Location-Aware Multimedia Stories: Turning Spaces into Places

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Abstract — This paper explores the idea of interactive narrative systems which are site specific and rely on large-scale movements around that space to mediate access to their content. Essentially, by walking around an area with a handheld device, the audience gains access to different short video clips related to (and usually depicting) their immediate environment. The motivations behind this work are that the overlap of space and narrative will provide a deeply compelling experience and a high level of immersion. Furthermore, such a system may also speed up the process by which the audience forms a semantically rich conception of place from the socially empty physical space. In line with an experience design methodology, a case study is presented and key features of its creation, development, use and evaluation are highlighted. The paper concludes with recommendations for future designers of location-aware narratives.

Index Terms — Locative media, multimedia, mobile devices, GPS, interactive narrative.

I. INTRODUCTION

This paper discusses the use of real space as a design element in the construction and production of audiovisual narrative artefacts. It deals with fictional and historical tales conceived, set, produced and ultimately presented in the actual locations which they depict or to which they otherwise relate. This is achieved through the adoption of mobile technologies, which support rich multimedia experiences. The key motivation for developing such systems is that by overlapping narrative and environment each may reinforce the other, strengthening not only the audience's immersion in the stories but also contributing to the formation of a sense of place by layering historical background and atmosphere on top of the physical environment. This paper introduces Location-Aware Multimedia Stories (LAMS) as cinematically rendered narrative content related to specific locations and embedded in those real spaces through the use of location-aware mobile technologies. LAMS combine the mobility of the audience with spatial distribution of the story content in interactive, multi-threaded narrative experiences to create a synergy that this paper argues encourages the development of a sense of place from otherwise unknown spaces.

In the emerging genre of LAMS, many disciplines come together. The process involves various stages of authoring, capturing, designing and producing media. Stories must be researched, written and dramatically rendered and then translated into visual content and produced. Furthermore,

the interaction and interface that supports the viewing of the stories must be carefully constructed. Through the mechanism of an in depth case study, this paper describes an interdisciplinary approach to the development and analysis of a location-based story project: the Media Portrait of the Liberties (MPL) [1]. One unique aspect of this kind of work is that it must consider the poetics of both narrative and location simultaneously.

The MPL project focused on capturing local community anecdotes and memories in the form of multimedia fragments and embedding them in the streets of the inner city neighbourhood of the Liberties in Dublin, Ireland. Local residents and transient visitors could then roam the neighbourhood and access these story fragments using mobile location-aware devices. A multifaceted user study was conducted to examine the audience reactions to this novel experience, resulting in valuable insights into the use of narrative in locative media systems. The practical investigative approach described in this paper was inspired by the emerging area of experience design research which recognises it as the best way to advance the state of the art [2].

In the following sections, LAMS are first positioned within the broader area of Locative Media. Next, the concepts of space and place are discussed and the ways in which LAMS can influence them are elaborated. The MPL case study is then presented in detail. This paper concludes with a discussion of the future potential of location-based stories.

II. LOCATIVE MEDIA

Tuters states: 'Locative media refers to a mobile media movement in which location and time are considered essential to the work' [3]. It implies the use of mobile location aware technologies to combine content with places and it alludes to the fact that a user's context and their movements through space need to be taken into consideration during the design process for a mobile media system. Locative media encompasses a number of different fields and applications: from art projects to academic research. Authoring tools, games and specific narrative experiences have all been constructed to explore the potential of locative media as a platform for expression and communication. To situate the work presented is this

paper within the larger territory of locative media it is helpful to distinguish between the following areas:

- Location-aware tour guides [4]-[5]
- Authoring tools for annotating space [6]-[7]
- Location-based games [8]-[9]
- Location-aware narrative-driven projects [10]-[11]

This last category is of particular relevance for this paper. It can be further subdivided into:

- Mobile distributed narratives. These deliver a narrative experience to a mobile audience independently of where the story occurred or was initially conceived, produced and demonstrated [12].
- Site-specific narrative experiences. These are systems that relate stories about and in particular places through mobile technologies [13]-[14].

The content in this final type of locative media is tightly coupled to specific locations, and it is within this category that the work described in this paper belongs.

III. SPACES TO PLACES

A key aspect of this paper is how to use stories to turn spaces into places. However, although commonplace, these very concepts are murkily defined, and much thought (across disciplines such as philosophy, architecture and geography) has been directed towards understanding them. The geographer Yu Fu Tuan hinted at their differences when he remarked [15]:

"When space feels familiar to us, it has become a place."

In an influential paper, Harrison and Dourish [16] extend and expound upon this distinction. They define space as:

"… the structure of the world; it is the three-dimensional environment, in which objects and events occur, and in which they have relative position and direction."

While a place is:

"… a space which is invested with understandings of behavioural appropriateness, cultural expectations, and so forth. We are located in 'space', but we act in 'place'. Furthermore, 'places' are spaces that are valued."

Scottish writer Samuel Smiles [17] reinforces this view when he wrote about a:

"… sense of place: something we rather feel than understand, an indistinct region of awareness."

This paper adopts these definitions and this distinction, namely that spaces are sterile physical environments while places are invested with deep personal and social meanings.

Numerous methods for fostering the development of places from spaces have been suggested. Harrison and Dourish [16] follow the analogy of a home or office and

emphasize customization: altering, adjusting and tweaking their physical surroundings allows people to take virtual possession of their environment, imbuing it with meaning. Other authors [18] have highlighted the role of information: by providing background about a space, it can be contextualized and related to past experience. In this way, it acquires significance beyond its physical characteristics and becomes a place. Stories about a place are one way to achieve this. As Thomas Hardy writes in The Woodlanders [19] that to belong in a place is:

"To know all about those invisible ones of the days gone by, whose feet have traversed the fields. What bygone domestic dramas of love, jealousy, revenge or disappointment have been enacted in the cottages, the mansion, the street or on the green."

Location-aware applications, and Location-Aware Multimedia Stories in particular, can present this kind of knowledge. They offer a way to impart detailed contextual information to people who unfamiliar with a space, as well as to extend the historical lexicon of those who know it well (perhaps by surprising them with stories and anecdotes of which they were unaware). Enhancing a place with meaningful content about it can transform how it is viewed, perhaps by increasing its familiarity, or conversely, by challenging a person's preconceptions and causing de-familiarization. Locative media in general has the potential to highlight aspects of a place that we usually do not notice and to stimulate a new view of familiar places. Locative media may also encourage a new kind of 'sightseeing' among local residents of a place, drawing them to locations that they would not normally visit. Coupling stories with real locations provides an opportunity to express the history and personality of a place, and stimulates an audience by augmenting their physical perception with stories, memories and a palpable atmosphere. LAMS can present a broad and detailed perspective to an audience, creating, reinforcing, challenging or altering their preconceptions and are an effective mechanism for transforming empty spaces into rich, socially meaningful places.

IV. EMBEDDING STORIES IN SPACES

If we accept that LAMS can enrich a space, the next key question that arises is as to what narrative structures can be laid out on top of the physical environment. Clearly, media intended for sedentary, sequential viewing in the home is of an inappropriate format. How can stories be distributed and fragmented but remain meaningful? Interactive textuality provides a valuable starting point when considering this problem. Ryan [20] gives the following definition:

"In this mapping, the text as a whole is a territory, the links are roads, the textual units, destinations, the reader is a traveler or navigator, clicking is a mode of transportation and the itinerary selected by the traveler is a story"

Mobile technologies enable this metaphor to be fully extended and the physical space merged with the digital story space. A story world (territory) can be created composed of individual fragments (textual units) which are physically positioned in space. By navigating down the real roads (links) between these, an audience member can construct a personalised itinerary which forms a unique story experience.

This approach clearly restricts the format, topic and content which are suitable for LAMS. However, it also offers some advantages when compared to other forms of digital storytelling. These are centred on the concept of immersion, or involvement in the story experience. Traditional approaches to increasing levels of immersion rely on Virtual Reality (VR) technologies, such as CAVEs or Augmented Reality (AR) systems, which typically feature head-mounted displays, sophisticated speakers and even haptic feedback. They represent an attempt to artificially reproduce the experience of being in the real world. However, LAMS shown on mobile devices allow a viewer to be simultaneously present in the real world, a potentially much more compelling experience.

A further advantage comes from the natural mechanism in which a viewer makes narrative choices when experiencing LAMS. In a typical interactive narrative the process of making a decision interrupts the suspension of disbelief in the audience. They are no longer involved and immersed in the story but instead make an explicit choice as external and clinical observers [21]. By its very nature, this phenomenon can disrupt the story experience and can cause frustration [22].

LAMS offer the potential to alleviate this conflict, as the process of navigating around the story is one that inherently fosters the audience's engagement. Moving round the physical setting of the story serves to draw viewers further into the content, rather than forcing them to recede from it. This not only provides motivation for them to continue with the narrative experience but may also bolster their feelings of immersion in the story world. This is a key issue being addressed by this research: practically exploring frameworks for embedding audiovisual stories in real space to realise a captivating and immersive experience.

V. CASE STUDY: THE MEDIA PORTRAIT OF LIBERTIES

The Media Portrait of the Liberties is a LAMS system deployed in an outdoor space, the deprived neighbourhood of the Liberties in Dublin, Ireland. It is intended to capture the neighbourhood's atmosphere through the representation of real stories. The main goal of the project is to create an artefact that let its audience assemble a mental portrait of the local history and culture.

One way to envisage the social space of a neighbourhood is as an intricate web of stories generated by the inhabitants. Every story is set in a specific location and each location has a story. The MPL uses this model to associate spaces with stories, and also extends this concept by featuring recurring characters and themes. By appearing in multiple stories at multiple locations, these characters and themes act to further connect the individual story fragments that make up the piece. The audience is not only able to explore the narrative by roaming the streets but also by tracking the characters as they appear in different individual stories or the themes that unite them. This approach is intended to paint a detailed picture of a neighbourhood shaped not only by its physical structures but also by its history, inhabitants and their shared community memory. As Massey [23] explains:

"What gives place its specificity is not some long internalized history but the fact that it is constructed out of a particular constellation of social relations, meeting and weaving together at a particular locus. Instead then, of thinking of places as areas with boundaries around them, they can be imagined as articulated moments in networks of social relations and understanding."

By portraying its history, its community and its social life, the MPL aims to provide its viewers with a nuanced and evocative sense of the Liberties as a socially meaningful place rather than a sterile space. Furthermore, it is envisaged that the system will encourage visitors to get to know the neighbourhood and act as a catalyst for community members to recall and contribute their own personal tales.

A. Design and Production

The MPL project encompassed a number of diverse activities, chiefly a preliminary familiarisation with the Liberties area and subsequently the identification, collection and production of re-enacted neighbourhood stories in the form of video clips. In tandem with this effort, a location-aware handheld display system was developed (described in the following section). A content model which supports connecting clips according to the characters they feature, the periods in which they were set and their general themes was also developed. This structure allowed viewers to navigate the content not only by moving around the city, but also depending upon particular topics or plot elements that caught their interest.

To achieve this, MPL plots were developed around multiple themes and characters and instantiated in a series of narrative fragments that eventually intersected with one another. Each fragment formed a modular story unit, employing a classical narrative plot arc at a micro level. Each fragment was a self-contained anecdote that referenced a particular location in the Liberties neighbourhood, and depicted one or more recurring characters, themes or periods. Supporting links between the clips using all of these relationships enabled viewers to follow a storyline which interested them, perhaps the history of a particular family, a series of architectural anecdotes, or a broad depiction of a particular theme or period of time. This approach is beneficial as it places few requirements on the adjacency of story material and ensures that clips can be experienced in any order. Furthermore, viewers can end the experience at any time, without requiring the closure normally expected in stories with a large-scale plot arc. This kind of structure is also open and can continually evolve through the addition of new stories. The details of specific stories in MPL have been previously published [1], but the motivations underlying their selection are briefly reviewed here for completeness.

MPL was intended to be of interest to a wide variety of audiences from local community members to casual visitors. In accordance with this goal, stories were derived from the lore of the local community and explored the details of their everyday life throughout the history of the area. Everyday stories appeal to us generally because they are directly connected with what we perceive to be real events and history; such stories encourage reflection on own lives, prompting us to recollect anecdotes, memories and related personal tales. Like a spider web, real stories connect with each other, involve recurring characters and themes and provide a natural hyperlinked structure that can be used as the basis for a modular interactive narrative project. A book, *Around the Banks of Pimlico* [24], by Liberties author Maireen Johnston was used as a central text in the MPL and provided a socially and historically rich narration about the neighbourhood, its characters and anecdotes. It renders a warm and engaging picture of the Liberties in the period between the early eighteenth century and the 1950s and we believe formed the backbone of a compelling content library appealing to a wide range of potential audiences. From this starting point, the production process involved selecting, scripting and analyzing candidate story fragments.

A variety of methods were employed in the production of the stories, as befitted their plot. Topically, they ranged from ghost stories to factual descriptions to character studies. In creating the audiovisual media segments, a mix of video, animation and photographic media was combined with a first person voice-over elaborating on these images. A selection of frames from the audiovisual clips is shown in Figure 1. This conversational narrative style matched that adopted in Johnston's book. During meetings with the local community, numerous residents contributed their photographs, anecdotes and other media. This material contributed greatly to the production of atmospheric and realistic content. A collage of old images produced by the Liberties residents themselves during the research phase is shown in Figure 2. The project also benefited from the relatively undeveloped nature of the neighbourhood: good sets were easy to find. Furthermore, residents were eager to volunteer as actors or extras during filming. Figure 3 shows images from the MPL production phases.

Fig. 1.   Selections of frames the MPL audiovisual stories.

Fig. 2.   Collage of old pictures provided by community members of the liberties during the research phase of the project.

Fig. 3.   Location shooting during the MPL project.

B. Mobile, Location-Aware Media Display Platform

The MPL was shown on iPAQ handheld computers equipped with Global Positioning System (GPS) cards

(which provided location-awareness) and SD memory cards which stored the video material. iPAQs were chosen as they are easily programmable and comfortably capable of displaying rich multimedia content while GPS was selected as it is the standard technology for outdoor location-awareness. Finally, SD cards are a secure and reliable way to store multimedia files.

The main interface to the system took the form of a full-screen map. The map extended beyond the bounds of the screen and scrolling was supported through pen strokes. It was not possible to scroll beyond the edge of the map. Navigation aids in the form of a cursor showing the user's current GPS position and an overall radar view were also provided. Story locations were discretely marked on the map by small, high contrast dots. Access to the story content was mediated by the appearance and disappearance of graphical selectable icons. As with the dots, each icon represented a particular story and was positioned on the map in story location. The icons were normally hidden from the user. However, when a user was close to a physical story location, the icons associated with it would automatically appear on the map. These could then be selected through a screen tap. The associated video clip would then play full screen, returning to the map upon completion. This interface is shown in Figures 4 and 5, and a more detailed technical description of the system can be found in [1]

Fig. 4.   The iPAQ Interface to the MPL.

Fig. 5.   The iPAQ user interface to the MPL.

Viewers were able to follow particular story threads by selecting (through a simple dialog box) the types of relationships they were interested in: themes, periods or characters. Whenever a clip was viewed, all clips related to it (by the selected types of relationship) were discretely marked on the map. At this time, a user was not able to watch these related clips, instead simply to determine where they had to go in order to do so. For example, if a user was interested in following characters, after watching a clip they would be shown all other locations where they could find out more about characters they had just seen. As the MPL stories were richly and multiply linked, this mechanism supported a wide range of viewer paths through the content.

C. Public Exhibition

Beyond the evaluation described in subsequent sections of this paper, the MPL was also exhibited at a local art gallery, the Digital Hub. This long term installation involved making MPL capable handheld devices available to visitors (in exchange for a small fee and refundable deposit), who were when then able to explore the streets and experience the system as it was originally envisioned.

VI. EVALUATION

Evaluation of the MPL was a multi-stage process. An initial pilot study was followed by two increasingly detailed user studies. Only the final and most in depth study is reported in this paper (the others are described in [1]). This study was designed through an extended consultancy with a social scientist involved in the early stages of the MPL project, under the auspices of the socially motivated investigations of the WAND initiative [25]. Throughout the process the goals were to measure the extent to which the MPL project (and by extension LAMS as a whole) can:

- Foster immersive feelings in the audience's minds through the combination of real places and location-based stories.
- Act a place enhancer, capturing a site's atmosphere and presenting its community folklore to the audience.
- Stimulate community members to recall, revisit and tell their own local stories; act as a story catalyst which can challenge existing views of the space.

The evaluation methodology also reflected the artistic and subjective nature of the piece. In all three studies it relied on continual situated observations (backed up by audio recordings) of the system in use followed by in-depth semi-structured interviews debriefing participants afterwards. A detailed demographic questionnaire was also employed in order to characterise the audience.

A. Study Description

Audience members were selected based on their connection with the neighbourhood, but from different cultural backgrounds and hence with a different point of view in relation to the area and the MPL content. There were 15 participants, split evenly into the following user groups:

- Community users: born and raised in the Liberties, these users were intimately familiar with the area's folklore and traditions. They were recruited to determine whether the system could stimulate the generation of new stories.
- Non-residents: Dubliners from outside the Liberties neighbourhood, these users were generally familiar with the culture and city as a whole.
- Foreigners: this user group was composed of non-Irish, long term Dublin residents. They were not tourists, fluent in English, but lacking the cultural background of the Irish groups.

By observing the reactions of these three different sets of users, this study aimed to determine whether the system acted as a potential *place enhancer* for local inhabitants and visitors to the Liberties, from Dublin and abroad. Furthermore, it was intended to examine whether a system such as the MPL could function as a *stories and memories catalyst* for local community members. Finally, particular attention was devoted to whether the system evoked *immersive feelings* across all three user groups.

Community Users

The local community group were all born and raised in the Liberties area. They ranged in age from 26 to 70, and four of the five were male. Three stated they were familiar with technology, but only one had previously used a handheld device other than a mobile phone. All reported they both knew what interactive stories were and liked the concept, even if only one had experienced such a narrative before. While familiar with the Liberties area, several of the participants were not familiar with navigation tasks.

Analysis of the experience transcripts, recorded comments and semi-structured interviews showed that the community users focused on the neighbourhood and content, the stories, characters and personal memories they evoked, rather than on technology, interface or orientation issues. Their familiarity with the neighbourhood and its traditions drew their attention to the narrative and cultural aspects of the project.

The transcripts reveal the role of the system in triggering memories and acting as a catalyst for story recall. For example, one viewer reflected on the history of the area

when "the weavers and the Heugenots [who] lived in the area 300 years ago" and linked this to his own family history and his uncle "being a weaver himself". All users also spontaneously contributed anecdotes about the neighbourhood which were not featured in the system. Some were thematically related, including several about various medical professionals in the area inspired by a series of stories about a grumpy dispensary officer, and more about the working conditions in the two industrial factories which served as key employers. The physical changes in the neighbourhood also inspired stories, including reflections on a canal which has now been paved over and interred. Other anecdotes related to the social and cultural aspects of the Liberties: one user commented the project really captured its prevalent anti-authoritarian sentiment. The amount of personal and historical information in these conversations shows that the MPL functioned as an effective story catalyst. Experiencing the system encouraged residents to recall and express their own experiences in the neighbourhood. Such tales would make valuable additions to the system's library of content.

The system was less effective as an immersive medium for the community users. Most did not mention this issue, and only one viewer explicitly reported being immersed in the content. Another reported that the videos of the systems distracted him from the physical environment, reducing his level of involvement in the world around. Some of the community users who were intimately familiar with the neighbourhood needed very few cues from the stories to remember and relate to the events depicted in the videos: the images in their minds would easily take over from those shown on the screen, and so after a topic was introduced, the focus of these residents shifted rapidly from viewing to telling.

The system's role as a place enhancer could be observed in deeper reflections about the social conditions in the neighbourhood. These were primarily related to the underprivileged status of the neighbourhood and its reputation as somewhat unsafe. Several users commented about the risk involved in walking the streets with expensive handheld devices, while others highlighted particular government housing estates which have historically suffered from problems of squatting and a general lack of proper community support. There were no incidents during the MPL tours, something which challenged these perceptions of the neighbourhood. The area is now undergoing rapid social change and the MPL highlighted the pace of this process for these viewers.

Dubliners

The Dubliners group of participants were all born and raised in Dublin city. They ranged in age from 27 to 36.

Two were male, three female. Their self-rated level of technological experience ranged from 5 to 9 (on a 10-point scale). They all reported liking stories in general and interactive stories in particular. All had experienced some form of interactive narrative previously. Four of the members of this group reported they knew the Liberties area well, while the remaining one felt she might have difficulties as she was relatively unfamiliar with the streets. Going into the experience, several of the users also reported they were worried about the neighbourhood's disadvantaged reputation. However, in the final analysis, all said they enjoyed using the system, and four that they would like to see it deployed in other areas and would revisit it if content were regularly updated. Most also suggested they would be willing to contribute their own stories to an installation situated in their own neighbourhood.

Generally, the Dubliners group reported being immersed in the experience. One user stated they felt they were "in a bubble" and reported forgetting about the city traffic, noise and bustle of the environment and even that an observer was trailing her. Only a phone call, or warning from a passer-by to take care, brought her back to the real world. Other users reported feelings of immersion, but were less effusive. One stated she felt immersed in the content, another that the collocation of the space and stories helped foster immersion. These comments suggest that the system functioned much more effectively at drawing in these more unfamiliar strangers than it did with the community users. To these users the relatively novelty of the content and lack of memories connected to the places may have been an important factor here.

The role of the system as a place enhancer was more complex. Most users said they had problems linking the narrated events and the places they were set: at times the relationships between the video clips and the locations they were shown in were not obvious. Part of this problem was due to inaccuracies with the GPS performance, which was reported to be somewhat erratic. However, when the users successfully connected the story and the place, this was a key moment. One reported it "generated a thrill", others that it could be exciting or satisfying, like a puzzle which is suddenly solved. Several users also reported that they enjoyed the old images of the area as it allowed them to visually contrast the present with the past and gain an impression of the changes that have been wrought. They suggested this not only added to the sense of the place, filling in its history, but also that there was something special about the basic experience of standing in the exact location in which some past drama transpired. This is an encouraging sentiment.

Foreigners

All participants in this group were of different nationalities, and between 25 and 35 years old. Four were male and one female. Three had been living in Dublin for less than a year, while the other two were long-term residents. Some of the more recent arrivals had problems understanding the regional accents used in the MPL content. All but one said they liked technology and all rated themselves as familiar with it. However, only two had used a handheld device, other than a mobile phone, previously. As with the other groups, all said they liked stories. Three of them knew what an interactive story was before starting the experience, and two of them had experienced such systems before. After the MPL concept was introduced, four of them reported they liked the idea of an interactive narrative. Only one user said he was familiar with the Liberties area, and all but one that they were comfortable using maps.

After the experience was completed, all users stated they would like to see the system in other areas and four that they would revisit the MPL again if the content were updated. However only two of the users felt they would be comfortable sharing their own stories through a system like the MPL.

Although stating the system was both interesting and engrossing generally these users suffered some problems linking the stories to the locations. A few users reported that trying to take in the story, the video and the real place all at once could be overloading Two viewers in particular felt a trade-off between observing the video content and the real environment: to look at one was to miss out on the other. Several viewers from this category though mentioned that through the MPL they discovered unexpected features of the neighbourhood like some of the more unusual old cottage residences or the sheer range of architectural styles which are present in the area. It is to note that for this group of users the novelty of the surrounding neighbourhood features was demanding much more of their attention, compared to the other two groups. This factor may have influenced their involvement with the story as such. In fact, a general observation made by four of this group was that they expected more factual information on the items (and in particular architectural features) shown in the stories. The presence of this fairly abstract desire points towards different interpretations of the system from the different users groups. Foreigners seemed to view the system as a sort of digital tourist guide, and were less appreciative of the explicitly narrative focus of the MPL.

Foreign participants were aware of the disadvantaged nature of the Liberties area and several remarked they were unlikely to have visited the neighbourhood

spontaneously. These users voiced concerns about safety at the beginning of the study, although they relaxed after the tour began. Taking them through unknown areas of the city, this system challenged their perceptions of the Liberties. All members of this group mentioned that the system gave them a feel for the neighbourhood, allowing them to get to know it and providing insights into its community. One user found its mix of historical and personal anecdotes to be uniquely revealing, while another suggested the installation really conveyed the compellingly Irish atmosphere of the place. On the other hand, two suggested that a tour with a human guide would be a preferable way to get to know the area. Taken as a whole, these observations suggest that the MPL was an effective place enhancer. It served to paint a picture of a neighbourhood beyond that which could be derived from its physical environment.

B. Reflections

It is also worth discussing general issues relating to locative aspects of the project, orientation and navigation within the Liberties, practical problems experienced with the MPL software itself and some reflections on the story design and results. Solving these problems and improving this interface will greatly improve the quality of future MPL installations. Furthermore, they may be valuable for designers of other LAMS systems.

Locative aspects
One of the main issues reported across the three users groups was the fact that the link between the narrated events and the physical story site was not always clear. At times users lamented that they were unsure which nearby location was related to a story they were watching. Participants suggested a number of techniques to resolve this by strengthening the links between stories and physical sites. These included having the narrator suggest that the viewer keep an eye open for specific landmarks or directly state the location to which the story relates before proceeding with the narration itself. An alternative strategy some users suggested was that visible marks on the building walls should be used to highlight the story locations. A few users, on the other hand, experienced difficulties in finding the exact story locations because of difficulties with the GPS, which at times behaved erratically. The community users group suffered no navigation problems mainly due to the twin facts that they were highly familiar with the area and that they were firmly intent on the MPL story content and relatively uninterested in the enabling technology. Consequently, the issues regarding navigation and orientation reported below are derived from the other two user groups.

The Foreigners and (to a lesser extent) Dubliners all experienced navigation and orientation problems. Two key factors which contributed to this were the GPS accuracy (around 10-15 metres, and subject to erratic errors due to urban canyons) and the level of detail of the map (which was stylised rather than precisely topographic). In city environments, even relatively small distances of 10-20 metres can make the difference between being in line of sight of particular place, and it being hidden. Although higher quality hardware, such as differential GPS, and more accurate mapping may improve this experience it is also worth noting that solutions to this problem might lie in adopting an improved locative design strategy. For example, incorporating physical visible landmarks in the story clips themselves or adopting specific storytelling techniques which direct the audience's attention to the desired physical targets.

Numerous observations were made regarding the graphical interface. Several users reported they found the icons (which appeared to indicate when stories were available to view) obstructed the map and made navigation more difficult. On the other hand, most users indicated that the small dots that marked story locations could have been more informative, perhaps indicating whether or not a clip had previously been played. Several users also asked for a mechanism to structure their tour through the city, suggesting where they should go next. These users found the casual, opportunistic presentation of the MPL content to be too undirected. Possible solutions outlined were the inclusion of a numbered sequence of stories (indicating the order which they should be visited) or of a visual path on the map which could be followed. Others' suggestions for easing coordination issues including a "back" button to make re-viewing content easier and auto-centering the map on the user's current location to reduce the amount of scrolling required. A number of users also had problems orientating the map to the environment: automatically adjusting map orientation with data derived from a digital compass may alleviate this problem. Two final fundamental issues raised were that audio-only stories might sometimes be preferable (as they would not interfere with perception of the environment) and that the limited brightness of the PDA screen detracted from the quality of the viewing experience.

Story Design
The non-traditional and fragmented narrative structure used in the MPL evoked a range of responses in both evaluations. Some audience members enjoyed it, finding the format engaging and challenging. As they moved through the experience, these individuals found themselves increasingly motivated to seek more story parts, trying to

complete the picture, to finish the puzzle. Typically, these users enjoyed the anecdotal self-contained style of the story fragments, and the fact that they could choose where and what they would experience next. On the other hand, a few audience members found the non-linear story structure frustrating and confusing. A more common complaint was that the treatment of the characters and topics was shallow: the abbreviated story fragments lacked fundamental depth. The collection of stories was rarely perceived as a sequential narrative (although such an ordered sequence was sometimes requested), but it was generally recognised as portraying the character of the neighbourhood.

LAMS experience can be quite overloading and careful thought must go into ensuring all narrative content is effectively conveyed to viewers. It is possible that simple procedures such preceding each clip with a short audio introduction may be able to achieve this. Several users also reported difficulty following themes between clips, suggesting that the graphical mechanism (the highlighting of related content) employed in the MPL was not as useful as it was intended to be. One solution to this problem may be to have characters close the story fragments with suggestions or hints as to where to proceed next. Better software tools and UI paradigms to highlight meaningful story sequences may also resolve this issue.

C. General Discussion

Evaluating a complex, narrative artifact and novel story presentation system is challenging and consequently the MPL evaluation targeted three specific goals. It was structured to explore whether LAMS can form an immersive experience and act as a place enhancer and story catalyst. The mix of tightly specified user groups, semi-structured interviews and analysis of experience transcripts achieved these goals, although the results themselves were somewhat mixed. The study showed that local residents mainly experienced the MPL as a place enhancer and story catalyst LAMS. As they were unfamiliar with the area, the other two user groups could not contribute stories. The Dubliners reported considerable immersion in the MPL content and that the system served as an effective place enhancer, although this effect was hampered by difficulties with precisely aligning the story and real worlds. However, levels of immersion were not explicitly reported by the foreigner user group although most of them felt it enhanced the place, and revealed interesting and surprising aspects of a neighbourhood they would have not otherwise explored. From this discussion, it appears that the MPL system was most effective as an immersive experience with those with a certain level of familiarity with the neighbourhood: the Dubliners, but not the local residents or foreigners. We speculate that this is

due to the fact that they were able to appreciate the story material (because their background allowed them to easily empathise with it) without being distracted by either it (as with the locals) or the physical environment of the neighbourhood (as with the foreigners). On the other hand, the system effectively functioned as a place enhancer across all three users groups.

Design Recommendations

This paper highlighted many aspects of relevance to LAMS design, from both technical and narrative perspectives. These are presented below, structured as a set of design recommendations that are intended to be directly applicable to future LAMS systems and easily accessible to LAMS authors.

Focus on specific audiences. As in film and related disciplines, a key aspect of successfully engaging an audience is to target it in particular. Any LAMS system should therefore be designed for a specific audience or set of users. In the MPL evaluation, each of the three user groups expressed different opinions on many aspects of the system, from appreciation of the content to use of the interface. For locative media, the question of who the audience will be is a complex one since most of these experiences are designed for public spaces. Although somewhat self-evident, one key issue is that the role of navigation aids is inversely related to how well the user group knows the area. Furthermore, while locals are drawn in by stories, visitors may also demand supporting facts. A social study of the population inhabiting and using the targeted area is likely to help with identifying the range of possible users that the application would interest and how to design it so that they can best appreciate the system.

Modular stories convey atmosphere. Short story fragments work well in the context of LAMS experiences. Generally, the MPL's users were able to stitch together the disconnected scenes they watched into a cohesive whole; to link the fragments that directly connected with one another, and to absorb the rest as detail contributing to a richer and more atmospheric experience. However, care must be taken to ensure that characters and events are treated with depth: some viewers reject lightweight presentations.

Include guidance, such as paths or timelines. Users unfamiliar with a neighbourhood tend to use the system as a tour guide to aid navigation. Providing tools to support this, such as paths suggesting where to go next, may make the system more accessible for them.

Explicitly situate media. It is important that the media is explicitly designed to allow users to situate the content in the environment. If they are unable to superimpose the videos with their location, the effect of the experience is

lessened. One technique is to start each clip with a photograph of the relevant location. Others are to slow story pace, to dwell on key items, or use explicit dialog within the clips to highlight objects in the world.

Screen UI is visualization, not an interaction. Generally, the users wanted to see more (e.g., the path they had taken or might take next or indications about whether they had already seen a piece of content) but do less. They wanted to look at the system and see more, but keep actual, explicit interaction with the handheld device to a minimum. Movement in the physical space should be used to control the interaction as much as possible.

VII. CONCLUSION

This paper has presented a novel approach to space and narrative that combines the physical environment with audiovisual story fragments, superimposing narrative content on the world. It terms such artifacts Location-Aware Multimedia Story (LAMS) systems, a sub-genre within the wider field of locative media. In particular, it describes the design, construction and evaluation of one LAMS project, the Media Portrait of the Liberties. This project explored the practical issues underlying the combination of interactive non-linear narrative structures and the use of movements in a real place to control narrative progression. The evaluations indicated that it was a qualified success, offering an immersive experience to many users, fostering storytelling activity among local community members and enhancing and changing the perception of the deprived inner city neighbourhood in which it was set. Most users reported they would like to try similar systems in other areas, including their own.

Audience members appeared to engage well with the MPL stories, but there is still much to explore in the area of a specific cinematic language for small portable screens. On an artistic level, future directions for this work include exploring what visual aesthetics match the portable and intimate characteristics of mobile video display. On a technical level, interface improvements related to navigation and coordination issues should be implemented. The UI should be redesigned to further emphasise visualisation over interaction and the map should be elevated to the forefront of the display at all times. Finally, conceptual work on how to structure stories to better link to physical locations should be conducted, adjusting narrative pacing to better match user behaviour (so as to prepare users to look at the screen for key story events and make sure that they can look at the environment without feeling they are missing out on stories events.).

In conclusion, locative media is a paradigm which has been recently enabled by dramatic increases in the capabilities and popularity of mobile technologies. These capabilities are here to stay, and indeed are likely to become commonplace. GPS and video playback, the technologies required by the MPL project are increasingly shipped as standard in high end mobile devices, and likely to trickle down to lower end devices in the near future. This leads to the interesting prospect that location-aware multimedia stories, such as those presented in this paper, could soon be deployed to a very wide audience, using the mobile hardware they already have. As users demand more entertainment and information from their handsets, LAMS may develop into a key niche area. The experiences and insights presented in this paper will support future researchers and interaction designers who seek to push back the boundaries separating narrative and space to create cohesive, compelling and immersive story systems. Real space is an underused design element in interactive narrative and the paradigm outlined in this work offers its audience a mechanism to gain a new appreciation of spaces, places, stories and the compelling experiences that can emerge from their overlap.

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