

Connecting People and Places: Countering ‘Nature Deficit disorder’ with Location Based Games

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Abstract: This paper describes a project to implement location-based mobile games in a UK woodland, in collaboration with Forestry England, using a series of design guidelines developed through earlier research. The primary aim was to connect young people (aged 8-12) with rural environments, to counter the detachment younger generations have from our natural world. This study is part of a broader research undertaking and findings described here specifically relate to how affordances and signifiers in the physical environment can influence both the level of challenge and the will of the player to overcome such challenges. Co-designing with children helped to ensure playability and reveal properties that would appeal to their emotional needs. Working with wildlife experts at Forestry England and the Sussex Wildlife Trust also provided key information about real world activities suitable for children, facts about nature, habitats, landscapes and other content requirements. The design guidelines resulting from this project should be helpful to any researchers or developers that wish to develop games in future that encourage immersion across physical and virtual worlds, alongside an awareness of place.

Keywords: Location Based Games; Nature Deficit Disorder; Emotional Needs; Young People; Flow Theory.

1. Introduction

Location Based Mobile Games (LBMG's) require play across both the virtual and physical world. Proximity is the primary link we have to experiencing ‘place’ and geographical position tends to increase information flow about a location as well as interest in it (Ritchie, 2014). LBMG's, therefore, have the potential to introduce people to an environment, increase their engagement with surrounding objects and help them to learn through the experience (Nova, 2009; Sharples, 2010).

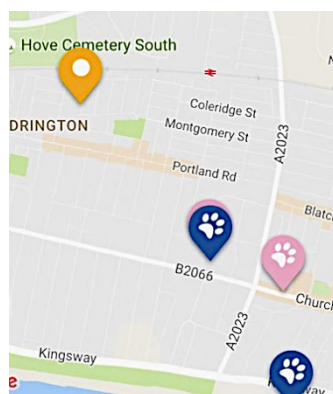


Figure 1: Map for navigating ‘Snowdogs by the Sea’

For some examples, the player seeks a particular location and, on arrival, the next piece of information or activity

is revealed (Avouris, 2012). Many of these games feature a map, annotated with GPS locations, that can serve to illustrate the connection between worlds. ‘Snow-dogs by the Sea,’ shown in Figure 1 provides an example; developed for The Martlet’s charity it had participants seek out 3D sculptures and related activities (Art, 2016). Earlier research for this study demonstrated that LBMG’s that were situated in a particular location and absolutely positioned to GPS points had the most potential for increasing awareness of a landscape. To simplify matters, they were renamed as ‘Place Based Mobile Games’ (PBMG’s).

Though some commercial LBMG’s have been appealing to children, they have not necessarily been associated with an awareness of the physical world. Pokemon Go! was successful with children and has been linked by Miyamoto, the director of the associated company Nintendo, to addressing particular key emotional needs (de Winter, 2015). However, players were sometimes so absorbed in the virtual game, that they encountered hazards in the real-world (Molloy, 2016). On a trip through Preston Station around this time, I noticed the screen announcement in Figure 2: “Enjoying Pokemon Go? Concentrate[...] It is illegal [...] to trespass on the railway”. By contrast, an aim of this study is to consider how LBMG’s can address the emotional needs of older children, in order to be enjoyable, while also connecting them to the physical world to learn about their surroundings. Both game and toy researchers express the significance of addressing emotional needs for audience success, especially children (Rigby and Ryan, 2011; Del Vecchio, 1997).

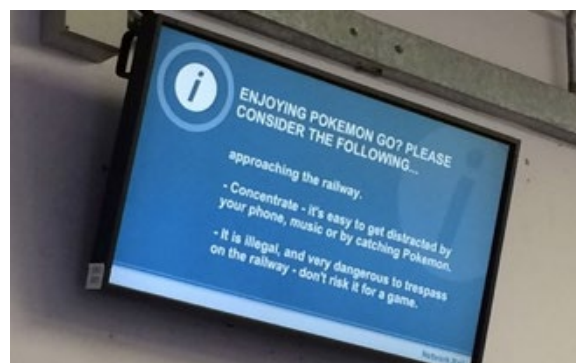


Figure 2: Railway station displaying a warning about Pokemon Go!

LBMGs that offer both entertainment and educational benefits associated with a place have largely been situated in urban environments (Avouris, 2012). Some mobile learning projects have been directed at natural phenomena; however, many are related to the principle of ‘taking the classroom outside’, following normal learning activities (Eliasson, 2013; Wilde, 2003; Rogers, 2010; Brown, 2010) with less focus on addressing key emotional needs. Even Geocaching, where players seek a cache of ‘treasure’ which can be connected to a specific location, is not based on exciting the player about their surroundings. The principles of designing enjoyable LBMGs that immerse the player within an environment are, therefore, not well understood.

As a context for design research, the subject of this study addresses a topical real-world problem, an identified disconnect between young people and nature. Moss created a report entitled ‘Natural Childhood’, for the National Trust (an organisation for the protection of British heritage and wildlife) to demonstrate how today’s generation of children are losing touch with the outdoors and the natural world, referring to the rise of ‘nature

deficit disorder', a term coined originally by Louv to describe a growing dislocation between children and nature (Moss, 2012) (Louv, 2005). There are several reports by Natural England that reaffirm these findings (England, 2009b); (England, 2009a) (Wooley, 2011). There are also well documented benefits of outdoor play (Wooley, 2011; Munoz, 2009; Pretty, 2009; Gill, 2011). The Forestry Commission (now Forestry England) discovered that behaviour can be improved for children with mild-to-severe mental problems (O'Brien, 2005). Forestry England have therefore been aware of concerns about nature deficit disorder for some time and consequently are keen to encourage young people to visit their woodlands. They have already attempted mobile applications to entice young visitors, for example the Gruffalo spotter App, aimed at primary level. However, they are keen to also encourage older children, who are able to recall their experiences more clearly and therefore they became interested in this project. This paper describes the process of forming design guidelines to locate GPS points of interest within a PBMG, by considering the affordances within the environment. The guidelines were subsequently used to create a prototype game for Friston Forest, Sussex, through a design-based research process, co-designing with children and Forestry England staff.

2. Aims and Key Challenges

The overarching aim for the broader research behind this study was to consider how PBMG's can engage older children, in parallel with understanding their potential to increase their awareness of a natural landscape. It was discovered that there are two areas of challenge that are significant for the study described in this paper, potentially detrimental to the experience. One problem with digital intervention within an environment is the cognitive demand required to divide attention across both virtual and physical worlds. (Naismith, 2007) reported issues with a "large amount of 'head down' interaction" due to the mental effort required to use an application within a physical environment. (Frohberg, 2009) studied 38 mobile learning projects; for 28 of them, the mobile technology was reported as too dominating. Schwabe and Goth noted that digital content which added included animations, moving images and other complex features (Schwabe and Goth, 2005). They proposed a series of guidelines to counteract this problem: 1. Plan in the focus switches (between virtual and real worlds) to the activity; 2. Use the technology only when it adds value; 3. Do not use animations if the application is meant to be in the background; 4. Reduce features as much as possible. These guidelines are potentially useful to reduce the cognitive load associates with the screen-based activity, however, an alternative approach, considered here, is to focus on drawing attention to the environment at appropriate times instead.

Negotiating a natural terrain is also particularly challenging, compared with urban environments, due to the higher physical and cognitive demands that are involved. A typical example of the landscape during this project is shown in Figure 3. On the screen-based map, there are fewer landmarks to recognise and an absence of pre-existing routes to follow, like the named streets in towns and cities, impacting on wayfinding. In the natural world, there are repeated elements, such as trees and bushes, rather than buildings that can be easily distinguished.



Figure 3 PBMG activity in a natural environment during this study

However, serious games researchers, such as McGonigal, suggest that we play games because we are motivated to overcome challenges and can be addicted to the feeling of competence that this creates (McGonigal, 2010; McGonigal, 2011). Thus, in a broader sense, there are two alternative approaches to dealing with challenge:

- Reduce the cognitive load required for play, optimise the level of challenge.
- Increase the will of the player to overcome challenges.

To optimize the experience, it was therefore necessary to consider both pragmatic concerns (the game should be playable) and affective emotional responses (the game should be engaging). Considerable research went into investigating how the emotional needs of children could be met through the game characters and narrative, to increase their will to overcome game challenges, however this is the subject of a different paper (Grundy, 2013). In this paper, we focus on how features in the natural environment can support both playability and the will to overcome challenge, through their inherent meanings and affordance and how they were applied to the prototype game in Friston forest, through design-based research with children and other stakeholders.

The questions addressed for this part of the study were therefore:

1. Which aspects of the landscape are preferred, likely to encourage play and attention?
2. Which aspects of the landscape appeal to the emotional needs of older children?
3. How can wayfinding best be supported in a natural environment, to reduce head down interaction and cognitive load?

3. Affordance and interaction principles

Norman describes 'affordance' as a relationship between the object and the person, conveying how they could interact with it (Norman, 2013). Affordance is one of a series of interaction principles, created to guide usability (playability for games). However, the notion of affordance has also been seen to play a part in leading players into action (Mateas, 2001) enticing players to continue with their quest to overcome challenges. Ritchie (2014) suggested that certain spaces can help to construct a story. He describes how paths, spaces and other objects perceived can support a motivational narrative by *affording* or *constraining*, revealing or concealing information (Ritchie, 2014). Norman also introduces the concept of 'Visibility' (Norman, 2008). He uses the term 'signifier' to define sensory cues that add visibility to help the player understand the actions that are possible and which lead to a clear affordance. The concept of indicating what is possible through affordance, communicated through visible signifiers, is described by Norman (2013) as 'feedforward'. 'Signifier' is a term originally discussed in the field of semiotics, the study of signs. Charles Sanders Peirce, introduced three possible relationships between a

sign and its object, interpreted by Liszka to help use signs practically (Liszka, 1996):

- **An index sign** has an indicative relationship between the signifier and the object. For example, an arrow indicates the direction of suggested travel.
- **A symbolic sign** has a learned or culturally understood relationship.
- For **an iconic sign**, the signifier has a tangible resemblance to the object.

Secret City Adventures are the creators of immersive game experiences with real props and provide an illustration of how different signifiers have been employed in physical games (Christine, 2016).



Figure 4 ‘Panic Room Door’ designed by Secret City Adventures

The door they created for a panic room representation, shown in Figure 4, exhibits all three types of Pierce’s sign/object relationships. Firstly, the whole form resembles a door that might be found in a nautical environment (an iconic sign); secondly, the round wheel indicates that the player must turn it (an index sign); the yellow and black warning sign indicates a possible hazard and that the player should proceed with caution or gain more information (a learned, symbolic sign).

Correspondingly in the natural physical world, scholars working on outdoor play for children have emphasised how nature *affords* opportunities for children to explore their physical abilities, challenging them in the mastery of skills, encouraging exercise through these persuasions (Fjortoft, 2004). They take a perception-action perspective, which asks “how does what we see suggest possible actions?” For instance, how can the topography afford obstacles for children to overcome: the vegetation and trees suggest climbing; the meadows are for running and tumbling; the sticks are for picking up (Fjortoft, 2001). Signifiers can also be considered through forms within the landscape. Some can have *associative* properties that are given meaning such as ‘faces’ being seen in the knots on a tree, which can be considered icon signs (Rivkin, 1990). Thomas and Thompson (Thomas, 2004) point to the way that children view spaces as “special” or “secret” and so imbue them with their own distinct symbolism (symbolic signs). Fjortoft (2001) describes how trees suggest climbing; their branches and form indicating particular places to hold feet or hands (index signs). Ritchie (2014) also alludes to the potential for affordances and constraints in the environment directing (or indicating) activities.

Theoretical perspectives can provide useful clues to support drawing attention to the landscape and the choice of locations for a PBMG, also the use of particular landscape features to aid with wayfinding. However, relying on theory to design for a specific application is no longer considered a sufficiently thorough way to gain

perspective for a given problem. Contemporary methodologies that allow the designer to work more closely with stakeholders, particularly, in this case, older children, allow a deeper understanding.

4. Methodology

To consider the questions raised about attention and wayfinding in the natural environment, the research was conducted in two phases, a preliminary phase to discover preferred locations and subjects and a later phase implementing these in a prototype game at Friston Forest. In the original study, in 2013, a group of 12 older children, aged 8 to 12 years, were included in a series of activities to observe their behaviour and choices. The series of activities were repeated a year later, with a different group of 12 children, with the same seasonal characteristics. These were, in turn:

1. A survey of preferences about nature. Here the children were asked to individually fill in an on-line quiz that asked about their preferred animals and activities in a natural environment, besides their dislikes.
2. A photography project, on location: the children were taken to a typical natural environment (Stanmer Park in Brighton) with mixed terrain. They were asked to pick out features that appealed to them as potential locations for their own game. They were observed during the procedure (1 researcher to 3 children), conversations recorded and the results of their imagery analyzed after the event.
3. Characters and stories created for their own game. After their outdoor experience, they were asked to design their own characters based on natural phenomena and a brief storyboard to show the plot of a potential game. This was an individual activity.



Figure 5 Example of a character exercise

In a second phase, findings were used to design locations and activities for the prototype game in Friston forest. Staff from Forestry England visited the chosen trail, commenting on locations and afterwards participating in a co-design event. The creative process was supported using a series of 'design cards' to help brainstorm the content of the game. Examples are shown in Figure 6.



Figure 5 Design Cards used to co-design a game with Forestry England staff.

The game was to be subsequently tested with a group of 14 children, aged 9 to 10, in July 2019.

5. Results

5.1 Preliminary Research investigation

The results will be considered primarily from the perspective of the photography activity, because this relates most directly to the research questions, however the findings are also discussed in light of data from the other activities and theoretical perspectives about signifiers. Typical examples are shown in Table 1. The numbers within the group are not high statistically, however as the results were highly similar over the two years, they appear to be significant, they were also matched to data from other activities and were supported by the theory.

During the photography activity (2), features frequently chosen included:

4. Objects and places that afforded physical activities, particularly those that had been identified as preferred in the survey. For example, several children had identified climbing objects as a desired activity and many had photographed trees which afforded being 'climbable', along with hiding places. This is in line with the perspective forwarded by Fjortoft et al. (Fjortoft, 2004) which suggests that such affordances are motivational, especially where there is an inherent interest in an activity. For other games and contexts, this also points to establishing preferred activities through design-based research in order to identify locations.
5. Indications of animal or plant activity. Signs of animals, such as mole hills, tracks and fox holes were photographed by all of the groups; a preference for animals as the groups overriding favourite aspect of nature was previously noted in the survey and animals were almost always chosen as the central subject of their character and story designs. Over half the groups also took images of new growth of plants, buds, seeds and other indications of activity. These subjects can be categorized as 'index' signs according to the Sanders-Pierce trichotomy.
6. Some subjects appeared to hold special meanings for the child, for example, there were 'secret' signs, referred to when they photographed the knots on trees, 'power' sticks and creepy dens, which seemed to inspire their imagination. Such subjects represent symbolic play and as such can be categorized as symbol signs, according to the Sanders-Pierce trichotomy.
7. Children also often chose subjects that appeared to have faces, human or animal characteristics. Such features seemed to also have added meaning and correspond to icon signs in the Sanders-Pierce trichotomy as they look like something else.

These subjects appear to provide answers to the question: **Which aspects of the landscape are preferred, likely to encourage play and attention through the projection of signifiers, affordance and feedforward?**






- There was a fascination with areas that were home to insects and mini-beasts. This could be seen as anomalous as, in the survey, most of the children suggested they hated or feared such creatures. However, there is a theory that children enjoy overcoming their fears and this could be meeting a key emotional need (Del Vecchio, 1997). This was also supported by 8 of the children choosing to include a 'scary creature' such as a bug or snake as the lead character in their stories.

- The children also took pictures where they had some knowledge of the subject, showing off what they knew during observations. The need to appear knowledgeable or competent has also been identified by games researchers as being a key emotional need (Rigby and Ryan, 2011)

These subjects appear to provide answers towards the question: **Which aspects of the landscape appeal to the emotional needs of older children?**

- Some subjects were just visually striking, through contrasting colours or shapes that stood out in the environment. Such features provide signifiers in a similar way to that described by Norman, where features stand out from an interface in order to indicate action to the viewer.

These subjects appear to provide answers towards the question: **How can wayfinding best be supported in a natural environment, to reduce head down interaction and cognitive load?** Though subjects that afford actions or areas that appeal to the child's imagination previously mentioned are all areas that stand out to the child and as such would also provide striking locations to help towards wayfinding.

Table 1: Children's Photography Examples	
	<p>Functional play and affordance: the same dead tree was photographed by all of the groups along with other trees that afforded climbing.</p>
<p>Symbolic play: Several children picked up a branch and used it as a staff. In the transcript of the conversation, they were talking about 'power sticks' and acting like wizards.</p>	
	<p>Indicators of animal activity were commonly featured, with photographs of holes they lived in and mole hills repeated by all groups.</p>
<p>Visual contrasts: for example, a copper beech tree against a background of green.</p>	
	<p>Scary subjects: All groups took pictures of insects or 'mini beasts' which were believed to be repulsive to the children, often they placed them on their hand or dared each other to touch them.</p>

5.2 Game Implementation.

For the prototype game, during the site visit, locations could be found that had previously identified visual properties, functional play affordance, indication of animal activity, or whether they should have special meaning to the child, due to their symbolic or metaphorical properties. Some examples of locations are shown in Figure 6.



Figure 6 Game locations chosen according to previous findings.

Activities and the subjects for content at key locations within the game were chosen according to their ability to meet the emotional needs of the child, asking key questions, such as: would they know about it? was the subject challenging, allowing them to overcome fears or display mastery? The game design was successfully developed in conjunction with Forestry England and content developed accordingly.

6. Conclusions

Locations for PBMG activity can be predicted using signifiers, according to the trichotomy of Sanders-Pierce (Liszka, 1996). Locations that can draw attention might be those that indicate desired activities to the child, or possibly indicate the presence of preferred creatures (index signs); they may represent a symbolic meaning that stimulates the child's Imagination (symbol signs) or they may have familiar associations, such as human like qualities that make them stand out (icon signs). Such places are more interesting and meaningful to the child; they are also more easily found and can therefore also benefit wayfinding to each location. The visual properties of the environment are also significant for finding one's way and careful selection of areas that have contrasting colour or form can greatly benefit playability. There are also other activities and associated locations that children would choose because they benefit other emotional needs. Although this paper has adapted theoretical principles to choosing locations for a location based game that can be followed by others; in order to establish preferred activities, key emotional needs and appropriate symbolism for a particular audience, design-based research including the audience will always be necessary.

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