Collocated Interaction in Cultural Storytelling Experiences: How to Coordinate Visitor Actions?

Figure 1: Participants brainstorming, storyboarding & testing, during the authoring session at the Visitor Centre, Çatalhöyük, August 2014

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Abstract

In this work we report on a recent user study where 20 couples experienced in a laboratory setting an interactive, mobile-based, digital story for an archaeological site. We describe the design of the experience and analyze our approach with regard to a design framework that was recently proposed for collocated interaction in mobile experiences. We present some key observations regarding the adopted approach for coordinating visitor actions.

Author Keywords

collocated interaction, mobile, digital storytelling

ACM Classification Keywords

H.5.1 Multimedia Information Systems

Introduction

Personal mobile devices are often considered antithetical to collocated social interaction, privileging the personalized experience. Although they promote remote interaction, the majority of mobile applications are designed in a way that hinders interaction between collocated users [1]. This is especially the case for mobile-based experiences in cultural heritage sites, despite the fact that people typically visit them in social

Figure 2: Interaction points providing narrative and visual variations to the two users

groups [2]. The value of social interactions during such visits has been stressed early on in museum studies and several works focus on the use of digital technologies as means to enhance this social context.

A variety of configurations and techniques have been used; in some cases a shared medium is employed, such as situated displays or shared mobile devices (projectors or tablets[3]), enabling groups of visitors to view the screen in a collaborative way. Other approaches leverage personal mobile devices and promote communication between group members in different ways, such as through communication and alerting services on the visitor personal devices [4], mobile drama using coordinated narrative variations [5], carefully designed trajectories [6]. A design framework was recently proposed in CSCW for the design and systematic analysis of such systems, providing four relational perspectives: Social, Technological, Spatial and Temporal [7].

Background Work and Contributions
In our previous work, we reported on a series of experience results from the creation of interactive, digital museum stories at high-profile cultural sites such as the Acropolis Museum (Greece) and the archaeological site of Çatalhöyük (Turkey) [8]. These stories were implemented with the CHESS prototype [9] and their design focused primarily on the personal dimension, aiming to tailor the experience to each visitor's attitudes. Focusing on the social dimension, we re-structured and extended the experience that was originally created for the site of Çatalhöyük, in an effort to promote verbal communication and physical interactions between visitors. The development and on-site testing of the experience is described in [10].

Knowing that an in-situ compared to a remote study might provide different results [11], a laboratory study was also designed.

Aiming to investigate and systematically analyze the effects of several interrelated dimensions of our approach, we recently conducted a user study in a laboratory environment; 40 participants were provided with individual tablets and experienced the interactive digital story in couples. In this work, we first describe and analyze the overall design of the storytelling experience. Supporting the effort to establish a common road map and aiming to place our approach within the CSCW field, we adopt the terminology proposed in [7].

Storytelling Experience Analysis
The digital story employed in the user study focuses on Building 52, a special building in the Çatalhöyük site. Two main characters, a Neolithic woman and an archaeologist from the excavation team narrate in an interleaved way their experience with this house.

Audio narrations are accompanied by one or more images and the user can interact with them primarily by zooming in and out. When the audio narration ends, the story flows to the next part, without requiring any input from the user, hence imposing a predefined story pace. In some cases however, the images are annotated with green circles; the user can tap on the circles to be provided with additional information regarding the selected part of the image. Whenever such interactive images are reached, the story flow is interrupted, enabling users to explore them at their own pace. For the story to go on, the user taps the corresponding "Go on" option.

Figure 3: Half of the interactive map is presented on each user's device; the map is "unraveled" when the two devices are place right next to each other

Figure 4: On-site testing of the social experience

Similarly to [9], our approach combines moments of isolation and social encounter. Verbal communication between visitors is facilitated in several points of the experience via visual prompts that ask users to:

▪ *Consult their companion to answer questions*.

Narrative and visual variations are employed on that front, inspired by the Information Gap technique in Communicative Language Teaching approach. By utilizing visual variations on the two users' devices, the couple is indirectly prompted to stand close to each other, open up and share their devices (e.g. look or even tap on the other device). In some cases the couple is even asked to align their devices in a particular position, creating an extended "shared screen" that is formed by the union of the two displays that the couple can subsequently explore together.

▪ *Reflect and discuss with their partner about particular issues, share personal memories, think out of the box and express their own ideas/arguments.*

▪ *Choose a virtual object and offer it to their partner.*
So examining our approach from the Technological Perspective proposed in [7], *Information Distribution* is unfolding and limited, while Information Symmetry is combined; it is symmetrical in most parts of the experience while assymetrical when narrative or visual variations are provided. The Interaction Abilities are symmetrical, in the sense that both users can act and interact within the experience in the exact same way, while there are no Event-Triggers in the system.

Regarding the Spatial Perspective of the designed experience, in order to efficiently provoke interactions between users, our approach relies on *Proximity* between people, as well as between people and devices

(each user holds a tablet or mobile phone), and between devices (in order to be able to look or use it in a combined way). The story about Building 52 was initially authored with the purpose to be experienced on site, within a particular excavation area where the remains of Building 52 may still be observed. For the laboratory user study, the story implies no physical *Location* requirements or *Movement* from the users (thus, no movement patterns studied here).

Focusing on the Social Perspective, the *Framing* of the experience is public and the *Focus* of our approach lies on the Communication of information, memories, ideas, reflections and personal opinions. It also creates a strong Focus on Collaboration, but on a physical rather than conceptual level, since the users are prompted to look or/and use their partner's device, or even combine it with their own. The interplay of couple interactions is shaped by carrying out simultaneous actions; users need to reach interaction points more or less at the same time. *Coordination of Action* has been carefully considered during the design of the experience and the content variations provided to the two users are curated to have almost identical duration and information depth. However, as already stated, while a common pace is generally defined by the story's flow, the interactive image activities may be explored on each user's personal pace, which may vary a lot. In addition, at any point of the experience the users may decide to pause or skip selected parts. So in practice, while coordination of actions may be achieved by some couples, there is no way to ensure it in the design level, unless some form of *Synchronization* is enforced.

Moving on to the Temporal perspective, the duration of the experience is quite short (~15 minutes), requiring

Figure 5: Participants of the user study that took place at the Human-Computer Interaction and Virtual Reality Lab of the University of Peloponnese. After watching the short documentary about Catalhoyk on a large wall display, the participants wear their headphones and start their storytelling experience.

continuous *Engagement*. Its *Pacing* is a combination of user and system paced while the experience was designed so that private moments are balanced and interleaved with the shared ones. *Synchronization* of user actions is system-driven but it is not enforced; couples are prompted to synchronize and coordinate their actions at particular points but they may as well neglect the system's encouragements and follow entirely different pace throughout their experience, hence choosing not to interact with each other (at least not in the way expected to). We deliberately decided not to enforce synchronization since we wanted to let the users decide whether they actually wish to engage in the social interaction activities or whether they prefer to adopt an individualized experience, following the storyline in private.

Experimental Procedure

The study took place in the Human-Computer Interaction and Virtual Reality Lab of the University of Peloponnese (2 day experiments, December 2015). The study was announced in the university Facebook page and we asked people to participate in couples (to bring a friend along). The participants brought a friend that should be a person they have either shared or they would share a cultural experience together. 20 couples participated in the experiment. When the participants arrived, they were shown a short documentary on the Çatalhöyük Neolithic settlement.

The participants were given two tablets and were asked to experience the stories presented in any way they wished as if they were actually visiting together the site, ignoring the experimental setting. Then the researchers withdrew and left the participants alone. Each session lasted for about 10 to15 minutes. After it
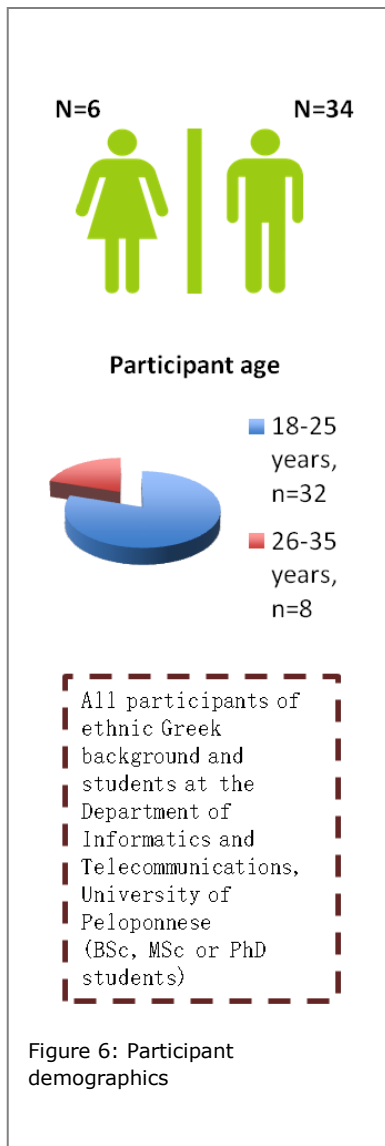
was finished, the participants answered a post experience questionnaire followed by a short interview in which the participants described in detail their experience.

Aiming to investigate and analyze the benefits of provoking verbal communication and physical interaction between the users, we decided to compare the social storytelling experience to the one that was originally authored for the site of Çatalhöyük on 2014 (referred to as baseline experience in the following). To that end, 10 groups participated in the baseline experience and 10 groups in the social one, while the exact same procedure was followed in all cases.

Results and Discussion

The data resulting from the experiment are currently being processed as to investigate correlations between user behavior and different aspects of their profile. In this work we focus only on preliminary results related to the coordination of user actions and the synchronization of their experience. Eight out of the ten couples who experienced the social version had a synchronized experience. This is a promising result concerning our non-strict approach to synchronization. Surprisingly, in the baseline version, two of the ten couples also managed to have a synchronized experience, coordinating their actions.

U3 (male) and U4 (female) arrived relaxed for the experiment, smiling a lot and joking, and experienced the social version. She seemed initially more focused on her device whereas U3 sporadically glanced at her screen, seemingly a bit more uncertain. At the first interaction point, they look simultaneously at each other, and he asks, smiling "Should we do something

N=6   N=34

Participant age

- 18-25 years, n=32
- 26-35 years, n=8

All participants of ethnic Greek background and students at the Department of Informatics and Telecommunications, University of Peloponnese (BSc, MSc or PhD students)

Figure 6: Participant demographics

now?" She replies, "Yes we should". They take off their headphones to engage in verbal communication. In this case, coordination of user actions was accomplished in a supreme level, intuitively and effortlessly. They reached all the interaction points at the same moment, thus totally synchronizing. They seemed casually aware of the other's pace, through sporadic glances and comments.

When U11(male) and U12 (male) arrived, they seemed quiet and a bit uncomfortable to behave naturally and speak in a loud voice, however they seem comfortable with each other. They started the baseline version, sitting slightly facing one another. Their experience starts with a difference of about 10 secs. During the first minute they exchange glances and then U11 asks U12 "Should I continue?" U12 says "Wait until I am there." and they press the button to continue together. They seemed from the start to consider as given that they will synchronize their experiences and in the first minute they make an effort to recover synchronization since in the beginning it was evident that one of them started later. This is accomplished through glancing at each other's screen and checking that they are at the same point before continuing. During the whole time their iPads are on the table, close to each other and towards the end they are completely side by side, until the experience finishes.

Similarly, U21 (male) and U22 (male) proceeded with a common pace and finished at exactly the same time. However, these users experienced the baseline version and did not speak at all throughout the experience. They assured synchronization by frequent glances at the each other's screen, as if in a non-verbal agreement that they go forward together.

U5 (male) and U6 (male) did not know each other prior to the experiment and were offered the social version. U6 seemed completely absorbed by the screen, sitting upright with his hands on the table whereas U5 was more relaxed, trying to find a comfortable position on the chair. Initially and throughout the experience, there were some attempts from U5 to see what was happening with U6, trying discreetly to look at his screen. This seemed less an attempt to synchronize but rather an attempt for communication, as the story prompted him to approach his partner. However, obviously he did not feel comfortable enough to verbally or otherwise approach U6, so after a few minutes he gave up and again relaxed on his chair. He finished 2 minutes earlier than U6. In this case we see that, although the experience included direct prompts for interaction, U6 decided to completely disregard them, whereas U5 did not feel confident enough to explicitly pursue interaction. Similarly, the U33 (male) and U34 (male), offered the baseline version, did not make any attempt to synchronize throughout the whole experience. Each one was focused on their own device.

Not surprisingly, this approach of system-driven synchronization seems ineffective for introvert users, however this should be further investigated by correlating the success of the social interaction experience with the user profile as to extroversion (extraversion/introversion have been identified by using the Big Five questionnaire).

Conclusions and Future Work
This work is part of our on-going effort to explore mobile collocated social interactions in a cultural heritage context, primarily on-site but also exploring digital interactive storytelling as a virtual experience,

where the user can approach cultural heritage through his/her mobile device with friends at home. The experiment at the University of Peloponnese has been duplicated at the University of Athens. The results are currently being analyzed. Synchronization in such a social experience is crucial, as its lack may seriously affect absorption and engagement of the users in the experience. To this end, we will investigate, additionally to our approach, other possibly system-driven synchronization paradigms, will systematically review types of visitor actions, and will add other parameters like movement patterns and personality styles.

Acknowledgements

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