Uncle Roy All Around You: Implicating the City in a Location-Based Performance

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ABSTRACT
Uncle Roy All Around You is an experience that mixes online and street participants, physical and virtual worlds, and programmed game-play with live performance. Street players journey through the city following clues on their PDA in search of the elusive Uncle Roy, while online players follow their progress in a parallel virtual model and try to help them. Analysis of the premier performance suggests that it was a compelling experience for street players, but less so for those online, leading us to propose several design changes. We also draw out broader design strategies including implicating the surrounding city in the game, creating ambiguity, enabling (safe) crossing of boundaries and encouraging social gameplay.

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Mobile & wireless games, performance

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C2.4 Distributed Systems; H1.2 User/Machine Systems; H5. Information Interfaces and Presentation.

INTRODUCTION
Our focus is on designing new artistic performances that mix online and street players. Online players inhabit a virtual world which they access over the Internet. Street players access the experience as they move through the physical world, for example by using handheld and wearable computers with wireless networking and a positioning system. Our experiences also mix preprogrammed gameplay with live performance, the latter through the involvement of professional actors, to create experiences that provoke as much as they entertain.

From a technology perspective, our experiences combine online gaming with emerging location-based games, including commercial games for mobile phones (e.g., *Bot Fighters!* [9] and *Battlemachine* [10]) and experimental augmented reality games from the research community (e.g., *ARQuake* [8], *Mindwarping* [7], *Pirates!* [1] and *Border Guards* [6]).

Since 1998 we have staged three such experiences. Each has been delivered as a professionally touring performance that has played to audiences around the world, but that has also served as a research project, being studied through a combination of ethnography, audience feedback and analysis of system logs in order to provide insights into experience design and technology development.

Our first experience, Desert Rain, was a multiplayer game based on the theme of the first gulf war in which teams of six players were sent into a mixture of a shared virtual world and a purpose designed physical set on a mission to locate six 'targets' – people who had experienced the war in different ways. Each participant saw the virtual world projected onto a rain curtain, a screen made of a fine water spray through which players and actors could pass. Studies of Desert Rain revealed the subtle ways in which performers and crew orchestrated a player's experience, guiding them and resolving technical problems [5].

Our second experience, Can You See Me Now? (CYSMN), was a game of chase between online and street players. The public access a shared 3D model of a city over the Internet. Performers, using handheld computers with WiFi networking and GPS positioning, chased them through this model by running through the actual city streets. They communicated with one another using walkie-talkies and their talk was streamed out to the online players who could tune in to their experience of the city and so understand how apparently simple actions in the virtual world (e.g., crossing a line on a map) could affect a runner on the streets (e.g., requiring them to dodge the traffic while crossing a busy road). Studies of CYSMN highlighted the ways in which different participants experienced the uncertainties inherent in GPS and WiFi [3] and also revealed how orchestration work spilled out onto the streets [2].

In this paper, we describe a third experience called Uncle Roy All Around You. This is also a game that mixes online players with street players. However, this time the members of the public are on the streets using mobile devices as well as online, with actors only appearing at key moments. Furthermore, the game has a more complex and nuanced structure which replaces the frenetic chase with a mysterious journey through the city.

DESIGN OF UNCLE ROY ALL AROUND YOU

Uncle Roy All Around You mixes street players who journey through a city in search of an elusive character called Uncle Roy, with online players who journey through a parallel 3D model of the same city, are able to follow the progress of street players, can communicate with them and can choose to help or hinder them. The core artistic theme of the work is trust in strangers – be they remote players, Uncle Roy or passersby.

A street player's experience

Street players purchase a ticket for an experience that will last for a maximum of one hour. On arrival at the venue they hand over all of their personal possessions including bags, wallets, mobile phones and keys, in exchange for a handheld computer, a ritual that is intended to increase their sense of anticipation, vulnerability, dependence on Uncle Roy and isolation and disconnection from the everyday experience of the city. An actor briefs them that their mission is to rendezvous with Uncle Roy and explains how to use the handheld computer. They then head out into the city, cross a busy road and enter a nearby park.

Their first task is to find a red marker on the PDA map, to get to the physical location that this indicates, and then declare their position to Uncle Roy. Street players declare their position by using the stylus to drag the 'me' icon on their PDA map to their current location and then pressing the 'I am here' button (figure 1).

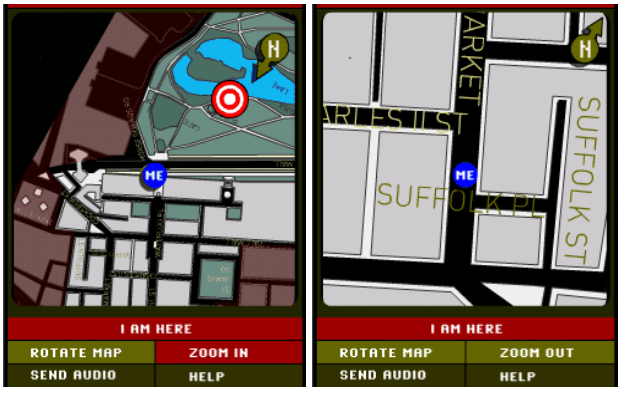

Figure 1: street player's map zoomed out and in

Whenever they do this, they receive a short text message back from Uncle Roy that provides them with a clue as to where to go next. In this way the street players undertake a journey through the city, following a trail of clues that lead them through the park and into the narrow city streets in search of the eventual goal – Uncle Roy's office.

Figure 2: following clues in search of Uncle Roy's office

The clues are preprogrammed (Uncle Roy is therefore the automated voice of the game, not a live actor) and are attached to different zones of the game map. A street player gets an initial clue the first time that they declare themselves to be in a regions and a second and different clue on subsequent declarations. A key feature of the game is that Uncle Roy's clues are deliberately designed to be ambiguous – some are relatively direct and useful, while others are misleading to the point of being mischievous, encouraging players to follow diversions, drawing on the history of the local environment, implicating passersby in the game, heightening the sense of being watched and also casting doubt on the intent and personality of Uncle Roy, especially the extent to which he can be trusted. Clues also constantly reminded players that they were on limited time and that the clock was ticking. Examples of clues include:

> Good. I want you to walk towards the Mall. Watch a tourist cross the road and follow them. There are some hidden steps among the buildings. You have NN minutes remaining.
>
> You are doing well. Drift towards Buckingham Palace. After a couple of minutes click I am here. You have NN minutes remaining.
>
> It's not a shock. The borders are policed. It's always been so. Look for a road leading of the square - one you have not been down before. Walk down it. You have NN minutes remaining.

And when they finally reach the zone containing Uncle Roy's office:

> Go to number 12 Waterloo Place and ring the buzzer marked Roy.

The performance was staged in a area of central London that was roughly 1600 meters East-West by 1200 meters North-South, centred on the Institute of Contemporary Arts (the hosting venue), with St James' Park in the south and the narrow streets of Westminster in the North (figure 3).

Overall, there were 49 distinct regions in the game covering an area of roughly 1 square kilometer, ranging in size from roughly 150 by 150 meters in the open park area down to roughly 10 by 10 meters in the narrow city streets. The clues were defined by colouring the game map (each colour mapped onto a distinct pair of clues), allowing regions to have irregular shapes and also providing artists

with an easy and yet flexible way of defining and refining the clue trail.

Figure 3: a map of the game area

Figure 4 shows the final colour-map for the game. The two outer regions contained clues that were intended to guide lost players back into the main game area. The innermost of these (orange) returned the message: “The policeman was firm but polite, not this way today” (first declaration) followed by “You are off track” (second declaration); while the outmost region (yellow background) returned the messages “I cannot guide you out here. You have got lost. Go back the way you came” followed by “Retrace your steps, you are too far away and in the wrong place”.

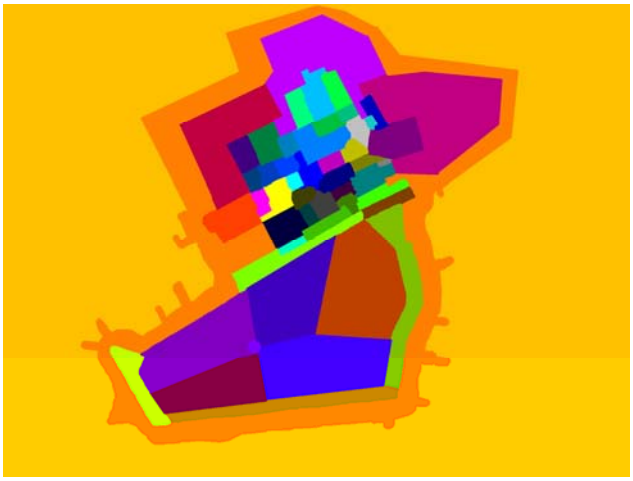

Figure 4: the final clue colour-map showing key locations

As they follow Uncle Roy’s clues, street players may also begin to receive text messages from remote online players who, it becomes apparent, are able to follow their progress through the city and who may appear to know important information such as the whereabouts of Uncle Roy’s office. In return street players can upload short (seven second) audio messages for these online players, and so can try to establish a relationship with them and enlist their help. Of course, online players may or may not be helpful, and their advice may often contradict Uncle Roy’s clues, bringing a further dimension to the question of who to trust.

Eventually most (but not all) street players find their way to Uncle Roy’s office door within their allotted time and they then enter the final phase of the game. At this point their PDA switches over to giving them a pre-scripted and timed series of text instructions. They are asked to press a buzzer by the door. The door slides open and they are invited to step into a deserted office and asked to look around. The office shows signs of recent habitation – the lights and radio are on – and laying on the desk is a postcard with the question “when can you begin to trust a stranger?” They are invited to fill in their answer to this question (figure 5) and then to site in the chair, look up at a nearby camera that is mounted on the wall and picture a stranger in their mind.

Figure 5: writing the postcard in the office

After a few more minutes, they are asked to leave the building – taking the postcard with them – and wait in a nearby telephone box. The phone rings and on answering it, a human voice tells them to walk around the corner and get into a waiting limousine. An actor climbs in beside them and the limousine pulls off. During the ride, the actor asks them a sequence of questions about trust in strangers, and tells them that somewhere else in the game another player is answering these same questions. Finally, he asks them whether they are willing to enter a year long contract to help this stranger if ever called upon. If they agree, he asks for their address and phone number, the car pulls up by a public postbox and the player is asked to post their postcard – addressed to Uncle Roy – to finally seal the contract.

Figure 6: The telephone box, limousine and postbox

An online player's experience

An online player, connected to the game over the Internet, journeys through a parallel 3D model of the game space. They can move their avatar through this model using the arrow keys on their keyboard, encounter other online players and send them public text messages. Online players also access a set of cards that provide details of the current street players in the game, including their name, gender, brief description and photograph that was taken when they registered to play. They can choose to send private text messages to individual street players or listen to their most recently uploaded audio message.

Figure 7: online player's interface: own avatar (white figure), street player cards (right), street player's position (red sphere) and text message boxes (bottom).

Online players find photo objects as they explore the model. Entering these triggers the display of photographs from the actual city streets at this location, one of which is labeled as Uncle Roy's office and shows an image of his distinctive office door (figure 8). In this way, online players can find out useful information for street players.

Figure 8: Accessing a photo of the office door

Street players' estimated positions as they move through the city are shown as pulsing red spheres in the 3D model (see below for a discussion of our approach to positioning). Whenever a street player explicitly declares their position to Uncle Roy in order to receive a new clue, this representation is significantly enhanced (figure 9) – red lines radiate from their position, a large red sphere becomes visible and gradually shrinks down to this position like a deflating balloon, a dramatic sound is played, and the online player also sees the clue from Uncle Roy.

Figure 9: watching a street player declare their position

Online players can zoom out to a bird's eye view that shows the positions of all online and street players and key landmarks marked and labeled (figure 10).

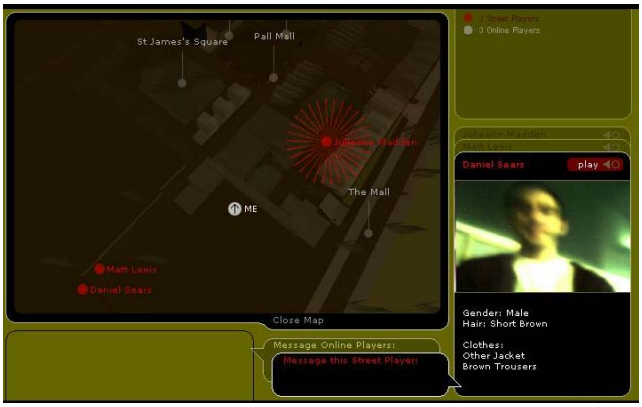

Figure 10: bird's eye view (one street player is declaring)

Finally, whenever a street player enters Uncle Roy's office, online players are invited to join them. This involves seeing a live webcam view looking into the office which enables them to see the street player in person for the first time (figure 11).

Figure 11: seeing the street player on the office webcam

They are then asked the same questions that the street player is asked in the limousine, including whether they will commit to help a stranger for the next year, in which case they enter their personal contact details.

After the game, street players and online players who made a commitment to help a stranger are (manually) paired up and sent each other's contact details. They have entered a year-long contract to help one another!

IMPLEMENTATION OF UNCLE ROY ALL AOUND YOU

At the core of the Uncle Roy All Around You implementation is our own game server and associated communications software which is responsible for: managing the shared game state including the positions of all the players;

- handling text and audio messaging;
- loading colour maps and associated clue trails and serving clues;
- queue management so that only a limited number of online players are admitted to the game at any one time;
- using an SQL database to store persistent game information (players details and state);
- communicating with remote clients including street players' clients implemented in Flash and online players' clients implemented in Shockwave.

Wireless communications took the form of commercially available GPRS mobile telephony services.

In addition to individual players' interfaces, there were two further interfaces onto the game. A behind-the-scenes control-room housed two members of a technical crew who were responsible for managing the game software and in particular identifying players who were in trouble (usually because they had lost their GPRS connection) and then sending one of three crew members who were out on the streets to assist them if necessary as well as communicating with a further two crew members who were managing the flow of players through the office, phonebox and limousine. The control room interface showed the positions and status of all players and also enabled the controllers to change the state of any player (e.g., manually advancing them to the next phase of the game) and to improvise clues and other messages from Uncle Roy. The second interface was a public spectator client that ran on a large plasma display back at the Institute of Contemporary Arts and that gave passersby an overview of the online world through a roving virtual camera that would cycle among the online players, following each for a short while.

One further notable aspect of our implementation was our approach to positioning. Our experience from Can You See me Now raised significant doubts about the suitability of GPS as a positioning system for Uncle Roy All Around You. Although discussion of GPS often focuses on its accuracy and this can indeed be an issue, especially in the way that it varies (in CYSMN we saw average reported position errors of a few meters but with occasional large errors of hundreds of meters), the biggest problem in our experience is coverage. In a city environment there can be many GPS blackspots such as in the shadows of buildings, where it is impossible to get a fix. From an end-users point of view these can be quite unpredictable and anyway, they vary over time as GPS satellites change their positions in the sky. The structure of CYSMN was such that the GPS-users were professional performers whose job it was to make the technology work and who built up an extensive working knowledge of its characteristics over many days play and subsequently who learned how to best make it work for them (see [2] for a study of this process). However, the GPS-users in Uncle Roy All Around You would be members of the public who we want to have the smoothes possible experience and who would enter the game with no familiarity with the vagaries of GPS. Given a central London location which would certainly have included many blackspots, we choose to reject GPS and adopt an alternative approach to positioning.

Our approach is called self-reported positioning. It is a low-tech 'system' in which street players report their own positions to the game. They do this both explicitly by declaring 'I am here' in order to receive a new clue and also implicitly through their general manipulation of the electronic map on their PDA. Specifically, their map only enables them too see a limited area of the overall game space at any moment and they have to drag the me icon across the map to pan this view. Implicit positioning takes the view that there is a good chance that the area map they are looking at is a good indication of where they generally are. Of course, they might potentially pan across the map widely when exploring where to go or could deliberately lie about their location, although in this particular game there is no great advantage to doing this as many of the clues only make sense in a specific location and anyway, the ultimate goal is to physically get to Uncle Roy's office. We return to these issues later on.

Implicitly and explicitly self-reported positions were represented differently to online players, through the pulsing red sphere (implict) and the enhanced sphere (explicit) as described previously.

EXPERIENCE OF UNCLE ROY ALL AROUND YOU

We now focus on how players' actually experienced Uncle Roy All Around You. At the time of writing, it has been staged once, in central London over two weeks in May and June of 2003. During this time it was experienced by 272 street players and over 440 online players.

Building on the techniques used to study previous virtual and mixed reality experiences [2], the following reflections draw on the following four sources of data.

Ethnographic observation of different participants' activities. In this case, ethnographers spent time online,

'hanging around' on the streets (including following a few players through the experience), and some time studying the activity in the control room. Ethnographic data is particularly useful for uncovering the ways in which different participants – players, actors and crew – coordinate their activities to create the experience and in particular how they deal with various problems.

Direct feedback from players through interviews, subsequent emails and in this case, one hundred completed questionnaires that were filled-in by street players, a few of whom had also played online, directly after their experience. These questionnaires gathered some background information on our players and then asked them to quickly summarise what they liked, what they didn't like and key suggestions for improvement. This feedback gives a general sense of how our players received the experience.

Feedback through critical review, both in terms of press reviews and also essays written by fellow academics and students analyzing the work from a critical theory and/or media studies perspective. To date there have been four press reviews and one such essay produced. Critical review helps us place the work in the broader context of related experiences and helps us get a first impression of its success as a professional product.

Analysis of system recordings of participants' activities. We have instrumented our system to log all events that occurred in the online environment – participants movements, text and audio messages, triggering of clues and underlying system events such as periods of network disconnection. These logs can be reviewed by humans or analysed using statistical techniques to build a picture of online activities.

Between them, these sources enable us to build a rich picture of what took place, with findings feeding back into experience (re)design, requirements for new technologies or raising hypotheses for future experimental work.

Our overall impression is that in spite of some technical teething problems (mostly with GPRS network availability), Uncle Roy All Around You was very well received. Press reaction was largely positive, especially from those reviewers who tried the experience after the first few days when we had resolved or at least managed to work around the worst technical problems. For example, London's Metro newspaper described the experience as *"one of the most exhilarating theatrical experiences you'll encounter"* and the London Sunday times observed that *"if such performances were supported and nurtured by the artistic establishment, Britain could produce its first new theatrical form for years"*. Player reaction was also highly positive.

Having noted this enthusiastic overall response, we now focus on some of the underlying details – both positive and negative – that affected players' experiences, starting with street players before considering online players.

Street players' experience of Uncle Roy

Uncle Roy All Around You often seems to have been a compelling experience, notable for being disconcerting and even slightly frightening for many street players who used words such as "uncertainty", "mistrust", "ambiguity", "scary", "paranoia", "safety", "fear", "lack of control", "strangers" and "trust" to describe it. Analysis of players comments suggests that these positive traits (in terms of this kind of experience, although certainly not for most Human-Computer Interfaces), emerged from several features of the experience design.

The feeling of being watched and yet being alone

Street players were very conscious of the feeling of being watched while they were in a public place:

> "Very interesting to see how much you can be watched and tracked"

which was heightened by being alone in the city:

> "That whole feeling of being on your own and trying to do something which to me is quite scary – you don't know if you are doing it right" "scary but great"

which in its turn was established through the initial briefing ritual where you had to leave all of your personal possessions behind, heightening your sense of isolation. One player summarized this as follows in a lengthy email:

> "My initial feelings were of slight paranoia because you knew you were probably being watched and certainly monitored. I felt very much on my own with no one to confer with or discuss how to do it, or if it was the right way. This was accentuated by the thought that people may be watching you 'doing it wrong'. I couldn't help but look around me to see whom else might be in on it ....
>
> Players were asked to leave all possessions at the ICA so I had no watch, mobile or map. This worried me because I didn't know the area and when directed to Pall Mall or other places, I had no idea where these were and unfortunately, the people I asked for directions got it wrong resulting in me heading in the wrong direction. This, however, didn't detract from the experience."

Implicating strangers

As this player suggests, a key strategy was to implicate passersby in the game, even when they were not involved, for example through clues about following strangers:

> "I liked the instructions to follow ppl"
>
> "the sense of looking at everyone and thinking that they ere part of this" & "I never usually get impatient about people using phone boxes"
>
> "not knowing who was involved and who was watching"
>
> "The area it was played in gave you the feeling of everyone in London passing being involved"
>
> "not knowing who at first was a performer and who was not a performer – everyone is a performer"
>
> "The sense of fear of strangers"

And for some players, interacting with strangers was also a notable feature of their experience:

> "The kind online gentleman guided me at just the right time" & "I don't think I saw any mad people in the street as I was expecting – although I suspected everyone"

> "asked a bunch of strangers if they were uncle roy"

Live performance

The impact of live actors was clearly a significant factor, especially as they would be met close-up in a one-to-one situation (quite different from being in a theatre audience)

> "The human presence I could feel (people watching, the actor coming and tell my name)"

> "the physical intervention to street players was great"

> "You're given enough to feel safe, but not too safe. Great sense of anticipation. Loved seeing someone approach the car."

> "The feelings of uncertainty and mistrust I experienced when facing your street actors"

Relationship to online players

Street players also commented positively on interaction with online players:

> "The fact that street players could actually interact with players online"

> "by asking online players I managed to engage their attention + help and find number 12"

> "Having online help was great, worked in real time"

> "it was hard to trust online guys at first"

> "when it worked the communication between online & street players was excellent"

Although some players clearly wanted more contact:

> "I didn't get any help from online players. I felt a bit abandoned or disconnected too"

> "sometimes difficult to get info from online players"

Crossing boundaries

Another key feature of the game was crossing boundaries, in particular going into places where you wouldn't normally venture such as the empty office and especially the limousine.

> "Enjoyed going into the building"

> "At one point near the end you were directed to get into a car. I felt uneasy about this because you 'never get in a car with a stranger' but you assume it must be part of the game because of the sequence of events that lead you to that point. I probably wouldn't have got in the car if there weren't this sequence of events leading up to it."

This comment about assuming that it is part of the game is an important one. Ultimately street players trust the game producers to look after them and assume that they have been given permission to cross certain boundaries and that this they are operating within a safe framework. As one player put it:

> "the last bit was very odd – but u didn't feel too uncomfortable. The set up is lightly connected - it is not blind trust as I have some institutional trust in Blast Theory and the ICA"

However, there were several criticisms of the experience too and also suggestions for how it might be improved:

A common frustration was with the reliability of the technology (nearly always due to problems with GPRS networking). Although we tried to spot such problems early on from the control room and send an actor to help, ideally without breaking the flow of the experience too badly, street players would sometimes have to wait for minutes, even tens of minutes for reconnection, or on a few occasions abandon the game altogether.

Several players commented that the clues were too simple and that the game could have been more taxing or could have avoided you following a set route. Certainly, a few players finished very quickly (within twenty minutes), perhaps because they were 'lucky' or maybe because an online player guided them to the office straight away. Related to this many players said that they would have liked a longer experience.

There were a few frustrations with physical bottlenecks and conditions including having to wait while the phonebox was being used, park gates being locked and also more general issues with rush hour traffic and rain.

Several players would have preferred an automated positioning system (although many appeared not to have noticed the lack of one) and a couple mentioned GPS.

A few players mentioned wanting to be able to share the experience with other street players afterwards.

Finally, one player was disappointed that the climax of the experience was the conversation about trust "Talk about trust at the end is a little anti-climactic" and one reported being so confused that they didn't really know what to do: "I didn't understand enough about what it was to say anymore. To be honest I've spent more interesting 45 minutes walking around the market."

Online players' experience of Uncle Roy

Our overall sense of online players' experience is that it was often less compelling or coherent than that of street players. The main role for online players was to guide street players and their main payoff was to see them via the office webcam and we feel that the experience was most rewarding if a player had first completed the game as a street player as they would better understand the goals and structure of the game, emphasise with street players' feelings and possess enough knowledge to be able to guide or play around with them. Conversely, the experience often seems to have confusing for those who hadn't first been on the streets. Beyond these broad observations, we pull out the following several issues for more detailed discussion.

Relationship to street players

A key issue for online players is establishing and then maintaining an appropriate relationship to street players. Anticipating that it might be difficult to locate street players, engage their attention and then keep in touch with them, we initially designed the game so that an online player could communicate with any street player just by selecting their card. While this allowed online players to follow the progress of many street players, with hindsight we feel that it reduced the likelihood of closely engaging any one of them and conversely, may have led to situations in which a street player was swamped by many online players. In addition, some online players seemed to have made almost exclusive use of the bird's-eye view, following street players at a distance, but not really engaging with the virtual model of the city and its photographs. Consequently, we are considering several changes to our design:

- Communication between online players and street players should be proximity driven, i.e., an online player must remain close to a street player in the virtual city to be able to communicate with them. This would require them to actively follow the street player.
- Removing the bird's eye view, requiring online players to experience the virtual city from ground level.
- Providing further information in the virtual world that they might use help street players.

However, making these changes involves a potentially delicate balancing act. Increasing mutual dependency between online and street players may lead to greater frustration when the connection between them fails. Requiring close mutual proximity may also reveal issues with the use of self-reported positioning, for example causing frustrating for online players if street players appear to jump around rapidly and unpredictably as they pan across the map (we return to this issue below). One option may be to make this proximity threshold configurable so as to be able to control the game dynamics. Choosing a large threshold would revert back to our first design in which all players could communicate, whereas a small value would require online players to closely follow street players.

Entering the office

Being invited to join a street player in Uncle Roy's office via the webcam is intended to be a key moment of the online player's experience. In this first version of the experience, online players were invited into the office whenever *any* street player reached it (in the same way that they could follow and communicate with any street player). On reflection, we feel that the online experience would be enhanced if gaining access to the office is more of an achievement, specifically, if it results from managing to sustain a relationship with the online player. The question is how to determine this. One possibility is to grant access to the office when the online player has sent and listened to a given number of messages to/from this street player, although we may also need to consider the timings of these messages (e.g., avoiding granting access as a result of an initial flurry of messages that was followed by silence).

sSelf-reported positioning

It is also revealing to consider how our online players experienced self-reported positioning. First, we broadly assessed its 'performance' (from a purely technical point of view) by analysing system logs of the 5,309 explicit declarations and 18,610 implicit position reports (henceforth called 'map manipulations') that were generated by all 272 street players. , The average frequency of declarations was 0.9 per minute and of map manipulations was ten times that at 9 per minute. The average distance moved between declarations was 80 meters and between map manipulation was 40 meters. Our estimation for the average error was 25 meters for declarations and 39 for map manipulations (here we recorded 10 street players on video, estimated their physical positions whenever they reported a position and calculated the difference between the actual and reported values). At first sight it therefore seems that self-reported positioning gives less frequent, less precise and less accurate updates than GPS (which typically gives an update per second, with a few meters resolution and error), although, the availability of self-reported positioning is certainly better.

However, we then analysed the text messages that were sent from online players to street players in order to underatand how they actually reacted to reported positions. Of the 3,109 private text messages that were logged, approximately 1,670 were concerned with location in some way. We coded these location oriented messages into five categories. The first category is 735 messages in which the online player appears to have a precise enough fix on a street player's location to be able to give directions or tell the street player where they are, for example:

"The big street in front of you"
"U r very close step back 5 feet"
"Stop take a right NOW"

The second category is 112 messages where the street player appears to have a good idea of where the online player might be, but is less confident, for example:

"My map shows you near the bridge. Are you?"
"Did you just pass some steps?"

The third category is 569 messages where the online player gives general directions or makes geographical references that do not necessarily assume precise knowledge of the street player's location (although they also don't raise doubts about it either). Such messages are neutral with respect to the validity of positional information:

"Go to 12 waterloo place"
"Head towards steps by George statue"

The fourth category is (only) 32 messages that cast doubt on the usefulness or validity of reported positions or that appear to question the behavior of the positioning system in some way. These messages reflect moments when the

operation of the positioning system may have been noticeable or even problematic for the online players:

> "You are jumping all over the place on my map"
> "Your locator shows you standing still in the park is it broken?"
> "How did you get over there?"

Our fifth category is 222 requests for location updates (i.e., general messages of the form 'where are you?').

What emerges from these observations is that while online players appear to be concerned about the frequency of reported positions (often asking for updates), they hardly appear to notice inaccuracies or other problems, and instead seem to be comfortably working with reported position, often in an apparaently precise way.

Observations of street player behaviour shed some light on this. They would often declare themselves to be at landmarks, such as in the middle of junctions or at statues. They would also sometimes declare themselves to be ahead of their actual location, perhaps to get information in advance. As one street player put it:

> "One thing I also remember doing was quite the opposite, that is, reporting my position in advance before I got there to have quicker feedback of whether or not I was on the right track. Maybe through a desire to anticipate and plan ahead …"

Finally, they would sometimes re-declare their position to be somewhere where they had previously been, perhaps to revisit a clue or as a result of pressure from online players who had missed it, as in the following quote:

> "… being pressured by players to report my position, which I probably repeated just to be sure they got the updates."

In summary, although reported positions were quite inaccurate in purely numerical terms, they generally appear to have made sense to the online players in terms of the game play. Put another way, self-reported positioning produced broadly plausible positions that effectively supported collaboration. This casts further doubt on the use of GPS as this does try to report where you are and its errors, although numerically smaller, may in fact be more randomly distributed possibly resulting in less plausible positions. Given the presence of network delays (about five seconds from street player to online player in this game) GPS also actually reports where you (roughly) were a short while ago. Perhaps strategies such as placing yourself at key landmarks and declaring ahead of yourself are in fact more appropriate to this particular game?

DESIGN STRATEGIES

We finish out of paper by drawing out from our observations general strategies for designing location-based and mixed-reality performances and similar experiences.

Use the city as your canvass

One set of strategies involves exploiting the existing physical world – in this case the city, complete with its streets, buildings, history and not least its people – as the backdrop for the experience. Perhaps the most successful aspect of Uncle Roy All Around You is the way in which it draws on elements of the city, in both its general theme and through the details of its clues. Three strategies here are:

- **Refer to real-locations and draw on the events associated with them**. The clues in Uncle Roy All Around You refer to real places and events that happened there (for example, one clue refers to an infamous shooting of a policewoman).
- **Actually use real locations**. Another possibility is to make direct use of physical locations (in our case, the office, phonebox, and limousine) in a further attempt to blur the boundary between fiction and reality, although this can introduce physical bottlenecks into the experience (our crew in the control room and on the streets had to expend considerable effort in managing access to these spaces and stalling some players so that several did not reach these places at the same time).
- **Implicate passersby**. The city is already full of actors even if they not conscious of it. A particularly powerful feature of our experience is the way in which it suggests that they are part of the performance.
- **Inject live action**. The use of actors can clearly be very powerful, although given the expense involved, this is likely to be limited to just a few key moments.

Exploit ambiguity and crossing boundaries

A second strategy is to use ambiguity to provoke participants and to ask questions without giving answers. Our reflections show that Uncle Roy All Around You employs ambiguity in several ways to create a provoking experience: the 'task' itself is open-ended; the clues are puzzling and invite interpretation, as does the nature of the relationships between players and Uncle Roy.

This strategy captures one of the essential differences between artistic experiences and other more conventional applications of computers which are concerned with giving accurate information and supporting efficient completion of tasks and in which ambiguity is seen as a problem. The deliberate use of ambiguity to create engaging interfaces has been discussed in [4], which offered three general design strategies:

- **Ambiguity of information** – present information in a way that demands interpretation, for example deliberately reducing its resolution or in contrast, presenting it in an overly precise way in order to question its validity. This strategy can be seen in the design of Uncle Roy's clues.
- **Ambiguity of context** – where an experience deliberately and sometimes jarringly juxtaposes different structures or genres and so provides multiple simultaneous contexts for interpretation. This is reflected in our mixing of game and performance and the juxtaposition of the physical and virtual worlds.
- **Ambiguity of relationship** – where an experience calls into question the relationship between the participant

and the material, challenging them to make intellectual, aesthetic or moral judgments. Uncle Roy All Around You involves extensive use of ambiguity of relationship by questioning the relationship between a player, Uncle Roy, other players and passersby.

A related strategy used in Uncle Roy All Around You is to encourage participants to cross the boundaries of normal behaviour. We have seen that this can lead to powerful experiences, but also that it needs to be employed carefully within a clearly defined relationship between participant and designer/producer. Under the surface, participants must be able to judge what is genuinely safe and what is not while being able to suspend disbelief and feel what is might be like to take risks – but without actually doing so.

Encourage social gameplay

Our third strategy is to draw on the social relationships between different participants. The pre-scripted content of Uncle Roy All Around is relatively small – a map and some clues – but the relationships between its players are rich. One tactic is to deliberately give different players distinct perspectives, motivating them to exchange information and work together. This means aiming for quite different, but connected, physical and virtual worlds, rather than a seamless augmented reality style overlay. We see this approach in Uncle Roy All Around You where online players can help street players and also in the chase game Can You See Me Now, where online players perceive the physical world through the talk of the street players rather than seeing it directly.

However, the key challenge with this strategy is the difficulty of balancing the numbers of online and street players. Is it possible to ensure that there will always be sufficient of each for a social-experience to work, while avoiding having any one player overwhelmed by others?

Be realistic about positioning and networking

Our final strategy focuses on designing location-based experiences to reflect the characteristics of the two key underlying technologies involved: positioning systems and wireless networking. We know from previous experience that automated positioning systems such as GPS can be unreliable, both in terms of accuracy and coverage and that designers need to take this into account [2,3]. Uncle Roy All Around You has shown that low-tech solutions such as self-reported position may provide useful alternatives, at least in experiences where players benefit from truthfully reporting their location, and may even better reflect the way in which people refer to position when guiding one another. Another possibility is to temporarily fall-back on self-reported positioning when automated positioning systems fail during an experience. On the other hand the reliability of networking was still a major problem for Uncle Roy All Around You, in spite of the move from WiFi to GPRS and need to develop similar low-tech and fallback options to deal with this, for example, falling back to stand-alone experiences that can maintain a participant's engagement until connectivity can be restored.

FUURE WORK

Uncle Roy All Around You is the latest in a series of mixed-reality performances in which we have explored how online and street players can take part in experiences that span physical and virtual worlds. On reflection, we feel that our initial design worked well for street players, but perhaps less so for online players, leading us to propose a series of design strategies. Future work will involve redesigning the experience and restaging it during 2004. At the time of writing this is planned to involve touring to two further cities in the UK and also staging a variant of the experience using 3G mobile phone at the Adelaide festival.

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