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# Cultivating mobile-mediated social interaction in the museum: Towards group-based digital storytelling experiences

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## Abstract

The museum visit is a collaborative activity: people typically visit museums in social groups, and conversation between group members has been highlighted as a key aspect for an engaging visitor experience. In this work, we detail initial findings and experience results from the design and evaluation of a group-based digital storytelling journey, where visitor-to-visitor engagement takes place under the frame of an interactive, mobile technology-based story. The results suggest not only the potential to cultivate social interaction between individuals using their own mobile devices, but also to generate immediate transcultural and transgenerational understanding and cooperation in situ.

Keywords: group interaction, digital storytelling, mobile technologies, museum narratives, interpersonal interaction, mobile guides

## 1. Introduction

People typically visit museums and heritage sites in social groups, either in conjunction with organized parties or with family or friends (Falk, 2009; Petrelli & Not, 2005). The value of social interactions taking place in such visits has long been recognized as important in museum studies (Hood, 1989; McManus, 1992), and a growing line of research now focuses upon digital technologies as a means to enhance this social context. Recent initiatives have sought to facilitate interaction among group members by using large situated displays that enable collaborative delivery of information, interaction with other group members, and collaborative planning and re-planning of the visit (Belinky et al., 2012). Other approaches have offered communication and alerting services on visitor devices, aiming to stimulate conversation about the museum's contents (Kuflik et al., 2007).

Mobile devices, on the other hand, are often understood as antithetical to social interaction, privileging the personalized experience and hindering engagement between visitors (Wessel & Mayr, 2007; also see Heath and vom Lehn, 2008). Headphones, regularly used to deliver content to improve the visitor-exhibit relationship, can further impede human-to-human connectivity; and efforts to deploy mobile media for enhancing "social navigation" (Höök, 2003) arguably tend to draw visitors into passive forms of interactivity.

Face-to-face conversation is thus seemingly more challenging to achieve in the mobile-mediated museum—a point of concern given that conversation and sociality have been highlighted as key aspects for engaging visitor experience in museum environments (Jafari et al., 2013). To test

possibilities for achieving social interaction in such environments, Szymanski et al. (2008) have used synchronized audio delivery of guidebooks to pairs of visitors with their own mobile devices to promote conversation between visitors. Similarly, Callaway et al. (2014) have experimented with mobile-delivered drama employing coordinated narrative variations (i.e., different versions of the narrative offered to each user) to induce conversations in small groups. These approaches suggest that conversation can in fact be used as a measure of successful engagement.

Inspired by these complexities in the museum-mobile relationship, here we detail initial findings and experience results from the design and evaluation of a group-based digital storytelling journey, where visitor-to-visitor engagement takes place under the frame of an interactive, mobile technology-based story.

In our previous work, we reported on a series of experience results from the creation of several interactive stories at high-profile cultural sites: the Acropolis Museum in Greece, the UNESCO World Heritage Site of Çatalhöyük in Turkey (Roussou et al., 2015), and the Stedelijk Museum in Amsterdam (Vayanou et al., 2015). These stories were implemented using the CHESS system, a research prototype developed under the CHESS (Cultural Heritage Experiences through Socio-personal interactions and Storytelling) project (http://www.chessexperience.eu/). The CHESS stories were delivered in the form of branching narratives, employing multimedia content in the form of audiovisual presentations, games, and augmented reality activities on mobile devices (Pujol et al., 2013; Vayanou et al., 2014).

Aiming to investigate how to author and evaluate digital stories that promote conversation and collaboration between group members, we restructured and extended the experience that was originally created for the archaeological site of Çatalhöyük. Here we discuss the development and initial on-site testing of this experience with visitor pairs who interacted via a combination of digitally mediated prompts, narrative variations, “shared screens” (mobile devices held together to form a “whole” view that visitors subsequently explored together), and interpersonal decision making and reflection. The results suggest not only the potential to cultivate real-world social interaction among individuals using their own mobile devices, but also to generate immediate transcultural and transgenerational understanding and cooperation in situ—at the cultural heritage sites themselves.

## 2. Experiment design

Our main assumption was that an underlying storytelling framework delivered to visitors at cultural sites could be the key to establish, stimulate, and enrich face-to-face physical and interpersonal interactions between individuals and their surroundings. The main research question we investigated is how to design for such interactions, in the context of a co-located, mobile-mediated storytelling experience. While there is a range of interactions that could have been considered, in this experiment we focused on promoting (i) verbal communication between pairs of visitors and (ii) shared use of their individual devices.

In case of group visits at museums, there are typically two main configurations for shared mobile-guides (Lanir et al., 2013): using a single device or using multiple devices. In this experiment, we employed the latter configuration, investigating how to use the devices as private channels of content communication in some parts of the experience, while also sharing them with the rest of the group in other parts.

Instead of designing and producing a new experience from scratch, we restructured and extended the

experience that was originally created for the site of Çatalhöyük during a digital storytelling workshop organized on site in July 2014 (Roussou et al., 2015). The story focused on Building 52, a special building at Çatalhöyük. Two main characters—Abla, a Neolithic woman, and Archie, an archaeologist from the Çatalhöyük excavation team—remember their experience in relation to this house, offering information about its use, significance, and the mystery of its destruction. The two characters narrate their stories in an interleaved way, providing two different perspectives on each of the main topics covered throughout the experience (Figure 1).

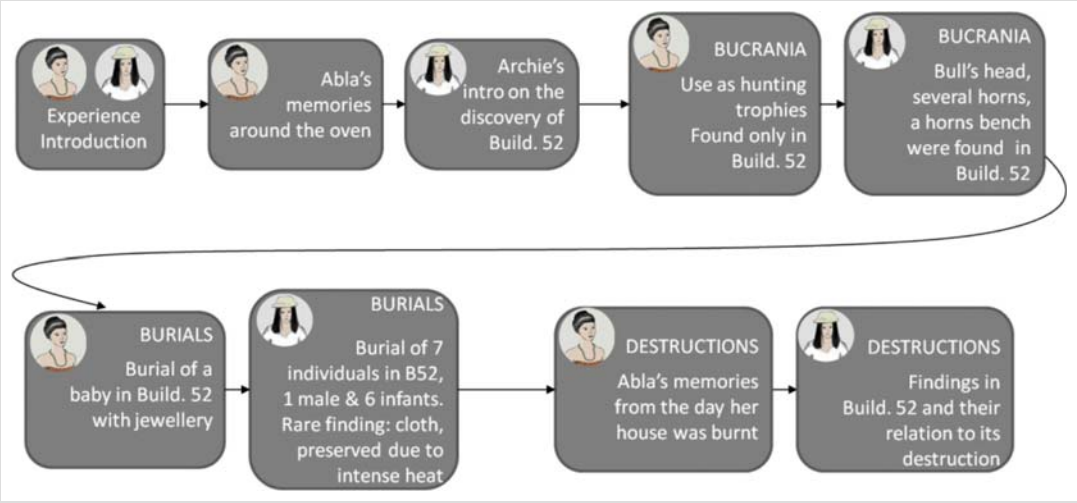


Figure 1: original storyline for the site of *Çatalhöyük* (August 2014)

To create the story, we formed a multidisciplinary authoring group composed of several archaeologists from the site, interaction designers, and researchers and technical experts from the CHESS project. Inspired by techniques used in Communicative Language Teaching—an approach that emphasizes interaction as both the means and the ultimate object of study—several interaction points were added, including information gap, reasoning, and opinion gap tasks.

For instance, in information gap tasks, the system provided different narrative and/or visual clues to the two users at specific points in the experience (indicated with blue and green colours in Figures 2–4). At the first interaction point (Figure 2), two different narratives are offered about the Bucrania (bull horns) at Çatalhöyük: user 1 explores Abla's point of view, whereas user 2 follows Archie's. Then, a different image is displayed on each user's device: one depicting a bench with bull horns and another highlighting its location within Building 52. The pictures are accompanied by related questions or suggestions, such as "Can you imagine what a bench of bull horns may have looked like?" and "Ask your companion to show you where it was," which can only be solved by exploiting the visual clue on the other user's device. The two users are then prompted to exchange their screens and collaboratively explore the clues displayed on both of them.

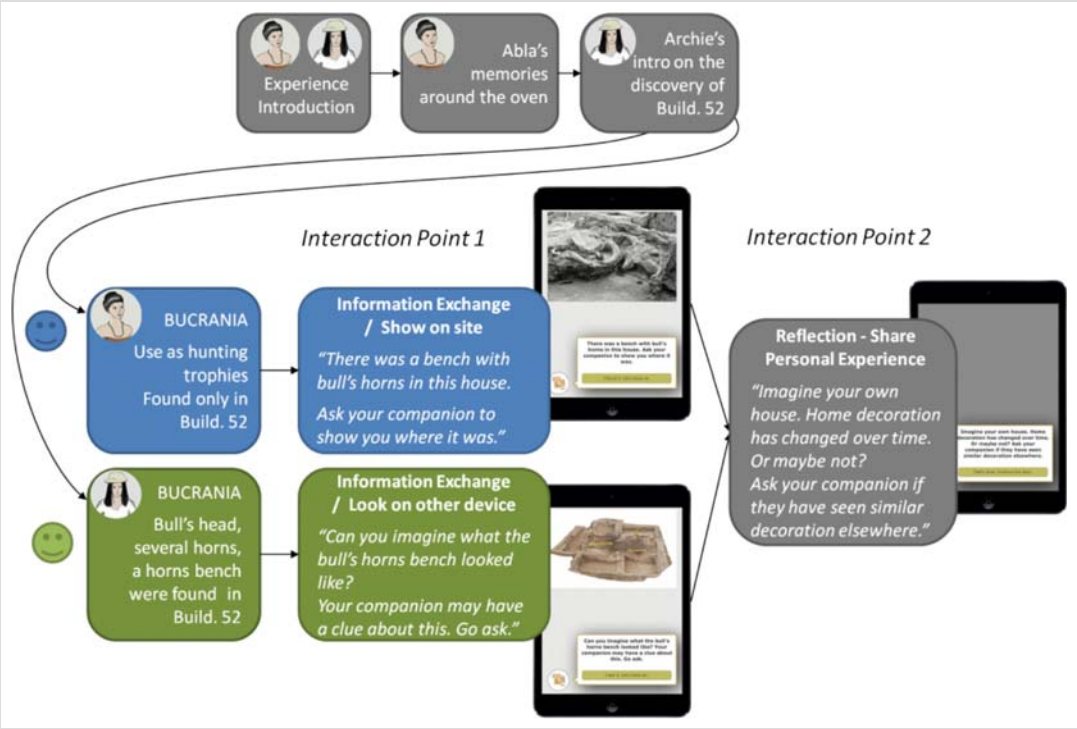


Figure 2: interaction points in the "Bucrania" topic

Narrative variations have been also investigated by Callaway et al. (2014): in order to enable users to identify that different versions of the story are available at a particular point, they adopt a narrative-tension model. Their main assumption is that users will initiate a discussion with their partner in order to resolve the (artificially) sustained tension. So, in this case, no explicit prompt to communicate with the other group members is provided. Instead, a short idle time follows each narrative variation, and users are expected to start discussing on their own initiative.

In our experiment, we decided to follow a different direction: users were explicitly prompted to communicate or/and collaborate when an interaction point was reached. Our main purpose was to observe and report user reactions and emotions towards such prompts. Do they welcome the idea of discussing and physically interacting during a visit to a cultural heritage site? To what extent do they engage in the discussions? Do they effectively collaborate to achieve common goals, and in what ways? Do they create time to jointly interact on a particular device, or do they proceed separately and just peak at the other's screen? Do they enjoy that they have to work as a team for the full narrative to become evident?

We deliberately decided not to forcibly synchronize the users' devices, since we wanted to let the users decide whether they actually wished to engage in the interaction points or whether they preferred to adopt an individual experience, at their own pace.

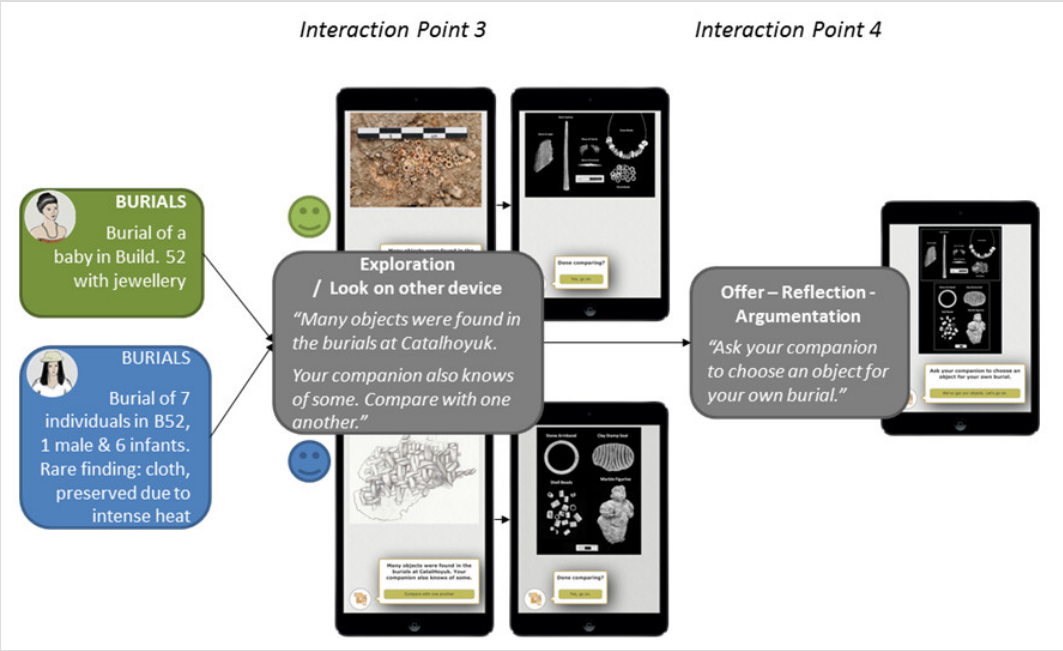


Figure 3: interaction points in the “Burials” topic

Besides narrative variations, we also experimented with different types of interaction in order to investigate their implications for users’ physical, verbal, and interpersonal communications. We added several prompts to various parts of the story in an effort to compel discussion, reflection, sharing of personal memories, establishing links between past and present, and promoting collaborative decision making about past inhabitants and activities in Building 52 (interaction points 2, 5, 7). Aiming to add playfulness to the experience, we included a “gift giving” task, based on deeply rooted transcultural social practices (Mauss, 2011): users were prompted to choose a particular archaeological find for their companion’s burial.

Moreover, in order to enhance the haptic nature of holding/looking at the mobile device, users were prompted to open up and share their individual devices with their partner in several cases; for example, by aligning them in a particular position (interaction point 6) or/and by collaboratively tapping on and unlocking the provided content (interaction point 1, 3, 6). This created a kind of “shared screen” for visitors, pulling the content on their individual devices into a larger whole—something they could subsequently explore together.

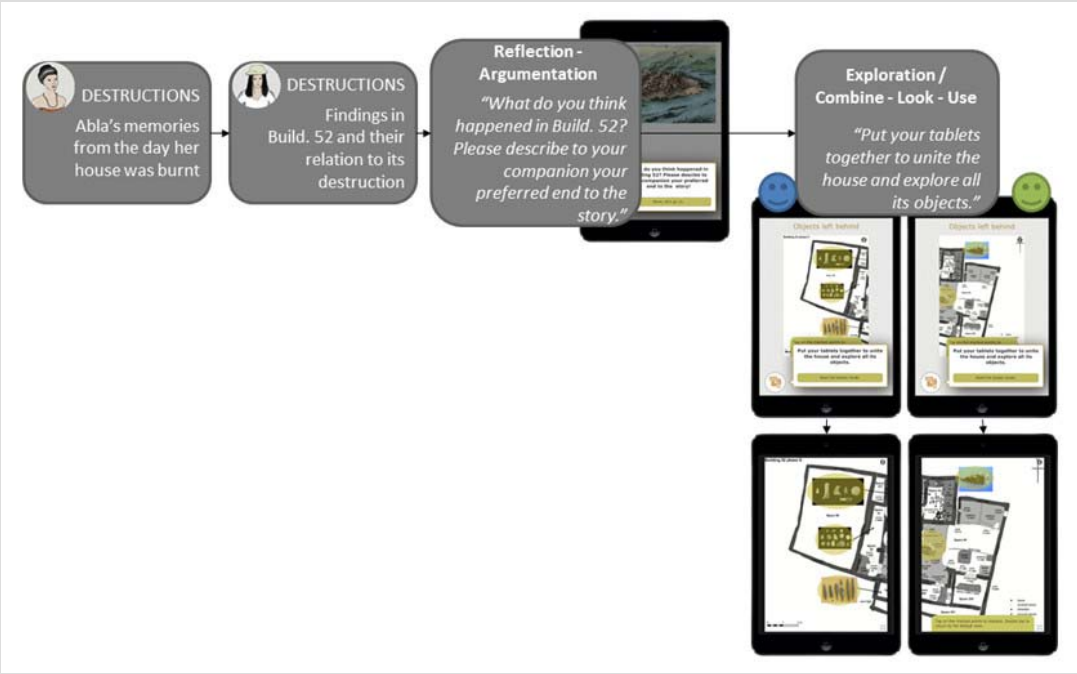


Figure 4: interaction points in the "Destruction of Building 52" topic

### On-site testing process

The experiment took place in late July to early August 2015 at the archaeological site of Çatalhöyük in Turkey. In order to examine our prototype from the points of view of usability, interaction design, and heritage interpretation, we opted for a heuristic evaluation approach (Nielsen, 1994) with a small set of evaluators from computer science and archaeology. On-site testing was conducted in groups of two users. Each group was selected based on three criteria: familiarity with the use of mobile devices for leisure and entertainment; familiarity with the other participant; and expertise either in mobile computing or archaeology. The evaluation involved sixteen participants (ten female and six male), between twenty and thirty-five years old, with English as their first or second language.

After a brief introduction to the experiment and signing the consent form, participants were taken to the site, in front of Building 52, which was the focus of the storytelling experience. Each user was given an iPad with headphones. All sessions were videorecorded by the experiment facilitators. After the end of the experience, users were led to the site café, where a semi-structured interview took place. A set of thirty questions helped gather their general impressions and opinions about the story plot, the social aspects in general, and the different kinds of social interaction introduced by the particular activities. Finally, a multimodal analysis (Jewitt, 2013) triangulating the information from on-site experiences and interviews was conducted to identify patterns of interaction between users, between users and the system, and between users and the interpretative content.

## 3. Evaluation results

Based on the participants' overall feedback, one of the main objectives of the study, namely, to introduce system-driven interpersonal interaction at cultural heritage sites, was positively received. The introductory narrative was designed to inform participants about the social nature of their experience and encourage them to communicate with their companions in order to obtain a complete view on the topics presented. We observed certain characteristic gestures, such as glances, smiles, and nodding between participants, during this audio narration. Such reactions suggested attempts on

behalf of participants to initiate interactions with their companion or welcome what might follow.

Figure 5: a user shows to her companion the location of the Bull horns bench (Interaction Point 1)

The positive reaction to system-driven interpersonal interactions has been confirmed in the interviews. User 7 notes that ‘‘it made you think a lot about what you could see but also to converse with your companion to understand better what it is that you experience.” As commented by some users, questions, even though not always explicitly answered, provoke thought and debate. User 4 reports: ‘‘I liked the questions you had to ask your companion. I didn’t always know what to say but I liked that aspect.” However, some users felt they would have appreciated some feedback from the system confirming the answer to these questions.

Additionally, User 5 refers to a feeling of engagement with this type of prompted interaction when she mentions, ‘‘I liked it a lot. It gets you more engaged when you discuss with someone.” User 8 elaborates on engagement ‘‘…it got us engaging with each other. It’s quite nice because one person has been given some information and the other hasn’t so they feel they can contribute to their friend’s understanding of the site by actually pointing out where it was [the Bull Horns Bench]. It just gives you that sense of helping and giving to others.”

Another response highlights that the merit of such interactions is that they support the users to visualize and reflect more deeply on the site. As User 7 reports: ‘‘‘It made you think a lot about what was there and converse with the person next to you, not just looking around. Being able to talk to the other person was positive, makes you visualize and reflect more easily. Normally when you go around in a museum you look and read by yourself, you rarely get a chance to hear what other people hear or feel. Helps you think deeper.”

Figure 6: users sharing their screens to explore the objects displayed in Interaction Point 6

Participants also mentioned that this kind of digital interpretation, combining storytelling with interpersonal communication prompts, felt “more fresh without being flashy,” “funnier,” and gave the opportunity to “develop your own points of view and interpretations.”

Critically, two paired participants also referred to situations of awkwardness and forced behaviour. As User 1 commented: “It is kind of awkward to interact with your companion during the visit. It was not natural, we were forced to interact. We were doing it because we had to. The questions forced us. If we did not have the questions we would probably talk about this after the experience was over, not during it.” We are inclined to associate this feedback with a number of points raised in our evaluation relating to the design of conversational sessions in the story flow. Some users felt that their collaborative activities were disjointed from the main story flow, and in some cases even disrupted it. To avoid such negative impacts in the future, users proposed that the results of their interpersonal interactions could be fed into the system, later affecting the rest of the story.

It was also observed that User 4 constantly checked her companion’s screen across the storytelling experience. She explained such behaviour was due to a developing feeling of not being told all she needed to know and not knowing where the two narratives overlapped or what bits of information were commonly or individually presented. In her own words: “It’s nice to check back with your companion about other information. It says in the beginning that you and your partner are going to hear different aspects of the story, but you wouldn’t know each time which bits of information are different. So the only way you can find out is to ask your companion; but this becomes a bit repetitive.” Moreover, this feeling was intensified by the open-ended character of the questions asked and the lack of clues about the differences between narratives: “The questions were too open ended and general which makes it even harder. So unless the question is framed around the different information then it’s not very clear which bits of information we could exchange.”

Another issue related to synchronization of the experience presented itself. User 7 commented on this: “The tasks were clear but I was not always sure that we are at the same point and ready to communicate.” In cases where one user skipped part of the content, they found themselves ahead of

their companion. In other cases, they were not sure if they had somehow missed the interaction activity or if they were not there yet. The puzzlement of participants was evident from their bodily movements. Often, as per our observations, when one of the participants finished a narration snippet, s/he would attempt eye contact first with the pairing companion. If the latter ignored the first contact attempt, usually the former would respond with more extroverted bodily movements, such as turning their body or moving towards the other person, in order to become noticeable and initiate the conversational session.

Several users felt that more interaction with the device was needed. User 5 “expected more importance to be placed on the app. We could declare our decisions and choices with buttons to provide more feedback between us and the app.” Being more and more accustomed to impressive and engaging mobile apps, participants felt a digital experience with a linear story offering mostly audio and illustrations was poor. User 1 characteristically reported: “It was not interactive enough to keep me engaged. There were not enough things to do in the app.”

However, the “sharing screens” component of the narrative demonstrated that interaction with the system could also enhance interaction between individuals. Users were excited to actually bring their devices together as a method of communication and interaction between them. But, at once, they reported that they would have liked a stronger result than merely holding their devices together to interact on this “shared screen” space. As User 3 reported: “It would make more sense if something else happened on screen when we put the iPads together. We felt something would happen like the site coming to life.” User 4 suggested that “actions on the tablet could affect what is going on the other person’s tablet, causing things to happen.”

However, these technological limitations were compensated for by strong emotional and social engagements. Asking users to choose an object for their companion’s burial was one of the most successful activities. Users visibly enjoyed choosing an object for their companion based on a selection offered on screen: their reactions, in some cases, included lively conversation and laughter. This activity was also mentioned spontaneously in the questionnaires. User 1 said: “It was the best part of the questions. It helps you interact with the other, it is an opinion question. We had to choose, and we had to talk about the reasons for our choice.” On a more general level, once users realized they would be asked to interact with their companion based on the information they were given, they seemed more actively engaged in the experience. As a participant commented, “When you are asked to explain or summarize information you need to attempt to comprehend it first.” User 3 explained that “being asked to condense the information into something verbal can keep you engaged and active.”

Participants were asked whether this type of digital experience would meet their needs when visiting cultural heritage sites. Based on their previous experience in museums and with desktop applications, they expected some of the activities, like being asked questions, but they didn’t expect interacting with their companion. Again, a number of participants expected to interact more with the application and the story itself, even at the expense of social interaction. As User 4 reported: “I would have enjoyed it more if the app gave me the opportunity to be an active agent in terms of the story. That would probably distract from the social aspect, but I feel like the app is not taking advantage of the digital medium to present the site.” Nevertheless, when asked if they would choose to experience this type of interaction at cultural heritage sites in the future, the majority replied positively. User 4 characteristically said, “I wouldn’t go to Pompeii just because I would know that there is this kind of social interaction app, but I would definitely try it out once I was there.”

Visitors in cultural heritage settings tend not to be accustomed to activities that require—much less

promote—interpersonal interaction. Our users spoke in low and subdued voices, almost seeming reluctant to speak to each other inside a cultural space. Furthermore, at Interaction Point 1, where users needed to share information about the location of the bull's horns bench and its appearance, they all seemed unsure of how to proceed and how to interact with their companion. As the site is an ongoing excavation, it is possible, as some participants noted, that the lack of correspondence between what users saw on screen and the current state of Building 52 may have contributed to the difficulties they encountered in locating the bench. However, the unfamiliar expectation that users would actually work together to interpret the archaeological record could have been equally responsible.

## 4. Discussion

The experience conducted at Çatalhöyük about the capacity of mobile storytelling experiences to foster social interaction has provided interesting insights on three levels. First, it has forced attention on rationales for, and ways to encourage, interpersonal exchange at cultural sites. Some users stated they felt forced to communicate and would not have done so without the application. This presumption is debatable and deserving of further interrogation. On the one hand, there is very little interpretative material currently available in relation to Building 52 at Çatalhöyük, making unprompted and knowledgable conversation about its history virtually impossible. On the other hand, interaction, and especially social exchange, is still not always natural at cultural places. Visitors, as evidenced by our participants, still follow very strong—more or less conscious—patterns of behaviour (e.g., maintaining silence) at such sites.

Our intent with such a mobile-mediated experience was therefore to help break down some of the interpretative barriers experienced (and often reproduced) by visitors at Çatalhöyük (Perry et al., 2013; Perry & Chrysanthi, 2014) and beyond. Mobile technologies deploying system-driven interpersonal interactions are in a privileged position to begin shifting visitors' pre-visit expectations about the experience. In this case, we sought explicitly to create spaces of socialisation in a setting where it was previously not common.

However, as our tests indicated, visitors may struggle to perform the interactions that are "expected" from them. As a general guideline, if social activities are to be included in a mobile experience, they should be made explicit and explained to users early on. For example, introductory collaborative activities could be added at the beginning of the experience to "break the ice" and familiarize the participants with the interpersonal interaction elements they will later encounter. As noted during the experiment, users seemed to appreciate clear instructions in interpersonal interaction, even in cases where the assigned task was to reflect about the content.

At a finer level of detail, and again based on our participants' feedback, we believe that the partial information exchange approach must be carefully designed. There should be a clear objective for the exchange, beyond simply having the users repeat information to one another. It should also be justified within the narrative flow, in order to ensure smooth transitions between different parts of the experience. Further, partial and conflicting information should be followed by information exchange activities to explore this conflict. All such solutions need to be investigated further in future developments of the prototype system.

Second, our research has drawn attention to matters of synchronization between users' systems. Our initial design decision was to neglect such synchronization; yet, in the light of our findings, it proved to be one of the biggest flaws of the system, and therefore requires reconsideration. Two critical

problems presented themselves: i) there was no signal to users to indicate completion of their tasks; and ii) there was nothing to distract users while they were waiting for their companions to finish. Of course, experience designers would not want visitors to feel as though they were in a race, but neither would they want to leave them in limbo. Future iterations of the experience should test different possibilities for activities to be completed or displays to appear in the “waiting time.” Another option would be to find seamless ways, whether on the back-end system or integrated in the story plot, to keep users in sync as much as possible.

Finally, our findings raised issues about the balance between the application’s prominence and social interaction. In our opinion, this is representative of a more general problem with mobile applications. Not only do they tend to take precedence in the visitor experience, but users may actually come to cultural heritage sites with expectations that this is meant to happen (Perry, 2016). As a consequence, they can fundamentally never act as a true complement to the visit, because they are seen to take priority rather than weaving seamlessly into the visitor experience. However, our findings provide some clues as to how to reach a balance. On the one hand, the system should not leave questions unanswered, but provide feedback immediately after social interactions, so that visitors verify their activities. On the other hand, visitors’ exchanges can be integrated as feedback into the system to affect the subsequent development of the story. Strong emotional, transcultural activities may also reduce expectations from the technology. Finally, on the technical side, dynamic events could be added at very specific moments to enrich the content.

## 5. Conclusions and future work

In this paper, we reported on the findings of a series of tests conducted at the UNESCO World Heritage Site of Çatalhöyük in Turkey. Our goal was to investigate ways to overcome the user isolation generated by mobile-based experiences at cultural settings. Existing scholarship has demonstrated different methods to promote spontaneous interaction between users, mainly deploying the information gap technique. Our aim was to explore a more guided approach, where users are prompted to participate in different information gap and other collaborative activities. Although preliminary, the results of our tests at Çatalhöyük have been promising in relation to the contribution of system-driven interpersonal interaction activities to the quality of experience when visiting a cultural space.

To explore further these conclusions, a follow-up laboratory evaluation was organized during December 2015 and January 2016 and is still ongoing. In this case, pairs of users are asked to follow in the laboratory the same (but slightly updated) storytelling experience of Çatalhöyük. The objective is to gather rich qualitative and quantitative data on the effectiveness of interpersonal interaction in the visitor experience, focusing also on learning and in relation to visitor profiles. We suggest that such research may eventually enable a reconfiguration of the typical experience of cultural sites, transforming them into spaces of knowledge making through socialization. Here, visitors would ultimately come to know the world not only through interaction with its materials but also via direct emotional engagement with one another.

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