

This is a repository copy of *Shared Digital Experiences Supporting Collaborative Meaning-Making at Heritage Sites*.

White Rose Research Online URL for this paper:

<https://eprints.whiterose.ac.uk/id/eprint/133026/>

---

## Book Section:

Perry, Sara Elizabeth [orcid.org/0000-0002-9694-000X](https://orcid.org/0000-0002-9694-000X), Roussou, Maria, Mirashrafi, Sophia et al. (2 more authors) (Accepted: 2019) Shared Digital Experiences Supporting Collaborative Meaning-Making at Heritage Sites. In: Lewi, Hannah, Smith, Wally, Cooke, Steve and vom Lehn, Dirk, (eds.) The Routledge International Handbook of New Digital Practices in Galleries, Libraries, Archives, Museums and Heritage Sites. Routledge International Handbook. Routledge. (In Press)

---

## Reuse

Other licence.

## Takedown

If you consider content in White Rose Research Online to be in breach of UK law, please notify us by emailing [eprints@whiterose.ac.uk](mailto:eprints@whiterose.ac.uk) including the URL of the record and the reason for the withdrawal request.

# Shared Digital Experiences Supporting Collaborative Meaning-Making at Heritage Sites

**Sara Perry\***, **Maria Roussou\*\***, **Sophia S. Mirashrafi\***, **Akrivi Katifori\*\*** and **Sierra McKinney\***

\*University of York

\*\*National and Kapodistrian University of Athens

## INTRODUCTION

A growing body of research testifies to the capacity for archaeological and other cultural heritage sites to generate wonder, attachment, personal transformation and restoration, family bonding and community building amongst their visitors. However, these aspects of the visit to a heritage site are underexplored, especially in the design of digital tools and experiences. The social dimension of the museum, in particular, has received little attention. Even if it is well known that museums and heritage sites are primarily visited by groups of people rather than individuals, the digital experiences created for them are often inadvertently designed for the individual alone.

In the context of two related European Union-funded research projects, CHES<sup>1</sup> and EMOTIVE<sup>2</sup>, we set out to develop mobile-based emotionally-engaging digital stories for groups of visitors to diverse cultural heritage sites. The collaborative projects have brought together the resources of participating organisations from at least 5 different European countries in each case, and from different sectors; i.e. industrial partners, academia and research institutions, and representatives of the GLAM Sector, ranging from world renowned museums, such as the Acropolis Museum in Athens (Greece), to UNESCO World Heritage sites, such as the Çatalhöyük archaeological site in Turkey. Our evaluation studies feature detailed observations of visitors on-site, as well as post-experience questionnaires and interviews, providing us with rich data on several axes; e.g. in relation to interactive story plot and narration, staging and wayfinding in the physical space, personalisation and social interaction.

In this chapter, we specifically focus on shared experience and the impact that digital technology can have in promoting the cultural site as a social space. On the one hand, our findings testify that digital empathic stories can evoke narrative transportation, and even, in some cases, personal attachment and critical (self-)reflection. This leads us to consider how their enchanting capacities might be pushed even further into the building of broader, collective social conscience. At the same time, the findings reveal the challenges, both conceptual and practical, of designing a shared digital experience in which visitors engage with the site and each other in meaningful ways.

---

<sup>1</sup> <http://www.chessexperience.eu/>

<sup>2</sup> <https://www.emotiveproject.eu/>

A critical next step in our ongoing and future work will be to develop even deeper means for visitors to meaningfully speak and interact with one another; and, ultimately, to explore the broader global implications of enhancing meaningful shared digital experiences in museums by drawing out differences and similarities in the way social groups interact in different global contexts.

## THE MUSEUM AS A SOCIAL SPACE

Visitor studies research confirms that visitors to most sites and museums come in groups (Dierking, 2012; Petrelli & Not 2005, 2017) and that museum visits tend to be driven by a social agenda (Perry, 2012). According to Dierking (2012, 202), about 60-70% of museum visitors in the United States, United Kingdom and Australia are families, and 25-35% are school or adult tour groups, while only 5% or less are individuals visiting by themselves. Even amongst these individuals, vom Lehn et al. (2001) underlines that peripheral awareness of other strangers within museums shapes how visitors move through an experience.

However, existing approaches to museum displays of information often do not seem to cater to groups, while very few studies explicitly attend to how people engage with museum exhibits in groups (Davies & Heath, 2013; Tolmie, 2014). Even in those contexts where sociality *has* been accounted for, it can often seem narrowly conceived, ignoring pre-and post-visit experience as well as the complexities of the visit itself, which may entail both shared and independent encounters (e.g., López Sintas et al., 2014). Indeed visitors themselves may still hold expectations that prompt them to quietly absorb information individually, rather than challenge and engage with it as a group (Chang, 2006; Katifori et al., 2016).

Digital technology in museums and archaeological sites, if appropriately designed, provides the potential to support groups and the social interactions among their members. The social aspects of a mobile-enhanced visit have been explored by several researchers (Damala et al., 2008, Massung 2012, vom Lehn and Heath, 2001), yet social interaction is one of the aspects that many mobile guide technologies fail to encourage (Othman, 2012; Woodruff et al., 2001). The design of digital applications for visitors has to date been geared toward the individual rather than the group, primarily because it is difficult to conceive and implement shared experiences with and around personal devices. This is evident in the wide use of headphones and small screens to learn from, plugging the visitors into their own individualised experience (Hindmarsh et al., 2002). Furthermore oftentimes instead of connecting the visitor to the site, mobile applications create more distance between the two, with ‘little or no physical relevance’ to connect them to the historical space (Perry, 2016).

When it comes to opportunities for human-to-human interaction, isolation between different members of a group of visitors when using electronic guides has also been cited as a disruption to the social aspects of a museum visit. Massung (2012) observed that such isolation seemed self-imposed by the visitor rather than the technology. Even when co-visitors have been made to stand side-by-side to listen to the same commentaries via mobile technology, discussion between visitors was rarely observed to occur.

In the early steps taken to bring digital applications to the world of heritage, the fostering of collaboration and dialogue was a main concern (e.g., Holtorf, 1999; McDavid, 1998). Arguably, however, their deployment through personal mobile media served to heighten the problematic qualities of such media by focusing users inward. To encourage external-facing social interaction, we argue below for a prioritization of the human-to-human experience. Herein, digital platforms are woven in to enhance the experience, rather than to drive it.

## **ISSUES WITH GROUP EXPERIENCES**

While there are many reasons why social experiences in museums are beneficial, they come with their own challenges and problems. For instance, groups may not act like a single unit, with group members going through museums at their own pace, each with their own expectations and goals. Trying to preserve group coherence can be a challenge as it is a common occurrence for people to get ‘dragged away’ from exhibits or information which they find interesting (Tolmie et al., 2014, 1051). When constructing group experiences, a certain amount of flexibility must be taken into account.

Children often offer another challenge, breaking expectations of collaborative learning and ultimately taking on the role of decision maker in a larger group (Hope et al., 2009). If a child is unwilling to participate, then their parents will more likely than not compromise in the child’s favour for the coherence of the group at large (Rennick-Egglestone et al., 2016). On the other hand, children acting as the primary decision makers in a group could be interpreted as an asset to experience construction, encouraging the accompanying adults to get involved.

Moreover, some visitors are simply not interested in speaking with each other. Because there is often an expectation of individual experience at a museum, to subvert this may not always be a welcome change. Forced interaction can hinder rather than enhance a visitor’s experience. As an example, a follow-up to the CHERS project, which worked to take steps forward (with mostly positive effect) in the introduction of collaborative digital storytelling in museums, was not without its critics. One user of the experience pointed out the awkwardness in forced interaction with a companion, stating that it was not natural because conversation would have occurred after the experience, not during (Katifori et al., 2016).

While there is indeed much work being done in shifting the perception of museums from a solitary to a group-centric space thus more accurately reflecting the demographic of people who visit, there is still room for improvement. Open air museums and art museums make a distinct effort to encourage people to speak to one another and question what is in front of them. As noted above, a great many articles discuss the importance of collaborative experience in museums, while relatively few offer real ways in which to create them.

## PREVIOUS WORK IN DESIGNING GROUP EXPERIENCES WITH DIGITAL TECHNOLOGY IN CULTURAL SITES

Successful digital collaborative experiences must effectively work to enhance the space that visitors are inhabiting, rather than drag them out of it. The ‘eavesdropping’ technique, proposed by the pioneering electronic guidebook application of *Sotto Voce* at Filioli (a historic house in California), encourages group communication in a museum environment (Woodruff et al., 2002). Essentially, a synced device is given to each visitor with content they choose themselves, as well as a volume controller which determines how loud they can hear the audio from their companion. If one visitor chooses a clip, the other can either choose to hear what their companion had selected, or listen to their own. The team found that when visitors could hear what their companions’ audio guide was saying, they were much more likely to engage with each other over objects, whether those objects were mentioned directly in the guide or not (Aoki et al., 2002). Fascinatingly, the researchers found that the shared experience shifted the importance from the objects to the space around them, allowing visitors to navigate themselves around the museum rather than being led. This is an interesting method to ‘increase awareness’ of what the other members of the group are interested in and doing (Tolmie et al., 2014, 1053). Indeed, it is not uncommon for pairs of people to want to synchronize their experience, especially if the purpose of the outing is to spend time together (Fosh et al., 2013).

Another approach involves goal-directed tasks in which the speaker and listener engage with each other to achieve a particular goal (Yule, 1997). An example of this was tested at the Mackintosh Interpretation Centre in The Lighthouse in Glasgow, where a group of visitors on site shared their location and orientation to a partner off-site i.e., a virtual visitor on the internet, communicating with each other via a voice channel. Through the audio channel, they ‘navigated around a shared information space’, learning and sharing different aspects of the site with each other based on their location (Brown et al., 2003, 577). The trials found that while much of the conversation between onsite and online visitors was devoted to reporting where they were, there were also instances of reading text aloud, sharing opinions, and making connections from the space around them to their everyday lives (Galani & Chalmers, 2013). These experiences utilise gaps in knowledge to encourage the collaboration of individuals. The interconnectivity of the physical and digital surroundings can thus open paths of interaction between museum visitors.

The previous examples offer ways in which visitors can experience a curated exhibition together without interacting with it directly. Interactive storytelling could be another effective way of developing social engagement between visitors, while giving them a chance to take part in the narrative. Such initiatives have been of particular interest to our work in the CHESS project (Roussou and Katifori, 2018). A number of experiences were authored for the Acropolis Museum in the course of the CHESS project, each of them based around a central character who tells a story around a set of objects in the museum. Each experience is delivered via a browser-based interactive application run on a tablet. The content is largely communicated through voice narration ideally experienced with a set of headphones (Figure 1). Users are directed to look at objects in the museum that parts of the narrative are built around. In addition to the narration, there are images and animations shown at times on the tablet’s screen.

Although not particularly designed to foster collaborative museum visits, the evaluation of the experiences revealed a group of challenges associated with the requirement to assist the predominantly social nature of visits. More than 50 visitors (among them 12 pairs) were observed while using the mobile storytelling guide at the Acropolis Museum in Athens and were later asked about their opinions regarding individual vs. group experiences (Figure 1). Their responses varied, depending on their personal visiting style: while some visitors expressed preference for a mostly individual visit (with the possibility to exchange impressions at some points), others expressed the wish for a constantly shared experience. Similar to other studies, our research found that practical encumbrances (e.g., the need to tie everyone together with headphones on a single device) limited conversation between members. Nevertheless, visitors adopted non-verbal techniques, expressions and body language strategies, to communicate and share the experience.

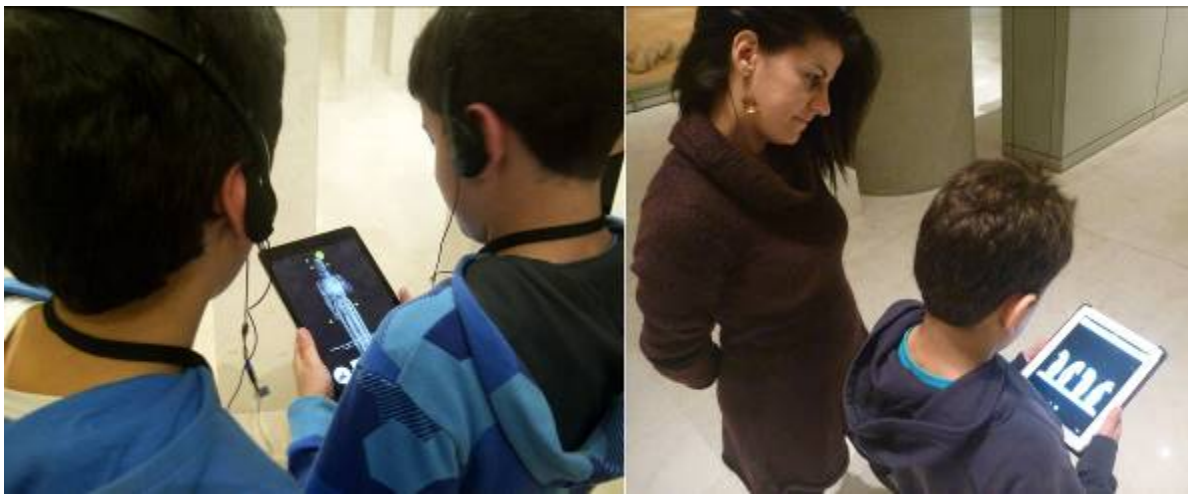


Figure 1: The composition of the pairs experiencing the CHEAD stories varied. Here peers and parent – child pairs experience stories at the Acropolis Museum.

Furthermore, our observations from previous ethnographic studies (Tolmie, 2014) were confirmed. In particular, the role that one group member takes can impact that member's or even the whole group's engagement with the content. For example, in the case of parents visiting with children, the experience was mainly led by the latter (who usually carried the device); parents acted mainly as content mediators, thus sacrificing their own experience for the sake of facilitating their children (Rennick-Egglestone, 2016). In subsequent iterations, we made the interaction and navigation structures clearer so that adults could modify, assist and direct children's experiences to fit the immediate local social concerns, but also to facilitate synchronised experiences. Finally, adding a playful element to storytelling was seen as another way of engaging groups of people. Collaborative games in museums, where there are a mix of characters to manipulate and explore, allow the visitor to step into the narrative themselves via a proxy (Klopfer et al., 2005). It is not difficult to encourage people to interact with each other when asked to play a game, as gaming brings with it the assumption of collaboration and questioning.

Based on the findings from CHESS, we have been exploring the design and development of applications which aim to engender engagement between groups of visitors at the archeological site of Çatalhöyük in Turkey. Located near Çumra, Konya in central Turkey, Çatalhöyük is a UNESCO World Heritage-listed site taking the form primarily of two mounds, containing at least eighteen levels of continuous occupation dating from 7100 to 6000 BC. Occupied by thousands of individuals 9000 years ago with little evidence of social hierarchies or inequality (Hodder, 2014), Çatalhöyük sparks great interest around how these people may have lived.

To investigate how to author and evaluate digital stories that promote social interaction, in Summer 2015, we restructured and extended a storytelling experience designed for individual visitors to the site (Katifori et al., 2016). Fictional characters narrated their stories in an interleaved way, providing two different perspectives on each of the main topics covered throughout the experience. Several interaction points for visitors, including information gap, reasoning, and opinion gap tasks were added and visitors were explicitly prompted to communicate or/and collaborate when an interaction point was reached. Our main purpose was to study user reactions and emotions towards such prompts, narrative variations, and different types of interaction.

The experiment took place in late July to early August 2015 at Çatalhöyük with sixteen participants who evaluated the experience (Figure 2). Interviews and observations with these participants both indicated that they positively received the use of system-driven interpersonal interaction. Participants suggested that social interaction enhanced engagement, understanding, and reflection. It also gave a feeling of active participation. Asking users to choose an object for their companion's burial was one of the most successful and engaging activities. It fostered reflection on each other's character, guiding the selection of the most appropriate object, which led to a deeper understanding of the process of grave goods offering in the past.



Figure 2: Visitors pairing their devices during early evaluation studies of a group experience at the archaeological site of Çatalhöyük in Turkey.

One of the issues that the users brought up as a shortcoming was that, in some of the cases, the prompts for conversation did not feel natural, but rather constructed and forced. This was especially true of the information gap prompts, where users had to exchange information which was given individually to one of 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 should 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 relation to such interaction, even in cases where the assigned task was to reflect about the content.

Our intent with this mobile-mediated experience was to help break down some of the interpretative barriers experienced (and often reproduced) by visitors at Çatalhöyük and beyond. The following section describes our latest experiment, implementing a more experiential approach to social interaction on site.

## **AN EMOTIVE SHARED DIGITAL EXPERIENCE AT ÇATALHÖYÜK**

The very layout of the site of Çatalhöyük paints a detailed picture of how tightly knit the community must have been. A variety of evidence suggests little to no social hierarchy, implying an egalitarian socio-political organization. Such an egalitarian structure offers a fascinating contrast to many current societies, including those of the main visiting audiences to Çatalhöyük (Turkish nationals followed by Japanese, American and Australian visitors, among others), offering an opportunity for a group experience to be developed echoing this Neolithic mindset. Below we present an overview of the conceptualization and implementation of this experience, highlighting the main findings from its first evaluation with visitors. A more detailed report on methodology and collected data can be found in Mirashrafi (2017).

When setting out to design a collaborative experience at Çatalhöyük, we considered it critical to develop an approach that enables the rich conceptualisation of users, both as individuals and as members of touring parties, who engage socially with cultural sites before, during and after a visit. We therefore began our experience design by identifying and describing our visitors in the form of personas. A method utilised in the design and evaluation of digital products, personas are essentially fictitious individuals constructed by designers to represent a typical end-user (Roussou et al., 2013). Traditionally, the persona is an individual with a unique combination of characteristics. But as discussed, research shows that people visiting museums usually do so in groups, and so a singular persona in these situations ignores the social complexities of their experience. Over fifteen years of observational and demographic data from visitors to Çatalhöyük shows that the vast majority fall into the following categories: local parents with children, international and local families or a mix of the two, and larger bodies of people like school or tourist groups. Thus, we extended the model of the 'persona,' introducing group personas to better



reflect the group-based nature of most visits to the site, and the synthesis of the visitor groups we were targeting.

## OVERVIEW OF THE EXPERIENCE

The primary aim for this collaborative experience was to allow visitors to Çatalhöyük to explore what it might be like to exist in an egalitarian society, encouraging them to collectively reflect on their own socio-economic practices in the present while also considering the everyday lives of past peoples from this Neolithic town.

The on-site experience provides visitors with 3D prints of selected Çatalhöyük artefacts that they personalise as their own, before a mobile application guides them through four of the site's replica houses, where they are prompted to swap and, eventually, leave those objects behind. By physically going through the motions of exchanging and leaving behind artefacts, visitors are asked to question modern assumptions around material ownership and community. Central to this experience, therefore, is the underlying goal of sparking empathy in the visitor. Wolfe (2006) suggests that this kind of hands-on learning is more likely to be emotionally engaging and memorable to a visitor.

Before arriving on site, the pre-visit phase of the experience asks visitors to establish an online profile wherein each visitor is assigned (via a form of personality quiz) a different role relevant to life at the Neolithic site (a Hunter, a Storyteller, an Artist, etc.). Each role corresponds to a small set of artifacts, one of which the user is asked to select. Consequently, the visitors arrive at the site with a ticket containing the information about their role and the artefact they chose. This is delivered to them as a 3D printed object once they arrive and check-in at the site's Visitor Center. (Note that for the formative evaluation we were required to use laminated cards as proxies for the 3D prints.)

Along with the objects, visitors receive a mobile device to use in small groups. Currently the application is designed for two companions (although we are extending it for three users) and it introduces them to the means by which egalitarianism may have operated on a day-to-day basis as they make their way through the houses together. The application firstly guides them to "personalize" their object, through painting on it or attaching stickers, ribbons, and other decorative elements, thereby making it "their own". They are then prompted to use the Near Field Communication (NFC) tag glued onto their object to register it in the app. Given that the object is related to their visitor profile, as they are prompted to swap, take, and leave behind these artefacts in each house, the items slowly become layered with the profiles of different participants every time they change hands (Mirashrafi, 2017). At the end of the onsite experience, visitors are asked to decide among themselves which object to leave behind for good. This means one of the party parts from their experience with nothing at all. The pair, however, takes home with them a single object which they may keep as a physical souvenir. However, asking one of the participants to leave behind an object altogether reinforces the theme of fluid ownership in Çatalhöyük.

Finally, the third, post-experience phase zooms out to connect strangers digitally through layers of profiles embedded on NFC tags used throughout the experience. The users are able to log in with their profile and view the itinerary of the objects they themselves held during the on-site experience as well as the web of past and subsequent visitors that may have taken these objects home.

Throughout the experience, users are prompted to reflect on their decisions and feelings. Such reflection allows ‘an opportunity for emotional engagement’ within the experience itself (Sakr et al., 2016, 63). The script aims to encourage discussion over the course of the experience, provoking understanding through movement and conversation. In this way, visitors not only connect with the past people of Çatalhöyük by going through the motions of their lives, but so too with people participating in the present.

## EVALUATION PROCESS AND PARTICIPANTS

A formative evaluation of the pre- and on-site experience was conducted in Turkey in the summer of 2017. A total of six pairs completed the evaluation, both international and Turkish (Figure 3).

The data collected during the evaluation included audio recorded through dictaphones, lapel microphones, and in some cases video cameras; standardised observational notes produced by a researcher during each tour; and 30 to 60-minute audio-recorded interviews conducted with each pair immediately following their tour.



Figure 3: Pairs of users touring Çatalhöyük’s replica houses as part of a collaborative digital experience centered around reflecting on egalitarian ways of life.

## SUMMARY OF FINDINGS

Broadly, the user feedback collected during the evaluation can be divided into two categories: process (usability and functionality of the mobile experience) and experience (emotional and social engagement). With respect to the former, users found the app to be immersive, with the few identified distractions being for just short periods of time. However, users were split regarding the role of the mobile experience in connecting them to the environment. Some indicated it limited their interactions, prompting them to focus more on the device than the room. Others identified

multiple instances of engagement with the physical environment through their visual and physical examination of the space.

With respect to experience, users developed feelings of attachment to the items used in the activity. These items were commonly referred to as ‘mine’, ‘my’ or sometimes by a given name (i.e., “Grandma”). Users also discussed reluctance in parting with the objects, as well as their connections to what the objects represented. Their comments (see below) showcased a strong sense of personal bond with the items, which was key to their overall experiences. The concept of personal attachment was also discussed in the context of personalization or ownership of belongings.

Many of the users connected strongly with the role that they were assigned in the pre-visit stage of the experience. Users would refer to their role multiple times throughout the interviews, often as a defining characteristic of themselves (i.e., “I am a storyteller”). This was also connected to periods of self-reflection, as users discussed whether the role accurately or non-accurately reflected how they viewed themselves. The experience promoted social engagement both immediately between the two participants and with the larger global community through the users’ expressed interests in engaging in the post-site experience. (Note, however, that at the time of the formative evaluation, the post-site experience had not yet been implemented.)

The true impact of this use case can be seen most strongly in the frequency that visitors made comments indicating self-reflection and being affected or changed by the experience. Many of the users were prompted to engage in self-reflection. This included direct statements about being compelled to become self-reflective, but also through descriptions of connections to personal experiences, both real and imagined. Most positively, there were frequent statements identifying that users related to the space in one way before and another after participating in the experience, including expressing higher levels of empathy with the people of Çatalhöyük.

## **SHARING EMOTIVE EXPERIENCES**

Of particular interest to our team is the frequency with which users reported both to have experienced strong feelings (of various forms) during their participation in the on-site experience (87% of participants), as well as to have found the shared, collaborative nature of the experience a positive one (100% of participants). “I’m amazed. I feel [long pause] emotional. It was a lovely thing for me,” one Turkish user offered after completing the on-site portion of the experience. “It was the [most] perfect thing I have ever [felt] in these houses” he went on to explain, “I mean I left my [object] over there, and if I see someone else from some other part of the world [has] that object it means just, you know, you feel it.”

Some users described very specific emotional reactions in relation to certain aspects of the experience, including a final revelatory moment wherein it becomes clear that Çatalhöyük’s residents would have likely also communally raised their children. As one British participant noted, “It made me realise the gravity...of their family life.” Her teammate agreed with how the

experience encouraged the participant to step into the minds of past people, stating “because obviously you can have all this talk about how they used to share, but until you’re actually doing it yourself, you don’t really put it into your own personal context.” Another American user mentioned something similar, noting “I do feel like I understand them more as actual people now.”

This connection to past individuals was articulated by several pairs in their interviews: “I feel in touch with the people...like, you can actually begin to imagine what their life was actually like...The whole purpose of archaeology is to connect to the past, but now I do feel like I can almost imagine what their day-to-day life was.” She went on to describe the overt bond she had developed not only with the people of the past, but with her object in the present (to such an extent that she anthropomorphizes it): “giving away one of ours [objects] it was like, Ah! But then it was like Oh, somebody else might come along and pick that up later so they’ll be fine.” A British participant also spoke (unprompted) in anthropomorphizing fashion about her object attachment: “I didn’t expect to get such a connection to either [of our] objects and feel that possessiveness. Nor did I feel the want to leave her [the object] behind afterwards because I didn’t want her to be taken away from the site...And I didn’t expect the experience to make me feel that way, but it does...which is surprising.” Comparably, a Turkish participant, reflecting on his original object, described that “The bear stamp made me feel powerful” later noting that “I was really committed to the bear stamp” because he drew something on it and it became his own, leaving him regretful to say goodbye.

There is no question that the shared nature of the on-site experience was critical to its success. Sometimes this matter of collaboration is mentioned explicitly by users, for instance in one case where a pair specified that they were learning together “but not like a classroom environment...it was like we were bouncing off each other.” In other cases this is implied, as pairs regularly had to engage in compromise to decide which of their objects to leave behind. The tactics deployed to reach such compromise (from games of ‘rock-paper-scissors’ to more nuanced debates over attachment) are in themselves worthy of further research.

While our formative evaluation was constrained by many factors, including a small sample size, use of printed cards in place of 3D prints, and lack of a fully-operational post-visit experience, the results hint at several opportunities as we move into the next stages of design and development. Firstly, digital media were fundamental to the connectivity (personal and social, to the past and the present) at the core of the experience, yet their implementation was incredibly straightforward, necessitating only basic web design, use of NFC tags and simple authoring (text-only) of the app via the EMOTIVE project’s Storyboard Editor (developed for the most novice of users).

Secondly, the experience relied on a relatively simple set of strategies to facilitate group-based meaning-making, which are arguably replicable in other contexts. These include (1) the pre-visit quiz, which profiles visitors, linking their present day personality to one of the past; (2) the visitor-

selected object, which is connected to users' personalities and is further personalized by them via physical modification/decoration; (3) embodied group exploration of a concept (in this case, egalitarianism) while on site, where the purpose is not to force factual information on participants, nor to demand that they explicitly imagine themselves as inhabitants of Neolithic Çatalhöyük, but rather to collaboratively perform actions in the present in ways that may seem unfamiliar to them. It is in reckoning with this unfamiliarity as part of a group that meaning-making and connectivity come about. Indeed, as one participant noted in interview, "[I] felt it was more about us, ...placing us in the situation, and making us think about each other and our opinions and our thoughts. I didn't really think factually. I didn't think archaeologically...I felt, like you [her partner] said, like I was exploring myself in that situation."

## CONCLUSIONS

The possibilities for developing meaningful shared digital experiences in museums and other cultural contexts are tremendous and still mostly untapped. Although our research is in its early phases, the data hint at levels of emotional impact and potential for personal transformation that are highly encouraging. It is worth considering, however, that our results point to the fact that the better participants know each other, the more they get out of their experience. Studying this relationship between known and unknown visitors - and developing means for strangers to meaningfully speak and interact with one another - is a crucial next step in our studies. Not only would such research address a major gap in the literature (vom Lehn et al. 2001) but it would also help these types of shared digital experiences reach their full potential. Herein networks of people could be joined in fostering a larger collective conscience or, at minimum, in reflecting on their own assumptions and taken-for-granted beliefs around 'normal' ways of life. As one participant described to us, "I connected with a human being on another level, that I'd never met before and I also appreciated people a lot differently." Such collaborative digital experiences can encourage participants not merely to identify with the past, but to rethink their place in the present and future, imagining the world and its inhabitants in a more complex and malleable fashion. To conclude with the words of one user, "Having to actually force myself to give something away, having to negotiate with someone about what we give and the reasons why we give away, it increased my connection to the object...I felt like I had been taken to the past, and sort of really made to connect with the object and connect with the people in a way that isn't knowledge...In terms of immersion, in terms of feeling, that is one of the best experiences I've had."

## ACKNOWLEDGMENTS

This research has evolved across multiple projects funded through various grants, including two research grants from the British Institute at Ankara (2014, 2015), the European Union Horizon 20/20 Research and Innovation Grant EMOTIVE (grant no. 727188) and the FP7 CHESS (grant no. 270198). We are indebted to Katrina Gargett for assisting in many aspects of data collection and transcription at Çatalhöyük in 2017, including observing and interviewing participants. We

extend great thanks to all who graciously agreed to participate and share their views on the experience at Çatalhöyük.

## REFERENCES

- Aoki, P. M., Grinter, R. E., Hurst, A., Szymanski, M. H., Thornton, J. D., & Woodruff, A. (2002). Sotto voce: exploring the interplay of conversation and mobile audio spaces. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, Changing our world, changing ourselves - CHI '02* (pp. 431–438). New York, New York, USA: ACM Press. <http://doi.org/10.1145/503376.503454>
- Brown, B., MacColl, I., Chalmers, M., Galani, A., Randell, C., & Steed, A. (2003). Lessons from the lighthouse: Collaboration in a shared mixed reality system. In *Proceedings of the conference on Human factors in computing systems - CHI '03* (p. 577). New York, New York, USA: ACM Press. <http://doi.org/10.1145/642611.642711>
- Chang, E. (2006). Interactive Experiences and Contextual Learning in Museums. *Studies in Art Education*, 47(2), 170–186.
- Davies, M., & Heath, C. (2013). *Evaluating evaluation: Increasing the impact of summative evaluation in museums and galleries*. London, UK. Retrieved from [http://visitors.org.uk/wp-content/uploads/2004/01/EvaluatingEvaluation\\_November2013.pdf](http://visitors.org.uk/wp-content/uploads/2004/01/EvaluatingEvaluation_November2013.pdf)
- Falk, J. H., Moussouri, T., & Coulson, D. (1998). The Effect of Visitors ' Agendas on Museum Learning. *Curator: The Museum Journal*, 41(2), 107–120. <http://doi.org/10.1111/j.2151-6952.1998.tb00822.x>
- Fosh, L., Benford, S., Reeves, S., Koleva, B., & Brundell, P. (2013). See Me, Feel Me, Touch Me, Hear Me: Trajectories and Interpretation in a Sculpture Garden. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems - CHI '13* (p. 149). New York, New York, USA: ACM Press. <http://doi.org/10.1145/2470654.2470675>
- Galani, A., & Chalmers, M. (2003). Far Away is Close at Hand: Shared Mixed Reality Museum Experiences for Local and Remote Museum Companions. In *ICHIM03, International Cultural Heritage Informatics Meeting* (pp. 1–20). Paris, France: Archives & Museum Informatics Europe.
- Grinter, R. E., Aoki, P. M., Hurst, A., Szymanski, M. H., Thornton, J. D., & Woodruff, A. (2002). Revisiting the Visit: Understanding How Technology Can Shape the Museum Visit. In *Computer Supported Collaborative Work (CSCW)* (pp. 146–155). New Orleans, Louisiana, USA: ACM Press. <http://doi.org/10.1145/503376.503454>
- Hindmarsh, J., Heath, C., vom Lehn, D., & Cleverly, J. (2002). Creating assemblies:: aboard the Ghost Ship. In *Proceedings of the 2002 ACM conference on Computer supported*

- cooperative work - CSCW '02* (p. 156). New York, New York, USA: ACM Press.  
<http://doi.org/10.1145/587078.587101>
- Hodder, I. (2011). *Çatalhöyük: The Leopard's Tale: Revealing the mysteries of Turkey's ancient 'town.'* London, UK: Thames & Hudson.
- Holtorf, C. (1999). Is History going to be on my side? On the experience of writing and submitting a hypermedia Ph.D. thesis. *Internet Archaeology*, 6(6).  
<http://doi.org/10.11141/ia.6.2>
- Hood, M. G. (1983). Staying Away: Why People Choose Not to Visit Museums. *Museum News*, 61(4), 50–57. Retrieved from [http://ls-tlss.ucl.ac.uk/course-materials/ARCLG190\\_50159.pdf](http://ls-tlss.ucl.ac.uk/course-materials/ARCLG190_50159.pdf)
- Hope, T., Nakamura, Y., Takahashi, T., Nobayashi, A., Fukuoka, S., Hamasaki, M., & Nishimura, T. (2009). Familial collaborations in a museum. In *Proceedings of the 27th international conference on Human factors in computing systems - CHI 09* (p. 1963). New York, New York, USA: ACM Press. <http://doi.org/10.1145/1518701.1519000>
- Katifori, A., Perry, S., Vayanou, M., Pujol, L., Chrysanthi, A., & Ioannidis, Y. (2016). Cultivating mobile-mediated social interaction in the museum: Towards group-based digital storytelling experiences. In *MW2016: Museums and the Web 2016*. Los Angeles, CA, USA. Retrieved from <http://mw2016.museumsandtheweb.com/paper/cultivating-mobile-mediated-social-interaction-in-the-museum-towards-group-based-digital-storytelling-experiences/>
- Klopfer, E., Perry, J., Squire, K., Jan, M.-F., & Steinkuehler, C. (2005). Mystery at the museum: a collaborative game for museum. In *CSCL '05 Proceedings of the 2005 Conference on Computer Support for Collaborative Learning: learning 2005: the next 10 years!* (pp. 316–320). Taipei, Taiwan: International Society of the Learning Sciences (ISLS). Retrieved from <https://dl.acm.org/citation.cfm?id=1149334>
- López Sintas, J., García Álvarez, E., & Pérez Rubiales, E. (2014). Art museum visitors: interaction strategies for sharing experiences. *Museum Management and Curatorship*, 29(3), 241–259. <http://doi.org/10.1080/09647775.2014.919175>
- Martin, D. (2000). Audio Guides. *Museum Practice*, 5(1), 71–81.
- Massung, E. (2012). Visitor Reception to Location-based Interpretation at Archaeological and Heritage Sites. In *Thinking beyond the Tool. Archaeological computing and the interpretive process*. BAR International Series.
- McCarthy, K. F., Ondaatje, E. H., Zakaras, L., & Brooks, A. (2004). *Gifts of the muse: reframing the debate about the benefits of the arts*. Santa Monica, CA. Retrieved from [https://www.rand.org/content/dam/rand/pubs/monographs/2005/RAND\\_MG218.pdf](https://www.rand.org/content/dam/rand/pubs/monographs/2005/RAND_MG218.pdf)

- McDavid, C. (1998). Archaeology and “the web”: Writing multi-linear texts in a multi-centered community. In *1998 Conference on Historical and Underwater Archaeology*. Retrieved from <http://www.publicarchaeology.org/webarchaeology/html/carolsha.htm>
- Mirashrafi, S. S. (2017). *A Collaborative Experience in Çatalhöyük: Conception, Construction, and Evaluation*. University of York.
- Othman, M. K. (2012). *Measuring Visitors’ Experiences with Mobile Guide Technology in Cultural Spaces*. The University of York. Retrieved from [http://etheses.whiterose.ac.uk/4067/1/MK\\_OTHMAN\\_Thesis\\_PhD.pdf](http://etheses.whiterose.ac.uk/4067/1/MK_OTHMAN_Thesis_PhD.pdf)
- Perry, D. L. (2012). *What makes Learning Fun? Principles for the Design of Intrinsically Motivating Museum Exhibits*. AltaMira Press.
- Perry, S. (2016). Mobile apps and the material world. Retrieved June 17, 2018, from <https://savageminds.org/2016/01/08/mobile-apps-material-world>
- Perry, S., Roussou, M., Economou, M., Young, H., & Pujol, L. (2017). Moving Beyond the Virtual Museum: Engaging Visitors Emotionally. In *23rd Int’l Conference on Virtual Systems and Multimedia-VSMM* (pp. 1–8). Dublin, Ireland: IEEE. <http://doi.org/10.1109/VSMM.2017.8346276>
- Petrelli, D., Marshall, M. T., O’Brien, S., McEntaggart, P., & Gwilt, I. (2017). Tangible data souvenirs as a bridge between a physical museum visit and online digital experience. *Personal and Ubiquitous Computing*, 21(2), 281–295. <http://doi.org/10.1007/s00779-016-0993-x>
- Petrelli, D., & Not, E. (2005). User-Centred Design of Flexible Hypermedia for a Mobile Guide: Reflections on the HyperAudio Experience. *User Modeling and User-Adapted Interaction*, 15(3–4), 303–338. <http://doi.org/10.1007/s11257-005-8816-1>
- Rennick-Egglestone, S. J., Brundell, P., Koleva, B., Benford, S., Roussou, M., & Chaffardon, C. (2016). Families and mobile devices in museums: designing for integrated experiences. *ACM Journal on Computing and Cultural Heritage (JOCCH)*, 9(2), Article #11. <http://doi.org/10.1145/2891416>
- Roussou, M., & Katifori, A. (2018). Flow, Staging, Wayfinding, Personalization: Evaluating User Experience with Mobile Museum Narratives. *Multimodal Technologies and Interaction*, 2(2), 32. <http://doi.org/10.3390/mti2020032>
- Roussou, M., Katifori, A., Pujol, L., Vayanou, M., & Rennick-Egglestone, S. J. (2013). A Life of Their Own: Museum Visitor Personas Penetrating the Design Lifecycle of a Mobile Experience. In *CHI 2013 Extended Abstracts on Human Factors in Computing Systems - CHI EA ’13* (pp. 547–552). New York, New York, USA: ACM Press. <http://doi.org/10.1145/2468356.2468453>



- Sakr, M., Jewitt, C., & Price, S. (2016). Mobile Experiences of Historical Place: A Multimodal Analysis of Emotional Engagement. *Journal of the Learning Sciences*, 25(1), 51–92. <http://doi.org/10.1080/10508406.2015.1115761>
- Sheng, C.-W., & Chen, M.-C. (2012). A study of experience expectations of museum visitors. *Tourism Management*, 33(1), 53–60. <http://doi.org/10.1016/j.tourman.2011.01.023>
- Tolmie, P., Benford, S., Greenhalgh, C., Rodden, T., & Reeves, S. (2014). Supporting group interactions in museum visiting. In *Proceedings of the 17th ACM conference on Computer supported cooperative work & social computing - CSCW '14* (pp. 1049–1059). New York, New York, USA: ACM Press. <http://doi.org/10.1145/2531602.2531619>
- Vayanou, M., Katifori, A., Antoniou, A., & Chrysanthi, A. (2016). Collocated Interaction in Cultural Storytelling Experiences: How to Coordinate Visitor Actions? In *19th ACM conference on Computer-Supported Cooperative Work and Social Computing (CSCW '16)*. ACM.
- vom Lehn, D., Heath, C., & Hindmarsh, J. (2001). Exhibiting Interaction: Conduct and Collaboration in Museums and Galleries. *Symbolic Interaction*, 24(2), 189–216. Retrieved from [http://www.vom-lehn.net/Dirk\\_vom\\_Lehn/Museums,\\_Interaction\\_&\\_Technology\\_files/Exhib-interact-SI2001-24-2\\_1.pdf](http://www.vom-lehn.net/Dirk_vom_Lehn/Museums,_Interaction_&_Technology_files/Exhib-interact-SI2001-24-2_1.pdf)
- Wolfe, P. (2006). The role of meaning and emotion in learning. *New Directions for Adult and Continuing Education*, 2006(110), 35–41. <http://doi.org/10.1002/ace.217>
- Woodruff, A., Aoki, P. M., Hurst, A., & Szymanski, M. H. (2001). Electronic Guidebooks and Visitor Attention. In *6th International Cultural Heritage Informatics Meeting (ICHIM)* (pp. 437–454). Milan, Italy: Archives and Museum Informatics.
- Woodruff, A., Szymanski, M. H., Aoki, P. M., & Hurst, A. (2001). The Conversational Role of Electronic Guidebooks. In G. D. Abowd, S. Shafer, & B. Brumitt (Eds.), *Ubiquitous Computing (Proc. 3rd International Conference)* (pp. 187–208). Berlin: Springer-Verlag. [http://doi.org/10.1007/3-540-45427-6\\_16](http://doi.org/10.1007/3-540-45427-6_16)
- Yule, G. (1997). *Referential Communication Tasks*. Mahwah, NJ, USA: Lawrence Erlbaum.