Planning Locative Media within Physical Space and Collaborative Workspace

Rung-Huei Liang
Dept. of Commercial and Industrial Design
National Taiwan University of Science and Technology
Taipei, Taiwan, R.O.C.
liang@mail.ntust.edu.tw

Yin-Huan Chen
Dept. of Computer and Communication Engineering
Ming Chuan University
Taoyuang, Taiwan, R.O.C.
s0160205@ss23.mcu.edu.tw

Abstract

As internet technology develops, we transfer more and more physical activities into cyberspace. On the other hand, mobile technology frees the location of cyberspace participants, and therefore, the situation and context of an avatar come back to the physical space which not only plays a role of computing interface but also provides physical social interaction and contextual experience. The emerging of locative media in urban space focuses on placing media at a location and in advance, it is often designed, planned, discussed, experienced, and modified forward and backward. Due to the complicated and time-consuming procedure of locative media planning, this paper proposes a collaborative workspace to support tangible, participative, and collaborative design by linking physical location and workspace simultaneously.

1. Introduction

Recently emerging, locative media cover many areas such as mobile technology, geospatial web, place and space, public art, social science, urban planning, and so on. In the forthcoming future, multi-disciplinary team-work for locative media design is obviously necessary. Generally, within a collaborative environment, team members collect data, organize and digitize data, discuss in the same physical space, solve problems, share information and provide data for decision making. Moreover, computer-supported collaborative workspace extends the possibility of integrating virtual and physical space. It is usually a table equipped with tangible interface, computers, and display devices such as projectors.

Typically, a collaborative location-specific content planning is conducted by discussing around a scale model or a map (Figure 1-1). This global view of each location and area is helpful to arrange, organize and plan the locative media. However, the time and space of the planning are completely different with those to be experienced. For example, the created media are usually downloaded some other day and experienced at the location while the participant might find that a bad smell around this location destroys the whole music listening. Probably, the observation and opinion of a participant would feed back to the planners to make some modification. On the other hand, even though the planners can fix the problem, the location in situ might go through other unexpected events and alter contexts.

To solve the problem, two major methodologies of researches can be included in locative media design. One is laboratory or experimental research which is conducted in a quasi-controlled environment. The typical collaborative workspace in laboratory is of this type which is often conducted in an isolated and controlled laboratory. The other is field work which is generally adopted for the collection of raw data in the natural and social sciences (Figure 1-2). The unexpected context in urban space certainly will affect the locative media placement and experience. Thus, field work method for mobile user study is also an important aspect in mobile service planning.

Our research is to integrate these two methodologies. An augmented reality platform visualizes the information to enhance the spatial concept of locative media. Planners can easily assign missions and overlap information onto a scale model. Moreover, the collaborative platform is connected to the physical location to enable participants in physical location to directly experience the overlapped media planned in the collaborative workspace in real-time. Furthermore, participants in situ (Figure 1-3) can collect real raw data (people's sense of a place, the dynamics of the crowd, the relation between place and community, location-specific information) with mobile devices and transfer to the discussing platform.

We will introduce previous researches of collaborative workspace systems and location related applications in the following section. Section 3 will depict more detail of our research concept. The system architecture and scenarios are described in Section 4 and 5, respectively. Section 6 will illustrate our prototypes and discuss the merits and drawbacks.

1-1 1-2 1-3

Figure 1. Locative media planning

1-1. Cooperative discussion, 1-2. Field work, 1-3. Locative media experiencing

2. Related works

Most collaborative desktop systems put emphasis on the interaction between users and systems [3][4][5][13], and these systems facilitate simple manipulations such as inserting, deleting, and modifying digital information on desktop. Some system focused on intuitive interaction through tangible objects [6], and others highlighted the working area of each participant within the collaborative process [2]. We summarize the properties of these systems in Table 1. For examples, such properties include granularity of information, multiple layers of visualization, highlight of focus, interaction of tangible object, and so on.

Instead of using real-time information for planning, many systems employ prepared database of simulation during collaborative work. However, certain situation would require real-time data input. For example, using sensors in an automobile to transfer real-time data to the collaborative designers is extremely helpful to understand the dynamic property [5].

Collecting physical data in material world [14], for example, taking pictures or videos in urban space, is very significant in geospatial research. Moreover, to plan locative media efficiently, our research emphasizes the bidirectional connection and real-time negotiation between physical space in situ and the collaborative workspace.

Table 1. Properties of collaborative desktop systems

Reference / Co-workspace	[1]	[2]	[3]	[4]	[5]	[6]	[11]	[12]	Our system
Granularity of information		●	●						
Multiple layers of visualization	●		●	●					
Visual highlight of focus		●		●					
Interaction of tangible objects						●			
Personal and collaborative space on the table	●	●	●	●			●		
Input of real-time data					●				●
Digital information of duplication, edition and modification.			●	●	●		●		
Personal orientation of viewing digital data		●							
Physical data								●	
Bidirectional connection between physical world and laboratory									★

3. Design principles

The following paragraphs are some concepts in our research.

3.1. Connecting physical world

While planning locative media in collaborative workspace with scale model, participants can overview the geographic and spatial relations with global viewpoint. However, the information in situ can only be collected in the physical environment. The pre-collected data can hardly represent the contextual interaction at the location. We think that the physical world around the mobile users should be connected to the collaborative workspace.

3.2. Augmented scale model

Instead of digital map, we use augmented scale model to provide much stronger spatial sense. As in the typical urban planning, 3D spatial information is especially important for planners to find out the shortcoming.

3.3. Real-time bidirectional communication

We think that instant and bidirectional communication between collaborative workspace and physical world is particularly necessary in planning locative media. Generally, designers and planners often discuss and arrange media on a collaborative platform in advance. Placing media in physical space, experiencing the media in situ, and observing if there being contextual conflict are common procedures to feed back planners for modification (Figure 2). Thus, a second iteration of the whole process repeats between the two spaces until acceptable feedback appears. Therefore, real-time communication in these two spaces could be more efficient in planning and experiencing locative media without iterative repetition.

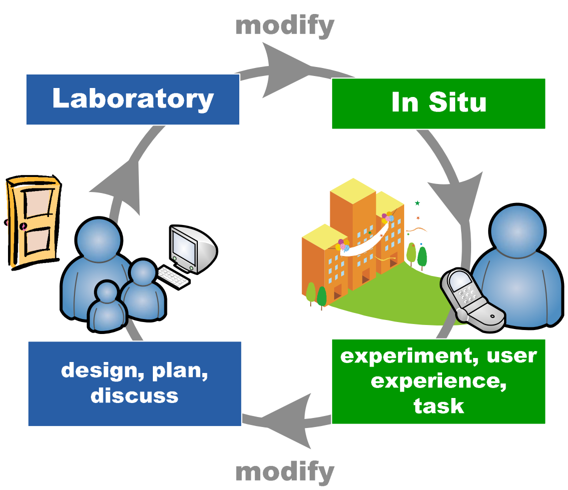


Figure 2. Locative media design procedure

3.4. Supporting field work

In field work, a researcher is often a participant at a location to interview or observe people and place. The aim is to collect raw data in situ and to understand the subject of study at the location of daily life. Investigators usually collect data during a period of time, observe and interview intensively, and keep as objective without interference as possible. Due to the social environment or physical world is too complicated to observe objectively and comprehensively, a researcher in a social situation has to make decision about what to collect or not. If a system supports multiple users to collaborate in field work in real-time, the collected data are supposed to be more comprehensive.

Field work is essentially related to location. Therefore, our proposed collaborative workspace for locative media planning can easily support fieldwork. Planners can assign missions to field workers at a specific location, and also the collected data can be visualized and overlapped on the scale model. Rate of progress of every locative investigation can be known and updated dynamically.

4. System architecture

Our system consists of two spaces: one is collaborative workspace and the other, is physical space. The collaborative workspace is a scale model with AR tangible interface. We use MXRToolkit [13] to recognize and track visual markers and superimpose digital information onto markers, so that participants can directly manipulate markers to attach or edit digital information at the corresponding location. Different layers of locative information are overlapped on the scale model. Participants in situ hold PDAs (HP iPAQ h6300) with GPS (HOLUX GPSlim 236) to collect data and transfer them to a web server. Thus, the system can overlap the real-time collected data at the corresponding location on the scale model (Figure 3).

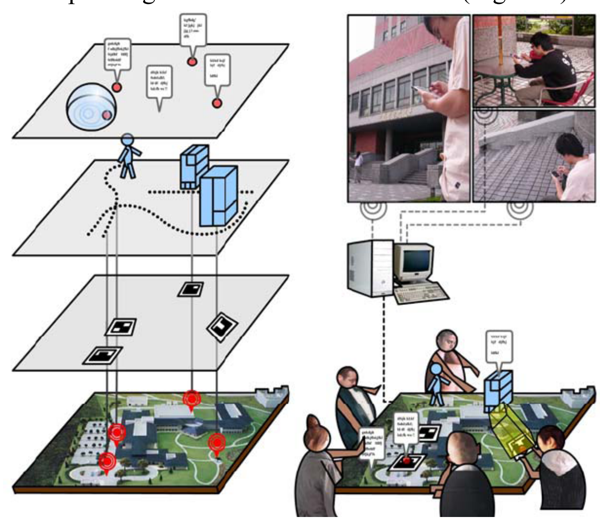
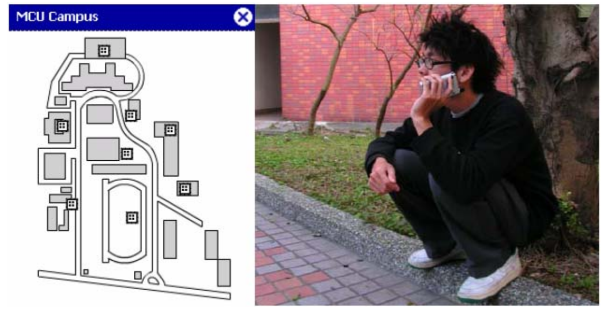


Figure 3. System architecture

The goal of the collaborative space is to provide designers and planners with face-to-face discussion, and to provide a bird's-eye view of an area (Figure 4). This global viewpoint can facilitate the comprehensive design of digital information. Tangible AR interface also supports intuitive manipulation while discussing (Figure 5 and 6).

Figure 4. The 3D collaborative workspace with special markers at relative locations



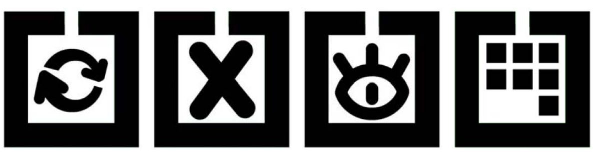
7-1 7-2

Figure 7. Interface and a mobile user

7-1. The interface of the PDA shows selected location, 7-2. User collect authentic data in physical space

Figure 5. Media planning with tangible blocks

Planners can rotate the control block to trigger and select different media



(a) (b) (c) (d)

Figure 6. The function of the control block

(a) select (b) delete (c) copy (d) location

On the other hand, users in the physical space can collect more authentic data compared to the data provided by the collaborative desktop (Figure 7). Especially when humans are the subject of study, for example, social interaction in situ, observation can be transferred to the system via wifi connection. Moreover, users can instantly experience the attached media by planners in laboratory within the real environmental context, and report their comments in real-time (Figure 8).

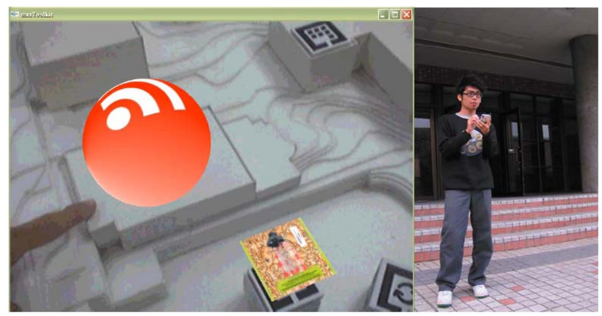


Figure 8. Real-time workspace and a mobile user

Users experience the attached media in the real environmental context and report their comments in real-time to the collaborative workspace

5. Scenarios

5.1. Spatial storytelling

Network technology has made spatial storytelling possible for mobile users in physical space. Nanasezita and her friends like to record, narrate, and share their experiences in urban space in a collaborative manner. Thus, decision about where to provide narrative service becomes important. With our platform, planners can discuss and decide the location of story node and Nanasezita's friends can instantly experience and sense the story in the real context of physical world. As time passes, the surrounding context of some story node might change such that the original location is no longer suitable for storytelling. For example, a new store opens and the environment becomes too noisy to listen to story. Contextual conflict of the attached stories might also occur as conflict in geosemiotics. These situations can be collected and feed back in a field work manner to our platform.

5.2. Field study

John, a sociological graduate student, researches Military Housing's culture of Guishan Village. He interviews residents and records everything with PDA everyday. After he completes a stage, he often discusses with his teacher and classmates. They don't spend time for find data in disorderly paper when discussing. Paper record provides text data, sketch, and location data. However, John can't connect with context of the location afterward. He must imagine or rethink what happens and what is here at that time. Paper does not support space and location awareness. On the other hand, before field work starts, group members will talk about how to assign tasks and locations for group members. Collaborative workspace is easy to observe which part of progress of location does not finish, and what information of location needs to be investigated more.

6. Experiments and results

We have tested our system with experiments. One experimental group is assigned to perform the task of placing music clips at appropriate locations in Ming-Chuan University campus with our system (Figure 9). On the other hand, the control group is asked to do the same task without our platform, that is, no real-time and bidirectional mechanism. In our preliminary observation and interview, members in the experimental group felt easier to perform planning with tangible markers on the desktop. Moreover, while interacting around the scale model, planners felt interested and satisfied with the face-to-face discussion with other members. However, since the control group was not allowed to use our scale model, members tended to place music clips and experience them in campus with trial and error. The result also showed that the control group would place music clips in a relative small area than the experimental one.

Participants in the experimental group also reported that real-time editing and experiencing locative music in situ could reduce the time of design. In the beginning, planners around the scale model could arrange almost all of the music clips with a global view, and afterward, they modified them immediately after receiving the feedback from participants at the real location. Forward and backward modification and experiencing simultaneously sped up the whole planning process.

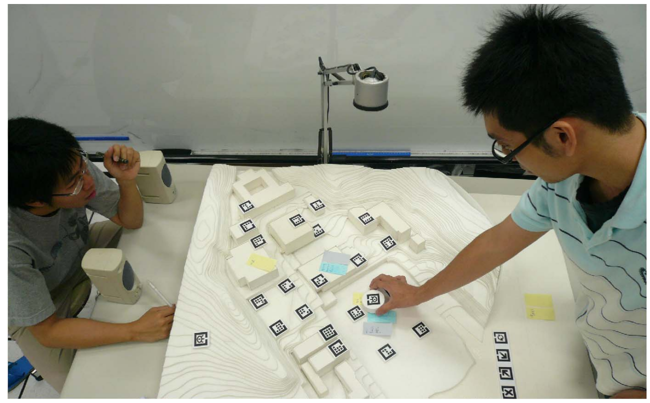


Figure 9-1. Planners at laboratory
Planners interact with AR tangible interface to place locative music clips

9-2 9-3 9-4 9-5

Figure 9-2, 9-3, 9-4, 9-5. Interaction detail
Figure 9-2. Proximity interaction: to put music clip at the location, 9-3. Participants in situ are shown as avatars, 9-4, 9-5. Controllable objects are used to perform inserting and deleting music clips

7. Conclusion

Locative media planning is such an emerging area in urban planning that neither the experimental research nor the field work can solve the problem solely. We try to solve the problem by integrating two research paradigms, a collaborative workspace connected with mobile users in physical space.

Our work provides global and in situ viewpoint on a collaborative platform such that designers and participants can cooperate in virtual space and physical space.

Instead of preliminary observation, we will test our system with quantitative evaluation.

8. References

[1] M. Haller, P. Brand, D. Leithinger, J. Leitner, T. Seifried, and M. Billinghurst, "Shared Design Space Sketching ideas using digital pens and a large augmented tabletop setup," *Proc. 16th International Conf.(ICAT 2006)*, LNCS4282, Springer, 2006, pp. 948-959.

[2] U. Hinrichs, S. Carpendal, and S.D. Scot, "Evaluating the Effects of Fluid Interface Components on Tabletop Collaboration." *Proc. AVI 2006*, pp.27–34,

[3] A. Tang, M. Tory, B. Po, and P. Neumann, "Collaborative Coupling over Tabletop Displays," *Proc. SIGCHI conf. on Human factors in computing systems (CHI 2006)*, ACM Press, pp.1181-1190.

[4] D. Wigdor, C. Shen, C. Forlines, and R. Balakrishnan, "Table-Centric Interactive Spaces for Real-Time Collaboration." *Proc. AVI '06*, pp. 103-107 2006

[5] R. Shannon,A. Quigley, and P. Nixon, "Collaborating in Context: Immersive Visualisation Environments." *Proc. AVI'06*, pp.13-16, 2006

[6] M. Hirano, I. Kase, A. Narita, K. Kobayashi, H. Nakanishi, and H. Ishii, "A Tangible Interface for IP Network Simulation." in Extended Abstracts of *Conference on Human Factors in Computing Systems (CHI '03)*

[7] R. Scollon, and S. Wong, Discourses in Place, Taylor & Francis Ltd, 2003.

[8] N. Nova, F. Girardin, and P. Dillenbourg, "Location is not Enough! an Empirical Study of Location Awareness in Mobile Collaboration." *Proc. WMTE* 2005. *Musical Expression*, Vancouver, BC, Canada, May 2005, pp.26-28,

[9] W. Carter, and L. Liu, "Location33: A Mobile Musical," *Proc. the International Conf. on New Interfaces for*

[10] J.L. Chen, and R.H. Liang, "The Never Ending Story: A Collaborative Narrative Storylog." *Proc. International Computer Symposium, (ICS2006)*, vol 2, pp. 745-752

[11] M. R. Morris, A. Huang, A Paepcke and T. Winograd "Cooperative gestures: multi -user gestural interactions for co-located groupware" *Proc. SIGCHI 2006*, pp. 1201-1209

[12] G. Reitmayr, E. Eade, T. Drummond "Locasation and Interaction for Augmented Maps" Proc. International Symposium on Mixed and Augmented reality (ISMAR 2005)

[13] MXRToolkit. http://www.mixedrealitylab.org