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Immersive Experiences in Museums, Galleries and Heritage Sites: A review of research findings and issues

Dr Jenny Kidd and Dr Eva Nieto McAvoy

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School of Journalism, Media and Culture, Cardiff University.

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About the authors

- **Dr Jenny Kidd** - Reader, School of Journalism, Media and Culture, Cardiff University, Two Central Square, Central Square, Cardiff, CF10 1FS; kiddjc2@cardiff.ac.uk

- **Dr Eva Nieto McAvoy** - Research Associate, School of Journalism, Media and Culture, Cardiff University, Two Central Square, Central Square, Cardiff, CF10 1FS; NietoMcavoyE@cardiff.ac.uk

Abstract

This paper offers an introductory overview and reference guide on immersive experiences for heritage organisations and their funders. It reviews emergent themes from academic research into immersive experiences in museums, galleries and heritage sites, and presents a number of recommendations. Given (in particular) technological developments over the past decade, there has been a resurgence of scholarly interest in immersive media and immersive storytelling in such contexts, and this paper highlights key debates and findings from that investigation. It brings together and makes connections between creative, production and audience opportunities and challenges, particularly challenges relating to evaluation. This discussion paper is intended for those working in arts and heritage contexts who are considering adding immersive approaches to their portfolio, are interested in how audiences or users might respond, and want to know more about some of the associated challenges. For those researching immersive experiences, it highlights gaps and potential agendas for future research. It also offers an insight into academic research findings that will be useful for policy makers and funders who may be considering the value proposition of such approaches. A full bibliography is included at the end of the report which provides a resource for others researching or practicing in this area.

Key Words: Immersive Experiences, Digital Arts and Heritage, Storytelling, Emotional Engagement, Evaluation

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Summary: findings and recommendations

This discussion paper is an introductory overview and reference guide on immersive experiences for heritage organisations and their funders. It summarises current academic research into immersive experiences within museums, galleries and heritage sites, and presents a number of recommendations. It will be of interest to people working in arts and culture, the broader creative industries and to policymakers.

Interest in immersive experiences within the context of museums and heritage has increased in recent years in response to some of the challenges faced by the sector and given the perceived potentials of emerging technologies. Institutions hope that immersive encounters will (a) increase visibility and contribute to a culture of innovation, (b) appeal to new audiences, (c) allow for more meaningful participation, (d) facilitate better engagement, and (e) provide additional revenue.

> ➢ *This paper proposes that the role of immersive experiences in fulfilling these objectives needs to be better evidenced as these ambitions are still being tested.*

The creative industries have the potential to become a driving force in immersive technologies and content, helping to fulfil two key objectives: capturing new audiences and contributing to the UK economy. This is reflected in the Industrial Strategy and the Creative Industries Sector Deal. Cultural institutions have been important early testbeds for immersive approaches and have – often in partnership with research institutions and creative economy partners – benefitted from investment through UKRI, the Arts Councils and National Heritage Lottery Fund. But attempts to find straightforward connections between investment and outcomes have been inconclusive (or resisted).

> ➢ *In summarising and reflecting on current academic research interests we make the case for increased efforts to test a value proposition that more adequately captures the nuances of immersion in museum, gallery and heritage contexts.*

In synthesising themes and challenges that emerge in the literature, this paper recognises that cultural and creative innovation in these spaces is helped by, but not limited to, technological innovation. 'Immersion' is a complex phenomenon and has been broadly defined. We utilise an expansive definition of 'immersive experiences' in this paper but encourage clarity about – and reflection on – the kind of immersion being sought in individual projects.

The themes and challenges that this paper identifies apply not only to the museums and heritage sector. Opportunities for cross sector learning are to be encouraged, and are enhanced by recent initiatives in the field, not least of all those emerging from the UKRI Audiences of the Future Challenge. Its demonstrator programme is funding four projects crafting immersive experiences in the fields of performance, sport entertainment, the moving image and visitor experiences.[1] Through their partnerships, these industry-led consortia will have the opportunity to test immersive experiences with large-scale audiences.

Themes in the research

Storytelling. Immersive approaches broaden the possibilities of digital storytelling – whether enhancing experiences, challenging conventions or giving users a more active role to play. New audience propositions are emerging. Narrative techniques can be used to step or pace an experience so that users do not become overwhelmed or bored.

[1] The 'Visitor Experience' team, for example, is creating two multi-sensory and interactive worlds: dinosaurs in the Natural History Museum and robots in the Science Museum. Combining mixed reality technology and immersive theatre, they are both concerned with the relationship between immersive experiences and the spaces they will take place in – an iconic room in each of the museums. As with the immersive practices identified in this paper, the team is considering the social nature of the museum experience, the importance of storytelling, and the opportunities and challenges afforded by mixed reality in regard to user agency.

- ➢ *Avoid technology-centric approaches. Careful consideration should be given to audience, intended impacts and narrative, before opting for any particular technological solution.*

Social experiences. Social exchanges are important aspects of usability and accessibility and can be powerfully enhanced during an immersive encounter – whether it is being experienced by several people or only one person at a time.

- ➢ *Consider the kind of social interactions an experience will facilitate – directly or indirectly – as sociability is very often crucial to meaning making and enjoyment.*

Emotional engagement. Institutions increasingly want to understand the affective responses of users to their programming. One of the most pervasive assumptions is that immersive experiences increase empathy, but this proposition needs further exploration in these contexts.

- ➢ *Iterative rounds of user testing – including qualitative investigation – can offer insight into possible impacts on users, but note that such impacts will be unlikely to be universal ones.*

Embodied and spatial interaction. Immersive approaches – even those seemingly experienced 'wholly' digitally – are grounded in a physical and sensorial reality and have the potential to become full body experiences. There is strong evidence that an immersive experience can change the relationship between participants and the physical spaces they occupy.

- ➢ *Consider how the physical and bodily dimensions of an immersive experience can be made into an asset.*
- ➢ *The interactions between story, people, place and technology can powerfully enhance an immersive experience, and careful consideration should be given to these flows.*

Authenticity. Debates about authenticity, re-creation and fakery are amplified by digital technologies, and are particularly knotty in heritage contexts. A sense of authenticity is important to those encountering immersive heritage experiences, even where those interventions are playful and performative.

- ➢ *The possibilities of re-creation come with increased responsibilities that designers and institutions need to take seriously, both for quality and ethical reasons.*

Learning. Many cultural institutions seek to offer users a learning experience through immersive encounters. While some research suggests that this can be the case, the full possibilities of immersive education still need to be explored.

<u>Challenges</u>

Usability, uptake and onboarding. Technologies often pique the interest of users encouraging engagement, but there are challenges that can undermine an immersive encounter.

- ➢ *Framing an immersive experience to manage expectations is key so that users have some sense of what is expected of them (time commitment, movement in physical space, etc).*
- ➢ *Using technology is itself an object interaction within a heritage context. Consider how best to make it frictionless, or even invisible.*
- ➢ *Consider sustainability issues: What will be necessary to keep an experience 'live'? (staff training, further funding, technical support, etc).*

Evaluation. There is a consensus that mixed methodologies are desirable where possible to adequately account for the nature and quality of experience.

- ➢ *Institutions should be live to the challenges of evaluating 'in the wild' and plan for repeat user testing and iteration where practicable.*

Opportunities going forward

- *Further efforts to consolidate and articulate a more holistic 'value proposition'.*
- *Consideration of the ethical implications of immersive practices, particularly in relation to the roles and responsibilities of cultural institutions into the future, and in connection with other current priorities and debates in the sector.*
- *More research into the impacts of immersive technology. Heritage contexts provide a rich testbed for further investigation.*

1. About this discussion paper

Purpose of the paper

This paper offers an introductory overview and reference guide on immersive experiences for museums, galleries and heritage sites and their funders. It reviews emergent themes from current academic research into immersive experiences across the heritage sector. Given recent technological developments there has been a resurgence of scholarly interest in immersive media and immersive storytelling in such contexts,[2] and this paper highlights key debates and findings from that investigation.

Digital heritage research and practice has been a rich testbed for the possibilities of immersive technology. Museums, galleries and heritage sites are of interest to designers, developers, and those working in Human-Computer Interaction[3] because (a) they offer unique material to work with, for example, as a basis for mixed-reality and 3D printing projects; (b) they are compelling physical sites/spaces; (c) they have a captive audience on which to trial things; and (d) they often have pre-existing textual/visual digital content which can be overlaid in, for example, augmented reality. Such sites are uniquely situated across physical and digital domains; the intense materiality of the objects they continue to collect, preserve and display now needs to be understood in relation to enormous digitisation efforts, increased use of 3D imaging and varied forms of digital storytelling online and offline. Indeed, museums and heritage sites allow us to explore the points of collapse and erasure between physicality and digitality, and as such are a testbed for ideas and approaches that can inform practice across – and beyond – the creative industries.

Immersive practice within museums and heritage contexts represents a mixed ecology, which has benefitted from investment through UKRI, the Arts Councils and National Heritage Lottery Fund, as well as varying levels of institutional support. The sector itself is a mixed economy, including large museums – many of them Nationals – receiving public subsidy, as well as independent charities, smaller regional institutions (often in receipt of limited local council funding) and entirely volunteer run operations. Those working on immersive projects in the sector have trialled a number of different cost models for visitor experiences, from those free at the point of use, to paid downloads and high-profile ticketed events.[4] The diversity of practice in this sector is one of its strengths, and we try to reflect that in the discussion that follows.

This discussion paper is intended for those working in cultural institutions who are considering adding immersive approaches to their portfolio, are interested in how audiences or users might respond, and want to know more about some of the associated challenges. It offers an insight into academic research findings that will be useful for policy makers and funders who may be considering the value proposition of such approaches.

Parameters of the paper

The paper takes a purposefully broad definition of immersive experiences, recognising that there is much cross-over amongst different approaches, and within debates about their potentials. It doesn't focus only on those immersive technologies collectively defined as extended reality (XR) or even Creative XR[5] – mixed reality (MR), augmented reality (AR) and virtual reality (VR) for example – but also includes research using mixed media approaches, installation art and performance.

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[2] For an overview of historical developments in the usage of virtual reality and augmented reality in these contexts, see Petrelli (2019).

[3] See Hornecker and Ciolfi (2019) for a detailed overview.

[4] Such as 'The Lost Palace', 'Nightwatchers' and other offerings from Historic Royal Palaces.

[5] See for example https://creativexr.co.uk/

Immersive practices lie at the intersection of art and technology (Davies and Ward Dyer 2019) and are an important driver of creative innovation and creative economy (Mateos-Garcia, Stathoulopoulos and Thomas 2018). Looking across both technology-rich and narrative-rich approaches here, we hope to further encourage and facilitate the breaking down of barriers between the creative arts and technology. Following Kidd (2018), this review explores practice that is 'story-led, audience and participation centered, multimodal, multisensory and attuned to its environment' rather than defined by hardware.[6]

There is a wealth of policy documentation that highlights the value of immersive experiences, particularly in economic terms.[7] Not only do the Industrial Strategy and Creative Industries Sector Deal place an emphasis on the great opportunities for return on investment in immersive technology and content, but, through *Culture is Digital*, the DCMS also support 'cultural immersive production' on account of British cultural institutions' potential to 'play an influential role in positioning the UK as a global leader in content creation for immersive technology' (DCMS 2018: 12). This discussion paper suggests that there is rich potential for these outcomes, but some way to go before we truly understand the nature of the value proposition in relation to direct return on investment, or in more nuanced ways. The literature in this paper is concerned precisely with understanding the complexities of designing and evaluating immersive experiences, taking a more holistic approach to capturing and unpacking their value.

The paper offers six short case studies which illustrate recent practice, but it is not its scope to provide a detailed overview of the many examples of immersive practice that have emerged within these contexts. We have also excluded mainstream reporting on these issues, such as in the press, blogs or other non-academic resources, because that too is beyond the scope of this paper. Such resources are insightful however for a broader understanding of the issues raised here, and an illustrative list can be found at the end of the reference section.

Structure of the paper

Section two offers a brief overview of the potentials of immersive experiences in cultural institutions according to the research. Section three offers more detailed insight into some of the main themes identified in the literature; storytelling, social encounters, emotional engagement, embodied and spatial interaction, authenticity, and learning. This section is interspersed with short illustrative case studies. Section four presents some of the challenges that are highlighted in those resources related to usability and onboarding, and methodologies for research, evaluation and impact assessment. Section five considers future research directions.

2. The potentials of immersion

Increased interest in immersive experiences within museums, galleries and heritage sites is unsurprising given how well such experiences underscore current policy (and other) priorities in those contexts. **In particular, it is hoped that immersive encounters will:**

a. **Increase an institution's visibility and contribute to a culture of innovation**: Heightening brand awareness and seeding a compelling narrative about an institution in relation to innovation; being seen as a pioneer and sector-leading.
b. **Offer more dynamic ways of communicating with the public**: Appealing to new audiences – including more diverse audiences (Jung and tom Dieck 2017), for example, 'hard to reach'

[6] For a more extensive unpacking of 'immersion', 'immersive media' and/or 'immersive storytelling' see Gröppel–Wegener and Kidd (2019).
[7] While acknowledging their importance as the context of this paper, they are not included here as they are not within the scope of the literature review.

16-24 year olds;[8] experience-based marketing for tourism (Huang et al. 2016, also Chung et al. 2018).

c. **Encourage rich – and more consequential – practices of participation** (Dinesh 2016, Warren 2017, Machon 2013, Bucher 2017): Centring participants within a cultural encounter and offering them the possibility of increased agency.[9]
d. **Engage users with sites, institutions, collections and themes**: To encourage them to look deeper, or to engage with alternative viewpoints (Amakawa and Westin 2017); to see the past, the present, or the future differently; to provide memorable (Little et al. 2019, Bec et al. 2019) and possibly even transformative learning experiences (Damala et al. 2008, Yoon et al. 2008, Ghouaiel et al. 2017); to enable them to interact with faithful reconstructions of sites (Younes et al. 2017) or more playful and ambiguous content (Huws et al. 2019).
e. **Provide a possible new revenue stream** as institutions try and position themselves within the 'experience economy' (Pine and Gilmore 1999) where members of the public are demonstrably – according to the latest statistics on consumer spending – willing to pay for cultural encounters that are out of the ordinary; escape rooms, outdoor cinema and street games for example. This is all the more striking against a backdrop of uncertainty about more traditional forms of spending.

These assumptions and ambitions are as yet only being tested, but the perceived benefits of immersive practices have not gone unnoticed to other industries and policy-makers. This is reflected in the Industrial Strategy (2017), which highlights the importance of investing in developing the UK's immersive technology and content as a driver of its economy and global competitiveness. How the government and industry are undertaking this is detailed in the Creative Industries Sector Deal (2018), which includes a combined public and private £58 million investment through the UKRI's Industrial Challenge Fund in the Audiences of the Future Challenge, with a focus on immersive technology and content. The different initiatives funded by the Audiences of the Future programme aim to advance theory and practice in the field of immersive storytelling, and the consortia include industry, cultural institutions and academics. It offers a unique opportunity to share insights across sectors and will result in a number of reports and publications over the coming months.

3. Themes in the research

Theme 1: Storytelling

Varied forms of digital storytelling are now commonplace within cultural institutions, including as part of their online offer; a narrative turn has been noted (Kidd 2018 see also Roussou and Katifori 2018). Immersive approaches allow an institution to explore the possibilities of digital storytelling further by, for example, layering multiple or competing narratives, playing with narrative conventions and structures, or positioning audiences more dynamically and consequentially within an experience. Steve Poole advocates what he calls a 'dialogical approach' which enables audiences to navigate their own pathways through historical content, rather than being subject to an 'authoritative third-party commentary' (2017: 306). This remains quite a radical proposition for many cultural institutions however, although in other cultural contexts such as theatres these approaches are well established.

[8] See research by The Audience Agency on who attends museums https://www.theaudienceagency.org/asset/1707.

[9] This aligns well with increased understandings of museums (for example) as 'participatory' (Simon 2010), 'interactive (Ntalla 2017) 'transmedia' (Kidd 2014) and 'post-digital' (Parry 2013), as well as broader ambitions toward 'transforming' (Black 2012) what cultural institutions do through 'letting go' (Adair et al. 2011) of some of their historical authority, embracing openness and sharing control (Sanderhoff 2014).

There is a seductive logic that the use of participatory and networked technologies leads to increased interaction between an experience and those that take part in it, and that this is in some way in and of itself empowering.[10] The broad conflation between more interactivity or more control over a narrative and more *agency* should be challenged however (Gröppel–Wegener and Kidd 2019).

Amakawa and Westin (2017) propose that augmented reality, for example, can be used to connect the stories of disenfranchised or underrepresented groups with physical sites, and allow for a greater emphasis on intangible heritages which are often sidelined. This is an exciting potential of these approaches, but they should not be used as a substitute for considered and longer-term programmes of change within institutions to re-balance and challenge existing representations and narratives.

The '*Nomad*' project (case study 1) is an example of the possibilities of engaging and enabling spaces for communities to explore their (often intangible) heritage. User agency was embedded in the design process that included teaching skills to co-produce an experience challenging the power relations in museum/heritage practices. In this case, it is not only a matter of which story is told, but of who is telling the story. Projects like *Nomad* notwithstanding, it is worth reflecting on a possible tension between these approaches and the current emphasis on economic returns within the research and policy landscape. Can such an emphasis allow for – and encourage – a diversification of narratives, or indeed narratives for diverse audiences, in practice?

Case study 1: 'Nomad', 2018, Abira Hussein and Mnemoscene, supported by the National Heritage Lottery Fund and Somali Festival Week, London

If you had to keep moving, keeping only what you could carry, what would you take with you?

Nomad explores the creative use of immersive mixed reality and web-based technology to contextualise archival and Somali objects with the people and traditions to which they belong. Going forward the project will be working in collaboration with All Change, to work with young Somali people to capture, collect and digitise heritage, making it accessible to all via Web Augmented Reality (WebAR). Supported by the Amplified programme by Nesta.

Young Somali adults and children interacting with AR cards at Elays Youth Network ©Intisar Yusuf

More info: The objects and their owners' oral histories can now be found on the online archive at https://nomad-project.co.uk/

Bec et al. (2019) note that immersive media can provide a mechanism for the exploration of myth and legend, and Kidd et al. (2019) unpack this proposition also. This is both a challenge and an opportunity

[10] 'Interactivity' is a complex term (or 'semantic universe' according to Pujol and Economou 2007) implying different things in different disciplinary contexts, and ranging far beyond straightforward technological understandings.

for heritage sites and museums where playing with the line between fact and fiction can be understood as provocative, and political.

Researchers agree that choosing a narrative structure and making decisions about which technology to use is an inexact science (Pietroni and Adami 2014, Pedersen et al. 2017). Technology should *facilitate* rather than *be* the experience (Kidd et al. 2018, see also Poole 2017), or, in the words of Abira Hussein, should *enable* rather than *drive* the work.[11] Decisions about which technology (if any) to use should not be foregrounded in the design process over and above other concerns. Huws et al. (2019) propose a form of intentional design which centres narrative and the potential affective dimensions of an experience, before making decisions about technology informed by logistical and financial considerations.

One of the main initiatives funded through the Industrial Strategy is StoryFutures and, associated with that, StoryFutures Academy: The National Centre for Immersive Storytelling. These explore and promote the centrality of storytelling in immersive technologies and experiences, through projects such as '*Virtual Veronese*' (case study 2).

Case study 2: 'Virtual Veronese', 2019, StoryFutures, Focal Point and The National Gallery

Virtual Veronese was a first of its kind prototype AR and virtual reality (VR) experience at The National Gallery. Participants could 'step back in time' and find out more about Veronese's 'The Consecration of St Nicholas'. They were transported to a digital model of the chapel where the painting first hung and could choose a guide to offer rich contextual information to tell the story behind the painting's commission.

Image re-produced with permission, StoryFutures.

More info: https://www.storyfutures.com/news/storyfutures-presents-virtual-veronese

Theme 2: Social experiences

Very often, visits to cultural institutions are social (Hornecker and Ciolfi 2019). Kidd et al. (2018) have written about how powerful social interactions can be during immersive experiences, noting that they can seed strong connections not only between people and place, but from person to person also.

Social interactions are important aspects of usability and accessibility in an experience, and their consideration is crucial to meaning making and enjoyment. Whether an immersive experience is anticipated in advance (possibly pre-booked for a specific time as in case study 3) or is chanced upon during a gallery visit, consideration of social dynamics and circumstances is hugely important, but has

[11] Personal communication, 2019.

often been overlooked (Hornecker and Ciolfi 2019).

Case study 3: 'The Lost Palace', 2016, Historic Royal Palaces in partnership with Chomko and Rosier and Uninvited Guests

The Lost Palace was a mixed media mobile encounter at Banqueting House, Whitehall. It was a timed and ticketed event where participants were given a handheld device and headphones, and a narrator encouraged them to explore the secrets of the (no longer physically present) Palace of Whitehall. The experience made significant use of binaural sound and haptic technologies.

Image re-produced with permission, Historic Royal Palaces.

More info: Tim Powell presenting at MuseumNext https://vimeo.com/226290456

Whereas social dynamics are often accounted for in the design of digital interactions that immerse multiple people at one time (immersive art installations or performances for example), they should also be a consideration where an experience is enjoyed by one person at a time (such as virtual reality). Such experiences are still contextualised by social interactions, for example, when a queue of people watches the actions of a user on screen, and can be important in helping other users understand how the technology works, or what the significance of an experience is (Hornecker and Ciolfi 2019).

In consideration of virtual reality in particular, there is of course a now extensive literature on the notions of presence, telepresence and social presence (see Oh et al. 2018 for a review). Social presence, or the feeling of being with a 'real' person within an immersive environment, has mostly been researched through laboratory studies, and needs further consideration in relation to complex environments like heritage institutions, where there are a number of other contextual considerations (Pujol and Champion 2012).

Theme 3: Emotional engagement

Across the cultural sector there has been a notable increase in discussion about the affective dimensions of engagement, including in relation to digital practice (Kidd 2015, Perry et al. 2017, Kidd et al. 2019). Institutions have become more interested in understanding how their interactions with users/visitors/audiences make them *feel,* and the extent to which those feelings might translate into other kinds of impacts; learning, for example, or changed behaviours.

A number of exploratory studies have trialled emergent methodologies for 'capturing' some of those impacts within heritage contexts. The EU funded EMOTIVE project (see case study 4)[12] has explored the proposition that immersive experiences can lead to more – or better – emotional engagement through

[12] See the work of the EMOTIVE project at https://emotiveproject.eu/.

observational research and psychological approaches such as the 'Where on Your Body?' post-experience evaluation tool (Economou et al. 2018, developed from Reason 2015). Kidd et al. (2018) have trialled user mapping of experiences to test the impacts of 'affective design',[13] and Jess Hoare (2018) has explored the gathering of physiometric data within real world heritage environments – rather than using a traditional laboratory based approach – as a way of accessing emotions; although she notes that these approaches need careful consideration as 'biosensing devices propagate forms of biopower' (see also Canning 2018).

Case study 4: 'A Window to the Scottish Past: Views on Verecunda's Life', 2019, Hunterian Museum Onsite Experience

The Verecunda EMOTIVE experience is a multi-part, mixed reality and facilitator-led in gallery experience created for 4 concurrent users. It focuses on the story of a local Caledonian slave girl, Verecunda. Users first learn about something about each other and are introduced to the character as a physically absent member of the group. They then find out about her life at a Roman commander's house in the Bar Hill, one of the Antonine Wall sites, through VR and AR interactions with four lively characters who knew Verecunda at different stages of her life. Users are encouraged to explore real objects viewing these through mobile phones that act like 'magic windows', with Augmented Reality interactions bringing the objects and their role to life. Finally, users share what they have discovered about Verecunda and discuss what shaped her identity. The experience aims to encourage users to consider how thinking about the (Scottish and Roman) past is related to issues of identity today

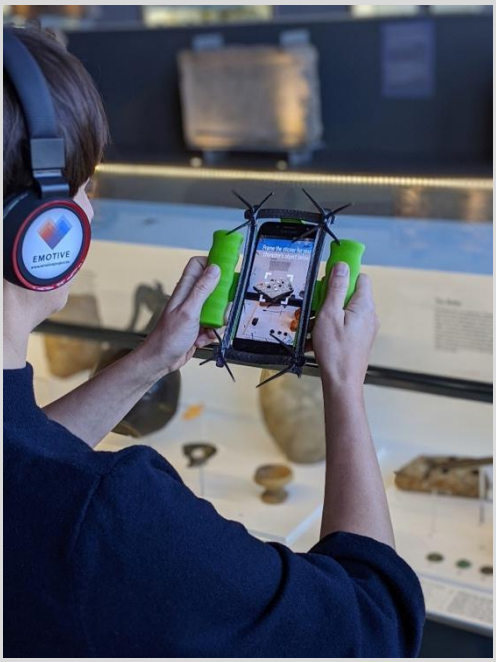

Image re-produced with permission, EMOTIVE.

More info: https://emotiveproject.eu/index.php/2019/10/08/new-video-a-window-to-the-scottish-past-views-on-verecundas-life-hunterian-museum-onsite-experience/

One of the more seductive assertions made about encounters with immersive technology more broadly is that they allow us to engage more empathetically, but this is not an inevitable or universal outcome and needs careful consideration at all stages of the design process. Although there seem real potentials here (Poole 2017, Mabrook and Singer 2019), we need to know more about the circumstances under which such perspective-taking is likely, when it is desirable, and there are no doubt ethical dimensions to these debates as well.

Theme 4: Embodied and spatial interaction

A number of scholars have been playing with the notions of multimodality and embodiment as ways of understanding how immersive encounters are experienced in physical space (Dinesh 2016, Machon 2013,

[13] Following an approach used by Ozkul and Gauntlett (2014) to map experiences of locative media.

White 2012, Kenderdine 2016, Kenderdine et al. 2014, Kidd 2019, Ciolfi 2015). Traditionally museums and galleries have privileged visual and textual resources, but there is much excitement about how other cues – aural, olfactory, spatial and environmental for example – might be built into experiences so that 'meaning making becomes a whole-body endeavour' (Kidd 2018 see also Galani and Kidd 2019).[14] '*Traces*' for example (case study 5) explores connections between people, place and story through a playful and performative suite of immersive narratives.

Case study 5: 'Traces', 2016, Amgueddfa Cymru – National Museum Wales in collaboration with yello brick and Cardiff University

Traces (*Olion* in the Welsh language version) is an immersive storytelling experience delivered via a freely available mobile application. Participants can select a single person fully accessible route, or the partner route which uses a branching and foldback narrative structure to send partners on different journeys around the St Fagans site, near Cardiff, reuniting them on occasion so that playful and performative things can happen.

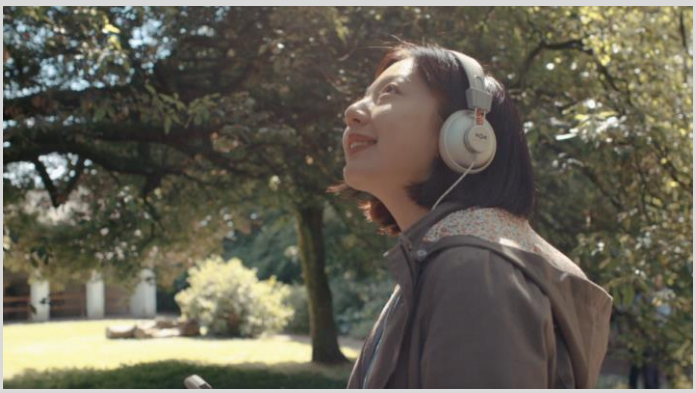

Image re-produced with permission, Cardiff University.

More info: Kidd, J. Huws, A. and John, A. [2019] 'Evaluating the affective dimensions of Traces-Olion: a subtle mob at St Fagans National Museum of History, Wales' in *IEEE*.

Increasingly we see the embodied and sensorial nature of interaction being prioritised. The meSch project[15] for example created and evaluated a series of tangible smart objects (a process outlined in Avram et al. 2019). Virtual reality similarly is understood to appeal to the senses, and the hope is that this in turn can help cognition and perhaps make an encounter memorable (Economou and Pujol Tost 2011, Pedersen et al. 2017)

Immersive encounters can simultaneously defamiliarise a space or site and make powerful new connections with it. Kidd (2019) found that an immersive encounter can alter relationships between participants and the physical spaces they are in, and others have explored whether wholly virtual encounters can do similarly.[16] The notion of 'presence' has been a powerful one within computing discourses, and has been used interchangeably with immersion (Oh et al. 2018). Presence is understood as the subjective experience of actually being within a virtual environment and comprises tele-presence, self-presence and social presence (Oh et al. 2018). How these discourses can be used to think about virtual experiences in heritage contexts is as yet under-explored, and how they can be translated into debates about other kinds of immersion is perhaps questionable. Many immersive experiences in heritage

[14] This accords with how visitors to art galleries (and presumably other cultural institutions) already use gesture and movement to make meaning – whether within digital encounters or not (Steier et al. 2015).

[15] More information about the meSch project can be found at http://www.mesch-project.eu/.

[16] The as yet unpublished work of Palmyre Pierroux and others with virtual reality on the Cultural Heritage Mediascapes project is insightful here https://www.uv.uio.no/iped/english/research/projects/mediascapes/

contexts are not seeking to completely remove 'real world' stimuli, and are instead interested in multimodality, interaction and deep involvement. In that regard, there are perhaps times when the notion of immersion used in 'immersive theatre' is a more apt one, and where clarity about the kind of immersion being sought would seem important.

Galani and Kidd (2019) note that the flow of information between a site, a participant and technology can be complex and multidirectional, crafting a storyworld unique to a participant. They understand this as a form of 'multimodal imaginative investment' where sense-making spans 'visceral, social, and cognitive domains'. It is in such processes that the sense of 'immersion' becomes possible. Terms such as 'spatialised narrative (Reiser 2005, Kitchin et al. 2017) 'locative narrative' (Ritchie 2014) and 'ambient literature'[17] (Ambient Literature 2016) highlight the possibility of rich interactions between story, tech, people and place.

Theme 5: Authenticity

Authenticity is widely considered to be important, and there is considerable debate about it within the scholarship on immersive media (Tsai 2019, Stogner 2011). In the computational sciences efforts to more faithfully and fully recreate whole environments in 3D inch forward, and there is evidence to show that authenticity is important to users also, especially in the context of immersive heritage experiences (Kidd 2019, Petrelli 2019). According to Amakawa and Westin (2017) working with reconstructions is a real responsibility as interpretations are often unchallenged and quickly become 'facts'. Economou et al. (2018) note that a major finding from their own evaluation was the importance of balancing storytelling and authenticity (in the form of communicating evidence and historical facts, but conclude also that there is 'no single approach which would fit all heritage contexts'.

Debates about authenticity, re-creation and fakery are by no means unique to immersive environments, but are amplified in our consideration of immersive technologies (Duval et al. 2019, Durand et al. 2014). They are complex themes however as – especially in the context of heritage – aging and material decay are a key component in our readings of 'pastness' (Holtorf 2013, Duval et al. 2019).

Theme 6: Learning

Many cultural institutions will be interested in learning outcomes from immersive encounters. The '*Museum ExplorAR'* project for example (case study 6,) had the delivery of additional and enhanced interpretation at its core. Whilst there is research suggesting immersive approaches may be valuable as learning experiences (Ghouaiel et al. 2017), other research has been more tentative (Nobles et al. 2019). There is more work to be done to explore the possibilities here; to understand what kinds of learning outcomes can best be facilitated by these approaches (rather than, say, other more traditional approaches), and to find methodologies that can adequately account for these processes beyond laboratory environments.

During any design phase thinking about narrative and framing is key, as simply positioning people within an immersive environment will not in and of itself be educative (Pujol and Champion 2012). Indeed, the opposite might be true. Perry et al. (2018) note that virtual museums – those seeking to recreate a museum in virtual space – 'privilege traditional didactic educational objectives' and can be viewed as 'rather immature cultural constructs' with limited relevance and resonance for everyday visitors who may well be used to more sophisticated experiences with the technology in other contexts.

[17] See https://research.ambientlit.com/ for more information.

Case study 6: Museum ExplorAR, 2018, Amgueddfa Cymru – National Museum Wales

Image re-produced with permission, Jam Creative Studios.

Museum ExplorAR was a self-led augmented reality (AR) experience available at National Museum Cardiff for a pilot period in 2018. Users borrowed a handheld device to explore additional animated interpretation in three of the galleries. The device used area learning to trigger content tailored specifically to where users were in the gallery.

More info: Dafydd James, Graham Davies, Jenny Kidd and Alison John [2019] 'Awe or Empathy, Fast or Slow? Articulating Impacts from Contrasting Mobile Experiences' https://bit.ly/2lvWD8C

4. Challenges

While the possibilities afforded by investment in immersive experiences are many, so are the challenges, as we explore in this section.

Challenge 1: Usability, onboarding and uptake

In 2007 Economou and Pujol carried out a critical review of literature to arrive at conclusions about how new technologies were being embedded into the offer of cultural institutions. They noted that such technologies often piqued the interest of visitors and encouraged engagement, but also that there were a number of challenges to adoption. Many of these challenges remain unresolved. Firstly, for virtual reality experiences, the fact that they are used by one person at a time can put them at odds with their environment (as alluded to in theme 2). Secondly, immersive experiences can be in conflict – or competition – with other interpretation strategies, including other media, and even exhibitions. Thirdly, people can experience usability problems (see also Ghouaiel et al. 2017, Pedersen et al. 2017).

A number of research projects have concluded that deep immersion in an experience is best achieved when the technology becomes invisible – that is, it fades into the background rather than itself being the experience as noted above (Ciolfi 2015, Poole 2017, Kidd 2018, Kidd et al. 2019). This is clearly easier for some experiences (such as mobile experiences) than for others. Virtual reality often necessitates a separate space for interaction, sometimes becoming disconnected from the site and/or its exhibits (Hornecker and Ciolfi 2019), and there is no doubt work to do to better understand how virtual reality experiences can be 'effectively integrated as part of [a] visit' (Petrelli 2019). They also need careful consideration as they follow a 'different communication paradigm' to that of the museum (Economou and Pujol Tost 2011). In virtual reality encounters interaction with a headset becomes itself an object experience that will resonate with some people but be unappealing to others; it may even cause unpleasant physical symptoms. Those working in these contexts need to be mindful that 'the experience of technology is a physical and embodied one, no matter what form interaction takes' (Ciolfi 2015: 420). Headsets can feel clunky and claustrophobic, often leading to access issues, whereas handheld devices, it has been suggested, are more democratic.

Referencing Van Der Vaart (2014), Pedersen et al. (2017) propose that 'for technology to be adopted in these settings, it must be easy to use, easy to navigate, and provide friendly instructions in order for visitors to be encouraged to engage with the new technology'. User testing is of course key and should highlight glitches that can in practice very quickly 'break' immersion (Kidd et al. 2018). There are many logistical and technological challenges that accompany site specific immersive work. For example: lighting conditions can be a big challenge for vision-based systems (Younes et al. 2017); anchoring between an actual site and a virtual overlay in an augmented reality system can be patchy; and connectivity issues can impact what kinds of mobile storytelling are possible. Where these challenges have not been adequately resolved the impact of an immersive experience can be significantly undermined, although as Economou et al. (2018) note, the relationship between usability and user experience remains 'ambivalent'. Many of these challenges may be addressed as the technology improves, and as it becomes cheaper users may become more accustomed to it and confident in its use, but technical issues remain an unavoidable real-world aspect of many immersive encounters at this time.

There are stated concerns in the literature related to uptake of some immersive activities also. These kinds of projects can be expensive to produce, especially when considered in light of the number of people they tend to reach. This is compounded in heritage contexts where, as Petrelli notes, 'cost-cutting strategies such as the reuse of existing 3D models are unlikely to occur' (2019). This is a difficult truth being recognised in the sector at the moment (Green 2016, Bennet and Budka 2018, James et al. 2019), and raises questions about return on investment, how well we understand the impacts of these initiatives, and how best to articulate their successes (and failures). According to research cited in Green (2016), the average mobile app for a cultural organisation is downloaded fewer than 1,000 times and opened less than once. That said, it is the contention of many within the field that simple quantitative metrics are not in themselves adequate ways of articulating successes or understanding impacts (Galani and Kidd 2019).

In a discussion about mobile experiences, James et al. (2019) note the challenge of getting users to buy into immersive experiences (figuratively and financially), and, where they do, ask what happens afterwards:

> Once people have tried these kinds of experiences and like them, what comes next? How do you maintain the momentum; is it important that visitors can follow up with other kinds of similar experiences? What happens to visitor expectations (if anything)?

They also raise challenges associated with institutional onboarding; how to ensure that people within an organization are comfortable with the experience being produced, and confident – and coherent – in their promotion of it. Where there are ongoing operational implications for an institution these need to be planned for from the outset, especially as immersive experiences can be fragile and costly to maintain

(James et al. 2019, see also Roussou 2001). Sustainability and upkeep of an experience can be an unresolved tension in the months and years following the launch of a project and will be important to address if we wish to mainstream these activities.

Challenge 2: Methodological challenges associated with assessing impacts

Researchers agree that evaluating the impact of immersive experiences on institutions, users and/or non-users is challenging (Pujol and Champion 2012). There is an emergent consensus that quantitative approaches such as user behaviour tracking/analytics or Likert rating systems to approximate user satisfaction in themselves do not adequately capture the nuances of participation in such encounters. Instead, mixed methodologies are desirable where possible, such as those that combine the above approaches with interviews, focus groups or creative forms of user mapping (Economou and Pujol Tost 2011, Economou et al. 2018, Canning 2018, Hoare 2018, Galani and Kidd 2019). Much user testing of immersive experiences – their usability, design and implementation – happens in conditioned environments such as laboratories, but it is important to consider, and to try to explore, their use in real world environments also (Petrelli 2019), where more challenging research questions can be centred (Galani and Kidd 2019). Such exploration can be unwieldy and complex, and in practice can mean working across teams with differing disciplinary orientations and underpinning logics. This can in itself be an additional challenge.

As noted previously there remains a question about the value proposition in this kind of practice. We have demonstrated a number of emergent approaches to exploring, for example, emotional impacts and impacts on connection with place/space. Less common within the digital heritage scholarship is literature reporting on impacts on an institution as brand, or on commercial opportunities. These conversations are no doubt taking place between researchers and users, but they have not been addressed as research questions and in the literature. An exception is Lessiter et al. (2018), who report from their own laboratory-based analysis that 58 per cent of their respondents would be willing to pay to access immersive experiences at home (optimal price point £9), and that 70 per cent would be willing to pay for access to an arcade scenario (optimal price point £17).

More research is recommended with a view to articulating a more holistic value proposition for immersive experiences within heritage contexts.

5. Future research directions

This discussion paper highlights the wealth of research endeavour in the space of immersive media for museums, galleries and heritage sites. This is a vibrant and interdisciplinary community of scholars whose openness and reflexivity is marked.

It also highlights some further avenues for research going forwards:

a. The 'value proposition' in this kind of work can be complex to articulate and reconcile given the levels of investment needed. As proposed above, further research to explore – qualitatively and quantitatively – what its impacts are on users/participants is needed.

b. Projects producing immersive experiences within cultural institutions are often collaborations with multiple partners. This can mean complex workflows (Little et al. 2019) and differing understandings of success/failure. Further reflection on these challenges would be valuable.

c. Cultural institutions (indoor and outdoor, online and offline) provide a perfect testbed for further investigation into the embodied and multisensorial dimensions of immersion.

d. As sites become more playful and provocative in their broader suite of interpretations, immersive experiences offer one mechanism for exploring new or more playful narratives, and those that blur the lines between fact and fiction. Research into user responses would shed light on the ways in which 'visitors' value and make sense of cultural heritage institutions, their role and their responsibilities, into the future.

e. An investigation into opportunities (or indeed barriers) for small, local and/or independent cultural institutions to take advantage of these approaches.

f. An open and reflective appraisal of sustainability and legacy issues that can inform practice going forwards.

The impact of immersive content – and, particularly, immersive technology – on the economy is being hailed, as is its importance in transforming the cultural industries. As we have seen throughout this paper, the potentials for both are significant. However, articulating a value proposition that adequately accounts for people's actual encounters with(in) immersive experiences is still proving problematic. A straightforward calculation of investment vs. reach is too limited and, as we have already argued, further mixed methods and 'in the wild' evaluations are needed to unpack the complexity of immersive experiences.

This paper has laid down the basis of what is an on-going research strand in the 'Arts, Culture and Public Service Broadcasting' workstream at Cardiff's School of Journalism, Media and Culture. As investigators on the PEC, our expertise is enhanced by research being undertaken by others in the consortium, particularly Nesta's involvement in the Audiences of the Future programme, funded by the Industrial Strategy Challenge Fund. Our objective is to propose a new way of thinking about the value proposition of immersive technologies for the heritage sector, and one that is informed by the ethical considerations that new technology and practices raise, as much as by public service values.

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