Mapping an experience for Location Based Games

Catherine Grundy
University of Brighton, Brighton, UK.
c.grundy@brighton.ac.uk

Abstract Experience maps are a convenient tool for any discipline that involves UX processes or methods to optimise the relationship between the user and interface. They provide a visual representation to support problem understanding during the design and development of an artefact and have been used across a range of design disciplines.
They potentially offer a useful mechanism for ensuring that all the appropriate attributes of a context and people involved are considered during a game design process. They can be used as a framework for research investigations with stakeholders, inspire creative processes or be used as an evaluation tool to check all aspects of the context have been considered. However, the exact form and nature of an experience map varies according to its area of application and purpose and there are a variety of definitions, depending on discipline and author. In this paper we review existing experience maps and propose a new version that addresses the requirements of researching and designing situated educational location-based games. The form of the map was developed through a design research methodology, using the case of an educational outdoor digital game and its co-design with children. Through this research, we were considering how useful an experience map would be for game design, the exact form it should take and also how to include the emotional and latent needs of the player besides playability considerations. The resulting visual tool proved to be a helpful design guide and also provided a framework for a series of guidelines that will support the creation of any location-based game.

Keywords:
Location Based Games; Nature; Mobile Games; Experience Based Design; UX; Experience Maps.

1. Introduction

The study discussed in this paper forms part of a wider study and was aimed at ensuring a holistic approach to researching requirements for the design of outdoor digital games that would ensure an enjoyable and usable experience for the player. The project involved a range of stakeholders and employed an open, flexible and iterative approach that would require understanding of a range of issues. To make sense of the volume of information to be obtained, it seemed logical to find classifications that can both prompt investigations and also help to categorise the findings. 'Experience maps' are a tool that can provide a visual representation of complex elements of a design context, employed for other design genres and, in this paper. we illustrate how an experience map was used when researching requirements for location-based games in natural environments and review potential use for game designers working with other contexts.

A motivation behind the broader investigation was to consider the 'real world' problem of disconnect between young people and nature and to identify, through a participatory design-based research process, how digital games could help to support engagement.

Figure 1: Playing LBMG games created by children during a participatory design process.

A lack of connection with nature is a widely recognised issue for young people, originally termed 'nature deficit disorder' by Louv (Louv, 2005) and has since been discussed widely by experts (Trust, 2014) (O'Neill, 2020) and the media alike (Greenfield, 2019) (Carrington, 2016, Monbiot, 2020) suggesting a topical subject for investigation, though this was also of personal interest. Pivotal aims were to encourage outdoor play for older children and encourage experiential learning in natural environments, including children, teachers and wildlife experts from a range of organisations as stakeholders in the project.

To make use of the enticing qualities of Location Based Mobile Games (LBMGs), emerged as a solution during the open investigation process. When contextual awareness is combined with the use of features that can introduce a range of media, photography, video, Augmented Reality (AR) and different forms of interaction, the potential for enjoyable learning from the physical world is greatly enhanced (McCracken, 2009). It was further identified that absolutely positioned games situated within a specific location can be particularly helpful as they require onsite activity and immersion in a particular landscape, ensuring outdoor play and experiential learning. They were subsequently labelled place based mobile games (PBMG's) for simplicity.

1.1 Project aims.

The wider objectives were focussed on encouraging children to play in natural environments and the primary research question focusses on the pragmatic and emotive attributes of games that would achieve this. A central aim therefore was:

- To understand how the properties of PBMGs contribute towards promoting an optimal experience, where a connection with the landscape is significant.

For this paper, however we are focussed on the development of a research tool in the form of the experience map that can be applied to the design of PBMG's for a range of contexts.
The aims were:

- To create an experience map for PBMGs that will help to prompt and frame a series of questions to be investigated for the game design.
- To apply the questions via a research through design approach and a concept driven design methodology to create a series of design guidelines.
- To revisit the experience map during the process and review its efficacy and structure.

1.2 Considering a 'Wicked Problem'

Design projects that consider complex experiences and questions with regard to an activity and systemic impact on the individual, their social sphere and the environment can be considered to present a 'wicked' problem'. Originally defined by Rittel, Webber and Melvin (Rittel, 1973) a wicked problem is a set of interlocking issues and constraints, with the following characteristics: formulating the problem and the solution are essentially the same; each attempt at creating a solution changes the problem understanding; various stakeholders will have differing views of acceptable solutions; the appropriate way to tackle wicked problems is to work with them, a consensus emerges through the process of laying out alternative understandings, competing interests, priorities and constraints. A worthwhile design contribution can, therefore, involve a series of variables, whose relationship to the final solution may be difficult to fully determine at the beginning. Buchanan refers to wicked problems in design thinking as a process of 'tying down' design attributes to meet the needs of the situation (Buchanan, 1992). It points to a process in which an initially large and diverse set of considerations can be systematically narrowed as particular requirements are identified. Dick Powell, founder of Seymour Powell, described this as 'an explosion in reverse, a slow congealing of chaos, which accelerates at the last to snap into something unbroken and defined' (Burke, 1995)

In sum, for the wicked problem this project represents, the process of gathering data and creation of design solutions began by being open to many variables. Through each stage, findings were pinned down as design attributes in the form of guidelines for PBMG's and the number of different considerations narrowed until the solution was defined. Such complexity pointed to the use of frameworks to guide the investigation, leading to the conclusion that an 'experience map' or a visual framework could guide the potentially fragmented investigation, prompting and categorizing a significant volume of subordinate research questions, while ensuring a holistic view of an ideal experience was maintained. During the process the experience map as a research instrument and contribution to practice could also be refined along with further contributions to design

theory made. There were a range of other theoretical outcomes outside of the scope of this paper. The way that outcomes were generated can be illustrated through an adaptation of the (Mor, 2010) model, which illustrates the iterative nature of solving a wicked design problem and the increased design knowledge, theory and research instruments that emerge.

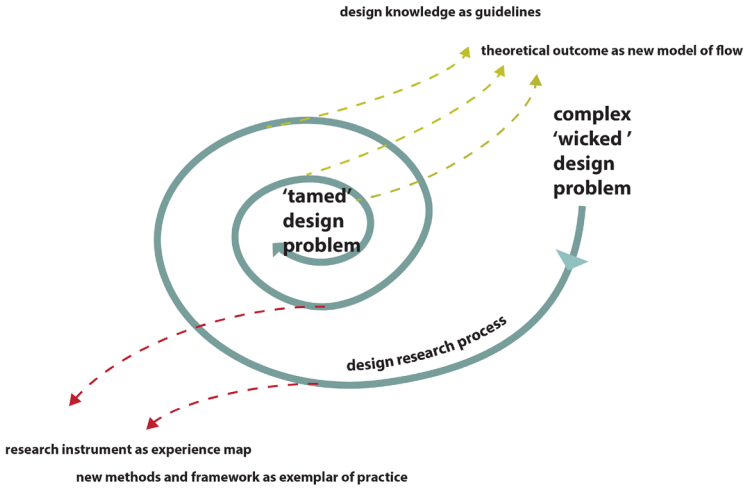

Figure 2: Adaptation of the Mor (2010) model displaying research outcomes when solving a wicked design problem.

2. Creating the Experience Map

To entice people to engage with both the physical and virtual worlds that the PBMG represents, the game must maintain an enjoyable experience across each landscape. The aim was to create a 'hybrid' game that included experiential learning but that also emphasised fun, pointing towards design methods that include affective responses. The project therefore included an investigation into the emotional needs of children and co-design methods to consider attitudes towards play, engagement during interaction with both the landscape and technology and continued motivation towards an experience over time.

2.1 Mapping the pragmatic aspects of context

Historically investigating the context for a design became important as digital applications were progressively more contextually aware (Dourish, 2004) (Reid, 2005) (Brown, 2010). However, there are different definitions of context in the literature, for example: the Mobile Bristol Group associated context with 'where', thus specifically a location (Reid, 2005) Others define context more broadly as "the setting in which a situation occurs" according to Brown (Brown, 2010). In this case, it can also include many 'dimensions', including environment, social activity, goals/ tasks of groups and individuals and time". Zimmerman also proposed a multi-dimensioned contextual model with fellow researchers (Zimmerman, 2007). The five dimensions, proposed for context aware systems, shown in Figure 3, were:

- Location
- Individuality
- Activity
- Relations
- Time and Duration

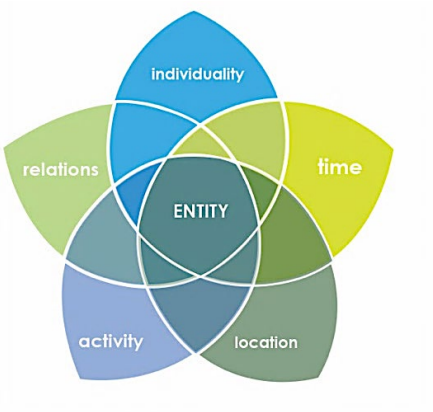

Figure 3: Map of context for digital applications (Zimmerman et. al., 2007)

Another example was provided by the A x 4 framework, illustrated in Figure 4, developed by Rothstein et al. (Rothstein, 2004)(2004); it includes Actors, Activities, Activities and Atmosphere and also provides more detailed components of these dimensions.

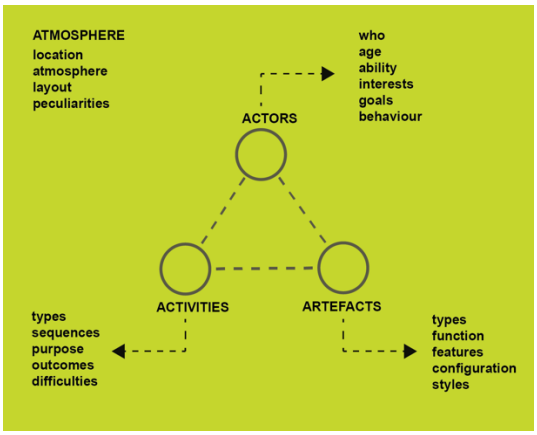

Figure 4: Ax4 model by Rothstein et al. (2004), including properties of the dimensions.

In a comparison of other design research frameworks, shown in Table 1, we see similar fundamental dimensions of context, with different terminology, e.g. 'people' (actors, persons, users); 'environment (atmosphere, space, situations, territory); 'objects' within environments (artefacts, stuff) and 'activity'.

Table 1: Comparing context maps across research groups historically.

Author	(Brown, 2010)	(Rothstein, 2004)	(Wasson, 2000)	(Sachs, 2004)	(Zimmerman, 2007)
Use	Mobile Learning	Design	Design	Community Study	Design
Dimensions	Groups & Individuals Goals/ tasks Environment Social Time	Actors Artefacts Activities Atmosphere	Users Objects Activities Environments Interactions	Persons Objects Activity Situations Time	Individual Activity Location Relations Time & Duration

Across these models, four primary pragmatic themes run consistently through their dimensions: 'people' (referred to as individuals, actors, users, persons or groups), 'environments' (referred to as environment, atmosphere, situations or location), 'activities' (referred to as: activities or goals/tasks), for some, 'objects' (referred to as artefacts or objects). For some, the component of time is included explicitly, for others it is implied in terms such as: 'activities'. Similarly, 'interactions' between dimensions are referred to for some but are implied for others. It would seem that for maps where interaction is considered a fundamental requirement

between all of the primary dimensions, it becomes unnecessary to state it explicitly, as is the case with this research.

2.2 Classifying emotional response

Chen et al. discuss contextual elements such as location, time, and temperature, however they suggest that these should also be considered alongside the desires, commitments, and intentions of the human to form the motivational components of the context (Chen et al., 2004). Ermi and Mayra suggest that a participant's experience of a game is a response to the context (Ermi, 2005).

Donald Norman proposed three different layers of response to an experience in his book, 'Emotional Design' (Norman, 2005). Firstly the 'visceral' layer that describes our initial response, triggered by a sensory scan, immediate and often subconscious. Secondly, a 'behavioral' layer relating to a more considered working relationship with the object over time, relating to usability and tacit needs. Finally, the 'reflective' response, based on familiarity, often grown from memory and previous experience. Norman's categorizations of emotional response are quite temporal in that they relate to the stage of involvement with an interface.
The categories of emotional response, offered by Norman, present a way of considering a user's reactions to a design, without separating practical and affective qualities (Norman, 2005). Ermi and Mayra consider that motivational components, desires, and anticipations should be considered in light of *previous* experiences to actively construct the context (Ermi & Mayra, 2005). Other researchers, similarly, regard a contextual model as formed through a process of interaction over time, with personal, social and physical components. (Falk, 2000; Sharples, 2010). These perspectives include a temporal relationship with a design and reflect Norman's model of emotional response, which could be considered in terms of length of association. This was considered to be a useful way to categorise response and of further merit for the project.

2.3 Context and response mapped as experience.

To ensure both context and response were included, Lee Crossley and I (Grundy, 2012) combined literature findings to create the experience 'map' shown in Figure 5. This was created some time previously, during a research collaboration with a design practice, PDD Ltd. working with both 3D and digital products. The model was evaluated through a range of live projects and found to be helpful for both prompting and communicating the data collected.

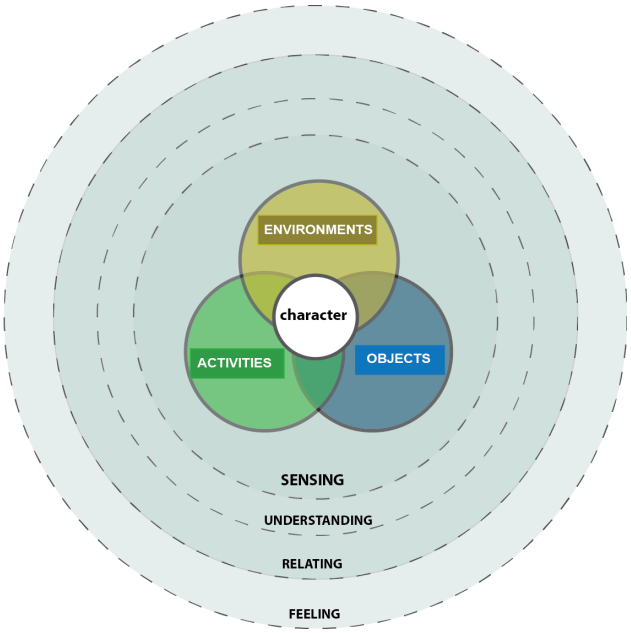

Figure 5. Map of an experience (Grundy et. al 2012)

The user response was categorised in a similar to Norman, defining the experience over a period of engagement:

- Sensing: How a design initially strikes us, perceptions, aesthetic properties. This shows similarity to Norman's 'visceral' layer of experience.

- Understanding: How a design is interpreted during use, the usability of what is presented. This shows similarity to Norman's 'behavioral' layer.
- Relating: How a design fits with existing preferences, based on previous experience or cultural influences. This shows similarity to Norman's 'reflective' layer of experience.
- Feeling; how the experience leaves the user feeling. This has been added to Norman's categories to represent a summation of all the other kinds of emotional response, after an experience. An overall, final impression.

2.4 Adapting the experience map for LBMG's

In order to review this model for LBMG's it was compared with other models of experience with motivational and emotional elements for a range of applications, as a form of checklist for its content. Table 2 lists the dimensions of some examples that were relevant.

Table 2: Contextual frameworks with emotional components in bold

Name	Spradley, Robson	SOUPA	Lonsdsale
Author	(Spradley, 1980). (Robson, 2011)	(Chen, 2004)	
Use	Real World Research	Mobile App Development	Mobile Learning
Dimensions	Actors Space Objects Activities Acts Events Time Goals **Feelings**	Person Space Agent Action Policy Time Event **Belief-Desire-Intention (BDI)**	People Settings Artefacts Technologies **Elements** (& Interaction over time between all)

Other researchers agree that identifying key emotional needs can help towards game success for a given audience (Rigby, 2011, McGonigal, 2011, de Winter, 2015, Freeman, 2003, Areliusarson, 2013). Whereas these models consider emotional *response*, identifying how key emotional needs can be pre-empted through understanding these responses seemed important to include. The map was therefore adapted to include an overall emotional response that corresponded to key emotional needs. The final revised map of an experience for PMBG's is shown in Figure 6 and its components can be described as follows (the dotted arrows indicate the interactions between the different contextual dimensions):

Game Context:

Player:

The player, their developmental stage of physical and conitive ability, their culture, preferences and needs are placed at the centre of the investigation.

Activities:

This can represent tasks in the game representing intermediate, or overall game goals, but can be anything the player needs to do to engage with the game.

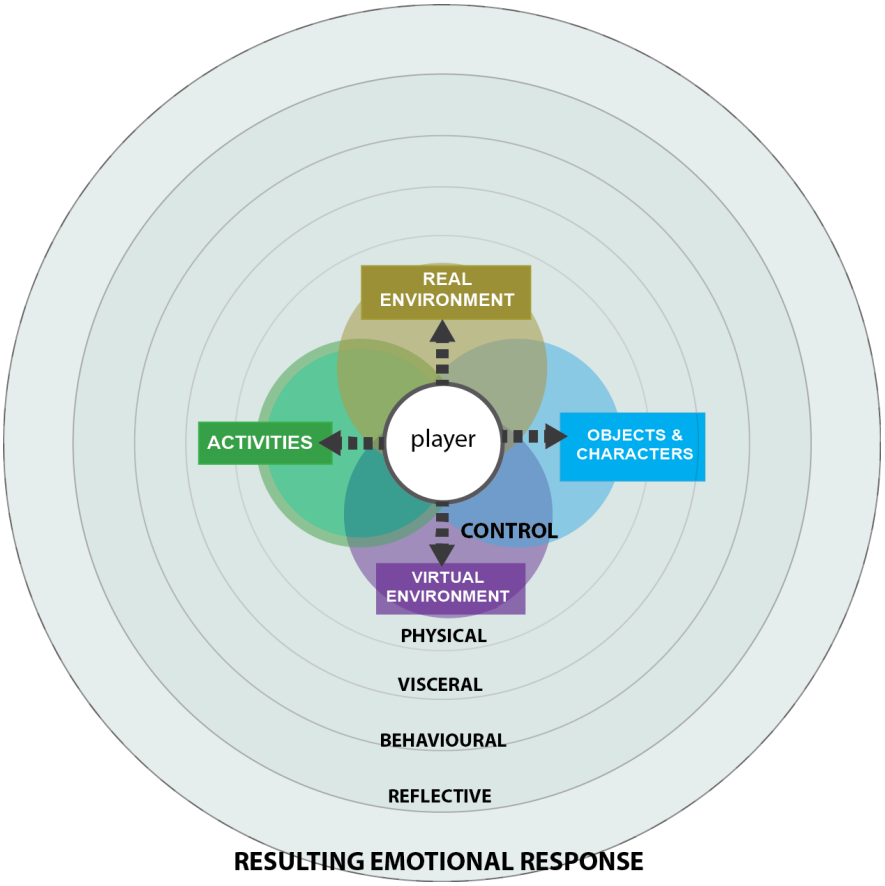

Figure 6. Adapted Crossley & Grundy map to include dimensions relevant to PBMGs

Environment, Virtual, Real:
The term 'Environment'' is used to describe the location and its associated atmosphere, including weather conditions or proximity to particular phenomena. The term is separated into physical, 'real' world and virtual components, because of the significance of this duality for PBMGs.
Objects & Characters:
The game will likely have physical or virtual objects, trees, virtual gold coins etc., the player will also encounter other characters.

Player responses:
Physical:
The tangible, physical reactions of the player to what is encountered; how it matches their ability.
Visceral:
The immediate response to the sensory qualities of the game, first impressions.
Behavioural:
How the game matches the cognitive ability of the player and issues with play during interaction.
Reflective:
Existing preconceptions influencing the situation.
Emotional Response:
How the game meets the key emotional needs of the player, including the previous types of response.

3. Method

To address the primary research question behind the wider project and understand how the properties of PBMGs contribute towards promoting an optimal experience for these games, it was necessary to drill down and investigate the influence of each aspect of the context. A literature review and observations of children and experts during programmed wildlife workshops helped to gather a series of specific points for investigation. The

experience map was then used to expand these into detailed questions that would ensure coverage of aspects for both the context and affective response. Table 3 below shows an example of how the experience map was applied to expand on emerging issues. To explain further, an issue around safety and security had arisen, leading to a question about how children could be safeguarded during play. The map helped to ensure that the question was considered from different perspectives of their relationship with context and also different stages of response, for example, how could they be safeguarded during play and what is it about their recollection of natural environments that causes fear about safety?

Table 3: How questions are detailed using the experience map.

Contextual Dimension	Experience Category	Question
IC 1 How can children be safeguarded during outdoor play and both parent and child to feel they are safe?		
Player/Real Environment	Behavioural	IC 1.1 How can children be safeguarded from real hazards by conveying information to the child on site?
Player/Real Environment	Reflective	IC 1.2 What are the children already afraid of?
IC 14 What are the test group's habits and feelings about nature?		
Player/ Real Environment	Reflective	IC14.1 What kind of predisposition do children have towards being in the natural environment?
Player/R Environment	Behavioural	IC 14.3 How much time do they spend in the countryside?
Player/ Activities	Behavioural	IC14.5 What are their usual outdoor activities?

Methods were then selected based on the size of sample needed and whether the information was qualitative or quantitative to address the questions under investigation. The approach and how the data was triangulated are covered in an earlier paper (Grundy, 2014). The research proceeded through the phases of investigation indicated in the diagram in Figure 7. The level of information and therefore number of questions still being investigated is also represented graphically by the size of each rectangle, also illustrating the reversed explosion effect described by Powell (Burke, 1995). (Spradley, 1980) (Robinson, 2016) (Robson, 2011) (Chen, 2007, Lonsdale, 2004)

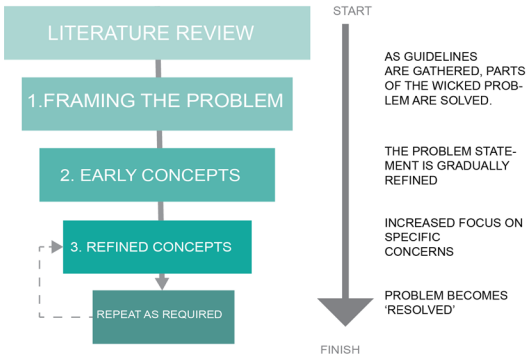

Figure 7: Narrowing of the research questions as attributes are 'tied down'. The blocks represent volume of information.

4. Discussion

Use of the experience map was helpful to classify relevant issues and prompting the research, through adding detail to the emerging questions. Concerns were raised that may otherwise have been overlooked and the choice of methods was easier to predict for a complex mixed methods approach. It also helped to maintain an overview of the game experience as a whole during the investigation and ensured coverage of each dimension of the game context, alongside the different type of possible response from the player. A sample of the guidelines that emerged at the end of the process is provided in Table 4 for the example question about fear and safeguarding children and this illustrates the range of information gathered. It was originally intended to match the guidelines with the map categorisations; however, in practice this became unnecessary and impracticable, some of the guidelines belonged in several categories. Only a few of the emerging guidelines were specific to natural environments, shown in darker grey and most were generalisable for any context of play.

Table 4: Emerging Guidelines on questions of safety and feelings about the environment.

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Emerging Guidelines
General precautions for play should be introduced at the beginning of the game to keep the player safe.
Hazards specific to a particular area, or objects located within it, should be introduced in situ.
Traditional play activities, adapted for a PBMG, should be safe and understandable without adult supervision.
Allow the player to overcome latent fears about the environment, by confronting them through the narrative and encounters in the game.
Include objects and characters that support the empowerment of the player (will feel safer).
Activities should be age appropriate and not embarrassing to the child, e.g. avoid role play activities in public places (fear of humiliation)
Protocols for behavior in the countryside should be included to protect them and the natural environment.
Follow NICE guidelines to ascertain suitability of a site for a PBMG based in a natural environment.

A series of prototype games were created during the process described (Grundy, 2018), also employing co-design methods with children as part of the research and were evaluated as being engaging and playable by the children, which would evidence the successful approach to gathering information and applying findings to the design. More completed games were subsequently developed for woodlands in the UK, working with Forestry England, in an attempt to encourage visitors to their forests, which were also a success.

4.1 Limitations of the Context Map

During this project, the context map was used to prompt research for a game that would be played by an individual or a small group of children, therefore the influence of social engagement and interaction with other players was not considered, due to safety concerns. Transactions with other objects and characters may also not fully represent the complexities of co-creating such engagements. To relate to more complex social structures, future research and developments of the context map could perhaps include a range of social theories. An example might be Actor Network Theory (Latour, 2007), which considers that objects, ideas, processes, and any other relevant factors are seen as just as important in creating social situations as humans.

5. Conclusions

Using an experience map provides an excellent prompt for wicked design problems and the version created was helpful in understanding both context and response for Place Based Mobile Games. Though some guidelines created were specific to natural environments, many were generalised for any context and this is therefore useful for other applications. However, the map has been designed from the perspective of a single player (or small friendship group) in order to maintain safety and more work needs to be done to consider the influence and responses for situations with multiple players.

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