Parallel Worlds : Immersion in location-based experiences.

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ABSTRACT
This paper analyses the stages and circumstances for immersion based on quantitative and qualitative feedback from 700 people who took part in a three week long public trial of a location-based audio drama. Ratings of enjoyment, immersion and how much history came alive all scored highly and people often spent up to an hour in the experience. A model of immersion as a cycle of transient states triggered by events in the overall experience is defined. This model can be used to design for immersion in future experiences.

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Immersion, Situated, Interactive, Located, Mobility.

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H1.2 User/Machine Systems; H5.1 Multimedia Information systems; H5.2 User Interfaces.

INTRODUCTION
Immersion is a powerful phenomenon that is frequently cited as a measure of success for games and virtual reality experiences. It has a strong affinity to the concept of flow where the sense of time and self are lost, and attention is completely focused on the current activity [3].

In a study of computer games Brown and Cairns [2] identify three stages of immersion, engagement, engrossment and total immersion. Total immersion is only reached when a player has become competent at the game interaction and has become engrossed in the game dynamics to the extent that they have some emotional investment in the game.

Unlike computer games or virtual reality where the environment is simulated, in a situated experience the environment is often a real public space where the physical structures and social protocols are pre-defined [7]. Elements like weather, other people, animals, noise and other events cannot be controlled and will become part of the experience. Our research examines how these environmental elements, combined with the physical aspects of movement, affect how immersed people can become in an experience.

Overview of *Riot! 1831*
We commissioned two writers to write an interactive play called *Riot! 1831* which was staged for public consumption in Queens Square, Bristol, England for a period of three weeks in Spring 2004. The interactive play is based on the actual riots that occurred there in 1831. Walking round the square triggered a variety of sound-files, each one a short vignette based on real events that took place in the square. For example you could hear the rioters' voices as they plundered the surrounding buildings, the flames as buildings burn, the merchants as they flee for their lives and the Dragoon Guards as they sabre-charge through the crowds cutting the rioters down.

Thirty-four regions covered the 150m wide square and associated with each region were three different sound files. In general moving into a region would trigger one of the sound files to start playing and moving out of the region would cause it to stop.

The trial
Visitors could sign up and receive the loan of a small back-pack containing an iPAQ PDA, GPS receiver and headphones with which they strolled around the square. They could choose to walk round the square individually or as a pair, physically linked by a headphone splitter.

During the trial period over 700 people tried out the experience, from which we have 563 usable questionnaires, 531 trace file recordings of their movements around the square and 30 semi-structured interviews with participants.

This paper is about the stages of immersion in this location-aware situated mobile experience and the implications for future designs. We first describe the experience of a father and son as an illustration of the findings from the interview data and the system-trace files of movement. We then relate that experience to more general findings drawn from the questionnaires, interview analysis and other trace files. We go on to describe the design implications for future situated experiences.

THE EXPERIENCE OF A FATHER AND SON
In this section we describe the experience of a father and son, aged 10, who took part in *Riot!* and then volunteered to be interviewed.

The following extract shows how the son in particular initially experiments with the system to discover the effect

of being on a region boundary. This is similar to the engagement stage of immersion in computer games. He enjoys the process of discovery and engages with the interaction style.

> Father: *... We took a while to familiarise ourselves. I think we must have crossed over a few times because sometimes we would say, "What's this" and then it would drop out. Yeh I got used to it and then I was fine. Did you get used to it?*
>
> Son: *Yeh I always find that I stand at the edge of the zones and sometimes it turns off and then turns back on the sound.*
>
> I: *So you worked out that you were on the edge of the zone did you?*
>
> Son: *Yes*
>
> I: *Did you try to move in so that you were less on the edge?*
>
> Son: *Yes*
>
> I: *And how did you work out where to go?*
>
> Son: *I just tried going each way and if it stayed for a while then I knew I was nearer the middle.*
>
> Father: *I could see you were going like a crab at times. You were going two paces that way then that way*

Figure 1 shows the map of the regions in the square and the thick line punctuated by dots shows the path that the son took around the square. Each dot indicates a sound file starting up or stopping.

Figure 1 also shows the amount of content heard in each of the regions. There are three files that can be played in each region and so to hear all of the content each region would have had to be entered three times and the whole of the sound file listened to each time. The son listened to a large proportion of the content and often revisited regions. Both father and son spent over an hour in the square and listened to sixty-two different sound files. The time that they invested listening and exploring the square shows that they were engaged in the content. The son also shows some emotional engagement with the play "*You could also see - like picture what was actually happening because you could actually know what it would have been like and you could actually picture the people who were in the riot*"
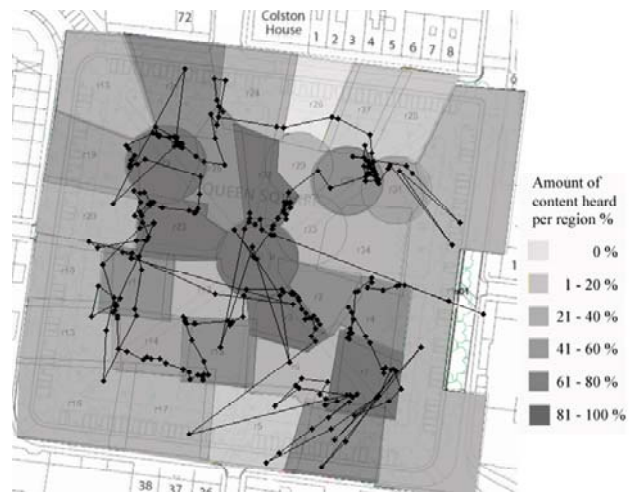
Their interview also indicates that they may have become totally immersed at times.

> I: *How about other people in the square?*
>
> Father: *I paid no attention to them whatsoever I must confess*
>
> Son: *I was more listening than looking really*
> Father: *We were well absorbed*

Figure 1. Son's route walked and amount of content heard

While both father and son report feelings of immersion they also describe talking to each other and swapping headphones to share their experience. The path in figure 1 shows that their experience was not smooth. A lot of dots clustered together on a boundary indicate a choppy experience with sound files frequently starting and stopping. The long "V" shapes indicate a large GPS bounce, where the person has not actually moved but GPS has reported an erroneous reading.

These discontinuities suggest that throughout the experience episodes of deep immersion are interspersed with episodes of navigation, searching and communication. This implies that fleeting or sporadic periods of deep immersion are so powerful that they can make the overall experience feel really compelling despite system problems and choppiness.

IMMERSION REPORTED IN THE WIDER RESULTS

The experience described of the father and son is fairly typical. Many people stayed in the square for nearly an hour and listened to a lot of the content. This section describes the findings from the questionnaires, interviews and trace files with regards to feelings of immersion.

Correlation between immersion, enjoyment and history coming alive

On returning their equipment visitors were asked to rate six questions in a graphic rating scale format [6]. Three questions asked how much they enjoyed it, how much history came alive and how immersed they felt. All three scored highly with mean ratings of 74.5, 73.7 and 73.3 respectively on a scale ranging from 0 (not at all) to 100 (very much). There were also highly significant inter-correlations between the three questions making them powerful determinants of the overall experience (table 1).

The strong interrelationship shows that immersion is a positive determinant for enjoyment (and vice versa). We also infer that history coming alive is a special form of

immersion that is related to the nature of the play and the historical setting.   For example interviewees reported empathy with the people involved in the riots and a sense of walking in their footsteps "*you can actually relate to this area and in some instances imagine that the people who were talking are in front of you because that was actually happening to people in 1831. You have to have that.*"

	Enjoyment	History
Immersion	r = .65, df = 561 **p < .001**	r = .65, df = 561 **p < .001**
Enjoyment		r = .70, df = 562 **p < .001**

Table 1. Correlations between immersion, enjoyment and history coming alive.

Sound and vision

In every interview remarks were made on how great the sounds were. The transition between the background noise and a new sound file starting up was immediately engaging. "*... the first sound is quite compelling, whatever it is, you catch it out of the periphery, it felt to me like you caught it peripherally, and it made you whip your head round. I often confused it for a real sound. There was a real moment of immersion and then when I had whipped my head round and realised there was no one there it was kind of oh I was out of it and I almost needed to close my eyes.*"

The dominance of the visual sense and the lack of visible structures that related to the experience in the open square stopped some people from getting immersed. "Y*ou can't get immersed in this because there weren't enough visual hooks. I was dominated by the visual scene and you had to almost shut your eyes to concentrate on the audio*".

Parallel worlds.

Two interviewees referred to the experience as like being in parallel worlds. These people seemed to be able to hold both the current day and the virtually created world in their minds and overlay the two "*I was enjoying being outside and seeing all the environment but at the same time listening to a different story. So you were in two worlds in fact.*"

Others felt they needed to block out the current context to get immersed with the virtual content and sometimes an event in the physical world, such as cars passing or a football flying past snapped them out of the imaginary world. "*I noticed them because of the contrast was so great between what you heard and what you saw*".

Narrative schema

The experience was designed to be random with your movement from region to region jumping you from one vignette to a different one. This non-linear structure introduces similar challenges to that of hypertext [4]. The lack of an overarching narrative schema hinders the process of immersion because of the lack of a familiar structure within which sense can easily be made of the different vignettes. Many people felt they wanted more of a background of the social and political context of the struggle.

Movement

The process of exploring how the system works by walking into regions that we saw from the son was common. Most of the people interviewed describe being confused at the start and it taking ten minutes before they were comfortable with how the system worked.

Most people enjoyed the act of "strolling" and having their hands free "*I did find on a cold day like today it was nice to be able to put your hands in your pockets and not have to hold anything and just listen*".

However it does appear that most people stopped to listen rather than walk continuously. Sometimes they stopped because they were worried about moving out of the region before the end of the file but it also seems that the physical act of walking and needing to look where you were going prevents some people from becoming as immersed as they wanted to be in the experience. "*I closed my eyes when we stopped, if we were walking along obviously I was just looking down but if there was a long bit and we stopped I closed my eyes*"

IMPLICATIONS FOR FUTURE DESIGNS

In this section we define a model of immersion as a cycle of transient states and discuss the implications for future designs.

Immersion as a transient state

We have observed that immersion is a transient state that can be fleeting or can last for several minutes. The circumstances that move people between immersive and non-immersive states are therefore an important consideration for future designs. In Riot the events that immersed people were when a powerful new sound started up, a familiar place was mentioned, a regional accent resonated, a familiar character was recognised or when a physical object in the present day could be related to the current event being described.

Equally important is the transition out of immersion which can be brought about either by the designed pauses in the narrative or through an unplanned interruption such as an event in the physical world or a system fault. If the structure and content of the narrative are not sufficiently engaging attention is lost much more easily.

It is also important to consider the range of feelings that can result following immersion. Feelings can range from euphoria, to terror or confusion. A feeling of euphoria can be achieved when the mind has not been confused by the immersive experience and the transition between immersion

and non-immersion has been smooth. This is most similar to the notion of flow.

A feeling of terror can be evoked through the physical or virtual creation of a dangerous event. For example one boy reported that he was really frightened when he heard the sound of a canon firing because he felt he had actually stepped onto a canon. The re-awakening of your senses to the actual environment after a terrifying experience will bring a feeling of relief. Thrill rides such as roller coasters typically work in this way.

The most frequent feeling reported was that of confusion. The randomness of the sounds you could encounter around the square was designed to emulate the confusion of a real riot. However many people expressed dissatisfaction at not being able to make enough sense of what was going on. Arguably if confusion is followed by a satisfactory sense-making process then it can, like terror, be an effective immersive mechanism.
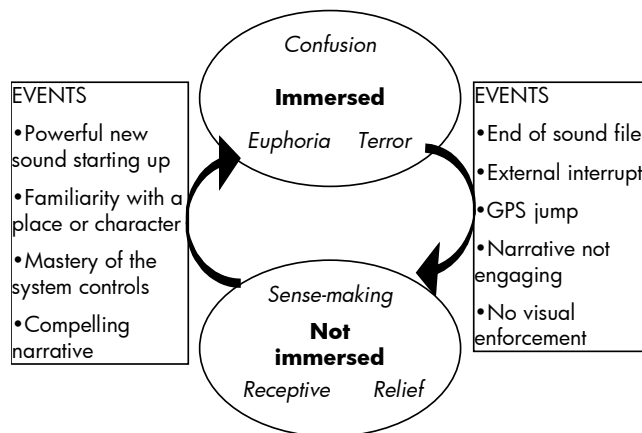
Figure 2. Model of immersion as transient states.

The events that caused a transition between states of immersion and non-immersion are summarized in the model in Figure 2. A general version of the model can be used to design how an experience should flow in and out of immersed and non-immersed states with both planned and unplanned events so that when someone is drawn out of an immersed state they have the context and resources they need to reflect, recover and smoothly become immersed again.

For example when people were trying to understand how the system worked and were confused at the start then extra supplementary structural information or a learning area, similar to that of a learning level in games, would have been useful.

Information, particularly images of the square as it was then, would have helped make sense of the narrative context and situation. It would also have helped to make the narrative more engaging for those who needed more visual clues to make sense of the whole scene.

Stopping on the region boundaries is a well-known problem in location aware mediascapes [1]. Design research is ongoing to help lead people into the central area of a region to overcome their natural tendency to stop as soon as they hear a new sound. [5].

CONCLUSION

The trial provided the means to gather rich quantitative and qualitative data from nearly seven hundred participants. *Riot! 1831* was rated highly for enjoyment, immersion and history coming alive, with many people staying in the experience for over an hour. The stages of immersion identified in video games can be applied to location-based experiences but the prominence of the real world environment means that the immersed states are short with continual dipping between the parallel worlds of the digital and physical. A model of immersion that identifies the different emotional conditions and the events that trigger them is a useful tool to design for immersion.

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REFERENCES

1. Benford, S., Rowland, D.,Flintham, M., Drozd A., Hull, R., Reid, J., Morrison, J., Facer K. Life on the Edge: Supporting Collaboration in Location-Based Experiences. *Chi 2005* (submitted)

2. Brown, E., Cairns, P. A Grounded Investigation of Game Immersion. *Proc. Chi 2004*, ACM Press (2004), 1297-1300

3. Czsentmihalyi M. Flow: *The Psychology of Optimal Experience*. Harper Perennial, 1990.

4. Douglas, Y., Hargadon, A. The Pleasure Principle: Immersion, Engagement, Flow *Proc Hypertext 2000*, ACM Press (2000)

5. Mobile Bristol. http://www.mobilebristol.com/.

6. Stone, H., Sidel, J.,Oliver, S., A. Woolsey & R.C. Singleton. (1974). Sensory Evaluation by Quantitative Descriptive Analysis. *Food Technology*, Nov , 24-34.

7. Whyte, W. "City: Rediscovering the Center", Doubleday, New York, 1988