

# BOLLOCKS!! Designing Pervasive Games that Play with the Social Rules of Built Environments

Conor Linehan, Nick Bull, and Ben Kirman

Lincoln Social Computing Research Centre, University of Lincoln, LN6 7TS, UK  
clinehan@lincoln.ac.uk

**Abstract.** We propose that pervasive games designed with mechanics that are specifically in opposition with, or disruptive of, social rules of the environment in which they are played, have unique potential to provide interesting, provocative experiences for players. We explore this concept through the design and evaluation of an experimental game prototype, *Shhh!*, inspired by the juvenile game *Bollocks*, and implemented on Android mobile devices, which challenges players to make loud noises in libraries. Six participants played the game before engaging in semi-structured interviews, explored through inductive thematic analysis. Results suggest that the game provoked in players a heightened awareness of social rules, as well as a complex social dilemma of whether or not to act. We conclude by presenting a model for designing games that play with the social, as well as physical, rules of the environments in which they are set.

**Keywords.** Pervasive Games, Social rules, Social Context, Unwritten rules, Non-players, Critical Games

## 1 Introduction

Pervasive games [22,24], location-based games [5], and mixed reality games [7,9] are all terms that describe entertainment computing applications in which the geography of the real world functions as an essential component of game play. These games typically use mobile computing technologies such as GSM [30], Bluetooth [8,27], WiFi [4] GPS, or augmented reality [8] in order to incorporate the movement of players through the real world as part of the fantasy narrative of the game. The assumption is that game tasks can make real world locations and activities more interesting or meaningful [28]. However, there is a surprising lack of variety in the design of these games and in the types of experiences they are designed to provoke. The majority take the form of treasure hunts, where players must visit real-world locations in order to tick off game-world tasks. Rarely do these games acknowledge or encourage players to engage with interesting physical or social features of the environments in which they are played. It appears that the motivation behind developing these games is often to explore the capabilities of the enabling technologies, rather than to provide interesting experiences for players.

Researchers have recently argued [20,21] that pervasive games have relatively unexplored potential to provide engaging experiences through provoking players to interact meaningfully with already interesting real-world environments. For example, the game *Blowtooth* [20,21] is designed to explore the unique affordances of interna-

Note: This is the author's version of the work. It is posted here by permission for your personal use. Not for redistribution. The definitive version was published as: Linehan, C., Bull, N., and Kirman, B. (2013). Designing Pervasive Games that Play with the Social Rules of Built Environments. In proceedings of Advances in Computer Entertainment (Springer), 123-137.

tional airports (see [16]). The game narrative requires players to smuggle virtual goods through real airport security by planting them on fellow passengers, before later tracking those passengers down and retrieving their goods. Blowtooth is extremely simple both technologically and in terms of game design. Kirman, Linehan and Lawson [20] argue that, despite its simplicity, the game provokes interesting experiences for players, because, through the game mechanics, the player is confronted with aspects of the environment that already cause anxiety and exhilaration; in this case the unparalleled security and surveillance of the airport environment. Conversely, the game is not interesting or fun, or even a coherent game, if played anywhere other than an airport.

The Blowtooth game provides an interesting starting point for the current paper. Specifically, we were interested in exploring further the concept of designing simple pervasive games that interact provocatively with the implicit features of *built environments* (i.e., the human-made surroundings that provide the setting for human activity [26]). It must be noted that Blowtooth gained much of its engaging power from the extraordinary nature of the airport environment. Here, we aim to investigate whether similarly interesting experiences can be designed for more commonly experienced environments. Specifically, we propose that these experiences can be achieved through the design of game mechanics that are in opposition with, or disruptive of, social rules that exist in everyday built environments. Indeed, the mischievous breaking of social rules is a type of play that many find engaging [19]. Of course, all games are social experiences that take place in social spaces, as discussed at length in the literature (i.e., [18,29]). Here we investigate specifically how pervasive games can create engaging experiences through encouraging people to consider, explore, and play with, existing social rules of their environment.

The following sections of the paper will explore the rationale for designing pervasive games that ask the player to engage in the mischievous breaking of social rules. We first discuss how social rules effect the expression of behaviour, and identify the built environment as a particular type of behavioural cue. We then discuss mischief and naughtiness as a game play aesthetic, and consider the effects of mischievous play on non-players. Subsequently, we present the design and evaluation of a game, *Shhh!*, which challenges players to make loud noises in libraries.

## **Background**

### **Social Rule Following and the Built Environment**

Human behaviour is highly sensitive to social influence. The expression of our desires, goals, intentions and impulses is mediated at all times by expectations, spoken or unspoken, of what is appropriate in the particular context in which we find ourselves [3]. The definition of what is appropriate behaviour is often complex, and changes depending on a seemingly endless variety of variables, such as whether you are inside or outside, how many other people are present, what those people are wearing, your relationship with those people, the time of day, and so on. For example,

there are very different expectations on behaviour when attending a football match in comparison with attending a lecture, despite these being topographically similar behaviours (i.e., both feature large audiences passively focused on the activities of central actors). Humans show remarkable ability to adapt appropriately to these subtle changes in expectations [2]. Researchers have suggested that *social acceptance* is one of the most powerful unconditioned reinforcers for humans [1]. We work hard to gain acceptance and to avoid disapproval.

The specific expectations of any given context are both signalled and enforced by the behaviour of others. We observe others and infer appropriate social norms based on those observations [1]. For example, a busy dance floor invites participation, and while around children, an adult may soften their tone of voice and vocabulary. In situations where we have misinterpreted the norms, people are often quick to intervene directly and make sure that we understand. This is often an embarrassing and memorable experience for both parties.

Interestingly, buildings function as particularly strong contextual cues for behaviour. Indeed, there is a field of academic study that examines specifically how the ‘built environment’ (human-made environments) affects our experience and supports and encourages particular patterns of behaviour (see [26]). Thus, there seems great potential in designing games that are located in specific types of buildings. Such games could take advantage of the fact that certain types of buildings evoke certain types of behaviour, regardless of where in the world they are found.

### **Mischief as a gameplay aesthetic**

Social rules are essential to all game playing. For example, the ‘Magic Circle’ [15,29] is a term that describes the unspoken agreement about acceptable behaviour in the social context of game playing. The game-playing context provides players with cues for, and gives permission for, many types of behaviour that would be unacceptable or confusing in other contexts. Similarly, there are certain behaviours, such as cheating, which are unacceptable in the game-playing context. Thus, games inherently function as powerful social cues for appropriate behaviour and, indeed, all games are inherently social experiences [18,29].

Mischievous play is a type of behaviour that serves to explore and test the boundaries of social acceptability in game playing contexts [19]. Mischievous players enjoy subverting and appropriating game rules and social expectations of the game-playing context in order to produce surprising and entertaining experiences for themselves and other players. For example, in farming games, players create elaborate pictures using variety of crops [17], and in Spore [23], players used design tools to make humorous creatures modelled after various parts of human anatomy [19].

Importantly, there is a distinction between mischievous play and genuinely anti-social behaviour. The key to mischief is the apparent attitude of playfulness. The mischievous player knows there are limits to their behaviour, and the *intent* is to do no harm [13]. This is in stark contrast to the intent of grieving or trolling, which is purposefully disruptive, often with negative and anti-social intentions. Researchers have

argued that mischievous play is a valid, interesting and valuable form of game play behaviour, which designers should acknowledge and facilitate [19].

Kirman, Linehan and Lawson [19] primarily discuss mischievous play in terms of playing with the social environment that surrounds game playing. However, there are games that encourage players to mischievously explore and test the boundaries of social acceptability in other environments (i.e., beyond the safety of the magic circle of a game). For example, consider the game played by school children where a (typically obscene) word is chosen and players must take turns to speak the word in class (generally called “Bollocks” in the UK and Ireland). Each successive player must say the word louder than the previous, until somebody is caught by the teacher, or gives in. The attraction of the game lies in the tension between the rules of the environment (stay silent) and the rules of the game (make a noise), creating an exhilarating social experience. Another example is that of juvenile “kissing” games (e.g. “Spin the Bottle”), which give players permission to explore the social boundaries of intimacy.

We propose an extension to the conclusions of Kirman, Linehan and Lawson [19], who insist that mischievous play in game playing contexts should be acknowledged and supported. We suggest that mischievous playing with social rules can form the basis of exhilarating, memorable experiences beyond traditional game playing contexts. We call for the design of games that specifically encourage players to engage in behaviour that is in opposition with, or disruptive of, the social rules of built environments. We suggest that this approach may be particularly beneficial to the design of pervasive games. Since buildings function as powerful signals for controlling the expression of behaviour, and games do similarly, the playing of games in the built environment may present complex, challenging social experiences for players, particularly in situations where the rules of the game are in competition with the rules of the environment for control over player behaviour. This could be seen as an example of a 'dark gameplay pattern' that intentionally causes emotional dilemmas for players [31].

### **Considering Non-players**

The experimental game prototype described and evaluated in this paper, *Shhh*, asks players to make noise in a library. It is envisioned that, due to the convention for quiet working in the library environment, players will experience exhilaration at the challenge to break that rule, since that the consequence of being noticed involves harsh disapproval by peers. However, in designing such a game, some consideration must be given to the effects that game play may have on other library users. Indeed, such considerations are a necessary step in the design of all pervasive games [14,25].

Niemi, Sawano and Waern [25] suggest that *anonymity* and *accountability* are the most important factors when considering non-players in pervasive game design. *Anonymity* refers to whether the game intrudes on non-players privacy, or reveals information about non-players to the players through the technology employed in the game. *Shhh!* makes no attempt to record anything about the environment other than the loudness of sounds produced by the player. It doesn't even record the sound itself, just a measure of loudness. Thus, the game does not infringe upon non-player privacy,

according to the definition provided by Niemi et al. It could be argued, however, that encouraging noise in a quiet environment is in some way an infringement on privacy. We must remind the reader that the intention is not to provoke players into making lots of noise, rather, to encourage in players a heightened awareness of how well defined and understood the social rules are, as well as the implications of breaking those social rules. We envision that few, if any, players will cause any serious disruption to fellow library users. Further, any noise that players do create will be rare, brief and more than likely contextually appropriate. This is something that we will investigate in the user study.

*Accountability* refers to whether actions are traceable to the source, who can be held accountable for any adverse effects caused [14,25]. In the current game, the potentially invasive behaviour (the making of noise) is inseparably and observably linked with the player (i.e., the person who makes the noise). Not only is the player easily held accountable for their actions by non-players, but that accountability is actually a core component that drives fun of the game. Indeed, if players do not feel any compulsion to remain quiet, the game will not provide an interesting experience.

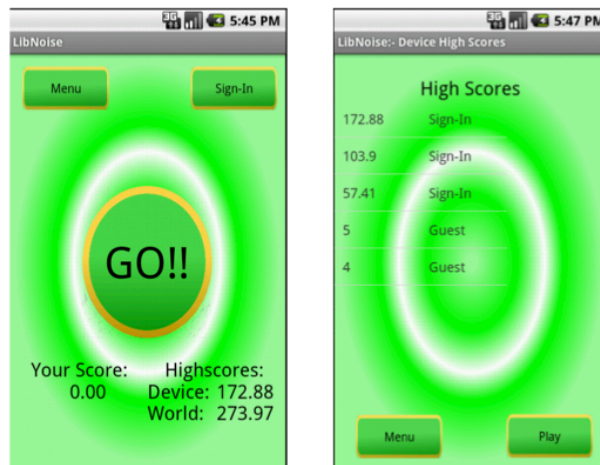
The experience that the game is designed to provoke is the complex dilemma of whether or not to act. This dilemma serves as an analogue for some of the most challenging situations that we commonly experience, which often involve the strong urge to act but reluctance to do so because of social norms; such as whether to intervene in arguments between spouses, or the need to tolerate the extreme political beliefs of a relative at a family gathering. We believe that pervasive games can provide fascinating, memorable experiences through allowing players to explore exactly these types of complex social dilemmas.

## Game Design

The experimental game prototype, called *Shhh!*, was inspired by the children's playground game, mentioned above, which dares players to make loud noises in inappropriate situations (usually the classroom). This game provides an interesting basis for our exploration of social rules of built environments as game mechanics, due to the combination of simple mechanics and the genuine excitement it encourages in players. We decided to set the game in libraries, as these are buildings that have obvious and easily understood rules that are (primarily) enforced by social convention (i.e., disapproval by other library users is a much more likely consequence of play than formal action by the library staff). Moreover, since we had a great deal of experience with observing the social rules of the library, were confident that players would feel compelled to engage in socially acceptable behaviour, thus creating for players the desired social dilemma of whether or not to act.

The original playground game was altered through the development of an application that runs on Android mobile devices. Specifically, the application uses the phones' audio input to measure sound levels. This allows players, upon making a noise, to see a score that corresponds to the sound that they made. It also allows for that score to be saved to a leader board, facilitating asynchronous play.

Upon reaching a library in which they wish to play, the player launches the game application on their mobile device. The application initially verifies whether the player is genuinely in a library (this feature was not implemented in the prototype evaluated), before presenting the main input screen (figure 1). This screen is composed primarily of one large button, which, when pressed, activates the device's microphone. The player is expected to make a noise at this point. The application identifies the volume of sound in the environment at that moment (using an algorithm that averages values returned by the 'getMaxAmplitude' function of the 'Media Recorder' utility within the Android OS). When they have finished making noise, the player clicks the button again to stop recording. The application returns a score to the player; louder noises produce higher scores. This score is then added to both the overall league table for the game, plus a league table for the specific library in which they played. The local league table facilitates people to compete with their friends, colleagues and classmates in an uncomplicated manner.



**Figure 1.** Screenshots of prototype application. Left panel shows the input screen. Right panel shows the leader board.

## Plan for Evaluation

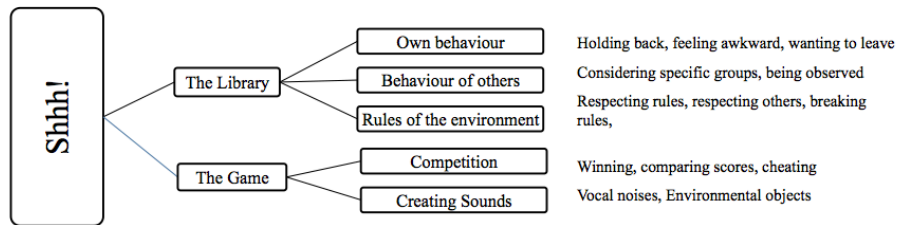
The intention of the study was to understand participants' experience of engaging with the experimental game. Since no model already exists for explaining the type of task the game asks players to undertake, it was important to explore participant experiences in an open-ended, qualitative manner. Six participants were recruited through a combination of advertisements and personal contacts. Each participant engaged with the study separately. The study took place in the main library of a UK University. Participants initially met the researcher outside the library, where a brief explanation of the game was presented. A smart phone, on which the game had been

installed, was then given to the participant and they were asked to carry out three simple tasks using the application to ensure that they understood how it worked; view the local high scores, view the global high scores, sign in. Participants were then asked to enter the library, to try to “get a high score,” and to return when they were finished. Subsequently, participants were taken to a more relaxed environment, where a semi-structured interview took place to understand the player’s experience of playing the game. The researcher began by asking participants how they felt generally about the experience, before asking specifically about the library environment, how they felt about making noise and playing games in that environment, and whether other library users reacted in any way to their behaviour. Participant responses were audio recorded and later transcribed. These transcripts form the basis of the analysis presented below.

Interview transcripts were analysed through inductive thematic analysis [6], a form of qualitative analysis particularly useful for investigating novel subjects in little-understood domains. Data was first read carefully multiple times by the first author. The structure of the data was then broken down to allow for analysis. Specifically, each separate concept (often, but not necessarily corresponding to a sentence) expressed by a participant was assigned a separate row in a spreadsheet. A total of 24 relevant conceptual labels, formed of short sentences and quotes, were derived from the corpus of interview data by the second author. These, together with a description and examples of each code, were given to the first author, who analysed the data independently and examined the fit of the codes to the data. Results of both analyses were compared and consensus reached on a code list of 13 categories.

## **Results and Discussion**

Six first-order themes were identified, which formed two second-order themes; *considerations of the library environment*, and *considerations of game play*. The coding scheme is illustrated in (Figure 2). While the themes identified appear to represent distinct concepts, it must be noted that they all discuss aspects of the tension between playing the game and behaving appropriately in the library. Hence, participant’s utterances could often be classified under a number of these codes. However, we are confident that this coding structure aids the reader in understanding the subjective experience of participants. The identified themes are expanded upon in detail below. All quotes are presented unedited.



**Figure 2.** Illustration of the coding scheme used to describe qualitative data.

### Considerations of the Library Environment

Understandably, a lot of discussion focused on the nature of the library as an environment in which to play. These discussions can be described under three first order themes; players' awareness of their *own behaviour*, the *consideration of others* and the *rules of the environment*.

**Own Behaviour.** This theme refers to instances when participants expressed acute awareness of their own behaviour while playing the game. This is interesting as it provides some insight into their willingness (or reluctance) to engage with the game task, as well as the impact of the social environment on their behaviour. Participants often regretted making sounds and drawing attention to themselves;

*"....I was stood in a stairwell where it was quite busy and I just yelled 'mic check' as if I was checking the microphone to get the levels right and I realised it was quite loud.....I sort of looked at it and went ' I'm in a library I need to be quiet'"* (P6).

The majority of the participants reported feeling out of place and out of their comfort zone by playing the game in the environment chosen. P1 suggested, *"it was a bit weird to be honest and very strange*. The word most commonly used by participants when describing how they felt when playing the game was *"awkward"*. They reported feeling awkward while walking around the library devising strategies for making sounds that wouldn't draw attention to them. Another participant mentioned that they spent a lot of the time sitting at a desk, speaking random words into the phone, which led to them feeling *"rather odd."*

Many participants tried to blend into the environment while playing the game, so that non-participants wouldn't think they were acting strangely or inappropriate. For example, P5 reported,

*"...the librarian walked passed me while I was sat at a desk and I turned the phone off and just sort of opened up an email from my tutor and pretended to compose an email..."*

A similar experience was reported by P3, who sat at a desk surrounded by books while playing the game, in order to give the appearance of doing work;

*"...I also sat at a desk by myself with some books, so I made a look round to make sure no one could see me..."* - P3.



P2 was very uncomfortable with playing the game; “...erm I played it for literally five minutes maybe a bit less and I felt like I didn’t want to play anymore.” Interestingly, despite only staying in the library for a few minutes, the above participant reported one instance of shouting directly into the microphone at the top of their voice. “I was like, I cannot get any louder than what they have done ...” In fact, it was after making this very loud sound that the participant refused to play anymore due to people staring at them.

The finding that the majority of participants felt very aware of their own behaviour, often to the point of awkwardness, suggests that they were very aware of the social environment while playing. However, it must be noted that only one participant (P1) failed to engage enthusiastically with the task. This participant reported discomfort at the task that the game asked them to carry out, “it had a whole stigma over the noise levels.” Thus, despite their awkwardness and reluctance, most players did seem to engage (cautiously) with the game, taking steps to minimise social disapproval.

**Consideration of Others.** This theme refers to instances when participants specifically expressed consideration of other library users (i.e., non-participants) in their discussion of game play experience. This provides further insight into their awareness of the social environment. One participant reported that, when in a part of the library where it wasn’t frowned upon to talk, they still felt a bit uncomfortable making loud noises. This was due to the fact that some of the nearby library users were mature students (the UK term for older students in higher education), “there were more older people in the library at that time as well. Yeah I thought about that a bit more as I didn’t want to disturb them” (P1).

Due to the fact that the prototype application was installed on a specific device, which was given to participants at the beginning of the session, participants often had two phones with them in the library. Participants reported awareness that people looked at them strangely for having two phones on them. “No-one came up to me, just the funny looks I had from holding two phones at one point....” (P4). Indeed, participants reported noticing that sometimes non-participants sat and stared at them in an intimidating manner. Interestingly, none of the non-participants actually came up to the participants to find out what they were doing or why they were acting so strangely. P6 suggested, “Most people are shy when you see someone doing something.

A number of participants reported paying more attention than normal to the behaviour and conversations of others in the library. For instance, P3 noticed how much non-participants discussed nights out and other social events rather than their work: “It has people who annoy you as they speak about their night out, but I suppose that’s it really, people have different attitudes towards the library.” This was very interesting, as it is some indication that the game led participants to not only notice others more than normal, but also pay attention to their conversations and actions. Interestingly, the above participant mentioned that if they were talking so much they would, “feel quite embarrassed by doing that. Just how it is really.” Ironically, they were also playing the game at the time, making sounds and breaking the rules of the envi-

ronment. Overall, it seems that the game provoked participants into deeper contemplation of social features of the library environment.

**Rules of the Environment.** This theme examines how players' awareness of the social rules of the library environment affected their experience of playing the game. Most participants reported initially respecting the rules of the environment, "*When I was first in there I was quite reserved 'cus I didn't want to make too much noise in the library*" (P1). Interestingly, while most participants felt like this initially, none of them refused to engage with the game entirely.

In the particular library where this research was carried out, there are numerous floors, only one of which has a strict rule on absolute silence. It seems that, out of respect for the rules, participants largely avoided playing games on that floor, "*...you see I was on the first floor, you're allowed to speak and do what you want, if I was on the third floor the yes, obviously.*" That participant was then asked if they had been on the third floor would they have played the game or been too afraid to. They responded with "*I would have felt to embarrassed and scared to do it.*" Thus, even while playing an intentionally disruptive game, participants carefully adapted their behaviour to subtle differences in social rules in different parts of the same building. This finding is fascinating, as it illustrates the dilemma that players of *Shhh!* felt they were faced with; the complex calculations involved in balancing the competitive, goal directed behaviour of game playing versus the social rules of the environment in which it was played. Players wanted to win, but they didn't want to be embarrassed or to get caught.

Since the third floor of the library in which we held the study has uniquely strict rules on noise levels, we assumed that absolutely none of the players would attempt to play there. However, this was not the case. Two participants saw the strict rules of this floor as a challenge. Fascinatingly, players adapted the sounds they made due to the less forgiving environment to something more "*subtle and something you could get away with*" (P5). These participants felt the need to make sounds that seemed natural in that context, for example, dropping books on the floor. P6 tried blowing into the microphone as a way of making noise. However, instead of simply picking the phone up blowing into the microphone the participant reported, "*I'll pick up the phone and look a bit confused into the phone and blow into the mic.*" (P6). The participant felt the need to put on an act in order to avoid disapproval.

The playing of the game on this floor by a minority of players is interesting, but not unproblematic, since it is not clear whether it crosses the line between mischief and genuinely antisocial behaviour.

"*...you could almost argue that competition in this game almost encourages extreme behaviour or cheating because you can't beat them without extreme behaviour.*" (P5).

However, these players did not simply go into the quiet area and shout into their phones, they attempted creative ways of gaining high scores that had less likelihood of bringing about undesirable consequences, and thus were interacting thoughtfully within subtle social rules of the social environment. In social terms, playing in this location had a higher likelihood to cause embarrassment for the player, to cause dis-

ruption to non-players, and, indeed, to bring about disciplinary action for the player. In gaming terms, these players saw this floor as having a higher level of difficulty and were intrigued and challenged to produce a high score in this less forgiving environment.

### **Considerations of Game Play**

While the majority of discussion focused on the library environment, there was also significant discussion regarding the playing of the game. These topics of discussion can be described under two first order themes; *competition*, and *strategies for gaining high scores*.

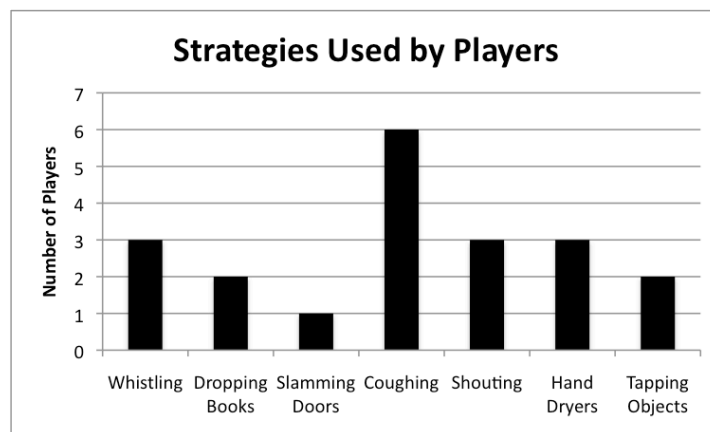
**Competition.** Competition was facilitated through a simple leader board in the application. Discussions of competition are interesting, as they demonstrate that the game design, while incredibly simple, was engaging enough to present participants with the dilemma of whether or not to break the social rules of the library environment.

Most participants reported competition as a motivator for their continued play, *“It said the world high score was 112. So I aimed for to beat that and I did beat that. I didn’t smash that record but I beat it! Will you acknowledge that I beat your score?”* (P3). Other participants found that they just wanted to get on to the leader board and not worry about being the best, *“...I mean I saw the scores and I wasn’t aiming for the top I was aiming to go mid table and I ended up score quite high on my first few tries....”* (P6). When participants saw that their scores were close to the record, it made them want to play more, *“...that’s when I thought, you know what if I’m going to make my mark on the game, you got to set the bar for someone so I just raised the bar an extra bit higher.”* (P6).

It became apparent through analysis of the data that what was happening in the game was being discussed amongst friends. For example, a number of participants reported that, before they participated, they discussed the game with people who had already played it. Rather than being upset at the apparent corruption of the naivety of our participant pool, we saw this as evidence of the engaging nature of the game and the inherent competition that it provoked. *“...I heard from a previous person ... that he coughed also and I thought I would just try and beat him”* (P1); *“Well yeah, I wanted to beat my house mate.”* (P2); *“it is more fun in a group”* (P1). Participants mentioned that their discussions of the game pushed them to get higher scores, as they dared other players to beat their scores, *“I mean I could twang a bass string or hit a drum and be like ‘yeah go on, try and beat my score, I dare you’”* (P6); *it is bragging rights really... ..So you know it is good fun to see that I had taken over all the leader board, absolutely”* (P6).

**Strategies for Gaining High Scores.** The only action available in the game was to make and record a noise. However, this action was in direct contradiction of the social rules of the library environment. Thus, it is interesting to understand the strategies adopted by players in making those noises, as they give some indication of the dilemmas faced in playing this game. It seems that generally the strategy was to use

sounds that are naturally loud, but also not uncommon in library environments. Figure 3 presents a summary of the different strategies reported by players. As seen in figure 3 many participants chose to play by coughing into the microphone. This strategy was chosen in an effort to not draw attention to themselves. When asked whether they tried anything else, many replied in the negative. Participant 1's response was this: *"No, as I didn't want people looking at me in a funny way"*.



**Figure 3.** Number of players who reported using each of a number of strategies for generating sounds. Note: some players used multiple strategies.

A number of participants did have creative ideas to make sounds, often choosing to stage ‘accidents’ in order to create loud noises without incurring the disapproval of fellow library users,

*“...as you know they have those little step stool kind of things to get to the top shelves. I sort of considered walking down the aisle with a book and not notice and just kick it by “mistake” and maybe try and pretend I sort of fell over. But yeah I didn't do that in the end” (P5).*

This combination of creativity and reluctance demonstrates the tension between the social rules and game rules, and the complex dilemma experienced by game players. As shown in figure 3 the most popular ‘accident’ was the dropping of books on the floor. Indeed, this strategy often led to high scores for the participants. Other players slammed doors, and tapped the device on objects such as desks. Participants preference to be seen as clumsy rather than intentionally loud demonstrates the powerful need for social acceptance in this environment.

Many of the participants felt that they couldn't achieve a high score by simply using their own voice or by making noises with books and door. This led to them to, in their own words, cheating, through using the hand dryer in the toilets to gain a score. Specifically, participants walked in to the toilets and put their hands under the dryer to set it off, put the phone underneath and pressed ‘Go!’ This produced a very high score. In discussion, these participants mentioned they did this because they couldn't find any other way of achieving the high score without shouting *“...I was*

*kind of coughing really loudly....to beat him, but I didn't so I thought I will cheat because I want that score!"* (P5). Participants were apparently more willing to break the rules of the game than the rules of the environment.

In summary, due to the competing demands of the game rules and the social environment, players demonstrated great creativity in adapting their behaviour to social expectations. This emphasises the social dilemma presented by the game as well as the power of the social environment over player behaviour. Players were reluctant to ever cause significant disruption to non-players.

## Conclusions

This paper proposes the harnessing of existing social rules in built environments as a basis for designing provocative and engaging pervasive games. An experimental game, *Shhh!*, was designed, which challenged players to make noise in an environment (a library) where that is acknowledged as inappropriate behaviour. Six participants played the game before engaging in semi-structured interviews. Participants reported a keen awareness of the rules of the social environment in which they played. While they demonstrated a willingness to play the game, and enjoyment at doing so, they also demonstrated a commitment to cause as little disruption as possible to non-players, taking steps to minimise social disapproval. Players showed remarkable sensitivity and creativity in adapting their behaviour to social expectations, and indeed, demonstrated great complexity of behaviour in playing with the rules of the social environment. These findings suggest that pervasive games that play with social rules of built environments have great potential to provide interesting, challenging and fun experiences for players.

Since participants in this study found their playing with social rules a challenging and engaging activity, it may be worth exploring this design strategy further. Specifically, few pervasive games have explored how the social rules inherent in the built environment can function as part of pervasive game play mechanics. We propose a model for designing pervasive games that acknowledges the engaging potential of the social, as well as physical, characteristics of a built environment (see Table 1). This model describes how, when designing the mechanics of a pervasive game, we should consider devices and mobility as means for players to navigate the physical environment, and the subjective experience and behaviour of the player as means to navigate the social environment.

**Table 1.** Description of the features that must be considered in the design of pervasive games.

<b>Opportunities for Design</b>	<b>Environment</b>	<b>Players</b>
Physical	Geography	Devices, Mobility
Social	Social Rules	Behaviour, Experience

In designing games that play with existing social rules it is important to consider the line between mischievous and antisocial behaviour. Mischievous behaviour is playful and serves to explore and test the boundaries of social acceptability [19]. This

is contrast to the intent of grieving or trolling, which is purposefully disruptive, often with negative and anti-social intentions. As pervasive game designers, we must consider our own behaviour in these terms, ensuring that while our games allow for an exploration and questioning of social rules, they don't simply give permission for players to behave in an antisocial manner (for example, 'dark play' [31]). We do not want to lower the barriers to behaviour that could cause real harm to the experienced quality of life of non-players. In this respect, we were guided by Niemi, Sawano and Waern [25], in understanding gameplay in terms of anonymity and accountability. In the design of the current game we speculated, based on a great deal of experience with the environment in question, that players were unlikely to ever cause significant disruption to the library. However, we could not be certain of this without carrying out a user study. Findings suggested that players were extremely reluctant to engage in any majorly disruptive behaviour, and indeed, went to great lengths to only generate context-appropriate noises. We suggest that an observational user study is particularly important, for ethical reasons, when designing a game that plays with social expectations in order to ensure that the game does not unintentionally provoke or facilitate genuinely antisocial behaviour.

The approach to pervasive game design outlined here may serve useful for the design of games for purposes other than entertainment (see [11]). Indeed, the approach seems ideal for provoking in players critical reflection on the values underlying the design of built environments, the social rules inherent in those environments, and the ways in which our behaviour is controlled by those rules. This seems to align well with the goals of critical design [10], which "*provides a critique of the prevailing situation through designs that embody social, cultural or technical values*" (p.58). Indeed, the approach outlined here may represent a uniquely powerful type of critical design, since it allows the designer to provoke users to reflection in the very environment the artefact is intended to criticise.

## References

1. Bandura, A., McClelland, D. C. (1977) *Social learning theory*. Prentice Hall: NJ.
2. Bandura, A. (2001). Social cognitive theory: An agentic perspective. *Annual review of psychology*, 52, 1-26.
3. Baron, R. A., Byrne, D. E., & Branscombe, N. R. (1999). *Social psychology (9<sup>th</sup> Ed)*. Holt, Rinehart and Winston.
4. Bell, M., Chalmers, M., Barkhuus, L., Hall, M., Sherwood, S., et al., (2006). Interweaving mobile games with everyday life. In *Proceedings of ACM CHI* (pp. 417-426). ACM.
5. Benford, S., Anastasi, R., Flintham, M., Greenhalgh, C., Tandavanitj, N., et al. (2003). Coping with uncertainty in a location-based game. *Pervasive Computing*, 2, 34-41.
6. Braun, V. and Clarke, V. (2006) Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3, 77-101.
7. Cheok, A. D., Yang, X., Ying, Z. Z., Billinghamurst, M., & Kato, H. (2002). Touch-space: Mixed reality game space based on ubiquitous, tangible, and social computing. *Personal and ubiquitous computing*, 6, 430-442.

8. Cheok, A. D., Goh, K. H., Liu, W., Farbiz, F., Fong, S. W, Teo, S. L., et al. 2004. Human pacman: A mobile, wide-area entertainment system based on physical, social, and ubiquitous computing. *Personal Ubiquitous Computing* 8, 71-81.
9. Crabtree, A., Benford, S., Rodden, T., Greenhalgh, C., Flintham, M., et al., (2004). Orchestrating a mixed reality game'on the ground'. In *Proc ACM CHI* (pp. 391-398). ACM.
10. Dunne, A., & Raby, F. (2001). *Design noir: The secret life of electronic objects*. Springer.
11. Flanagan, M. (2009) *Critical Play: Radical Game Design*. MIT press
12. Gentile, A.P. Reinventing Airspace: Spectatorship, fluidity, intimacy at PEK T3 (2009). *J of Architecture, City & Environment*, 4, 9-19.
13. Foo, C.Y. and Koivisto, E.M.I. (2004). Defining grief play in MMORPGs: player and developer perceptions. In *Proc. of ACE '04*. 245-250. ACM.
14. Friedman, B., Kahn Jr, P. H., & Borning, A. (2006). Value sensitive design and information systems. *Human-computer interaction in management information systems: Foundations*, 4.
15. Huizinga, J. (1956). *Homo ludens*. Hamburg: Rowohlt.
16. Kellerman, A. (2008). International airports: Passengers in an environment of 'authorities'. *Mobilities*, 3, 161-178.
17. Kirman, B. (2010). Emergence and playfulness in social games. In *Proceedings of Mindtrek* (pp. 71-77). ACM.
18. Kirman, B. (2011). Playful networks: Measuring, Analysing and Understanding the Social Effects of Game Design. PhD Thesis, University of Lincoln.
19. Kirman, B., Linehan, C., & Lawson, S. (2012). Exploring mischief and mayhem in social computing or: how we learned to stop worrying and love the trolls. In *Proceedings of ACM CHI* (pp. 121-130). ACM.
20. Kirman, B., Linehan, C., and Lawson, S. (2012). Blowtooth: A Provocative Pervasive Game for Smuggling Virtual Drugs through Real Airport Security. *Personal and Ubiquitous Computing*, 16, 767-775.
21. Linehan, C., Kirman, B., Lawson, S., & Doughty, M. (2010) Blowtooth: pervasive gaming in unique and challenging environments. In *Proc ACM CHI Extended Abstracts* (pp. 2695-2704). ACM.
22. Magerkurth, C., Cheok, A. D., Mandryk, R. L., & Nilsen, T. (2005). Pervasive games: bringing computer entertainment back to the real world. *Computers in Entertainment*, 3, 4-4.
23. Maxis (2008). *Spore*. PC: Electronic Arts.
24. Montola, M., Stenros, J. and Waern, A. (2009). *Pervasive Games: Theory and Design*. Morgan Kaufmann
25. Niemi, J., Sawano, S., and Waern, A. (2005). Involving non-players in pervasive games. In *Proc 4th conference on Critical computing*.
26. Rapoport, A. (1982). *The meaning of the built environment: A nonverbal communication approach*. University of Arizona Press.
27. Rashid, O., Mullins, I., Coulton, P., & Edwards, R. (2006). Extending cyberspace: location based games using cellular phones. *Computers in Entertainment*, 4, 4.
28. Reid, J. (2008, September). Design for coincidence: incorporating real world artifacts in location based games. In *Proceedings of the 3rd international conference on Digital Interactive Media in Entertainment and Arts* (pp. 18-25). ACM.

29. Salen, K. and Zimmerman, E. (2003) *Rules of Play: Game Design Fundamentals*, MIT Press
30. Sotamaa, O. (2002) All the World's a Botfighter Stage: Notes on Location-Based Multi-User Gaming. *In CGDC Conference Proceedings* (pp. 35-45).
31. Zagal, J. P., Björk, S., & Lewis, C. (2013). Dark Patterns in the Design of Games. *In Proceedings of Foundations of Digital Games*.