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Evaluating Digital Cultural Heritage 'In the wild': the Case For Reflexivity

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ABSTRACT

Digital heritage interpretation is often untethered from traditional museological techniques and environments. As museums and heritage sites explore the potentials of locative technologies and ever more sophisticated content-triggering mechanisms for use outdoors, the kinds of questions digital heritage researchers are able to explore have complexified. Researchers now find themselves in the realm of the immersive, the experiential, and the performative. Working closely with their research participants, they navigate ambiguous terrain including the often unpredictable affective resonances that are the direct consequences of interaction.

This article creates a dialogue between two case studies which, taken together, help to unpack some key methodological and ethical questions emerging from these developments. Firstly, we introduce *With New Eyes I See*, an itinerant and immersive digital heritage encounter which collapsed boundaries between physical/digital, fact/fiction and past/present. Secondly, we detail *Rock Art on Mobile Phones*, a set of dialogic web apps that aimed to explore the potential of mobile devices in delivering heritage interpretation in the rural outdoors.

Looking outward from these case studies, we reflect on how traditional evaluation frameworks are being stretched and strained given the kinds of questions digital heritage researchers are now exploring. Drawing on vignettes from experience-oriented qualitative studies with participants, we articulate specific common evaluative challenges related to the embodied, multimodal and transmedial nature of the digital heritage experiences under investigation. In doing so, we make the case for reflexivity as a central - and more collaborative - feature of research design within this field going forward; paying attention to, and advocating, the reciprocal relationship between researchers and the heritage experiences we study

CCS CONCEPTS:

• Human-centered computing~Ubiquitous and mobile computing design and evaluation methods • Human-centered computing~Empirical studies in ubiquitous and mobile

computing • **Human-centered computing**~**Field studies** • Human-centered computing~HCI design and evaluation methods • Applied computing~Arts and humanities

KEYWORDS

On-site and remotely sensed data collection; storytelling and other forms of communication; multimedia systems; Web-based and mobile technologies for CH, ICT technologies in support of creating new cultural experiences or digital artefacts

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1 INTRODUCTION

As museums and heritage sites explore the potential of locative technologies, virtual and augmented reality, and ever more sophisticated content-triggering mechanisms - for use inside or in the open air - the kinds of experiences and questions digital heritage researchers are able to explore have complexified. Researchers, creative practitioners and heritage professionals have been progressively crafting ever more challenging digital heritage encounters for members of the public, so that they increasingly find themselves not only in the realm of the situational and the experiential, but also the immersive and the performative. We have seen increased experimentation with forms of narrative and new modalities of engagement, which can render these experiences less predictable in-situ and more resistant to conventional modes of guiding and constraining.

A specific dimension of these digital approaches to heritage interpretation, following Wright at al.'s distinction, is that they are not designed as an experience but are designed for experience: visitors who engage with these applications 'do not simply engage in experiences as ready-made, they actively construct them through a process of sense making. This process of sense making is reflexive and recursive' [1]. The highly situated and dynamically constructed nature of these experiences, which emerge through people's engagements with heritage content, the ever-changeable natural/urban environment, technological interfaces and other visitors/participants, make these experiences challenging to evaluate in conventional ways; for example, they are affected by weather conditions and unexpected co-occurrences in the open public spaces they take place in. They also lead us to more complex ethical considerations, perhaps indicating a need for new phenomenological models and/or approaches to subjectivity. Indeed, they may necessitate an entirely new lexicon for talking about authenticity, learning and feeling beyond and between the strictures of 'the digital' and 'the material' within digital cultural heritage work. It follows, we argue in this article, that both

the experiences and their evaluation within these contexts are similarly best approached as reflexive and fluid.

The arguments for reflexive museological and exhibition design practice are not new: Catherine Styles [2] and Shelley Ruth Butler [3] specifically reviewed a number of self-reflexive museum exhibition displays to conclude that ‘transparent or self-reflexive’ exhibitions ‘enable visitors to see the questions and tensions arising from the material, rather than the answers alone’ [2] and that the best reflexive interventions ‘are highly site-specific’ [3]. Scholars in the field of digital cultural heritage have also begun to creatively explore the dynamic and fluid nature of ‘experience’ within digital heritage programmes (see for example [4, 5, 6, 7, 8, 9, 10, 11, 12, 13]). As Robert Stein notes, ‘the quality of debate and discourse in the field has matured substantially’ so that museum technologists and researchers are ‘tack[ling] challenging questions about the identity of museums, their role in society, their responsibilities to serve a global public, and the nature of collecting, preservation, education, scholarship, primary research, and ethics in the digital age’ [14]. But the specific issue of what methodological concerns this more challenging research agenda might raise for outdoor heritage experiences has been less of a focus.

This article explores key empirical and ethical questions that are nascent given this context, using two case studies to demonstrate and navigate some of the frictions identified. Both are digital cultural heritage projects that were designed for delivery ‘in the wild’, by which we mean in real-life outdoor dynamic contexts, which are not officially designated heritage sites. They were also primarily concerned with creating opportunities for audiences to engage with and explore ambiguities in heritage narratives. Firstly, we introduce *With New Eyes I See* (WNEIS), an itinerant and immersive encounter which collapsed boundaries between physical/digital, fact/fiction and past/present in the context of a narrative about World War One. Secondly, we overview *Rock Art on Mobile Phones* (RAMP) which aimed to explore the potential of mobile devices in delivering heritage interpretation of Neolithic rock art (i.e. rock carvings) in situ in rural Northumberland. Each author has been closely involved in only one of these cases, yet this article allows us to look outward from our own projects to find common points of contact on questions of method that will be pertinent too for other researchers evaluating open-ended heritage experiences ‘in the wild’. In this respect, the article does not aim to function as a direct comparison between two mobile heritage applications but as a platform for critical reflection on common challenges arising from this work and as a means to synthesize our thinking beyond the single case study approach, which dominates the existing literature in the field.

Following brief overviews of the case studies, we look at common challenges they bring into sharp relief for us as researchers. They demonstrate how reliance on conventional evaluative methodologies presents limitations for our investigations of multimodal experiences outside the framework of a structured museum or heritage site. In response to these challenges, we make the case for increased time and space for reflexivity in – and

between – research projects, especially given the highly intricate – and sometimes even sensitive – nature of emergent enquiry in this field. In this article, through practicing and performing our own reflexivity, we hope to encourage others to pay attention to ‘the way different kinds of linguistic, social, political and theoretical elements are woven together in the process of knowledge development, during which empirical material is constructed, interpreted and written’ [15]. It is our belief that in so doing, digital cultural heritage researchers can equip themselves for a more challenging new agenda.

2 OVERVIEW: *WITH NEW EYES I SEE* (WNEIS)

In 2013 Cardiff University received prototype funding to work on a digital heritage experience called *With New Eyes I See*¹. Alongside Amgueddfa Cymru - National Museum Wales, and our creative economy partner yello brick², we worked with fragments from the Museum’s institutional archive to try and cohere a narrative about one museum employee, botanist Cyril Mortimer Green, and his experience of World War One. What emerged however was an incomplete narrative, full of unknowns and guess-work. This ambiguity intrigued us, and we decided to work with it in the project, rather than make attempts to eradicate it.

The resultant output, WNEIS, was a timed event which transformed the civic centre of Cardiff as archival materials were projected onto, and playfully distorted by, buildings and the natural environment. Mirroring our own endeavours in the archive, audiences worked in groups to piece together a narrative from a variety of digital and analogue stimuli including projections on walls and monuments, animations, found objects, paper documents, a soundscape, and the voice of an unidentified narrator. WNEIS was designed to be immersive and itinerant. Participants navigated the encounter using a mocked up old military torch which housed a projector, speaker, and a mobile phone full of content which was triggered by Radio-Frequency Identification (RFID) as they traversed the space. WNEIS, part of which was temporally located between 1914 and 1917, was staged in the park outside the museum to reflect the fact that National Museum Cardiff was still very much under construction in this period; the foundation stone was laid in 1912, but progress slowed considerably during the War. This added to the sense of fragmentation, as we asked participants to imagine absence where there was presence, and to make this familiar place unfamiliar.

WNEIS was a group encounter that took place at sunset. Near or total darkness was important in making the projections visible and impactful. Up to six participants worked together using a map and the ‘torch’ to cohere an encounter within the park from our curated fragments, at the same time as they scripted in additional (unanticipated) stimuli from the

¹ The project was funded with a grant from the AHRC REACT creative economy hub. The latest iteration of the project is *Traces (Olion* in the Welsh language) which has been funded by an ESRC Impact Acceleration Award. Further information about *Traces* can be found at <https://museum.wales/stfagans/whatson/traces/>

² <http://yellobrick.co.uk/>

environment [13]. Other people in the park, a helicopter overhead, or the smell of the flowers for example, were drawn into the narrative in ways that were visceral and unpredictable.

Ours was an experiment in taking narrative beyond the screen or the interpretation panel, working with archival materials to interpret a fractured and ambiguous story beyond the walls of the museum [13]. This was a digital cultural heritage project, yet it worked with and between the analogue and the digital. Some aspects of the experience were resolutely analogue and material; a first aid box which could be opened and explored, a white lab coat resting on a bench, and a series of printed botanical samples pinned to a tree for example. Yet most aspects blurred the physical and the digital, and the movement in the experience was a reminder that digital encounters are themselves very much embodied.

Evaluating participant responses to this encounter naturally presented multiple challenges for us as researchers: How satisfactory is observation as a technique when the observed are operating in the dark? How would approaching people for responses as individuals or as groups change the ways they talked about WNEIS? Would it be appropriate to interrupt them during the experience to ask them to talk about how they were feeling? What would we miss by asking them to reflect after the event? Would this lead to a forced narrativising and rationalising of the experience? We were trying to work with fragmentation and ambiguity, not to eradicate it, and such narrativising would have been out of kilter with our ambitions. We were interested in how participants made sense of the experience — what had they learned and was it important to them that they had learned anything? — whether they found the format compelling, whether the (seeming) invisibility of the technology was helpful, and how they conceived of this encounter we had constructed as a process of history (and heritage) making.

We decided upon a mixed-method approach to gathering data which centred around participant observation and focus groups. As with the RAMP case study introduced in the next section, the utilisation of a mixed methodology insured triangulation of the findings, an approach also promoted by other researchers in the study of immersive and multimedia technologies in heritage (for example [16]). Six groups (a total of 29 individuals) attended our user tests and agreed to take part in focus groups directly afterwards. These groups were populated via email lists collated by the project's creative economy partner, yello brick — meaning that our participants were predominantly 18-45, and had some pre-existing knowledge about street games and immersive experiences. They were with us and in their groups for approximately 100 minutes in total. The WNEIS experience lasted 30-40 minutes, and then we settled in a nearby University building for discussion. It was hoped that focus groups rather than one-to-one interviews would help to capture something of the group dynamic that had been forged, to explore any points of ambivalence or friction, and that the discussions might make room for sense-making as a collective (and importantly visible and audible) endeavour within the research. yello brick has an established track record of producing street games, and through that work have learned much about group dynamics,

working with uncertainty, and scaffolding non-linear experiences. We were keen to see whether and how these learnings could inform a digital cultural heritage encounter that might entice that kind of audience.

The detailed findings from the research have been presented elsewhere [13], but to summarise, we found that this project encouraged participants to perform their 'visitation' to this heritage encounter very differently to that of a typical museum visit. The approach necessarily increased the sociality of the encounter and heightened participants' senses of – and desire for – agency. We found that the project changed their relationship with the space of this heritage experience (in the short term at least) and encouraged them to talk thoughtfully and creatively about the stories constructed by museums, their truths, their fictions, and the ambiguities that emerge in between.

Complementary challenges and concerns – as well as findings – emerged in our second case study, which also took place outdoors but in a rural context.

3 OVERVIEW: *ROCK ART ON MOBILE PHONES* (RAMP)

Our second case study is a set of mobile web apps that encourages interaction with digital heritage 'in the wild'. The *Rock Art on Mobile Phones* (RAMP) web apps were developed as part of a digital heritage research project that aimed to explore the potential of mobile devices in delivering heritage interpretation in situ³. The three web apps were designed for three Neolithic and Early Bronze Age sites in rural Northumberland, which do not provide designated visiting facilities. Unlike WNEIS, RAMP used a participatory design (PD) methodology, which involved a group of 39 participants (local residents, archaeology and heritage enthusiasts, ramblers, geocachers and other interested individuals) in two sets of co-experience workshops. The participants in this phase of the project were not involved in their capacity as end-users of the RAMP applications but in relation to their use of the landscapes and locations connected with our research at large. Insights gained in the workshops provided the three key objectives of the mobile experience: (a) to aid the discovery of rock art, (b) to communicate ambiguity and encourage speculation around the meaning of the rock art, and (c) to support the visitor's sense of place and engagement with the landscape [7]. In this sense, the ambitions of this project mirrored those of WNEIS.

The resulting web apps were designed to support serendipitous encounters with rock art in rural Northumberland, which would allow visitors to the sites to use their own mobile devices to 'dip in and out' of the content. Small map plaques with QR codes, attached to the public path wayfinders on the sites, alerted visitors to the fact that mobile interpretation was

³ The project was funded by the UK Arts and Humanities Research Council (AHRC, 2010-11). It was led by Newcastle University, UK, in collaboration with relevant stakeholders including the National Park Authority and land owners in Northumberland. The resulting web apps are still accessible in the sites of Lordenshaw (near the village of Rothbury) and Dodd Law (near the village of Wooler). Further information about RAMP is available on the legacy website: <http://rockartmob.ncl.ac.uk/indexD.php>

available on each site. The content itself provided granular navigation instructions, combining a simplified map with wayfinding text-based instructions and photographs of the relevant surrounding views. Content about each rock art mark on the site was brief and delivered through text and/or audio in dialogic format (the audio was recorded in local regional accents), which simulated conversations and speculations about the meaning of rock art among visitors. In several instances during the engagement, visitors were encouraged to stop and ‘take-in’ the views as well as pay attention to the surrounding landscape(s). This was enhanced with photographs and diagrams, creating a non-linear, exploration-driven narrative. Unlike other apps of this kind, RAMP opted for openness in the interpretation [17] by providing multiple viable interpretations of the rock carvings to reflect the uncertainty in the archaeological record and encourage visitors to exercise agency in their engagement with each site. The capacity of Neolithic monuments to afford sensory and creative forms of experimental engagement has been identified by other scholars too (e.g. [18, 19]) but no digital interpretation of rock art in-situ had been attempted before.

Evaluating serendipitous and speculative encounters with rock art in public rural sites with no designated visitation facilities created both logistical and conceptual challenges. Unlike WNEIS, the RAMP web apps could, theoretically, be used by anybody present on the site, regardless of the time of the day or the purpose of their visit (for example, to walk the dog). Furthermore, the app could be used inconspicuously. Some of the conceptual challenges of the evaluation were shared with WNEIS, especially around the nature of the invitation to the evaluation process and the concern that the evaluation protocol might interrupt the experience of the site. In RAMP we were also interested in whether user-visitors would feel confident to speculate about the meaning of rock art and how they would make sense of the ambiguity of content and loose narrative. Last but not least, we were interested in capturing the role of RAMP content in visitors’ ‘sense of place and self’ [20], that is, how visitors might mobilise the apps in their personal relationship with and emotional connection to the sites.

Similarly to WNEIS, we decided on a mixed-method experience-driven approach to the evaluation, which included shadowing of the participants’ site visit using RAMP, debrief interviews in a nearby café using photo-elicitation techniques, such as printed screen grabs from RAMP to support recall of the experience, and a tailored Personal Meaning Mapping exercise post-visit only⁴. The combination of a walking research methodology, the use of visual prompts and the meaning mapping component followed the sensibilities of the ethnographic research tradition in human computer interaction and aimed to gain a more nuanced understanding of participants’ thought processes around their experience without relying on explicit, structured questioning. As the visitation patterns of the specific sites are varied and unpredictable and often affected by weather conditions, we decided to recruit research participants in advance. The participants were self-selected potential visitors in

⁴ This combined elements from the PMM approach introduced by Adams et al. [22] with insights from Participatory Design (PD).

groups/pairs (where possible) who had not visited the specific rock art sites before, had not been involved in the design of RAMP, and were not rock art specialists; they were recruited through an open call to the groups initially approached in the design process. In total 10 participants took part in the evaluation (4 male, 6 female) in 4 pairs and as two individuals. Three of these participants had professions connected to heritage but had not visited the specific rock art sites before. Site visits varied in time, dependent on how long participants lingered at each rock carving and on the weather but were no less than 40 minutes and no longer than 90 minutes. Participants were encouraged to explore the specific location as they would normally do during a visit or a walk and, were asked to use their own mobile devices if possible; failing that, a RAMP handset was provided along with brief instructions on how to use the handsets. Participants were encouraged to visit all the carved rocks included in RAMP during their visit, with the researcher acting as observer rather than guide. The researcher was presented as a mobile designer/developer rather than archaeologist, in an attempt not to be seen in an expert guide role.

Overall, the evaluation revealed that RAMP had achieved many of its goals in bringing digital unobtrusive interpretation to rock art sites in situ. Without exception, participants relied on the map on the mobile phone to find the carved rocks in the landscape and to confidently distinguish them from other rocks. They were also observed to explore the sites in greater detail, looking for rock art that might not have been mentioned in the apps. Similarly to the findings reported for WNEIS, participants engaged in conversations with their fellow participants during the visit and the post-visit interviews. They reported a sense of 'not being alone' in the landscape – this was an interesting finding particularly pertinent to rural heritage landscapes that can evoke a sense of loneliness due to their scale – which was often attributed by the participants to the social nature of the dialogic content in the apps. Furthermore, extensive speculation was observed as well as interaction with the landscape (for example, talking about the heather or the pine needles), which was attributed to the content provided by the apps. Participants made explicit connections between speculation and imagination as a way of making sense of the archeological ambiguity related to the interpretation of rock art.

In the following section we work across the case studies to detail common challenges that emerged for us in mutual reflection on these evaluations. We make the case for naturalising this kind of reflexivity in digital cultural heritage evaluation, and for the value of reflection as a collaborative and dialogic endeavour, as practiced in this article.

4 DISCUSSION: COMMON CHALLENGES

The richness of the evaluation materials collected for both RAMP and WNEIS demonstrate what can be achieved through experience driven mixed-method approaches to the evaluation of mobile digital heritage applications 'in the wild'. Yet our independent research projects also left us with some unease which emerged as we shared our experiences, reflecting upon our

own positionality and the relationality of our methods within the projects; in short, as we practiced our reflexivity. Had our methodologies really offered insight into peoples' experiences of these immersive digital heritage interventions, and had they sufficiently accounted for their natural, social and digital contexts? Do we have the appropriate language/tools to talk to our participants about experiences that are dynamic and unfold in time and space? Indeed, what kind of a performance had our research participants offered up for us and how do we account for the role of the evaluation process, and the evaluators, in generating new avenues for meaning-making? Mann [21] makes the distinction between reflection and reflexivity in doing research to summarise that reflexivity focuses 'on the self and ongoing intersubjectivities. It recognizes mutual shaping, reciprocity and bi-directionality, and that interaction is context-dependent and context renewing.' The following sections elaborate on and expand the three sets of questions above, continuing to draw on findings from both evaluations and relating them to relevant discourse in existing scholarship in the field. They demonstrate our process of reflexivity in action, highlighting ethical and practical considerations for the evaluation of fluid, fleeting and dynamic digital heritage experiences 'in the wild' going forwards. They also draw attention to the reflexive relationship between heritage experiences 'in the wild' and their evaluation 'in the wild' as mutually constituting the context of study.

4.1 Adequately Accounting For Transmedial Digital Cultural Heritage Encounters 'In the Wild'

Following previous scholarship on place-based digital cultural heritage, we both understand heritage encounters to be embodied, and constituted of 'personal, social, cultural, and physical experiential qualities' [8]. Particularly, Ciolfi [8] and Fosh et al. [23] emphasise the role of embodiment in experiencing a variety of cultural and natural heritage sites, while Betsworth et al. [24] pay attention to the role of spectators and bystanders in performative digital heritage applications in a disused Copperworks site. In the latter study, interviews and observations showed not only that participant experiences were diverse, but that they were highly contingent on how participants responded to the tangible and emotional resources, as well as the activity on the sites, which were not strictly scripted on the mobile application. Furthermore, Giaccardi and Palen [25] argue for the need to support 'cross-media' interactions in place-based heritage work.

Echoing the work of Jeff Ritchie [26] on locative narrative in particular, we see those inter-connections as essential and consequential. Ritchie holds that storytelling using mobile locative media cannot 'realise its narrative potential' if it does not 'take full advantage' of both the technology employed and the physical space [26]. Once these are activated by the user(s), Ritchie asserts, a variety of 'transmedia narrative forms' can be realised. But how can project evaluations adequately capture that multidimensionality and its consequences for individual user-visitors?

This conceptualisation of mobile digital heritage experiences as transmedia narratives resonates with the design of, and experiences embodied by, both WNEIS and RAMP. The physical outdoor spaces, as well as the stories/content hosted on the mobile devices, were expected to work together to intrigue and enable visitors to discover the respective storyworlds of Cyril and Northumberland rock art. Echoing the attention to the sensory dimensions of digitally-mediated experience in Pink's ethnographic practice [27], the natural landscape and the content on the mobile devices in our two case studies were dynamic and full of possibility in their own right, beyond the ways in which the experiences we had crafted anticipated them. For example, the Northumberland landscape is exposed to diverse and acute weather conditions (such as wind) as well as being very seasonal, with thick bracken covering the sites during the spring/summer period that renders the carved rocks invisible. Similarly, the park in WNEIS is animated in very different ways after dark. Members of the public use it to cut through from one side of the University campus to the other, they sit and smoke on the benches, and people from the street community often base themselves in the park. As one participant noted, 'it felt like people might intrude on our experience, or we might intrude on theirs' (WNEIS participant). In November, when we carried out our research, the World War One memorial in the centre of the park was suddenly surrounded by poppy wreaths which were subsequently appropriated by our participants into Cyril's story.

In our respective studies, people created a personal narrative of the experience through an imaginative pic'n'mix, that is, they were able to mobilise aspects of the landscape alongside aspects of the digital content (not always the 'correct content'), in order to craft a new story. The flow of their imagination was not always one-way – i.e. from what the digital content described to the physical landscape – but was cross-media and multidirectional. We understand this phenomenon as a form of multimodal imaginative investment. The emerging storyworlds we were working with in our evaluations were thus activated somewhere between the physical spaces, the mobile devices and our participants, in transmedial processes of sense-making spanning visceral, social and cognitive domains. Our evaluation approaches thus needed to be sensitive to this and allow for unpredictability, responsiveness and improvisation. To focus on the use of the devices only, in the tradition of usability studies (e.g. [28]), or the navigation of the physical terrain only, in the tradition of (museum) visitor observational studies (e.g. [29]), would have led to a clear mischaracterisation of the experience.

Multimodal imagination emerged as a key strategy that supported immersion in these case studies, and sense of place and self across different time-frames. In WNEIS, participants co-opted aural and olfactory cues in the park into their (collective) story-making about Cyril; for example, the noise of a police helicopter overhead became the noise of a bomber aircraft. In RAMP, a male participant, when talking through the mind map he had created after the experience, co-opted references to content about sacrifices that was available on the RAMP app to describe the sounds that came to mind in the hillfort in Lordenshaw:

It's possible that there were sacrifices going on, you know, in the hill forts, so you know- also defending something: battles were really brutal in those times. So there's- that brought to mind slightly rough sounds, you know. Sounds you don't associate with kind of calm civilisations. And it's quite- in terms of weather it can be a really grim place up there, especially if you don't have a car in the car park waiting to take you home. A taxi back to your environment. (RAMP participant)

What was fascinating about this participant's account of his experience of the aural dimensions of the site is that the reference to sacrifice was not made in relation to the hillfort commentary in the RAMP app but another carved rock on the site. We argue that the use of self-reflective mind maps in this instance was an opportunity for participants to re-tell their experience, revealing what Ritchie [26] calls the 'really nontrivial effort' that participants put into making sense and meaning from the transmedia heritage narrative offered by the RAMP app. The focus groups for WNEIS worked similarly.

A common characteristic of WNEIS and RAMP was the language of 'adventure' and 'discovery', which inspired participants to organically 'expand' the storyworld of their experience by engaging with aspects of the landscape that did not form part of the curated narrative but, in the context of the experience, became relevant to the individual participants. For instance, in WNEIS the smell of flowers became something that participants talked about; 'you can actually smell the blossom. You don't notice it in the day. But your senses have been all muddled up' (WNEIS participant). Although the flowers were not part of WNEIS's curated narrative, participants' exploration of the park gave them the space and opportunity to notice them. Furthermore, in RAMP, participants reported feeling compelled to have a good look around the sites just in case there were more rock art marks to be discovered outside the content of the app, as vividly described by one of the male participants: "'Keep your eyes peeled, you might see others.'" No, then I'd just become obsessed! [...] Makes you look at every single piece of rock, which is exhausting in this area!' (RAMP participant). Indeed, this participant was observed to look at many other rocks on the site outside the public path and the navigational suggestions included in the RAMP app.

The openness afforded by our evaluative approaches, which opted to capture both the activity of a small number of participants on-site as well as their retrospective narratives of experience within their groups, allowed us to gather insights not only into how well (or not) the curated elements of the transmedia experiences engaged participants, but also, insights into the elements of our designs that enabled participants to 'break free' from the curated experience and expand their respective storyworlds. This finding aligns with observations in other studies of place-based digital heritage experiences that use similar methodologies, and directly questions the capacity of data deriving from system logs (for example the length of time a mobile device is used, GPS tracking of the participants on site, neurophysiological

response data) to both capture and value embodied, visceral responses to digital heritage encounters and the transmedial experiences that enable them.

One of the key methodological challenges arising, however, is that such reflections are personal and often idiosyncratic, as demonstrated above. Although current methods, such as the ones used in WNEIS and RAMP, go a long way to capturing these experiences in a given moment (often immediately after the visit) there is scarcity of approaches and examples of research providing insights into longer term impacts on participants, both in terms of their engagement with the specific heritage and/or sites, and their attitude towards place-based transmedia heritage narratives more broadly. One might safely assume that participants' experiences of projects such as RAMP and WNEIS are likely to shape how they will approach similar interventions in future in the same way that our participants brought with them experiences from other mobile museum and tourist guides. Longitudinal studies would be insightful but are complex and (can be) resource intensive. They are rare in digital heritage research, although attempts have been made in related areas (for example Jackson and Kidd [30] on longitudinal impacts of encounters with(in) performance in museums and heritage sites). Such studies could begin to shed light on how a single (or indeed, a series of) digital cultural heritage intervention(s) is understood and valued over time, and the extent to which the 'adventures' and journeys of 'discovery' with particular narratives, spaces and places remain consequential and meaningful over time (or not).

4.2 Talking About 'Experience'

In both research projects we have been struck by the near impossibility of navigating the phenomena often termed 'experience'. In the projects detailed here, talk about 'the experience' encapsulates any number of things; the technology, learning, the sense of being in a somewhat unique place and time on your own or with others, and affect in all its various permutations including surprise, fascination, intrigue, boredom or unsettlement. Rose Biggin's understanding of immersive experiences is helpful here in making sense of why comprehensive and unproblematic assessments of 'experience' are necessarily tricky for researchers to access: 'I draw from philosophical aesthetics, cognitive science and computer games to define immersive experience as a graded, fleeting, intense and necessarily temporary state defined by an awareness of its temporal and spatial boundaries' [31]. As noted in the introduction, 'experience' is relational, subjective, and reflexive [1]. That it is fleeting makes it a 'fiendishly difficult' thing to capture and articulate [32]. And yet it was these knotty, unpredictable and unruly expressions of experience we were interested in for these research projects, both of which were interested in the value of ambiguity within heritage work.

Neither researcher wanted to revert to a more traditional usability study as a main evaluative method. Data analytics from RAMP for instance, would have given the researchers numerical indications of activity on the web platform that hosted the content of the apps (see

[33]), but there was uncertainty about how those statistics could be interpreted with specific reference to the research questions under investigation. As previously outlined, we saw it as a limitation to rely solely on behavioural data analytics, wanting instead to use qualitative research methods and explore the potential of these formats 'in the wild'. Others such as Hornecker & Nicol [34] and Ciolfi [8] have also advocated taking evaluation out of the lab, and Economou and Pujol [35] note that 'lab-based evaluations ... ignore the complexity of studying visitors in the natural environment'. As has been noted, both our studies opted for qualitative and interpretivist mixed-methodological approaches which necessarily shaped the language we used. Navigability and accessibility were of course important to us, but so too was capturing something of the processes of sense-making and interpretation that were happening in both cases. A subsidiary challenge here relates to how we articulate measures for success for these kinds of projects. Although both projects had set objectives, they were incredibly difficult ones to evaluate against. Each had nuanced and exploratory research questions.

As we move into the realm of the immersive and open up multiple avenues of interaction and interpretation, it seems important to find ways of talking with our participants that really enlighten the (arguably) richer questions we now wish to explore. For example, in the WNEIS research we were keen to know what people had gleaned from the narrative, yet to ask them to summarise or recount that narrative back to us ('What did you learn'? What do you remember? What can you tell us about Cyril?) would have required them to narrativise and rationalise in a coherent fashion that which we had purposefully presented as fragmented. Presenting us with a linear narrative would have been entirely at odds with what we knew about Cyril's story, and how we had wanted them to think about processes of musealisation and historicisation. These are perhaps challenges that are common within traditional formats of curation and interpretation, but here we find them manifesting in the digital domain too.

We wanted to make room for the varied potentials and limitations of these digital heritage encounters to emerge in peoples' responses in ways that felt authentic, that were unpredictable to us, and that revealed the ways our resources did (or did not) come together to constitute a 'multimodal whole' [36] with a 'multimodal grammar' [36] that was ultimately productive for our participants. Following other scholars within the field of digital cultural heritage [5, 6, 9, 8, 13] we have found multimodality a useful theoretical framework for exploring these cases, recognising as it does the importance of 'fine-grained detail of form and meaning' [36] and offering methodological prompts. This framework reminds us to pay attention not only to textual and linguistic resources, but also to spatial, visual, aural and embodied aspects of interaction and environments [37].

In the focus groups (WNEIS) and work around the personal mind mapping (RAMP), it was gratifying to hear participants voice in their own words how the encounter had been felt, how it had been embodied, how it had disrupted their understanding of historical narratives, and how ambiguity had been embraced and/or navigated. Two RAMP participants (both female

but from different evaluation groups and with different backgrounds) noted that a key takeaway for them was that multiple interpretations can be viable:

Participant: 'No-one works just with fact, they speculate on facts, and then maybe use their fact to prove that their speculation might be valid. Without our imagination, without speculation this wouldn't happen.

Participant: 'The one thing that I learned was there were a million different ways you could interpret it.

In response to WNEIS participants spoke at length about the ways this experience differed from a 'typical' museum visit or historical narrative, and how the ambiguities and holes in the narrative they had encountered had proved productive for them [13]. As one respondent noted: 'what I liked was that I was kind of on the backfoot and I had to piece it together. I really liked that element. By the end I felt I had filled in the gaps' (WNEIS participant). They repeatedly talked about it as 'not passive' and as a process of 'discovery'. Participants were also able to reflect on their own fascination with the 'facts' and 'the real', and to think about what actually (or potentially) is at stake where these are undermined or unseated. In focus groups and interviews with participants after both experiences, there was a desire evident amongst respondents to assess the validity of their speculations which we have seen in other projects too. For example, in RAMP, when a participant was asked about her choice of answer in the interactive question posed by the web app 'whether the carved motifs were coloured', she was keen to provide evidence to support her thinking: 'So I chose 'no' on the painting because it is made of sandstone so it is already a sort of yellow ochre, and sandstone rocks have got different things coming through it so it already can be ground down to a pigment. So, I don't know.' (RAMP participant).

With experiences that are not guided or scaffolded in the way participants are used to there is seemingly still a desire to locate an authoritative narrative or institutional line; a conditioning that seems very much encultured in our respondents. This is not to say that mobile heritage interpretations such as WNEIS and RAMP are less desirable; we argue that mobile heritage experiences designed for openness and ambiguity will naturally attract both enthusiastic and skeptical participant responses in the same way their didactic/structured counterparts do too. Acknowledging this diversity of experience helps us to position mobile heritage interpretations (both didactic and open-ended) within an ecology of mobile heritage experiences rather than in competition with each other. In the case of WNEIS and RAMP, the opportunity for discussions included in the evaluation protocol created space for participants to find (or request) certainty, and respondents were often reassured by this opportunity. This raises another challenge around the ways research itself necessarily (and inevitably) becomes a part of 'the experience'.

4.3 Evaluative Research as an Intervention in Meaning and Sense-Making

In both projects the evaluation opportunity itself became an extended part of the meaning-making cycle for all participants, by both responding to and also renewing the context of the experience. Respondents continued to make sense of their visit and what they had experienced as they were talking about it. In the WNEIS research, people emailed additional reflections and queries in the days following the encounter. In RAMP, the meaning mapping exercise was often used by the participants as a means to reflect on a specific personal interest in light of their experience. Here we see the value of the more open-ended subjectivity-oriented methods used in these cases. A focus on system performance and usability would not have offered us access to this continued cognitive and emotional work, as well as the collective meaning-making, that we saw in these projects. When interested in the felt, embodied and visceral experience of digital cultural heritage interpretation the nature of the invitation, and the kinds of techniques utilised, do need to differ from traditional user-testing.

For example, as already discussed, in RAMP participants were asked to draw a mind map post-visit. Departing from the traditional use of personal mind maps with museum visitors, which often focuses on visitors' responses to a specific concept or topic, participants in RAMP were asked to select one out of five phrases as a prompt (see [figure 1](#)): The Carver, Neolithic People, Sounds of the Land, Change, and The Views. This adaptation of the mind mapping method also reflected the conscious intention of the researchers to move away from a comparison-based evaluation framework to an analytical one. The prompts were chosen for their connection to themes arising from earlier participatory design workshops in the design phase of the RAMP web apps and were deliberately phrased using ambiguous open-ended language. The purpose of this mapping exercise was to elicit responses on the nature of 'sense of place and self', which may not have naturally emerged in the more structured environment of interviewing (even within a semi-structured interview framework), and are by their very nature difficult for participants to articulate explicitly; they are 'felt' or embodied responses to the rock art and the surrounding environment. Additionally, specifically questioning participants on how the environment made them feel may have been leading. The inclusion of five 'starting prompts' therefore required the participants to become aware of their own response towards the landscape and reflect on it. It also afforded, we argue, the opportunity for participants to exercise agency over the evaluation protocol – indeed one of the participants rejected all five prompts and, instead, opted to use a starting prompt of her own to draw the map; an option that was not available in the evaluation protocol but emerged organically and reflexively in the conversation. On selection of a 'starting prompt', participants were asked to map out their thoughts around their chosen phrase and then talk through their diagram. Their rejection of the other prompts led to interesting reflections, insights and discussions that were of as much or more value than the completed maps.



Fig. 1. A participant draws a personal mind map. Copyright: Debbie Maxwell.

Intimate evaluative approaches to embodied digital interactive experiences were also used by Loke and Khut [38], who encouraged audiences to draw body maps indicating the body sensations generated by their installation *The Heart Library*, which subsequently formed part of the exhibition. It is evident that in this kind of reflexive evaluative project, the research activities themselves become an intervention in meaning-making for both the researchers and the researched. This is not a new observation. Research methods training routinely introduces the idea of ‘observational reactivity’ for example, noting that the behaviours of those who are observed for research purposes may well alter due to the very fact of their being observed. Contrary to the precautionist spirit of the above warning however, we see these less as problems to be eradicated or explained away, but as features of twenty-first century heritage work more broadly, and of the digital environment perhaps especially [39]; heritage work is increasingly understood as (at best) collaborative, co-produced, relational and contentious. The research process as an intervention can be generative, productive and (sometimes) turbulent, mirroring other social interactions in our everyday lives.

We suggest that a narrow evaluation process, which often requires evaluators to assess experience against a pre-defined set of design objectives, overlooks the reflexive relationship between digital heritage interpretive products and the social, cultural and natural (i.e. physically bounded) contexts of their use. Our experiences with WNEIS and RAMP highlight the need for an alternative evaluation paradigm that does not limit evaluators to ‘objectively’ consolidate the views of heritage organisations, designers and participating audiences.

Instead, it ‘facilitates a more extended reflection-on-experience on the part of the audience’ [38] while enabling the evaluator(s) and participants to negotiate the focus of the evaluation, and review and reflect on their own positions as part of the process. One might want to liken our approach in digital heritage evaluation to the Wittgensteinian hammer; evaluation is not a mere ‘tool’ to deliver an assessing/measuring goal but an inseparable part of heritage meaning-making processes at large.

5 CONCLUSION

We set out in this article to look across two digital cultural heritage projects that took place ‘in the wild’ in order to identify and highlight common methodological challenges in their evaluation. It was a process of reflexivity itself that we were interested in, and that we wish to advocate and foreground as an innovation in digital cultural heritage evaluation. Our projects had related (complex) objectives around exploring ambiguity, subjectivity and relationality, themes that are nascent, and likely to become more common as the field embraces new kinds of experiences and research questions. As we have shown, although the experience of digital cultural heritage interventions is made of micro-moments and micro-interactions between users and technology, ‘experience’ of heritage extends beyond these interactions to encompass encounters with people, physical and imagined landscapes, the archive, and in these instances, with researchers also. It is our process of reflexivity within and across these projects that has enabled us to become aware of and pay attention to aspects of the mobile heritage experience that need to be more consciously included in our future evaluation approaches.

We have identified three challenges that emerged in carrying out evaluation of these projects. Firstly, we outlined practical and conceptual challenges associated with capturing, in a meaningful manner, transmedial heritage engagements ‘in the wild’; that is, encounters that span both digital content and the changeable physical environment as they intersect with each other over the course of an experience. As device data analytics and qualitative observational techniques alone lack the ability to represent the transmedial nature of the experience, new hybrid methodologies are required in this field to enable researchers to understand technology use in actual practice while affording participants the capacity to exercise their agency over their experience. Secondly, we described challenges associated with asking about and articulating multimodal experiences and their impacts; for us as researchers, and for our research participants. In this case the lessons learned from digital sensory ethnography advocated by Pink [27] offer a useful starting point for researchers of mobile heritage applications outdoors. Thirdly, we have been reminded again that research is itself an intervention in meaning-making, of how important it is to be mindful of that when reporting results, and also to be open to the opportunities that this insight provides. We have argued that the evaluation process in this context is an extension of the meaning-making process. This is not a weakness of experience driven methods; rather, it demonstrates how

digital cultural heritage encounters, and their evaluation, are in and of the world, their multimodality unremarkable in a social and cultural context marked by digitality. Our practice of reflexivity gives us renewed confidence to make these challenges visible and productive in our research rather than trying to eradicate them completely.

We advocate the kind of reflexivity that has been achieved through this writing project; a 'dialectical interrogation' of our familiar positions which might help to 'avoid the reproduction of conventional ideas and traditions' in our approaches and our interpretations [15]. In this respect, we aim to encourage the adoption of evaluation approaches in mobile heritage experiences that challenge the normative nature of evaluation practices. A number of those approaches have emerged through the discussion of our own methods in the two case studies, such as the need for the evaluation approach to be context-specific, dialogic and critically informed; for instance, as already discussed, in both RAMP and WNEIS the research teams paid attention in creating the conditions within the evaluation process for participants to deviate from the evaluation protocol being utilized in each instance. We acknowledge, however, that adopting more reflexive evaluation practices might mean researchers and practitioners need to negotiate and affect change in their organizational contexts.

In this vein, we want to champion a more nuanced understanding of both how to measure the value of digital cultural resources and how to articulate success and/or failure in this context. Why are digital cultural resources valuable and for whom? Latulipe [40] in her discussion of value in the context of digital artworks and performances, urges us to resist 'value reduction' approaches in the evaluation of art, culture and heritage, and to think beyond financial and innovation metrics. Geoffrey Crossick and Patrycja Kaszynska [41] highlight the need for more nuanced ways of understanding the value of digital engagement with culture more specifically, beyond the number of downloads and likes. What the reciprocal reflection on the two case studies shows us is that the value of mobile digital heritage resources in situ often extends beyond the curated boundaries of individual digital heritage experiences; its meaningful capture and analysis can be achieved, but it is complex and iterative work that requires greater investment in longitudinal studies and collaboration across case studies.

On a practical level, capturing the sensory and embodied aspects of digital cultural encounters 'in the wild' requires both resources and time commitment, which are not often budgeted for within traditional digital project commissioning processes in heritage organisations. By acknowledging this tension, we also call for a stronger commitment from funding bodies and cultural organisations to develop a sustainable practice around the evaluation of mobile heritage applications and the sharing of evaluation protocols and findings. It also requires nuanced understandings of both research contact and the analysis of collected materials to mitigate against positivist readings of open-ended reflexive methods, such as mind maps and in situ observations of heritage meaning-making in action. This draws our attention to the ethical challenges associated with methods that aim to capture fleeting,

visceral and self-reflective encounters and, particularly, their conflictual relationship to traditional claims of generalisability and reproducibility often associated with both digital technology evaluations and social science approaches. If meaning-making is situational and context dependent [42] then it would seem problematic to claim that our findings should be applicable in different contexts. Do ungovernable digital cultural resources lead to seemingly ungovernable evaluation approaches? Our effort to openly reflect on two individual evaluation protocols which were applied on separate occasions by different research teams and within diverse digital heritage contexts, suggests that mobile digital heritage evaluation approaches 'in the wild' have now reached a level of maturity, allowing us to articulate common concerns and imagine innovative methods to address them.

These challenges and opportunities weigh heavy on us as we design research methodologies for the next iterations of our projects. Their consideration impacts how we engage our respondents in discourse around and in response to our research outputs; outputs informed by questions which are, over time, becoming more multifaceted. They increasingly circulate around themes of embodiment, social interaction, lived experience, subjectivity, relationality, affect and the inner world of feelings, and necessitate that we become more multidimensional and intentional researchers in response.

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References

- [1] Peter Wright, John Mccarthy, and Lisa Meekison. 2004. Making sense of experience. In Mark A. Blythe, Kees Overbeeke, Andrew F. Monk, and Peter C. Wright (Eds) *Funology*. Kluwer Academic Publishers, New York, 43-54.
- [2] Catherine Styles. 2011. Dialogic Learning in Museum Space. *Ethos* 19, 3, 12-20.
- [3] Shelley Ruth Butler. 2015. Reflexive museology: lost and found. In Andrea Witcomb, and Kylie Message (Eds) *The International Handbooks of Museum Studies*. John Wiley & Sons, New York, 159-182. DOI: 10.1002/9781118829059.wbihms109
- [4] Daniela Petrelli, Luigina Ciolfi, Dick van Dijk, Eva Hornecker, Elena Not, and Albrecht Schmidt. 2013. Integrating Material and Digital: A New Way for Cultural Heritage. *Interactions* 20, 4, 58-63. DOI: 10.1145/2486227.2486239

- [5] Areti Damala, Tobias Schuchert, Isabel Rodriguez, Jorge Moragues, Kiel Gilleade, and Nenad Stojanovic. 2013. Exploring the Affective Museum Visiting Experience: Adaptive Augmented Reality (A2R) and Cultural Heritage. *International Journal of Heritage in the Digital Era* 2, 1, 117-141. DOI: 10.1260/2047-4970.2.1.117
- [6] Areti Damala, Merel van der Vaart, Loraine Clarke, Eva Hornecker, Gabriela Avram, Hub Kockelkorn, and Ian Ruthven. 2016. Evaluating Tangible and Multisensory Museum Visiting Experiences: Lessons Learned from the meSch Project. MW2016: Museums and the Web 2016. Los Angeles, CA. Accessed May 22, 2018 from <http://mw2016.museumsandtheweb.com/paper/evaluating-tangible-and-multisensory-museumvisiting-experiences-lessons-learned-from-the-mesch-project/>
- [7] Areti Galani, Aron Mazel, Deborah Maxwell, and Kate Sharpe. 2013. Situating Cultural Technologies Outdoors: Empathy in the Design of Mobile Interpretation of Rock Art in Rural Britain. In Eugene Ch'ng, Vincent Gaffney, and Henry Chapman (Eds) *Visual Heritage in the Digital Age*. Springer, London, 183-204. DOI: 10.1007/978-1-4471-5535-5_10
- [8] Luigina Ciolfi. 2015. Embodiment and Place Experience in Heritage Technology Design. In Michelle Henning (Ed.) *The International Handbooks of Museum Studies*. John Wiley, New York, 419–445. DOI: 10.1002/9781118829059.wbihms319
- [9] Sarah Kenderdine. 2016. Embodiment, Entanglement, and Immersion in Digital Cultural Heritage. In Susan Schreibman, Ray Siemens, and John Unsworth (Eds) *A New Companion to Digital Humanities*. Wiley, Chichester, 22–41. DOI: 10.1002/9781118680605.ch2
- [10] Luigina Ciolfi, and Marc McLoughlin. 2017. Supporting Place-Specific Interaction through a Physical/Digital Assembly. *Human-Computer Interaction* 00 (online first), 1-45. DOI: 10.1080/07370024.2017.1399061.
- [11] Steve Poole. 2017. Ghosts in the Garden: locative gameplay and historical interpretation from below. *International Journal of Heritage Studies* 24, 3, 300-314. DOI: 10.1080/13527258.2017.1347887.
- [12] Jenny Kidd. 2014. *Museums in the New Mediascape: transmedia, participation, ethics*. Routledge, London and New York.
- [13] Jenny Kidd. Online first 2017. With New Eyes I See: embodiment, empathy and silence in digital heritage interpretation. *International Journal of Heritage Studies*. DOI: 10.1080/13527258.2017.1341946
- [14] Robert Stein. 2015. CODE|WORDS: The back story. In Ed Rodley, Robert Stein, and Suse Cairns (Eds) *CODE|WORDS: Technology and Theory in the Museum*. Museums Etc., Edinburgh, and Boston.
- [15] Mats Alvesson and Kaj Skoldberg. 2017. *Reflexive Methodology: New Vistas for Qualitative Research*. SAGE, London, California, New Delhi, and Singapore.
- [16] Maria Economou, and Laia Pujol Tost. 2011. Evaluating the use of virtual reality and multimedia applications for presenting the past. In Georgio Styliaras, Dimitrios

- Koukopoulos, and Fotis Lazarinis (Eds) *Handbook of Research on Technologies and Cultural Heritage*. IGI Global, 223-239. DOI: 10.4018/978-1-60960-044-0.ch011
- [17] Aron Mazel, Areti Galani, Deborah Maxwell, and Kate Sharpe. 2012. 'I want to be provoked': public involvement in the development of the Northumberland Rock Art on Mobile Phones project. *World Archaeology* 44, 4, 592-611. DOI: 10.1080/00438243.2012.741813
- [18] Christopher Tilley. 1994. *A phenomenology of landscape*. Berg, Oxford.
- [19] John Was, and Aaron Watson. 2017. Neolithic monuments: sensory technology. *Time and Mind* 10, 1, 3-22. DOI: 10.1080/1751696X.2016.1267922
- [20] Bradley S. Jorgensen, and Richard C. Stedman. 2001. Sense of place as an attitude: Lakeshore owners attitudes toward their properties. *Journal of Environmental Psychology* 21, 233-248. DOI: 10.1006/jevp.2001.0226
- [21] Steve Mann. 2016. *The Research Interview: Reflective Practice and Reflexivity in Research Processes*. Palgrave Macmillan, London. DOI: 10.1057/9781137353368
- [22] Marianna Adams, John H. Falk, and Lynn D. Dierking. 2003. Things Change. In Maria Xanthoudaki, Les Tickle, and Veronica Sekules (Eds) *Researching Visual Arts Education in Museums and Galleries. Vol 2: Landscapes: The Arts, Aesthetics, and Education*. Springer, London, 15-32.
- [23] Lesley Fosh, Steve Benford, Stuart Reeves, Boriana Koleva, and Patrick Brundell. 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)*. ACM Press, New York, NY, 149-158. DOI: 10.1145/2470654.2470675
- [24] Liam Betsworth, Huw Bowen, Simon Robinson, and Matt Jones. 2014. Performative technologies for heritage site regeneration. *Personal and Ubiquitous Computing* 18, 7, 1631-1650. DOI: 10.1007/s00779-014-0766-3
- [25] Elisa Giaccardi, and Leysia Palen. 2008. The Social Production of Heritage through Cross-media Interaction: Making Place for Place-making. *International Journal of Heritage Studies* 14, 3, 281-297. DOI: 10.1080/13527250801953827
- [26] Jeff Ritchie. 2014. The affordances and constraints of mobile locative narrative. In Jason Farman (Ed.) *The mobile story - Narrative practices with locative technologies*. Routledge, New York, London, 53-67.
- [27] Sarah Pink. 2015. *Doing sensory ethnography* (2nd ed.). Sage Publications, London.
- [28] Panagiotis Galatis, Damianos Gavalas, Vlasios Kasapakis, Grammati Pantziou, and Christos Zaroliagis. 2016. Mobile Augmented Reality Guides in Cultural Heritage. In Fahim Kawsar, Pei Zhang, and Mirco Musolesi (Eds.) *Proceedings of the 8th EAI International Conference on Mobile Computing, Applications and Services (MobiCASE'16)*, ICST, Brussels, 11-19. DOI: 10.4108/eai.30-11-2016.2266954

- [29]Theano Moussouri, and George Roussos. 2014. Mobile Sensing, BYOD and Big Data Analytics: New technologies for audience research in museums. *Participations* 11, 1, 270-285.
- [30]Anthony Jackson, and Jenny Kidd. 2008. Performance, Learning and Heritage. Project report. Centre for Applied Theatre Research, University of Manchester, Manchester.
- [31]Rose Biggin. 2017. *Immersive Theatre and Audience Experience: Space, Game and Story in the Work of Punchdrunk*. Palgrave Macmillan, London. DOI: 10.1007/978-3-319-62039-8
- [32]Alke Gröppel-Wegener. 2011. Creating heritage experiences through architecture. In Anthony Jackson, and Jenny Kidd (Eds) *Performing Heritage: Research, practice and innovation in museum theatre and live interpretation*. Manchester University Press, Manchester, and New York, 39-52.
- [33]Aron Mazel. 2017. Valuing rock art: a view from Northumberland in North East England. *International Journal of Heritage Studies* 23, 5, 421-433. DOI: 10.1080/13527258.2016.1274668
- [34]Eva Hornecker, and Emma Nicol. 2011. Towards the Wild: Evaluating museum installations in semi-realistic situations. In Luigina Ciolfi, Katherine Scott, and Sara Barbieri (Eds) Proceedings of the International Conference "Re-thinking Technology in Museums 2011: Emerging Experiences. University of Limerick, Limerick, Ireland.
- [35]Maria Economou, and Laia Pujol. 2008. Educational tool or expensive toy? Evaluating VR evaluation and its relevance for virtual heritage. In Yehuda Kalay, Thomas Kvan, and Janice Affleck (Eds) *New Heritage: New Media and Cultural Heritage*. Routledge, London, 242-260.
- [36]Carey Jewitt, Jeff Bezemer, and Kay O'Halloran. 2016. *Introducing Multimodality*. Routledge, Oxon, and New York.
- [37]Carey Jewitt (Ed.). 2013. *The Routledge Handbook of Multimodal Analysis* (2nd ed.). Routledge, Abingdon, and Oxon.
- [38]Lian Loke, and George P. Khut. 2014. Intimate Aesthetics and Facilitated Interaction. In Linda Candy, and Sam Ferguson (Eds) *Interactive Experience in the Digital Age: Evaluating New Art Practice*. Springer, Switzerland, 91-108. DOI: 10.1007/978-3-319-04510-8_7
- [39]Jenny Kidd. 2019. Digital Media Ethics and Museum Communication. In Kirsten Drotner, Vince Dziekan, Ross Parry, and Kim Schrøder (Eds) *The Routledge Handbook of Museum Media and Communication*. Routledge, London, and New York.
- [40]Celine Latulipe. 2013. The value of research in creativity and the arts. In Proceedings of the 9th ACM conference on Creativity and Cognition. ACM Press, New York, 1-10. DOI: 10.1145/2466627.2485921
- [41]Geoffrey Crossick, and Patrycja Kaszynska. 2016. Understanding the Value of Arts and Culture: The AHRC Cultural Value Project. Report. Arts and Humanities Research Council, Swindon.

[42]John H. Falk, and Lynn D. Dierking. 1992. *The Museum Experience*. Whalesback Books, Washington DC.