTION 6: PARTICIPANT DETAILS

Does this research specifically target (select all that apply):

Students or staff of this University	☐
Adults (over the age of 18 years and competent to give consent)	☐
Children/legal minors (anyone under the age of 18 years)	☒
The elderly	☐
People from non-English speaking backgrounds	☐
Welfare recipients	☐
Anyone who has a physical disability	☐
Clients of professionals	☐
Anyone who is a prisoner or parolee	☐

Any groups where a leader or council of elders may need to give consent on behalf of the participant	☐

Estimated number of study participants:	30
Age from:	9
Age to:	11
Source and means by which participants are to be first approached/recruited:	Teachers at Canning Street Primary School have agreed to participate with their classes as part of literacy lessons.

Does this project require approval from an external authority (e.g. LEA, school, governing body)?	**YES** ☒	**NO** ☐
Has approval already been granted?	**YES** ☒	**NO** ☐

SECTION 7: PARTICIPANT INFORMATION **YES** **NO**

Will you inform participants that their participation is voluntary?	☒	☐
Will you inform participants that they may withdraw from the research at any time and for any reason?	☒	☐
Will you inform participants that their data will be treated with full confidentiality and that, if published, it will not be identifiable as theirs?	☒	☐
Will you provide an information sheet that will include the contact details of the researcher/team?	☒	☐
Will you obtain written consent for participation?	☒	☐
Will you debrief participants at the end of their participation (i.e., give them an explanation of the study and its aims and hypotheses)?	☒	☐
Will you provide participants with written debriefing (i.e., a sheet that they can keep that shows your contact details and explanations of the study)?	☒	☐

If using a questionnaire, will you give participants the option of omitting questions that they do not want to answer?	*NA*	☐
If an experiment, will you describe the main experimental procedures to participants in advance, so that they are informed about what to expect?	*NA*	☐
If the research is observational, will you ask participants for their consent to being observed?	☒	☐

SECTION 8: PARTICIPANT CONSENT

Please describe the arrangements you are making to inform participants, before providing consent, of what is involved in participating in your study and the use of any identifiable data. (No more than 300 words)

Through the school, participants will be provided with a information sheet and consent form prior to the workshops, which they will also deliver to their parents. This will explain the goals of the project, the format of the workshops and the data that will be collected. This will emphasise that data recorded will be anonymous and will not be distributed, but that anonymous extracts may be used in research publications.

Participants should be able to provide written consent. Please describe the arrangements you are making for participants to provide their full consent before data collection begins OR If you think gaining consent in this way is inappropriate for your project, then please explain how consent will be obtained and recorded. (No more than 300 words)

As the participants are under 18 but capable of giving consent themselves, we will seek consent from both the participant and their parents. A combined consent form will be distributed through the school, to be signed by the participant and their parent/guardian. Only children who have returned the form will be able to participate.

Please attach a copy of the information to be provided to the participant(s) to enable informed consent, this should include the 'Consent Form' & 'Participant Information Sheet' on appropriately headed paper.

SECTION 9: PARTICIPANT DEBRIEFING

It is a researcher's obligation to ensure that all participants are fully informed of the aims and methodology of the project, that they feel respected and appreciated after they leave the study and to ensure that participants do not experience any levels of stress, discomfort, or unease following a research session. Please describe the debriefing that participants will receive following the study and the exact point at which they will receive the debriefing. If you do not plan to provide a written debriefing sheet then please describe your alternative position. (No more than 300 words)

At the end of the second workshop, a debriefing sheet will be distributed to participants and their parents thanking them for their participation, reiterating the purpose of the study, and providing contact details if they have any concerns. The researchers will also inform the participants that should they wish to be informed of further outcomes from the research they can register their interest and will be informed of future developments following on from this research.

Please attach a copy of the debriefing sheet that you will provide on appropriately headed paper.

SECTION 10: INSURANCE & RISK CONSIDERATIONS

Newcastle University must have in place appropriate insurance cover for its legal liabilities for research studies. Dependent upon the nature of the research and how it is governed cover will either come under **Clinical Trials Insurance** or **Public Liability Insurance.** Please refer to the supplementary guidance "When does the Insurance Office need to be notified of a research proposal" for clarification.

Potential risk to participants and risk management procedures
Identify, as far as possible, all potential risks (small and large) to participants (e.g. physical, psychological, etc.) that may be associated with the proposed research. Please explain any risk management procedures that will be put in place and attach any risk assessments or other supporting documents. Please answer as fully as possible, note 'None' / 'No risk responses' are not appropriate. (No more than 300 words)

The research will take place in West End Library as part of normal literacy lessons that often visit this library. Therefore this is a location that the participants are accustomed to and we do not anticipate that the activities conducted will be dissimilar to typical primary school activities. There are minor risks involved in taking children out of school to other locations, such as trips and falls and the potential of becoming separated from the group, particularly if behavior becomes disorderly. To mitigate this risk, each workshop will be supervised by at least four members of the research team and at least one teacher from the participants' school. This teacher will be responsible for ensuring the safe transportation of the children to and from the library, in accordance with existing school legislation.

All members of the research team are CRB checked.

Potential risk to researchers and risk management procedures
What are the potential risks to researchers themselves? For example, personal safety issues such as lone or out of normal hours working or visiting participants in their homes; travel arrangements, including overseas travel; and working in unfamiliar environments. Please explain any risk management procedures that will be put in place and attach any risk assessments or other supporting documents. (No more than 300 words)

Risks to researchers will be minimal. The library is a safe, public place and researchers will be in a group of at least four during the workshops. All members of the team have been to this location previously.

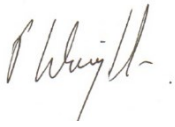
Please attach a risk assessment or any other appropriate documents as required.

SECTION 11: SUPPORTING DOCUMENTATION

Please supply copies of any applicable documents in support of your answers. Ensure that attached files have appropriate file names.

Document	**Attached**
Participant Consent Form	☒
Participant Information Sheet	☒
Participant Debriefing Document	☒
Questionnaire(s)	☐
Outline Protocol	☐
Risk Assessment	☐
Original Ethical Assessment (re-approval only)	
Others (please list):	

SECTION 12: DECLARATION

I certify that the information contained in this application is accurate. I have attempted to identify the risks that may arise in conducting this research and acknowledge my obligations and the rights of the participants.	
Name of Principal Investigator:	Peter Wright
Signed:	
Date:	13 Nov 2012

If you have any queries on this form, please contact your Faculty Ethics Coordinator or visit the website at http://www.ncl.ac.uk/business-directorate/ethics/index.php

Please email or send this form to the appropriate Faculty Ethics Coordinator

For office use only:

The appropriate Ethics Committee has considered the ethical aspects of this proposal. The committee recommends that the programme/project be:

☐ Approved ☐ deferred (for reasons attached) ☐ not approved

Name of Committee Member:	
Ethics Committee Concerned:	
Signed:	
Date:	

10.1.3 Info Sheet for Department of Hidden Stories

Dear Parent/Guardian,

We are writing to request consent for your child to take part in a research project, **The Department of Hidden Stories**, being run by Newcastle University and funded by the Arts and Humanities Research Council.

The aim of the research is to explore how games can be used to encourage children to explore the library and interact with books.

Participation in this project will involve two workshops, each lasting two hours. These will be held in the West End Library and will be carried out as part of your child's normal literacy lesson within the Library on **January 18th** and **March 1st**. The workshops will be run by researchers and PhD students from Newcastle University and an independent artist. Your child's teacher will be present throughout each workshop.

In the first workshop, pupils will play a card game that will require them to find books in the library and tell stories about the books they find.

In the second workshop, pupils will use an electronic version of this game running on a mobile phone. They will be able to leave stories 'attached' to books, which other pupils will be able to find by scanning the book's barcode.

Throughout the workshops, audio recordings will be made of pupils playing the games and discussing them. These recordings will be anonymous and will not be shared with anybody outside the research team. Extracts from the recording may be used as part of written reports published about the research.

Participation in this study is completely optional. During the study, participants can choose to withdraw at any time if they no longer wish to take part.

To consent to your child being involved in this research, please return the attached form.

Please keep this information sheet for your reference.

10.1.4 Consent form for Department of Hidden Stories

Department of Hidden Stories Consent Form

I, the undersigned, confirm that (please tick box as appropriate):

1.	I have read and understood the information about the project.	☐
2.	I have been given the opportunity to ask questions about the project and my child's participation.	☐
3.	I voluntarily consent to my child's participation in the project.	☐
4.	I understand that I can withdraw my child at any time without giving reasons and that I will not be penalised for withdrawing nor will I be questioned on why I have withdrawn.	☐
5.	I understand that my child can withdraw himself/herself at any point during the project and will not be penalised for withdrawing.	☐
6.	I understand that all data collected will be anonymous.	☐
7.	The use of the data in research, publications, sharing and archiving has been explained to me.	☐
8.	I understand that other researchers will have access to this data only if they agree to preserve the confidentiality of the data and if they agree to the terms I have specified in this form.	☐
9.	I, along with the Researcher, agree to sign and date this informed consent form.	☐

Participant:

_____	_____	_____
Name of Participant	Signature	Date

Parent/Guardian:

_____	_____	_____
Name of Parent/Guardian	Signature	Date

Researcher:

_____	_____	_____
Name of Researcher	Signature	Date

Questions and Queries

If you have any questions at all, please contact **Nick Taylor** by email (nick.taylor@newcastle.ac.uk) or telephone (0191 246 4634).

10.1.5 Full ethics application for the Wild Man Game

APPLICATION FOR ETHICAL APPROVAL OF A RESEARCH PROJECT FROM FACULTY ETHICS COMMITTEE

This application form is to be used by **STAFF** and **PGR STUDENTS** seeking ethical approval for an individual research project where preliminary ethical assessment has indicated that full ethical review is required.

A completed version of this document should be emailed to the Secretary of your appropriate Faculty Ethics Committee in the University. *Applications must be completed on this form;*

attachments will not be accepted other than those requested on this form. This form has been designed to be completed electronically; no handwritten applications will be accepted.

Research must NOT begin until approval has been received from the appropriate Faculty Ethics Committee.

SECTION 1: APPLICANT DETAILS

Name of Researcher (Applicant):	Gavin Wood
Email Address:	g.wood2@newcastle.ac.uk
Faculty & School:	SAGE / Computing Science
Contact Address:	Space 8, Culture Lab, King's Walk
Telephone Number:	0191 246 4634

SECTION 2: PROJECT DETAILS

Project Title:	The Wild Man Game		
Name of Supervisor(s) (for PGR):			
Is this project:	Internally Funded ☐	Externally Funded ☒	
If externally funded, please provide the MyProjects reference number: BH			
Category of Research:	Postgraduate Research ☒	Staff Research ☐	
Is this a re-approval following a change to an existing project? (If so please attach previous form)		Yes ☐	No☒
Who has overall control for the MANAGEMENT of this research? (Please provide their name and post)		Peter Wright, Professor	
Who has DESIGNED the research? (Please provide their name and post)		Gavin Wood, PhD student	
Who is CONDUCTING the research? (Please provide their name and post)		Gavin Wood, PhD student	

SECTION 3: TYPE OF PROJECT

Please indicate the predominant nature of this project (mark one box only):

Questionnaire/Survey e.g. surveys of members of particular groups / organisations; mail out questionnaires, street surveys	☐
Experiments e.g. participants completing tasks under controlled conditions, use of tasks/method other than or in addition to questionnaires/surveys	☐
Observational e.g. observing how people behave in a natural setting or in a laboratory	☐
Data-based e.g. the use of official statistics where individuals could be identified	☐
Other	☒
If you answered 'Other' please provide additional details.	Workshop-style sessions. Participants will be given set tasks in a natural environment, combining interviews and observation.

SECTION 4: OUTLINE PROJECT DETAILS

Proposed date on which project or study will begin:	28-Jul-2012
Proposed date on which project or study will end:	28-Sept-2013

Project Outline & Aims:
Briefly describe the aims of this research as well as the main tasks (or tests) that participants will be required to complete or what use will be made of sensitive economic, social or personal data. This description must be in everyday language, free from jargon, technical terms or discipline-specific phrases. (No more than 700 words)

Playful Narratives Real is a pilot project conducted as part of the larger Creative Exchange hub. In this project, we are working with the English Heritage Site: Belsay Hall, *(a primary*

school local to Belsay Hall, but to be decided) and Adam Clarke, an independent creative learning practitioner.

The broad aim of the project is to encourage children to create their own experiences around narratives as they explore an English Heritage site. Rather than explore the history of the site directly through traditional styled texts, the children will be encouraged to pick up small pieces of narratives through their digital delivery as audio, visuals, props or by reading (or a combination of those) before being asked to create their own play as they extend and shape the narratives to have personal meaning and significance.

In collaboration with our partners, we have created a non-digital card game in which children select a set of prompts. These are subsequently used to find books in the library that match those prompts. In groups, the set of books collected will be used to create a single story that will be presented back to the rest of the group.

Findings from the use of these digital technologies will be used to inform further designs built upon mobile devices or portable digital technologies (such as accelerometer based hardware). Due to the nature of the design process, the precise mechanics of the digital game are not currently known, but will involve players being able to navigate the site as they are prompted to express themselves creatively, imaginatively and safely.

Primary school pupils aged 9 to 11 years will be observed using the digital technologies, and feedback about the game and their current engagement with the space will be recorded annomously.

SECTION 5: PROPOSED RESEARCH METHODS

Please provide an outline, in layman's terms, of the proposed research methods, including where and how data will be collected and stored (including steps that will be taken to ensure the confidentiality of personal data) and all tasks that participants will be asked to complete. Specify if the research will take place outside of the UK or in collaboration with internationally-based partners, and / or if research will take place using the internet. Present an outline of the method in a step-by-step chronological order, and avoid using jargon and technical terms as much as possible.

(No more than 700 words)

The research will be conducted through four workshops at West End Library in Newcastle. There will be two stages of the project, each comprised of two workshops. Each of the workshops will have approximately 15 participants and last two hours.

Each of these workshops will be led by either Adam Clarke, an independent creative learning practitioner with extensive experience running such workshops, or Helen Limon, a Teaching Associate and published children's author. Three other members of the research team will be present to act as facilitators.

Participants will be recruited from Canning Street School, and will include children with very low literacy and English. Participants will be from years 5 and 6, aged between 9 and 11. The workshops will take place as part of the participants' normal literacy lessons, which are conducted in the library. Their teachers will be present in these sessions.

In the first pair of workshops, participants will be broken into groups of 3-4 to play two games. In the first game, participants will select a noun and an adjective from a pack of cards, then find a book that matches this description. In the second game, participants will select cards representing objects, characters and places, and then attempt to find books that match those cards. Returning with the books, participants will talk about the books and then attempt to tell their own story inspired by them. While playing these games, participants will be encouraged to talk about their existing engagement with books and the library. Throughout, researchers will observe how the games are played and how participants interact with books and the library.

Based on the findings of the first workshops, a mobile app will be developed to expand upon this game. In the second pair of workshops, the game will be replayed using the mobile application and participants will be able to 'attach' their stories to books using a barcode reader. Content submitted through the application will be anonymous and stored on a university server.

In all workshops, audio recordings will be made of discussions with participants. These recordings will be anonymous and stored on a password-protected server in Culture Lab, where they will only be accessible by the project team. This data will be stored for up to five years to allow for use in publications and PhD theses. The decision to delete this data will be taken by the PI (Peter Wright) in conjunction with relevant members of the research team. At this point, data will be securely deleted so as to be unretrievable (e.g. using shred).

SECTION 6: PARTICIPANT DETAILS

Does this research specifically target (select all that apply):

Students or staff of this University	☐
Adults (over the age of 18 years and competent to give consent)	☐
Children/legal minors (anyone under the age of 18 years)	☒
The elderly	☐
People from non-English speaking backgrounds	☐
Welfare recipients	☐
Anyone who has a physical disability	☐
Clients of professionals	☐
Anyone who is a prisoner or parolee	☐
Any groups where a leader or council of elders may need to give consent on behalf of the participant	☐

Estimated number of study participants:	30
Age from:	9
Age to:	11
Source and means by which participants are to be first approached/recruited:	Teachers at Canning Street Primary School have agreed to participate with their classes as part of literacy lessons.

Does this project require approval from an external authority (e.g. LEA, school, governing body)?	**YES** ☒	**NO** ☐
Has approval already been granted?	**YES** ☒	**NO** ☐

SECTION 7: PARTICIPANT INFORMATION **YES** **NO**

Will you inform participants that their participation is voluntary?	☒	☐
Will you inform participants that they may withdraw from the research at any time and for any reason?	☒	☐
Will you inform participants that their data will be treated with full confidentiality and that, if published, it will not be identifiable as theirs?	☒	☐
Will you provide an information sheet that will include the contact details of the researcher/team?	☒	☐
Will you obtain written consent for participation?	☒	☐
Will you debrief participants at the end of their participation (i.e., give them an explanation of the study and its aims and hypotheses)?	☒	☐
Will you provide participants with written debriefing (i.e., a sheet that they can keep that shows your contact details and explanations of the study)?	☒	☐
If using a questionnaire, will you give participants the option of omitting questions that they do not want to answer?	*NA*	☐

If an experiment, will you describe the main experimental procedures to participants in advance, so that they are informed about what to expect?	*NA*	☐
If the research is observational, will you ask participants for their consent to being observed?	☒	☐

SECTION 8: PARTICIPANT CONSENT

Please describe the arrangements you are making to inform participants, before providing consent, of what is involved in participating in your study and the use of any identifiable data. (No more than 300 words)

Through the school, participants will be provided with a information sheet and consent form prior to the workshops, which they will also deliver to their parents. This will explain the goals of the project, the format of the workshops and the data that will be collected. This will emphasise that data recorded will be anonymous and will not be distributed, but that anonymous extracts may be used in research publications.

Participants should be able to provide written consent. Please describe the arrangements you are making for participants to provide their full consent before data collection begins OR If you think gaining consent in this way is inappropriate for your project, then please explain how consent will be obtained and recorded. (No more than 300 words)

As the participants are under 18 but capable of giving consent themselves, we will seek consent from both the participant and their parents. A combined consent form will be distributed through the school, to be signed by the participant and their parent/guardian. Only children who have returned the form will be able to participate.

Please attach a copy of the information to be provided to the participant(s) to enable informed consent, this should include the 'Consent Form' & 'Participant Information Sheet' on appropriately headed paper.

SECTION 9: PARTICIPANT DEBRIEFING

It is a researcher's obligation to ensure that all participants are fully informed of the aims and methodology of the project, that they feel respected and appreciated after they leave the study and to ensure that participants do not experience any levels of stress, discomfort, or

unease following a research session. Please describe the debriefing that participants will receive following the study and the exact point at which they will receive the debriefing. If you do not plan to provide a written debriefing sheet then please describe your alternative position. (No more than 300 words)

At the end of the second workshop, a debriefing sheet will be distributed to participants and their parents thanking them for their participation, reiterating the purpose of the study, and providing contact details if they have any concerns. The researchers will also inform the participants that should they wish to be informed of further outcomes from the research they can register their interest and will be informed of future developments following on from this research.

Please attach a copy of the debriefing sheet that you will provide on appropriately headed paper.

SECTION 10: INSURANCE & RISK CONSIDERATIONS

Newcastle University must have in place appropriate insurance cover for its legal liabilities for research studies. Dependent upon the nature of the research and how it is governed cover will either come under **Clinical Trials Insurance** or **Public Liability Insurance.** Please refer to the supplementary guidance "When does the Insurance Office need to be notified of a research proposal" for clarification.

Potential risk to participants and risk management procedures
Identify, as far as possible, all potential risks (small and large) to participants (e.g. physical, psychological, etc.) that may be associated with the proposed research. Please explain any risk management procedures that will be put in place and attach any risk assessments or other supporting documents. Please answer as fully as possible, note 'None' / 'No risk responses' are not appropriate. (No more than 300 words)

The research will take place in West End Library as part of normal literacy lessons that often visit this library. Therefore this is a location that the participants are accustomed to and we do not anticipate that the activities conducted will be dissimilar to typical primary school activities. There are minor risks involved in taking children out of school to other locations, such as trips and falls and the potential of becoming separated from the group, particularly if behavior becomes disorderly. To mitigate this risk, each workshop will be supervised by at least four members of the research team and at least one teacher from the participants' school. This teacher will be responsible for ensuring the safe transportation of the children to and from the library, in accordance with existing school legislation. All members of the research team are CRB checked.

Potential risk to researchers and risk management procedures

What are the potential risks to researchers themselves? For example, personal safety issues such as lone or out of normal hours working or visiting participants in their homes; travel arrangements, including overseas travel; and working in unfamiliar environments. Please explain any risk management procedures that will be put in place and attach any risk assessments or other supporting documents. (No more than 300 words)

Risks to researchers will be minimal. The library is a safe, public place and researchers will be in a group of at least four during the workshops. All members of the team have been to this location previously.

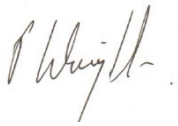
Please attach a risk assessment or any other appropriate documents as required.

SECTION 11: SUPPORTING DOCUMENTATION

Please supply copies of any applicable documents in support of your answers. Ensure that attached files have appropriate file names.

Document	**Attached**
Participant Consent Form	☒
Participant Information Sheet	☒
Participant Debriefing Document	☒
Questionnaire(s)	☐
Outline Protocol	☐
Risk Assessment	☐
Original Ethical Assessment (re-approval only)	
Others (please list):	

SECTION 12: DECLARATION

I certify that the information contained in this application is accurate. I have attempted to identify the risks that may arise in conducting this research and acknowledge my obligations and the rights of the participants.	
Name of Principal Investigator:	Peter Wright
Signed:	
Date:	13 Nov 2012

If you have any queries on this form, please contact your Faculty Ethics Coordinator or visit the website at http://www.ncl.ac.uk/business-directorate/ethics/index.php

For ***Please email or send this form to the appropriate Faculty Ethics Coordinator***

office use only:

The appropriate Ethics Committee has considered the ethical aspects of this proposal. The committee recommends that the programme/project be:

☐ Approved ☐ deferred (for reasons attached) ☐ not approved

Name of Committee Member:	
Ethics Committee Concerned:	
Signed:	
Date:	

10.1.6 Family consent form for the Wild Man Game

The Creative Exchange

Digital Interaction at Culture Lab

The linked image cannot be displayed. The file may have been moved, renamed, or deleted. Verify that the link points to the correct file and location.

Consent form for participants

I agree to be take part in a test of a mobile phone game at Belsay Hall, part of the Playful Narrative Realms, a Creative Exchange project, Newcastle University.

- I understand that audio recordings, photographs and video will be made during the workshops and used for research purposes. ☐
- I understand material collected will be stored in a secure location at Newcastle University. ☐
- I understand that I will authorise any recordings used for public presentat ☐
- I understand that I will not be mentioned by name on any documents or in any presentations if requested. ☐
- I understand that I can withdraw from the study at any time without needi o give a reason and still take part in the workshops. ☐

Signature of parent or guardian……..……Date……

Name (in capitals) ……..……Age……..……

Name (in capitals) ……..……Age……..……

Name (in capitals) ……..……Age……..……

Name (in capitals) ……..……Age……..……

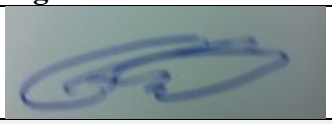
Signature of team member……...Date……....
Name (in capitals).....

10.1.7 Risk assessment form for the Wild Man Game

Newcastle University **Risk Assessment**	
Title of project or activity	***Playful Narrative Realms***
Responsible Person / Manager	Gavin Wood
School	Computing Science
Date of assessment	03/03/2014
Location of work **(Buildings and room numbers)**	Belsay Hall, English Heritage
Introduction	
The following risk assessment and guidance has been developed to assess the hazardous activities, risks and identify appropriate prevention and control measures. A simple implementation check is provided to assist schools in demonstrating that the control measures are being implemented. Please identify when they have been implemented.	
Activities with Hazardous Potential and Significant Risks	
These are contained within the shaded area. The first shaded area in the assessment identifies the hazard or hazardous activity and the second identifies the risks imposed by that activity.	

Preventative and Protective Measures to Avoid or Reduce Risks to an Acceptable Level			
These are contained within the un-shaded areas. This section identifies the control measures required and may require schools to choose options or carry out additional risk assessments.			
Help and Support			
Safety Office Occupational Health Service	Schools must visit the University Safety Office website. The website contains a wide range of guidance to assist schools to manage health and safety effectively including University Safety Policies and Supplements, Safety Guidance, Training, Forms, etc.		
Hazard 1	Accusation of impropriety directed at researcher	Implemented☐	Date 03/03/14
Risks	• Anything involving the public means working with complete strangers.		
Control Measures	• All researchers will be CRB checked • No single researcher will be left on their own with a member (or members) of public		
Hazard 2	Trips and slips on the site	Implemented☐	Date 03/03/14
Risks	• Trips and slips		
Control Measures	• Awareness of where visitors are meant to go – all visitors areas are carefully signed and out of bounds area are clearly marked and physically barred • Taking care on stone stairs at the property		
Hazard 3	Electric Shocks	Implemented☐	Date 03/03/14
Risks	• Electric shocks		
Control Measures	• Any equipment used from the University has been PAT tested yearly. • Mobile phones will not be used while plugged in • Equipment will not be used in the open air (in case it rains)		
	Emergency Procedures	Implemented☐	Date 03/03/14
Risks	• Fire		

Control Measures	• Follow fire risk and escape procedures as described on site by English Heritage.

Name	**Signature**	**Date**
Rachel Clarke		03/03/2014
Responsible Person / Manager		
Name	**Signature**	**Date**

10.1.8 Info Sheet for the Wild Man Game

Dear Parent/Guardian,

We are writing to request consent for you and your family to take part in a research project, **Playful Narrative Realms**, being run by Newcastle University and funded by the Arts and Humanities Research Council.

The aim of our project is to research how playful digital technologies can be used to encourage families to explore heritage sites.

Participation in this project will involve a single visit to Belsay Hall, English Heritage site, and will last approx. two hours. This visit will happen sometime after the start of a new exciting exhibition in May.

Throughout the visit, some video, audio recordings and observations will be taken of your family playing with our iPhone App. We would also like you to spend 20 minutes discussing your experience with us. This will happen in a private room at Belsay Hall where you will meet two people from the research team, who will also answer any other questions you have on the day.

All of the data collected will be anonymous and will not be shared with anybody outside the research team. Our findings will be published in written reports that will not identify your family.

By helping with our research you will receive free entry to Belsay Hall, although you will be expected to make your own way there. You will also get to take part in play testing a fun, safe and engaging computer game which will also help English Heritage to make exciting new games in the future.

Participation in this study is completely optional. You can choose to withdraw at any time if you no longer wish to take part, even after the study has finished. Please note if you choose to withdraw all data held about you will be destroyed.

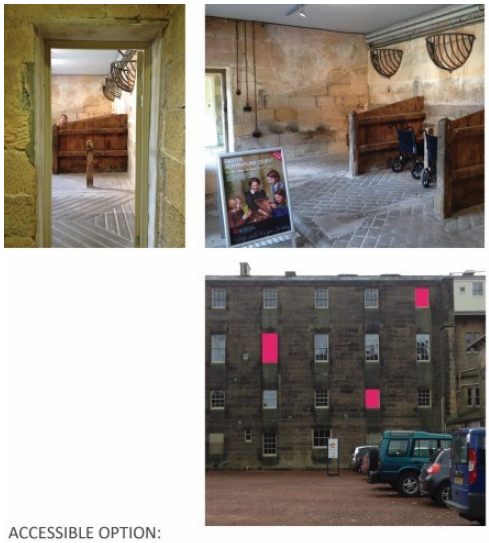
For your presence of mind all our research has to go through ethical approval and is also risk assessed. To consent to you and your family being involved in this research, please return the attached form. After this, a researcher will contact you by email and find the best day for your visit to Belsay Hall. Please keep this information sheet for your reference.

Questions and Queries

If you have any questions about the research, or would like to be informed of future progress on the project, please email **Gavin Wood** (g.wood2@newcastle.ac.uk). For more information please also visit the project information page at: http://www.thecreativexchange.org/projects/playful-narrative-realms

10.2 Space Investigations

The following images were created for the *Wild Man Game* by the interior designer to present work carried out in the space investigation. The following images feature a cartoonish representation of the wild man that was drawn by the researcher. This was not included in the final *Wild Man Game* as the style did not work particular well with AR – which in the case of the cultural space was not suited to the cartoon style that was first chosen. Instead the idea of a figure was replaced by the animated 3D owl.



ACCESSIBLE OPTION:

The Ground Floor can accommodate the entire game, for those with mobility issues, younger children in buggies, elderly grandparents etc. It highlights the key, popular rooms and also the less visited, yet possibly more architecturally fascinating rooms to the north side. It focuses on views out of the building towards the gardens and the path to the quarry.

Some thought should be given to initial intrigue created at the point of arrival: using the driveway and possibly the windows visible from the car park to indicate that there is more to come. A 'holding area' could be created such as the part of the stables visible from the shop, where children can find out about the app etc whilst parents pay for entrance.

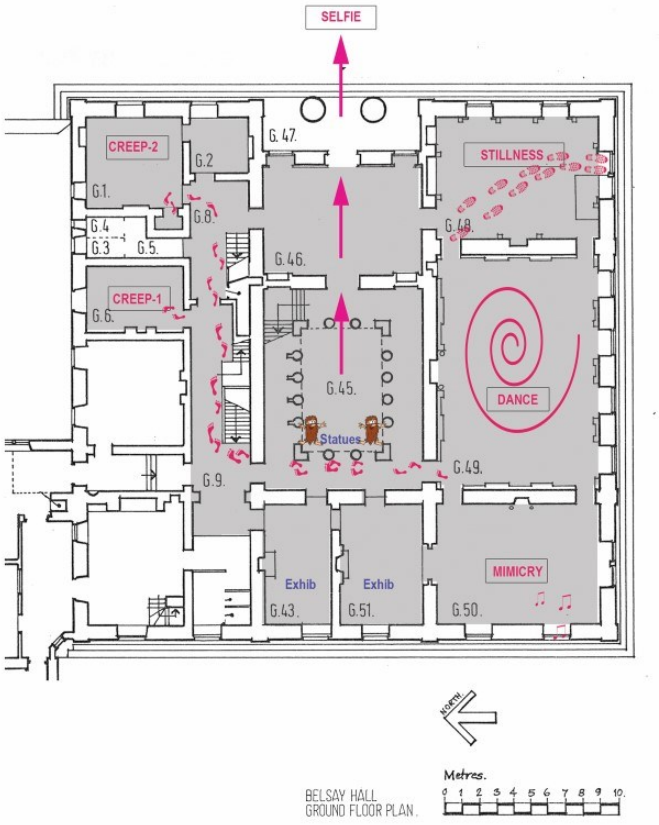


Figure 34. The canonical trajectory considered for the game.

Figure 35. A creeping game.

Figure 36. A dancing game in the ballroom.

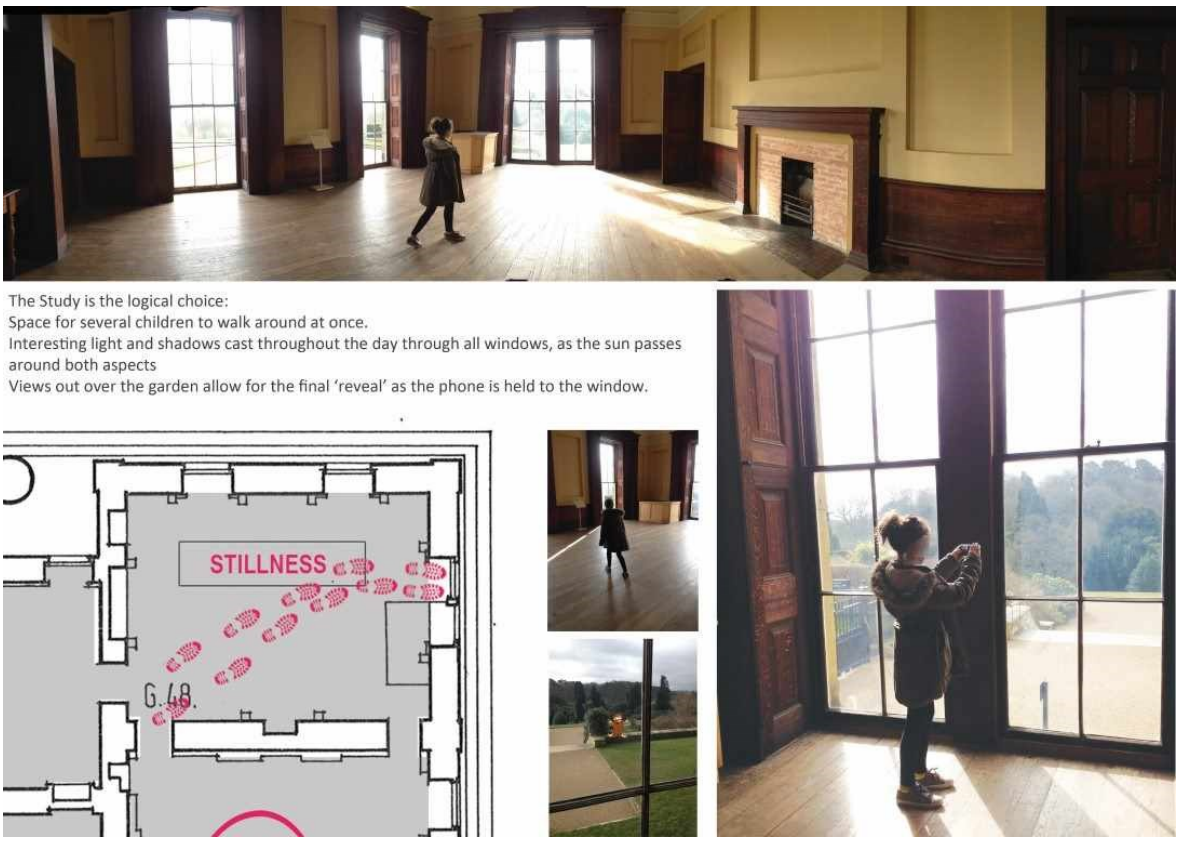


Figure 37. The stillness game providing a glimpse of the Wild Man in the garden.

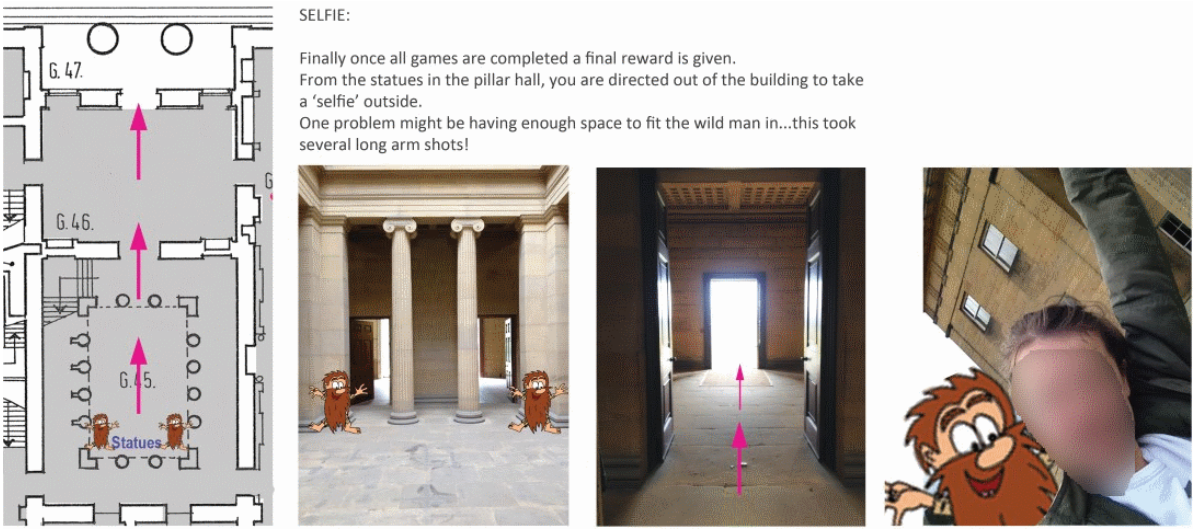


Figure 38. Selfie.

10.3 Game Engine Tutorials

The game engine has a number of different tutorials which are detailed in the Wiki on GitHub. The tutorials that can be applied to the game designs in this thesis are contained in the CardBasedGame tutorials which include CardTestBed, SynchronisedPlay, and TurnTakingPlay, and the PS-Move tutorial.

CardTestBed

This tutorial illustrates different digital playing-cards which are based on the functionality described in the game design framework chapter (see 6.3.3 What are the capabilities of the software). This tutorial supports different types of interaction which would not be possible using physical cards. This includes: (1) simple rendering and touch input; (2) differentiating between different forms of touch i.e. touch down, touch held, and touch released; (3) debug rendering; (4) automatic peer-to-peer connectivity without a lobby or setup; (5) sound playback that can use multiple channels, (6) rendering of 3D models with lighting; (7) sampling real time audio / performing a Fast Fourier Transform (FFT).

SynchronisedPlay

The synchronised play tutorial creates a peer to peer network between mobile devices or Windows instances of the app. This tutorial allows the game designer to present digital playing-cards to players which are synchronised across all the devices at once. This means when one card is turned over on one device, all cards across all devices turn over. Rather, than use an event to indicate a player has turned over a card, all the connected devices receive the current 'state of play'. This allows the games designer to look at what has happened on each device, for example, the game might decide to move at the pace of the slowest player, or alternatively at the fastest pace.

TurnTakingPlay

The turn-taking play tutorial creates a peer to peer network between mobile devices or Windows instances of the app. This tutorial allows the game designer to present digital playing-cards to players which are passed between the devices.

In this app when one card is turned over on one device, the next device can then have the option to turn to the next card, and so on. This implements a more democratic network where all the players are given a turn, but also the players must work together to complete a round.

10.4 Storyboards

The following storyboards were created to present ideas to the stakeholders in the *Wild Man Game.* The first four storyboards were used to explore what kind of play would be interesting. The last five storyboards illustrate more refined examples of the games.

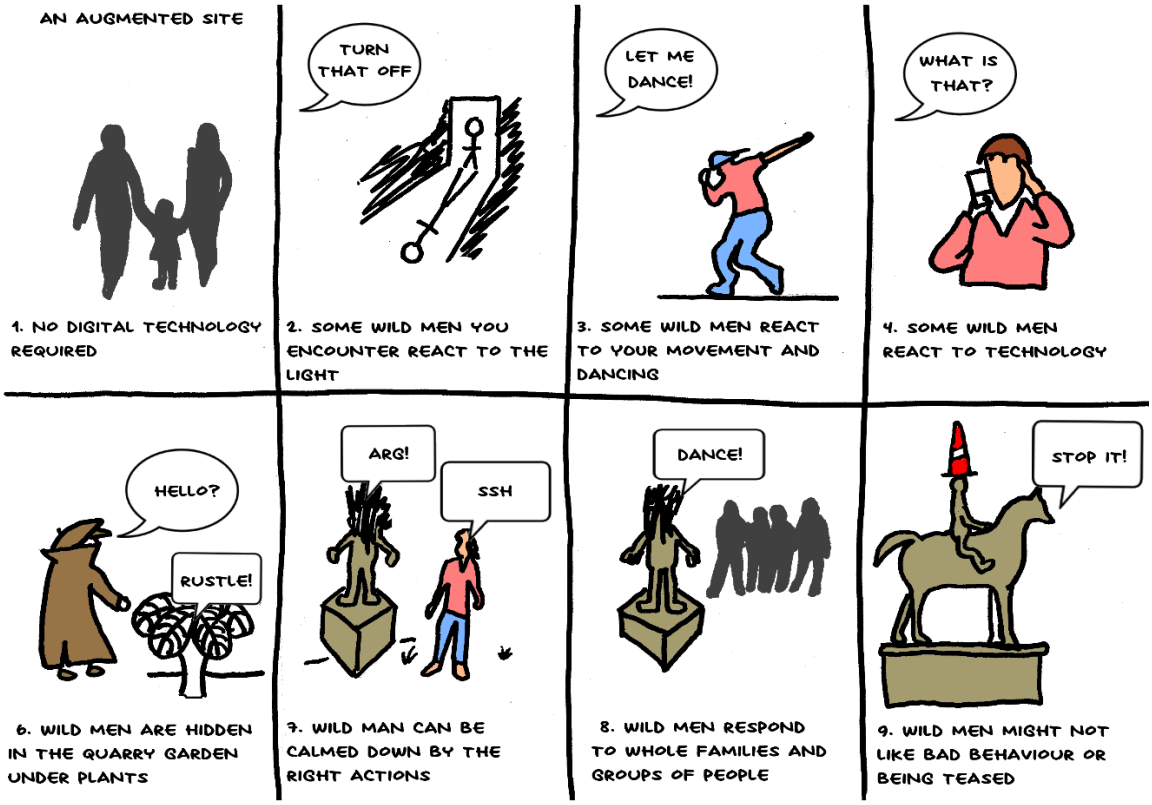


Figure 39. Storyboard for an augmented site.

Figure 40. Storyboard for movement based play.

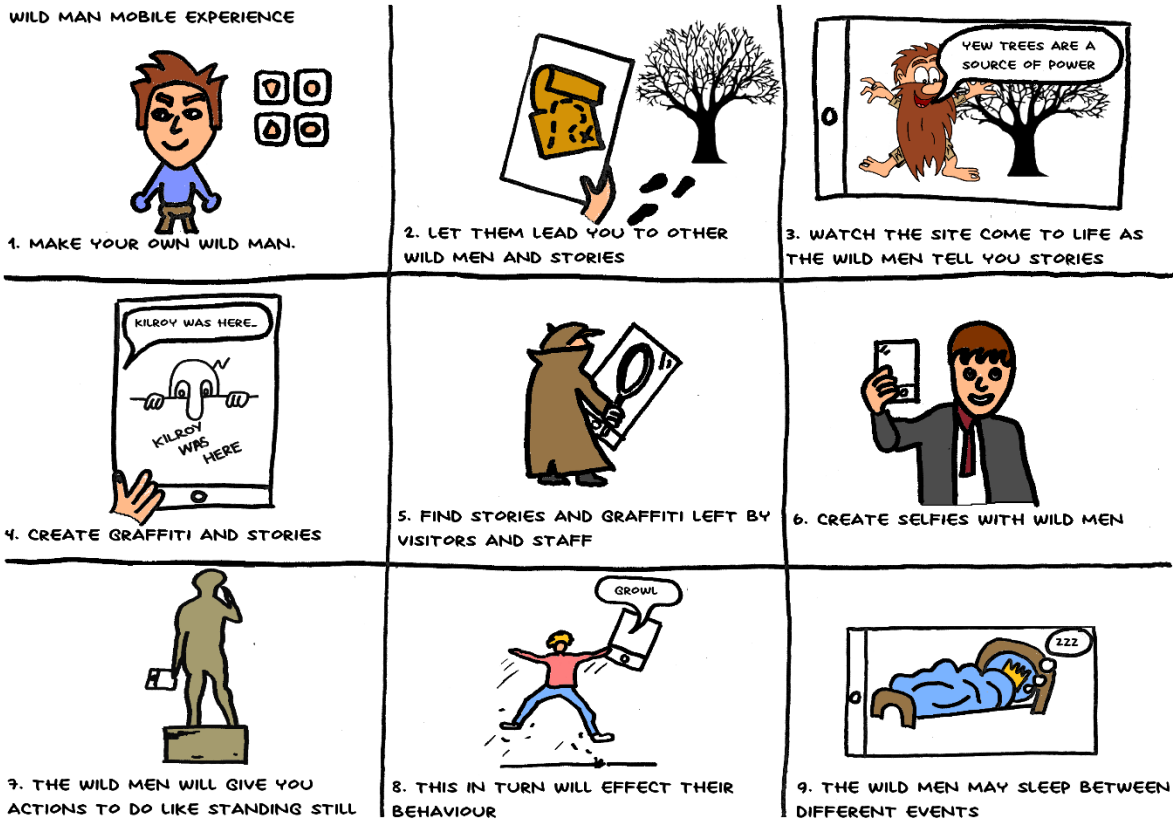


Figure 41. Storyboard for experiences that featured the wild man.

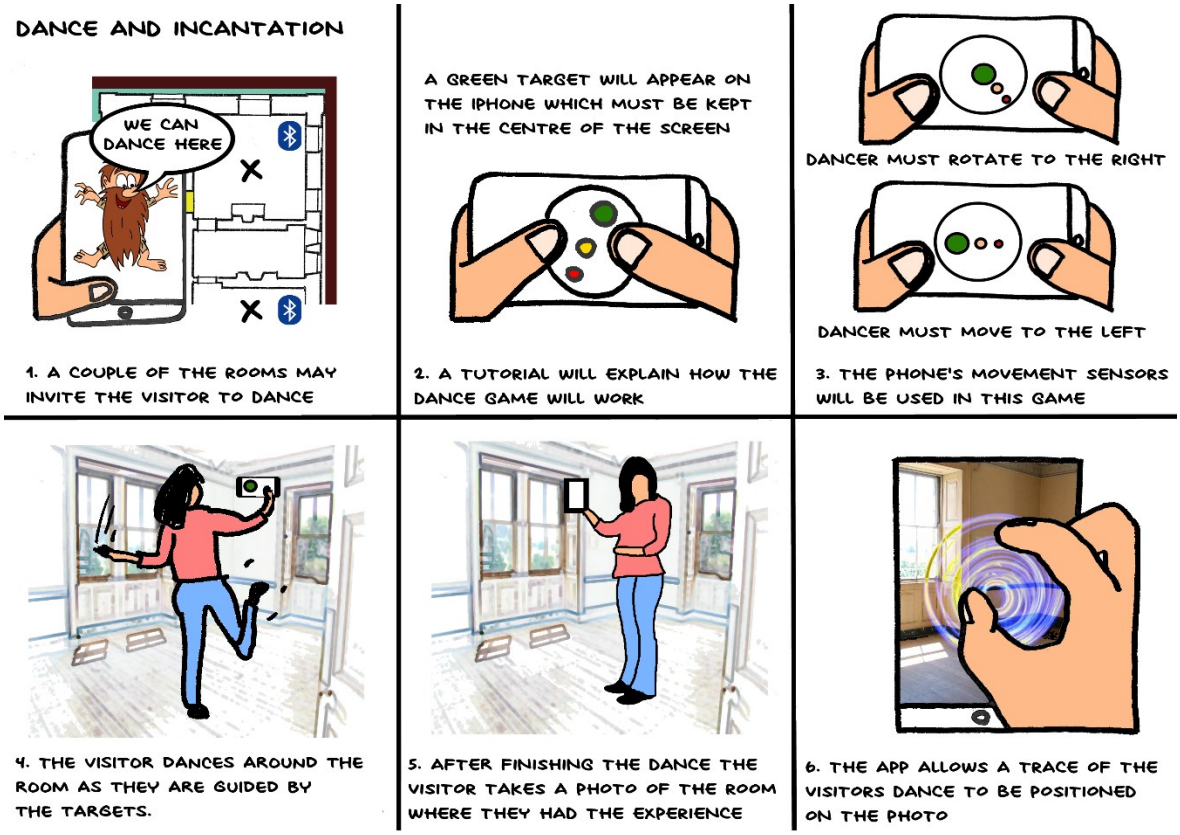


Figure 42. Storyboard for experiences that draw upon dance.

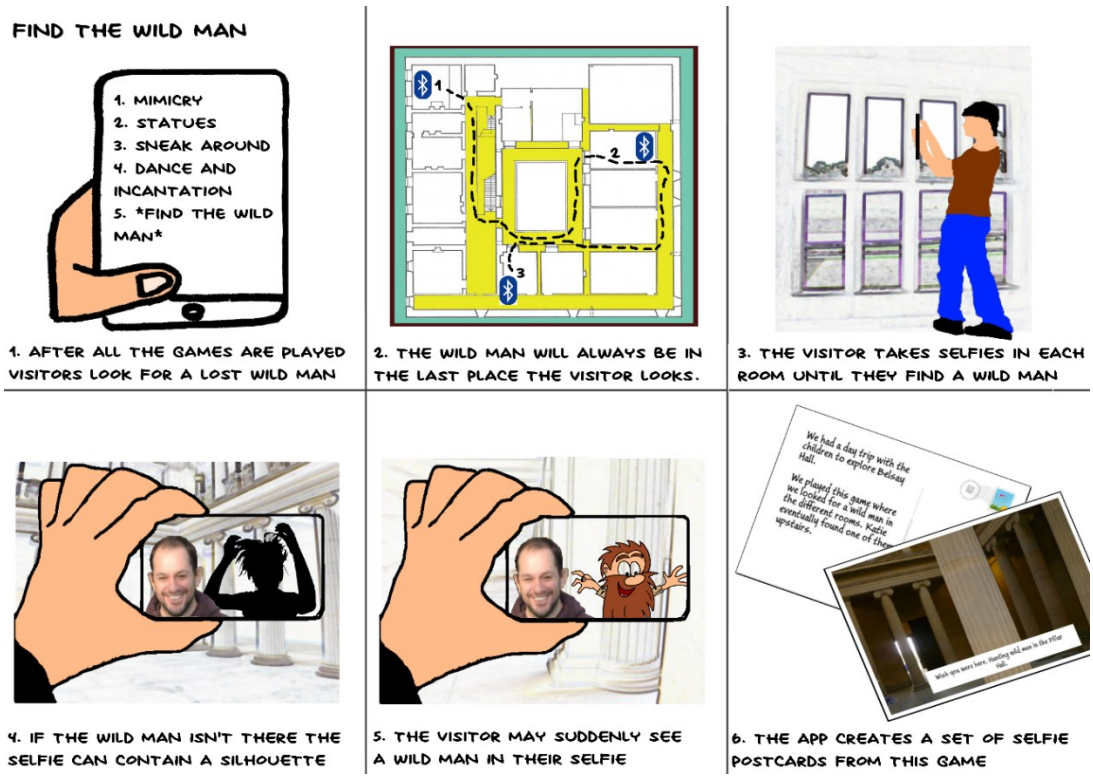


Figure 43. Storyboard that presented ideas around finding the wild man for a Selfie.

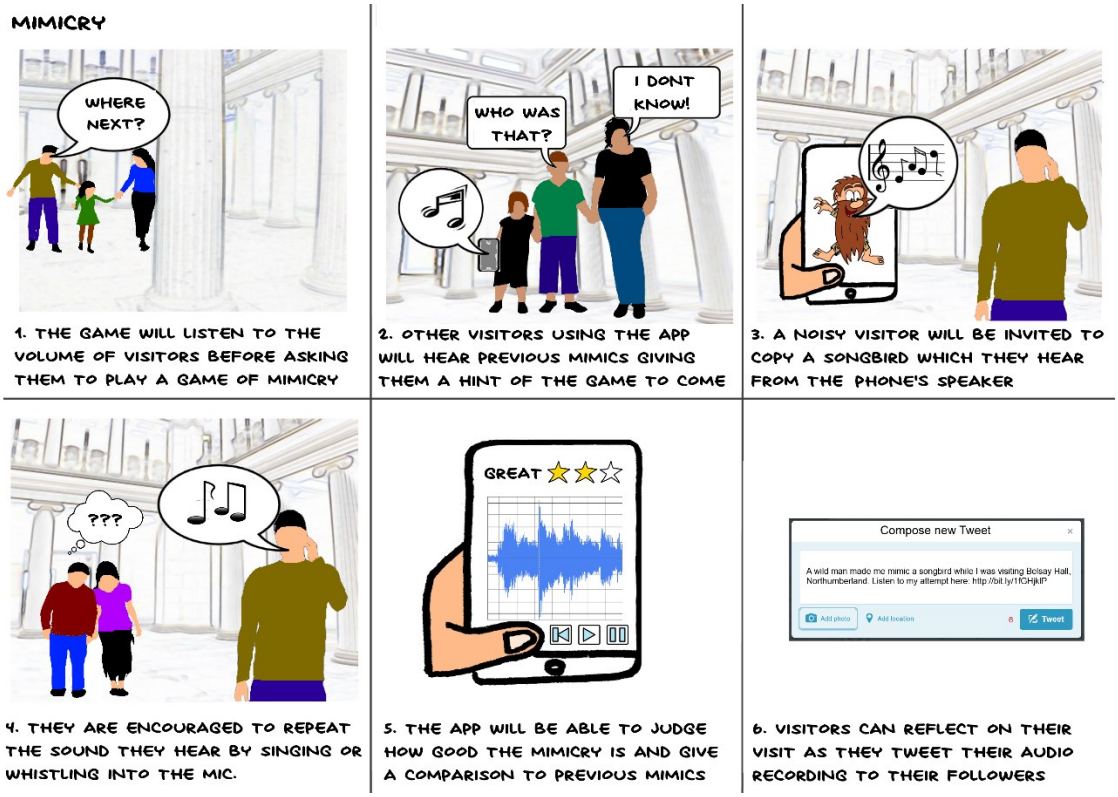


Figure 44. Storyboard for games that use mimicry.

Figure 45. Storyboard containing an overview of a visit.

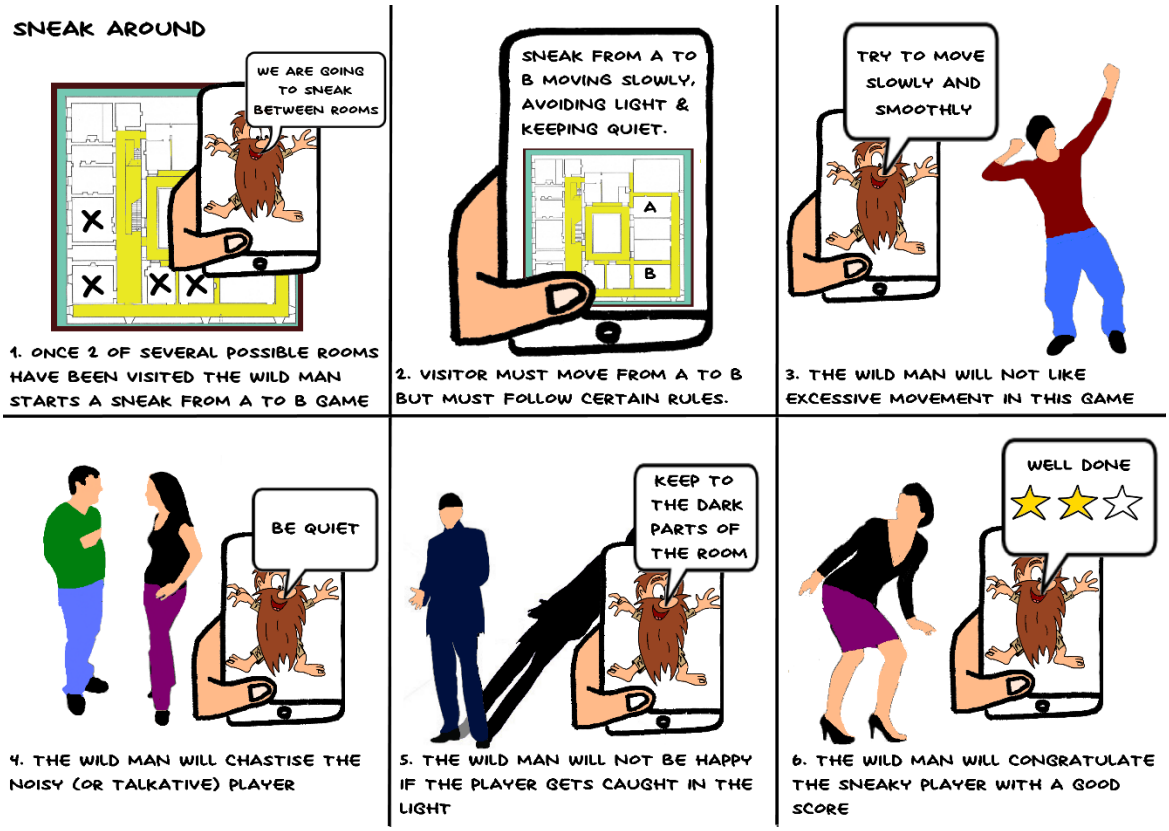


Figure 46. Storyboard for a creeping game.

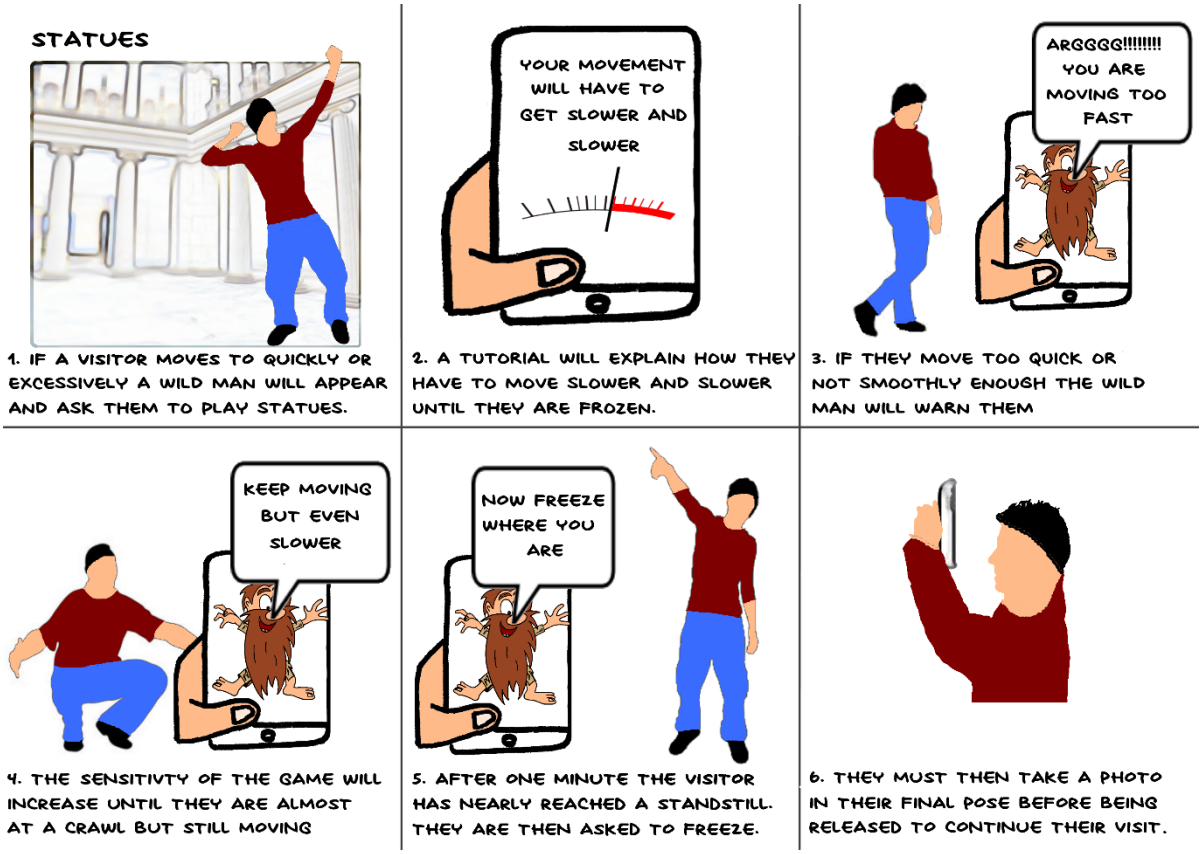


Figure 47. Storyboard for playing a game of Statues.