

**Mobile heritage practices.**

**Implications for scholarly research, user  
experience design, and evaluation methods  
using mobile apps.**

Submitted by Cristina Mosconi to the University of Exeter  
as a thesis for the degree of  
Doctor of Philosophy in Art History and Visual Culture  
In June 2023

This thesis is available for Library use on the understanding that it is copyright material and that no quotation from the thesis may be published without proper acknowledgement.

I certify that all material in this thesis which is not my own work has been identified and that any material that has previously been submitted and approved for the award of a degree by this or any other University has been acknowledged.

## **Abstract.**

Mobile heritage apps have become one of the most popular means for audience engagement and curation of museum collections and heritage contexts. This raises practical and ethical questions for both researchers and practitioners, such as: what kind of audience engagement can be built using mobile apps? what are the current approaches? how can audience engagement with these experience be evaluated? how can those experiences be made more resilient, and in turn sustainable? In this thesis I explore experience design scholarships together with personal professional insights to analyse digital heritage practices with a view to accelerating thinking about and critique of mobile apps in particular. As a result, the chapters that follow here look at the evolution of digital heritage practices, examining the cultural, societal, and technological contexts in which mobile heritage apps are developed by the creative media industry, the academic institutions, and how these forces are shaping the user experience design methods. Drawing from studies in digital (critical) heritage, Human-Computer Interaction (HCI), and design thinking, this thesis provides a critical analysis of the development and use of mobile practices for the heritage. Furthermore, through an empirical and embedded approach to research, the thesis also presents auto-ethnographic case studies in order to show evidence that mobile experiences conceptualised by more organic design approaches, can result in more resilient and sustainable heritage practices. By doing so, this thesis encourages a renewed understanding of the pivotal role of these practices in the broader sociocultural, political and environmental changes.

## Contents.

Acknowledgements.....	4
Portfolio .....	6
Introduction.....	11
Chapter 1: Mobile Apps for Cultural Heritage Sites .....	30
Chapter 2: Qualitative design conventions for mobile heritage experiences.....	76
Chapter 3: The industry approach to the design of mobile heritage experiences.....	137
Chapter 4: Research-based approaches to the design of mobile heritage apps. A practitioner perspective. ....	181
Chapter 5: Measuring the performance of mobile heritage experiences.....	228
Conclusion.....	267
Bibliography.....	285

## **Acknowledgements.**

I would like to express my sincere and heartfelt gratitude to everyone who has played a part in the creation of this thesis. Although it is impossible to mention each person by name due to the exploratory nature of this work, I want to extend my utmost appreciation to all the heritage professionals, creative technologists, and case study participants encountered over these years. Each of you has contributed to the rich digital heritage landscape from which my research has emerged, and I am truly grateful for your efforts.

I must give special thanks to my husband, family, and friends, who have provided me with unwavering support, engaging discussions, and countless moments of much-needed levity. I consider myself incredibly blessed to have all of you in my life.

I also want to express my sincere thanks to the Arts and Humanities Research Council (AHRC), REACT (Research and Enterprise in Arts and Creative Technologies), and Calvium Ltd., Bristol, for the funding that has made this research possible. Additionally, I am grateful to them for creating stimulating environments that have nurtured my work.

To Professor Andi Smart and all my colleagues at Interreg VISTA AR – Business School, University of Exeter project, it has been an absolute pleasure working with each and every one of you. I am grateful for the constant reminder that cultural heritage sites whether in the UK, in France and all around the world, are extraordinary places, filled with treasures that extend beyond their physical premises.



A special thank you goes out to the Tower Bridge of London, Exeter Cathedral, the National Trust site of Botallack, the South West Coast Path Associations, and all their staff and volunteers. Your openness in allowing me access to your facilities has been invaluable. Our journey together has been truly wonderful, and here's to celebrating our past as we strive towards an even more remarkable future.

To all the staff at the University of Exeter, I want to express my enduring gratitude for your unwavering support. Your investment in me, particularly from the humanities research staff, including Professor Gabriella Giannachi, my exceptional second supervisor, has been immensely appreciated. I couldn't have asked for a better mentor.

Lastly, but certainly not least, I would like to extend my eternal thanks to my senior supervisor, Professor Fabrizio Nevola. His profound determination and patience have been invaluable to me. I am grateful for the opportunities he has provided and for believing in me, giving me a chance to pursue this dream.

## Portfolio

### Figures:

Figure 2.1: *Battersea Power Station Trail* and the *SWCP Climate Trail* custom made maps (Source: author's own image).

Figure 2.2: *Hidden Florence* map POI icon's change (Source: author's own image).

Figure 2.3: *Family Learning Trail* tick icon colour change (Source: author's own image).

Figure 2.4: *Climate Trail app* closing the superimposed written layer (Source: author's own image).

Figure 2.5: *Battersea Power Station* gallery of pictures (Source: author's own image).

Figure 2.6: *Family Learning Trail* instructions for the paper game 'Origami Boat' (Source: author's own image).

Figure 2.7: *Battersea Power Station app* and the *Climate Trail* features AR (Source: author's own image).

Figure 2.8: *Battersea Power Station* descriptive/educational style (Source: author's own image).

Figure 2.9: *Battersea Power Station games* (Source: author's own image).

Figure 2.10: *Family Learning Trail* sound collection (Source: author's own image).

Figure 2.11: *Hidden Florence* example of trails (Source: author's own image).

Figure 2.12: *Family Learning Trail* customised start of the tour (Source: author's own image).

Figure 3.1: Schematic Design Thinking Model (Source: Design Thinking website).

Figure 3.2: Calvium 'co-creation Journey' illustration. (Source: Calvium website).

Figure 3.3: Calvium 'Experience Design Framework' (on the left, the original version, on the right the 2015 version)(Source: Calvium website).

Figure 3.4: The Pervasive Media Cookbook checklist (Source: Jon, Dovey and Constance, Fleuriot. "The Pervasive Media Cookbook", Bristol: DCRC Press, UWE Bristol, 2014, 80).

Figure 3.5: The *Agile Manifesto* 'four values' and its derived visual representations (Source: author's own elaboration).

Figure 3.6: List of the work packages (Source: 'Consultancy, Design and Production of a Digital Family Learning Trail for Tower Bridge').

Figure 3.7: The Forces of Creative Tension as proposed by Calvium (Source: Calvium Experience Design Framework).

Figure 3.8: Screenshots of the two starting points (Source: author's own image).

Figure 3.9: Screenshots of the visual navigation system (Source: author's own image).

Figure 3.10: Calvium mock-up of the proposed user journey (Source: 'Consultancy, Design and Production of a Digital Family Learning Trail for Tower Bridge').

Figure 3.11: Screenshots of the digital games (Source: author's own image).

Figure 3.12: Screenshots of the curiosity facts (Source: author's own image).

Figure 3.13: Screenshots of the reward page and sound collection (Source: author's own image).

Figure 3.14: Screenshots of the play sequence of the treasure-hunt game (Source: author's own image).

Figure 3.15: Screenshots of the different types of haptic functionalities (Source: author's own image).

Table 3.1: Table of the series of dimensions identified in the Experience Design Framework for Digital Economy (Source: Calvium website).

Table 3.2: Production timeline of the *Family Learning Trail* (Source: author's own elaboration).

Figure 4.1 The Business Model pipeline for digital innovation (Source: 'VISTA AR Interactive Workbook', 3).

Figure 4.2 The Business Model Wheel (Source: 'VISTA AR Interactive Workbook', 8).

Figure 4.3. Pipeline of the deployment of the BMI wheel (Source: 'VISTA AR Interactive Workbook', 13).

Figure 4.4: List of the key questions in the BMI (Source: Gatelier, et.al., "A business model innovation methodology", Table 3).

Figure 4.5: Screenshots of the *West Front AR app* (Source: author's own image).

Figure 4.6: Screenshots of the *Minstrels' Gallery AR app* Source: author's own image).

Figure 4.7: Screenshots of the '*Pilgrim's Tour*' (source: author's own image).

Figure 4.8: Screenshots of the '*Mining at the Edge of the World*' AR app (Source: author's own image).

Figure 4.9: Screenshots of the '*Climate Trail*' AR app (Source: author's own image).

Figure 5.1: Screen pages for central walk ('Politics and people') and S.Ambrogio walk ('Neighbourhood walk') (Source: author's own image).

Figure 5.2: Screenshots of the walks from the 2019 update (Source: author's own image).

Figure 5.3: Lists of main tracks and 'Discover More' tracks of the six walks (Source: author's own image).

Figure 5.4: Map of the 'core zone' (red) and 'buffer zone' of historical centre of the city of Florence (Source: author's own image).

Figure 5.5: Temporal distribution of the downloads (Source: author's own image).

Figure 5.6: Distribution of the installations by source and time (Source: author's own image).

Figure 5.7: Distribution app referrer by type and temporal distribution by location (Italy above, UK below) (Source: author's own image).

Figure 5.8: Distribution app referrer by type and temporal distribution by location (USA) (Source: author's own image).

Figure 5.9: Temporal distribution of users by country (Source: author's own image).

Figure 5.10: Geographical distribution of new users and temporal distribution by countries (2014-2018) (Source: author's own image).

Figure 5.11: Geographical distribution of users (2018-2020) (Source: author's own image).

Figure 5.12: Breakdown of the length of the sessions (January 2019 - January 2020) (Source: author's own image).

Figure 5.13: Overview of the average session duration by new and returning users (period 2019-2020) (Source: author's own image).

Figure 5.14: Overview of all users for 2018-2020 (Source: author's own image).

Figure 5.15: Distribution of new vs returning users in Florence and elsewhere (Source: author's own image).

Figure 5.16: Overview of access to categories in Florence and elsewhere (Source: author's own image).

Figure 5.17; Comparative view of scene access by unique users in Florence and elsewhere (Source: author's own image).

Figure 5.18: Distribution of the tracks by walks (Source: author's own image).

Figure 5.19: Distribution main track events by walks (Source: author's own image).

Figure 5.20: Distribution of expert track events by walks (Source: author's own image).

Figure 5.21: Comparative view main and expert tracks for 'Politics and people' (Source: author's own image).

Figure 5.22: Comparative view main and expert tracks for 'Master of Florence' (Source: author's own image).

Figure 5.23: Comparative view main and expert tracks for 'City of Women' (Source: author's own image).

Figure 5.24: Comparative view main and expert tracks for 'Crime and Punishment' (Source: author's own image).

Figure 5.25: Comparative view main and expert tracks for 'Saints and Sinners' (Source: author's own image).

Figure 5.26: Comparative view main and expert tracks for 'Neighbourhood World' (Source: author's own image).

Figure 5.27: Comparative overview of all walk by main and expert tracks (Source: author's own image).

Figure 5.28: Total Italian tracks played events (Source: author's own image).

Table 5.1: Breakdown of total downloads by platforms (Source: author's own elaboration).

Table 5.2: Comparative overview of downloads from first app release to June 2020 (included) (Source: author's own elaboration).

Table 5.3: Comparative overview between the periods 2019-20 and 2017-18 (from Google Analytics platform) (Source: author's own elaboration).

Table 5.4: Breakdown of the length sessions (period 2017-2018) (Source: author's own elaboration).

## **Further Documents**

- Response Proposal for the Consultancy, Design and Production of a Walk Trail for Penguin Publishers.

- Tower Bridge User Testing Questionnaire.
- Tower Bridge Family Learning Trail User Trials Feedback Statistics.
- Tower Bridge User Testing Observation Checklist.
- Exeter Cathedral Visitor survey 2018.
- Exeter Cathedral Evaluation of Visitor Experience.

## Introduction.

Heritage has always been important, and within an increasingly globalized world, our understanding of and attitude towards cultural heritage is shaping our sense of place and context more than ever before. In recent years, the rapid proliferation of new technologies has had an extraordinary impact, permeating nearly every aspect of our lives. As a result, the way communities worldwide experience and engage with heritage, whether their own or that of other cultures, has undergone a significant transformation. Today, digital mobile media has become a prevalent means through which people encounter sites, monuments, and historical narratives. This is particularly true for younger generations who often encounter cultural heritage for the first time through digital practices, shaping their understanding and perception of heritage<sup>1</sup>. The introduction of the smartphone has significantly impacted not only upon the way people communicate, but also on the modalities by which society accesses and consumes information.<sup>2</sup> People's experience and use of spatial dimensions is significantly expanded, and this shift had a particular influence on approaches to cultural heritage, shaping the methods and perspectives surrounding it.

Since the introduction of mobile technologies, the digital heritage landscape has broadened in its scope, both from a practical perspective as well as an academic one. The introduction of digital devices and interfaces in the heritage sector has been welcomed as 'a creative combination of the legacy of the past with

---

<sup>1</sup> Maria Economou. "Heritage in the Digital Age," in *A Companion to Heritage Studies*, eds. William Logan, Máiréad Nic Craith, Ullrich Kockel (Oxford: John Wiley & Sons Inc., 2015). <http://doi.org/10.1002/9781118486634.ch15>.

<sup>2</sup> Brian Droitcour and William S. Smith, "The Digitized Museum," *Art in America* 104, no. 9 (2016). <https://www.artnews.com/art-in-america/features/the-digitized-museum-63201/>.

innovative ideas aimed at shaping the future'.<sup>3</sup> Swift advancements in technology and related affordable costs has led to a technological democratisation, allowing museums and cultural heritage institutions to replace traditional interpretation using rented devices with novel and alternative bring-your-own-device (BYOD) means to reproduce, distribute and popularise their sites. Regardless to their size, popularity or mission, nowadays heritage sites use this type of storytelling as a means to present 'historical knowledge, interrelated facts and events, interpretations and narratives to non-specialist audiences in an engaging way.'<sup>4</sup> Accordingly, there has been a steady adoption of apps, which have been developed for different purposes, but foremostly with the aim at offering an engaging visitor's experience of touristic heritage destinations. On the main app stores, the volume of mobile heritage trails dedicated to heritage setting increases steadily, with apps spanning from experiences of individual sites or attractions, to digital walking tour and situated apps for specific urban events.<sup>5</sup>

Since the widespread of locative media, heritage has been a rich testbed for the possibilities of mobile technology. Creative designers, developers, and those working in Human-Computer Interaction have been increasingly connecting with museums and heritage sites 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

---

<sup>3</sup> ECORYS. *Economic Value of Ireland's Historic Environment. Final report to the Heritage Council* (Rotterdam: ECORYS, 2012), 94. Accessed November 29, 2023. [https://www.heritagecouncil.ie/content/files/ecorys\\_economic\\_evaluation\\_historic\\_environment\\_final\\_report\\_1mb.pdf](https://www.heritagecouncil.ie/content/files/ecorys_economic_evaluation_historic_environment_final_report_1mb.pdf)

<sup>4</sup> Xavier Greffe, "Concept study on the role of Cultural Heritage as the fourth pillar of Sustainable Development," *Sustcult* (2012). <http://docplayer.net/24195641-Concept-study-on-the-role-of-cultural-heritage-as-the-fourth-pillar-of-sustainable-development.html>.

<sup>5</sup> Nicole Basaraba, Owen Conlan, Jennifer Edmond and Peter Arnds, "Digital narrative conventions in heritage trail mobile apps," *New Review of Hypermedia and Multimedia* 25, no. 1-2 (2019). <http://dx.doi.org/10.1080/13614568.2019.1642963>.



trial things; and (d) they often have pre-existing textual/visual digital content which can be overlaid in, for example, augmented reality.’<sup>6</sup>

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 mobile storytelling online and offline. As in the words of Kidd, ‘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.’<sup>7</sup> This understanding is what has been driving the blooming across the UK of several collaborations of the heritage institutions with partners from both the creative industry and academic institutions, resulted in a constantly growing number of knowledge exchange and collaborative programmes, such as REACT, the AHRC’s South Western creative economy hub to whom this research belongs.

Firmly grounded in the idea that collaboration should lead to ‘the co-production of knowledge and ideas, not simply their exchange’<sup>8</sup>, the REACT project (2012 – 2016) worked in an Arts and Humanities context with the aim to establish what role Arts and Humanities researchers have to play in the field of creative technology. The project has articulated several co-creation projects within a STEAM (Science, Technology, Engineering, Art, and Math) based knowledge

---

<sup>6</sup> Jenny Kidd and Eva Nieto McAvoy, “Immersive Experiences in Museums, Galleries and Heritage Sites: A review of research findings and issues,” Creative Industries Policy and Evidence Centre, 2019. <https://www.pec.ac.uk/discussion-papers/immersive-experiences-in-museums-galleries-and-heritage-sites-a-review-of-research-findings-and-issues>.

<sup>7</sup> Kidd and McAvoy, *Immersive experiences*.

<sup>8</sup> Jon Dovey, Simon Moreton and Ian Hargreaves, “REACT Report 2012–2016” (Bristol: REACT, UWE Bristol, Pervasive Media Studio, 2016), 19.

exchange ecology. The 'hub' involved a multiplicity of forms, but 'a commonality of purpose in the co-production and co-design of knowledge, goods and services.'<sup>9</sup> The results of the project showed that without such Arts and Humanities inputs, in terms of insight and vision, it would not be possible to broaden our digital, cultural horizons in ways which enrich everyone, beyond the supply and demand for commercial products. These practices today are reflected in participatory experiences for arts audiences, museum visitors and gamers, as well as in 'open' government initiatives driving 'e-democracy' and in the application of patients' experience to health authority decisions and student feedback into university course design. The scale and breadth of these developments has been described as a broad-based 'participatory turn'.<sup>10</sup>

Initiatives like REACT did not enter a field empty of university–industry practice. There were already many existing models of collaboration, including those based on tech-transfer models, where patentable items were exchanged between universities and established businesses (materials, components, industrial processes, systems or other products). This wasn't the case in the arts and humanities, where the production of cultural products and services aimed at creating different kinds of experience for audiences and users.<sup>11</sup> As Senior, Moreton, and Dovey described it, quoting Crossick, the arts and humanities needed to support 'knowledge exchange without widgets'.<sup>12</sup> Despite this

---

<sup>9</sup> Ibid., 34.

<sup>10</sup> Keri Facer and Bryony Enright, "Creating Living Knowledge: The Connected Communities Programme, community-university relationships and the participatory turn in the production of knowledge" (Bristol: University of Bristol Press/AHRC Connected Communities, 2016). [https://research-information.bris.ac.uk/ws/portalfiles/portal/75082783/FINAL\\_FINAL\\_CC\\_Creating\\_Living\\_Knowledge\\_Report.pdf](https://research-information.bris.ac.uk/ws/portalfiles/portal/75082783/FINAL_FINAL_CC_Creating_Living_Knowledge_Report.pdf).

<sup>11</sup> Abreu, Maria and Vadim Grinevich, "Academic Entrepreneurship in the Creative Arts," *Environment and Planning C: Government and Policy* 32, no. 3 (2014). <https://doi.org/10.1068/c11144r>.

<sup>12</sup> Geoffrey Crossick, *Knowledge transfer without widgets: the challenge of the creative economy* (Goldsmiths: Royal Society of Arts in Leeds, 2006).

argument, 'knowledge transfer' has remained the dominant framework for understanding universities' impact upon industry. In these transitive models, knowledge was something that could be moved via a specific transaction, encouraging in turn only short-term collaborations.

Hubs of co-production between academic researchers and the creative sector are specifically aimed at understanding how to avoid merely transactional relationships between scholars and the creative industry. As reported by the European Creative Business Network, in 2015 there were an estimated 300 creative hubs in Europe, and of these 7 per cent are university-based indicating the scope to scale up university impacts on the creative economy.<sup>13</sup> The collaborative dynamics of these hubs have acquired additional momentum in the light of new modes of post industrial production, supported by the spread of digital communications technologies into art, culture, the creative industries and the wider creative economy. This is because it has been demonstrated that the co-production approach with the academic Research and Development landscape is an important player in a country's creative economy.

The connection established between heritage, creative industry, and academic institutions has been framed also in terms of generating local economy growth, in the hope to encourage a snowball effect, with more projects and new entrepreneurships in the creative industry sector. There is a general consensus that 'in most countries, cultural heritage is not seen as a priority for national development unless its relationship with economic activities, social values, and

---

<sup>13</sup> "Europe's Creative Hubs – Who they are, what they do," European Creative Business Network, accessed November 29, 2023, <https://www.ecbnetwork.eu/europes-creative-hubs-mapping/>.

local development is made evident.<sup>14</sup> As Kidd and McAvoy point out, ‘there is a wealth of policy documentation that highlights the value of immersive experiences, particularly in economic terms.’<sup>15</sup> While, an effective use of mobile experiences in the cultural sector can help in this direction, supporting the sustainable use of heritage as an essential engine for economic development, however evaluations of the performance of mobile apps in heritage sites so far carried out, seems instead to point in the opposite direction. According to a recent survey, the average mobile app for a cultural organisation is downloaded fewer than 1,000 times and opened less than once<sup>16</sup>, and therefore it seems that there is still some way to go before we truly understand the actual return on investment of mobile apps. In a critical review of the literature, Economou and Pujol note that, while these experiences are appealing to the public, the process of introduction of these practices is complicated because ‘there are a number of challenges to adoption.’<sup>17</sup>

These challenges, technical and operational, are often the result of a lack of a properly planned introduction of a new experience on site. Furthermore, we are assisting at the growing trend of creating immersive experiences that really tap into the emotional response of the users, creating a momentum. While this shows how apps have a potential to open up the heritage sites to new audiences, at the same time they also raise some questions. Once the novelty is passed, how do

---

<sup>14</sup> “Challenging hit and run tourism in cultural heritage sites,” Ruoss Engelbert and Loredana Alfare, accessed November 29, 2023, <https://destinationcenter.org/2013/10/challenging-hit-and-run-tourism-in-cultural-heritage-sites/>.

<sup>15</sup>Kidd and McAvoy, *Immersive experiences*.

<sup>16</sup> “What we know about mobile experiences in Museums after 6 years of research,” Lindsey Green, accessed November 29, 2023. <https://medium.com/frankly-green-webb/what-we-know-about-mobile-experiences-in-museums-after-6-years-of-research-42117def2c49>.

<sup>17</sup> Maria Economou and Lara Pujol-Tost, “Evaluating the use of virtual reality and multimedia applications for presenting the past,” in *Handbook of Research on Technologies and Cultural Heritage*, eds. Georgios Styliaras, Dimitrios Koukopoulos and Fotis Lazarinis. (Hershey, Pennsylvania: IGI Global, 2011), 237. <http://dx.doi.org/10.4018/978-1-60960-044-0.ch011>.

you maintain it the momentum? Do you go ahead and develop a new experience? But foremostly, these type of experiences are expensive, as they call for additional developing resources, mostly in terms of time and resources commitment needed for designing the storytelling and the bespoke app. The issues related to their uptake and their long-term sustainability are a stated concern that creative scholars are currently want to address, and a potential answer to that is to structure a more holistic 'value proposition' for the experience, that integrates within a context that is actually ready to sustain their adoption. Articulating a value proposition that adequately accounts for the site and people's experience with mobile apps is thus key to mitigate the challenges.

In establishing the background for this thesis, over the past ten years I have worked in the cultural heritage sector, both as a researcher and practitioner. These roles have included a wide variety of tasks including, amongst others, desk-based research, creative industry collaborations, and working with museums and other cultural heritage organisations in curating the design of engaging experiences for their audiences. Screen based approaches of informing storytelling of the past have always resonated with my approach to heritage interpretation, and so this has led to perception of how mobile heritage apps can be designed to foster public engagement with the heritage, whilst enhancing the efficiency of heritage sites, and to a greater extent the understanding of a new role of heritage as pivotal player in the broader sociocultural, political, and environmental changes.

In this thesis, the objective is to combine these two practices to present and explore methodological approaches for developing mobile apps for cultural heritage sites that are resilient and sustainable. While the thesis does not aim to encompass the entire spectrum of available or upcoming design approaches for

heritage professionals, it is hoped that the narrative presented in the subsequent chapters and pages will assist readers in contemplating the adoption and evaluation of mobile heritage practices from fresh perspectives. In doing so I am cautiously aware that ‘technology does not stand still - what is revolutionary one day is obsolete the next’<sup>18</sup>. Therefore, this thesis ultimately aims to examine not only specific technological aspects in the digital age, but also to investigate enduring themes and methods that will continue to underpin digital engagement with heritage content as modes of mobile delivery and interaction evolve in the future.

The specific focus in this work will be to illustrate the how defining the value proposition of mobile heritage apps is key for more resilient mobile practices. These apps have been designed using different methodologies of experience design, which combine several digital narrative conventions to deliver user-friendly mobile apps with an engaging user experience. What this thesis will show is that there are recurrent usability and narrative techniques which are currently used by creators to facilitate the delivery of a good user experience that stands the test of time. A deep understanding of what are the “ingredients” of a mobile app empowers the creators in designing a solution which is a good fit for the value proposition. For the purpose of this thesis these items will be classed into qualitative design conventions, and this thesis will explore the progressive expansion of the narrative potential of mobile apps through the use of these narrative strategies.

---

<sup>18</sup> William David Paul Barrett, “The Phenomenalisation of Heritage: Digital interactions through mobile devices with tangible and intangible heritage,” (PhD diss., University of Exeter, 2019), 9.

Recognising that the choice of mobile apps is only the starting point for heritage site to engage with the mobile practices, the main enquire line for this thesis is understanding the modalities by which these practices account for and address the challenges of creating public interpretation at heritage sites. For some time now we have been able to understand that mobile heritage practices, while offering new possibilities for heritage organisations to interact with their visitors (both on-site and off-site), raise also a number of challenges and important issues that can undermine their successful implementation.<sup>19</sup> What will be seen in this thesis is that challenges can be both technological and logistical. For example, the usability of the interface can be challenged by weather and light conditions; and connectivity issues can impact what kinds of mobile storytelling are possible. Furthermore, experiences can be in conflict or competition with other interpretation strategies, including other media, and even exhibitions. At the operational level, the site might not have regular staff or the capacity to sustain the initial investment and long-term maintenance. All these challenges can lead to other issues, such as institutional onboarding and upkeep, factors that are keys for more long-term engagement with the app.

By investigating the case studies of two different experience design frameworks, this thesis will show how thanks to a well-defined value proposition, these development approaches can address these issues, ensuring that people within an organisation are comfortable with the experience being produced, and confident and coherent in their promotion of it.

Evaluation is a further cause of concern, since often the user testing happens in conditioned environments such as research-lab contexts, and rarely post-delivery

---

<sup>19</sup> Economou and Pujol-Tost, *Evaluating the use of virtual reality and multimedia applications*.

evaluation is carried out to test the efficacy of the mobile implementation on the long-term. Thanks to the critical review of the analytics of a mobile heritage app, this thesis will show that while the evaluation metrics gathered through quantitative methods allow for only partial understanding of the user experience, they can provide a clearer picture on users' behavioural pattern. Furthermore, the case study will allow this thesis to discuss the potential of mobile apps also for broader heritage issues in connection with sustainability, such as their adoption as tourism strategy to mitigate overtourism. Ultimately, it will be shown how evaluation of the app is a crucial phase to prove whether the value proposition, that is the intended experience, aligns with the realised experience.

Designing resilient mobile apps for heritage experiences, as it is formulated by this thesis, describes the process of transforming the knowledge of several stakeholders, cultural heritage, creative industry, and academic institutions, into a digital and mobile form. Alongside situated narratives and curatorial-driven affordances, mobile heritage practices aim at providing users with meaningful experience while encouraging sustainable bonding with the heritage and attracting new audiences. Drawing from approaches in digital heritage studies, Human-Computer interaction theory, computational trends for digital product evaluation, and current design methods in contemporary heritage and creative industry practices and academic study, this thesis charts the process of creating mobile apps with the aim of understanding strengths and limitations of current methodological approaches in terms of designing a resilient app, with the aim of informing a new understanding of more organic and sustainable design practices.

At a time when the cultural heritage sector is stressed by the aftermath of the pandemic, and we are seeing a renewed interest on mobile experiences for its



potential as catalyst of new audiences and driver of the creative economy, it is commended shifting the focus from an appreciation of technology, towards critical review of the potential mobile practices to drive heritage in a sustainable manner. Therefore this thesis seeks to contribute an original understanding of mobile heritage practices, which reaches beyond the walls of cultural heritage institutions, and creates direct links with the broader discourse of contemporary sociocultural, political and environmental changes.

### **Methodology.**

Having briefly introduced the main concepts of the thesis, I now focus on outlining how the chapters that follow this introduction have been approached and delivered. In investigating the design of mobile experiences, this thesis benefitted from an embedded research methodology by working with a number of cultural heritage and technology partners across the UK, including the Tower Bridge of London, Exeter Cathedral, the National Trust Tin Coast site of Botallack, the South West Coast Path Association, and Calvium Ltd.

Originated as a conceptual and practical term to describe the investigative approach taken during doctoral studies, “embedded research” (ER) refers to a ‘mutually beneficial partnership between academics and their host organizations, regardless of whether they belong to the public, private, or third sector.’<sup>20</sup> Increasingly spreading as one of the most adopted knowledge co-production models across variegated research fields, the embedded researcher works inside partner institutions, operating as staff member ‘while also maintaining an

---

<sup>20</sup> Ruth McGinty, and Majia Salokangas, “Introduction: ‘Embedded Research’ as an Approach into Academia for Emerging Researchers,” *Management in Education* (January 2014). <https://doi.org/10.1177/0892020613508863>.

affiliation with academic institutions.<sup>21</sup> In the case of this research, this residency process allowed me as a researcher to gain access to the skills, resources, and knowledge of the above named cultural partners in investigating and curating the User Experience design of several mobile applications for the elaboration of this thesis, including Tower Bridge *Family Learning Trail*, Exeter Cathedral *Pilgrim Tour*, National Trust *Mining at the Edge of the World*, South West Coast Path *Climate Trail*, and the University of Exeter *Hidden Florence*.

The work conducted with Calvium and the VISTA AR project were central to the design of this thesis. Calvium is an awarded Bristol-based app developer agency which specializes in developing mobile and digital solutions for a wide client base. Working as user experience researcher brought a blend of digital and industrial experience to the process, which allied with the aims of this study and served to inform the design of content that not only matched the aims and objectives of the technology partner but also my own. Looking at this more specifically, the production of content was designed in order to meet the values of Calvium as a commercial agency, driven to design and develop business critical services and engaging customer experiences. As such my active role in the collaborative creative process of several mobile apps for the cultural heritage sector was not only of use to this study, but also served to broaden the boundaries of the technology partner in relation to the agency's values and mission. This process also provided my research with access to their know-how of industry standards for user experience design, which afforded opportunities to approach case studies that could draw from newly gained creative expertise in designing mobile

---

<sup>21</sup> Cecilia Vindrola-Padros *et al.*, "Addressing the challenges of knowledge co-production in quality improvement: learning from the implementation of the researcher-in-residence model BMJ," *Quality & Safety* 28 (2019). <http://doi.org/10.1017/S1463423614000310>.

experiences for cultural heritage sites, rather than from a strictly research based perspective.

My embedded research continued with the work at the VISTA AR project, an European funded research project at University of Exeter, with the objective of encouraging digital innovation of cultural heritage sites by adopting advanced immersive technologies. Working as main curator of digital experiences for three heritage sites across the UK, my research brought a blend of curatorial and managerial expertise to the research process. Throughout the research process, all the institutions provided valuable resources for the design of case study content, as well as providing access to their knowledge about heritage practices. Furthermore, the different nature of narratives and missions of these sites provided the perfect opportunity to evaluate the design of mobile applications within dissimilar organisations, each with specific agenda. Moreover, given the novelty of the technologies employed for the specific experiences, the process of embedded research represented an important learning moment for both myself and the partner institutions within the context of the project.

Additionally, the project-based data analysis of the *Hidden Florence* app, carried out with the Innovation, Impact and Business Centre (IIB) at University of Exeter, represented a further stage of my embedded research. My research process gained analytical experience, which served to deepen my understanding of user experience design that not only matched the aims and objectives of the academic partner but also my own.

Within this process of embedded research, my personal agenda was to work within the evolving missions of each organisation, whilst also serving to provide research and analysis for the further development of digital content, and to

instigate and support more sustainable practices. Additionally my work with National Trust evolved over the course of the research, and as co-founder of a small creative start-up, I am working with the site of Botallack to expand the mobile experience originally delivered during the VISTA AR project with a new AR trail, which will be launched in 2024.

Within this practical agenda, the primary research interest for this development of this thesis lies in the development of mobile apps using experience-centric design approaches, and how these can be used to address technological and logistical issue to develop more sustainable apps. In exploring each case study chosen for this thesis, the investigative chapters are structured as an auto-ethnographic account of my own personal experience of engaging with the development and the evaluation of the apps. Autoethnography is a research methodology that involves writing to describe and analyse personal experiences, aiming to gain insights into cultural experiences. As Ellis asserts, autoethnography combines the elements of self-reflection (*auto*) and the examination of cultural context (*ethno*) in order to delve into the complexities of human experiences.<sup>22</sup> Through employing the auto-ethnographic approach I was able to explore and analyse the mobile apps from a first-hand perspective. Furthermore, this approach served to identify the key characteristics of usability and user experience design and formulate the hypotheses to be tested in the investigative chapters.

---

<sup>22</sup> Carolyn Ellis, *The ethnographic I: A methodological novel about autoethnography* (California, USA: AltaMira Press, 2004).

## **Thesis Structure.**

This thesis seeks to examine the modalities by which mobile app for heritage sites is designed to encourage more resilient and sustainable practices, helping heritage to remain relevant in this fast pacing world. In doing so chapter one discusses the evolution of the digital heritage, and the sociocultural and economic influences in shaping the design and the purposes of mobile apps. By outlining the societal and technological contexts in which smartphone apps are developed and used, the chapter investigates how the mobile heritage landscape that has developed over the past fifteen years. Chapter two seeks to show the potential of mobile apps as tool for sustainable heritage practices by examining the current design standards and narrative conventions attested for mobile apps. In doing so, current taxonomies on mobile media contents will be expanded by proposing a new category on interest, narrative strategies.

The following two chapters seek to prove how designing an app as a result of a value proposition, encourages mobile practices which are more long-term resilient and in turn more sustainable. With the aim of providing examples of how design is carried out in practical terms, the chapter consists of case studies, each of which has been analysed using the taxonomic categories that emerged from the preceding chapter. Chapter three focuses upon the Tower Bridge *Family Learning Trail*, in order to investigate how the experience design approach, 'co-creation journey' elaborated by Calvium informs the creation of a resilient app for the site. Chapter four looks instead at the development of three heritage apps, Exeter Cathedral *Pilgrim Tour*, National Trust *Mining at the Edge of the World*, South West Coast Path *Climate Trail*, developed by researchers at the VISTA AR project using the design framework derived from the business model for innovation (BMI), in order to establish the ground of understanding how the value

proposition is articulated, and the impact of it in the design of the experience. Chapter five investigates the user-generated data for the *Hidden Florence* app and its social media ecology in order to evaluate the impact of design strategies on the performance of the app, and to prove the importance of value proposition for successful and resilient heritage practices.

The conclusion of this thesis then seeks to draw together the key strands of each chapter to form a coherent understanding of the nature of mobile heritage design practice for highlighting its future research perspectives.

## **Chapter 1.**

This chapter aims at conceptually contextualising mobile practices for the heritage sector within the scholarly research, with the goal of providing an overview of the main trends and lines of enquiry attested in the field about sustainable mobile practices and computational approaches to evaluate them, prior to the discussion of the design and development of mobile heritage experiences which constitute the main focus of this research. By reviewing the current literature, this introduction has the main purpose of identifying the gaps in the field studies and highlighting how these would be addressed in this research.

## **Chapter 2.**

The main objective of this chapter is to provide an overview of the common features of mobile experience apps, in order to establish a basic understanding of how current design conventions are used for creating sustainable experiences. Whereas a quantitative review of all available mobile heritage apps is beyond the scope of this research, the aim of this analysis is to offer a qualitative review of the design and narrative conventions used in these experiences by using

selected case studies, and by expanding on the categories previously identified in the current literature. This chapter takes a critical approach, reviewing the identified categories through new case studies and introducing a new category, 'narrative strategies', to present current practices for designing storytelling. This new category provides an overview of the different ways in which a storytelling can be designed or enriched using the narrative structure and the affordances of the device, expanding the proposed classification and providing more granular guidance for future development. Through this, a more comprehensive view of mobile media contents is established before exploring commercial and scholarly approaches to mobile experience development in the next chapters.

### **Chapter 3.**

This chapter examines the design of sustainable mobile experiences for heritage sites developed using standard industry frameworks, a topic which is under-investigated in the current literature. Using as a case study the “co-creation journey” elaborated by Calvium, the analysis is structured as an autoethnographic account of the process of design, develop, and implement a mobile app for the site of Tower Bridge, the *Family Learning Trail*. This chapter explores step-by-step the whole development process of the app, from initial brainstorming with the site staff to the final delivery of the experience to the site. By critically reviewing the different phases, the purpose of the chapter is highlighting the importance of the value proposition by providing a detailed overview of the deployment of a standard design framework. By doing so, it will be possible to identify strengths and areas of improvements of the approach in terms of working model to produce sustainable apps.

## **Chapter 4.**

Using the same autoethnographic descriptive approach, this chapter aims at providing an understanding of how the definition of a value proposition influences the design, development, and implementation of immersive experiences. The chapter investigates the development of mobile apps using an experience design framework resulting from a recently proposed research-based methodology for digital innovation for cultural heritage, the VISTA AR - Business Model for Digital Innovation (BMI). Using as case studies the mobile apps developed for three heritage sites in the UK (Exeter Cathedral, the Natural Trust site of Botallack, and the South West Coast Path Association site of Slapton Sands), the creative process of the app is critically described from a practitioner's perspective, with the aim of critically describe the development of these apps, highlighting the benefits and the limitations of this scholarly approach. The overall goal is to understand if and how the value proposition impacts the design process of the apps and the resulting user experience, and if the research-based design frameworks can offer a valid alternative to standard industry framework in terms of sustainability of the resulting product, whilst identifying areas of improvements and future directions in the investigation of mobile experiences for the heritage sector.

## **Chapter 5.**

This chapter explores an under-investigated evaluation tool for mobile heritage apps, the query and processing of tracking analytics. Extensively used in the industry for measuring the performance of the app, in the current literature works on app analytics for the heritage sector are still in their embryonic state and mostly interrogate the data with a cross-sectional approach. Using the case study



of the unpublished data set for the *Hidden Florence* app, this chapter aims at filling this gap by investigating the user-generated data for the app and its social media ecology using a longitudinal approach. By expanding a previous analysis with a new set of data, the purpose of this chapter is to broaden the view in order to identify insights on the impact of a recent design update over the performance of the app in terms of audience engagement, showing how the analytics allowed to inform changes and updates, helping creators to keep the app more resilient. Furthermore, the analysis offers insights on the potential of mobile apps for pivoting changes in tourists' behaviours, which informs the discussion in terms of future directions in the conclusion. Using mixed methods of quantitative data and qualitative data processing, the goal of this analysis is to show how the alignment between the intended experience, informed by the value proposition, and the realised experience results in apps that actively engage the audience.

## **Conclusion.**

The conclusion of this thesis aims to bring together the main ideas discussed in each chapter, creating a coherent understanding of how current approaches to the design of mobile heritage apps are addressing issues related to the sustainability of this kind of practices. By reflecting on the insights and analyses presented throughout the thesis, the conclusion offers a final reflection on potential directions for future research in this field, particularly towards reconceptualising the heritage as the result of sociocultural, political and environmental changes, and by doing so it will be possible to encourage more resilient and sustainable mobile practices which account the both the site and the society's needs.

## Chapter 1. Mobile Apps for Cultural Heritage Sites.

### 1.1 Introduction.

As with all kinds of interpretation of heritage, the analysis of mobile apps that have been developed over the last decade for cultural heritage sites ‘reveal more about our own contemporary views and interpretation of the past than about past societies themselves.’<sup>1</sup> Since the introduction of mobile technologies as interpretation tools, the agenda of the heritage sector has been shaped by several, and seemingly contrasting objectives, with practitioners aiming to adopt more sustainable, ethical and accessible practices while increasing revenue by attracting new audiences. For this reason, it is very useful to examine the developments in this area over the last few years, and see what approaches have been taken, what the underlying assumptions are, and where gaps exist.

The overarching aim of this chapter is to introduce the emergent and contemporary (digital) heritage landscape in which these mobile applications are adopted, by road mapping the wider context of heritage studies and interpretation practices enabled by the technology, and exploring various thematic elements that have influenced the emergence of the argument underpinning my thesis. In order to do so I will demonstrate that there are a number of approaches and forces that shape the agenda and the direction of heritage practices in the contemporary era: the development of the “experience economy”, the “immersive turn”, and a new critical consciousness towards more sustainable and inclusive heritage practices, as well as against blunt instrumentalism of the digital innovation. It will be shown how these trending topics in

---

<sup>1</sup> Economou, *Heritage in the digital era*, 216.

the scholarly research, such the increased interest use of big data and computational approaches for user experience evaluation, and the growing wave of concerns on ethical issues and tool criticism, are strongly intertwined to the objectives of heritage institutions, supporting the claim of this research for more sustainable heritage practices using mobile devices to help the sites remain relevant in this fast-paced world.

## **1.2 Heritage in the era of smartphones.**

The purpose of this section is to make clear the nature of digital heritage in order to illustrate where this thesis is coming from, and also to indicate the route it is taking, by looking at how cultural heritage institutions and scholarly research have been introducing digital (mobile) technology in the discourse of preservation and promotion of the heritage. Given that the primary objective of this research is to examine the sustainable design of mobile applications for heritage institutions as a mean of dissemination and promotion of their collections, it is crucial to outline the evolutionary process involved in collecting, preserving, and sharing heritage through mobile applications. This exploration will provide valuable insights into how mobile applications have emerged as one of the prominent digital tools employed in the field. By doing so, it will be possible to attain a comprehensive understanding of the specific manifestation and diverse perspectives adopted in this context.

Heritage is defined as our legacy from the past, what we live with today, and what we pass on to future generations. As common wealth of all mankind, its enduring value should be kept for future generations. Accordingly, the recognition and preservation of its outstanding universal value (OUV) has been a great concern for major cultural

institutions, such as the International Council of Museums (ICOM), UNESCO, and similar bodies at the national and international level. This has highlighted the emerging role of digital heritage, which is defined by UNESCO as ‘the use of digital media in the service of preserving, protecting, studying and presenting these heritages.’<sup>2</sup> The great value and significance of digital heritage was affirmed by two UNESCO documents released in 2003: the Guidelines for the Preservation of Digital Heritage (National Library of Australia 2003) and the Charter on the Preservation of the Digital Heritage (UNESCO 2003). The Charter describes digital heritage as thus:

any resources of human knowledge or expression, whether cultural, educational, scientific and administrative, or embracing technical, legal, medical and other kinds of information, are increasingly created digitally, or converted into digital form from existing analogue resources.<sup>3</sup>

Digital data therefore is the new cultural heritage of life. Significant digital data as a new type of digital cultural heritage product emerged as two distinct forms. The distinction first made official by UNESCO in 2003 divides digital data into *digitally born*, derived from data only existing in digital format, and *digital surrogates* (now popularly known as digitisations), or digital reproductions of pre-existing works.<sup>4</sup> When resources are born digital, there is no other format but the digital original, including text, databases, still and animated images, audio tapes, photos, software, and web pages. Scholarly, digital heritage have been classified by genres: information resources stored in specific carriers (such as optical disks, disks, and tapes), computer

---

<sup>2</sup> UNESCO. *Charter on the preservation of the digital heritage, 32nd session: The general conference of the United Nations Educational, Scientific and Cultural Organization, UNESCO, Paris.* 2009. Accessed November 29, 2023. <https://unesdoc.unesco.org/ark:/48223/pf0000179529>.

<sup>3</sup> UNESCO. *Voices of the City. Lab 2030.* UNESCO, 2019. Accessed November 29, 2023. [https://en.unesco.org/creativecities/sites/default/files/16\\_pages\\_villes\\_creatives\\_uk\\_bd.pdf](https://en.unesco.org/creativecities/sites/default/files/16_pages_villes_creatives_uk_bd.pdf).

<sup>4</sup> Ibid.

databases, or disseminated via the internet or digital media, and preprint materials or archives held in e-prints<sup>5</sup>. The technologies involved in digital heritage cover a variety of aspects including creation, storage, monitoring, dissemination, presentation and protection. Accordingly, the creation and documentation of digital heritage consist of technological processes such as digital perception, data collection and processing, information extraction and interpretation, and digital documentation. Generally, it is possible to identify five main research techniques of digital application and relative practices: digitalisation of the heritage ontology; preservation of digital heritage; the use of digital heritage, demonstration, sharing, and publicity of digital heritage; and laws and regulations on digital heritage protection.<sup>6</sup>

Digital cultural heritage is therefore conceived as all digital data that our society sees as important to retain and keep as a source of knowledge for future generations. Jānis Kārklīnš, discussing digitization as preservation practice, reflects on the value of any digital interpretative tool for the heritage stating that 'whether recorded on a clay or electronic disk, the methods by which we share content and knowledge must be protected.'<sup>7</sup> Since their widespread public adoption starting from 2009, mobile applications have been included within the digital data recognised by major heritage institutions.

---

<sup>5</sup> Fiona Cameron and Sarah Kenderdine, *Theorizing Digital Cultural Heritage: A Critical Discourse* (Cambridge, MA: MIT Press, 2007).

<sup>6</sup> Xinyuan Wang et al., "Digital Heritage," in *Manual of Digital Earth*, eds. Huadong Guo, Michael F. Goodchild and Alessandro Annoni (Singapore: Springer, 2020). [https://doi.org/10.1007/978-981-32-9915-3\\_17](https://doi.org/10.1007/978-981-32-9915-3_17).

<sup>7</sup> Jānis Kārklīnš, "Preface," in *Proceedings of Memory of the World in the Digital Age: Digitization and Preservation, An international conference on permanent access to digital documentary heritage 26-28/9/2012*, eds. Luciana Duranti and Elizabeth Shaffer (Toronto: University of Toronto Press, 2012), 4. <https://unesdoc.unesco.org/ark:/48223/pf0000373728.locale=fr>.

In contemporary digital heritage practices, mobile applications have become powerful tools for heritage organisations in their effort to reach new audiences and communicate in new ways. The creation of mobile apps with cultural content is rapidly expanding, with several heritage institutions, creative media agencies, and researchers around the world experimenting with their potential, particularly their advanced computing abilities, location awareness, and connectivity. Before looking at how the adoption of mobile devices in the heritage context have been evolving over the past decade, it is valuable to briefly introduce the technical specificity of the devices in order to highlight the influence of the physical medium on digital heritage practices.

Smartphones have revolutionised the way in which as society we communicate and we connect. Although technology does not determine specific outcomes, a close reading of them reveals a range of characteristics that should not be ignored. For instance, as a mobile media user moves through physical space, a range of coordinated hardware and software processes leads to a determination of the shifting mobility of that user and a visualization of this is articulated to that material space. Nowadays nearly every mobile device is equipped with location-based technologies, like GPS (global positioning system), cell tower positioning, Bluetooth, Wi-Fi (wireless fidelity, i.e. wireless networking protocol), RFID (radio frequency identification), and a series of sensors, such as compasses, accelerometers and proximity sensors. From a technological point of view then mobile devices are characterised by a convergence of portable media, wireless networking technologies, and positioning technologies.<sup>8</sup> Smartphones are still mobile devices as they allow people to place phone calls, send text messages, but they also have access to the Internet, use extensively GPS and

---

<sup>8</sup> For a detailed overview on networked technologies, Alex Monroe Ingersoll, "The Shadow Space of Allegorical Machines Situating Locative Media," (PhD diss., University of North Carolina at Chapel Hill, 2013).

other form of location awareness and are capable of running third-party applications.

As Hjorth points out:

‘it is important to specify that a smartphone is differentiated from a mobile phone by its ability to connect to online applications and services via 3G, 4G, and/or Wi-Fi networks.’<sup>9</sup>

Within this definition, the ‘smart’ element of the device refers to its ability to be reconfigured and repurposed by individual users through their choice of downloadable apps and content. Although the smartphone exists on the same continuum as a mobile phone, its ability for reconfiguration differentiates the smartphone from other devices that can access online content via mobile browsers. While different operating systems and device-level innovations pushed the proto-smartphone towards various possible destinies, a whole range of yet more remarkable developments revealed other possibilities: Bluetooth and Wi-Fi connectivity; GPS location finding; and 3G and 4G mobile data. The introduction of smartphones has thus been a revolution. According to Goggin, the arrival of the smartphone – the ‘iPhone moment’, as he refers to it – was significant in that:

it galvanized users, developers, industry, policy makers and a range of publics alike, to articulate their concerns and desires regarding mobile media, and facilitated the rapid wider take-up of locative media services.<sup>10</sup>

Since the official release in 2007 and the opening of the app store in 2009 which granted access to the download of third-party applications, the diffusion of smartphones has been rapid and has had far reaching consequences not only in terms

---

<sup>9</sup> Larissa Hjorth, Jean Burgess and Ingrid Richardson, “Studying Mobile Media Cultural Technologies, Mobile Communication, and the iPhone,” (New York: Routledge Taylor and Francis Group, 2012), 52.

<sup>10</sup> Gerard Goggin, “Going Mobile,” in *The Handbook of Media Audiences*, ed Virginia Nightingale (Oxford: Blackwell Publishing Ltd, 2011), 181. <https://doi.org/10.1002/9781444340525.ch6>.

of the use of smartphones in themselves, but also because their use often substitutes for the use of other media (radio, TV and desktop), in particular towards computers<sup>11</sup>. As Goggin argues, one of the most successful marketing campaign strategies of Apple was introducing the iPhone 'as a mobile computer that opens up the mobile Internet and provides easy access to mobile applications.'<sup>12</sup>

The increasing adoption of smartphones impacts on the time and place of the access to Internet which has become now intertwined with people's everyday practices, facilitating many of their conversations and their travels through physical space<sup>13</sup>. Smartphones have indeed shaped a new form of behaviours, fostering a remarkable technological shift, from fixed to mobile and wireless. Yet this shift is also a cultural one, as it is less about the device itself and more about our attitude towards it, since smartphones are now an integrated part of our everyday life, and on the mobile apps stores it is possible to find several applications helping us organise our work life, sharing our memories, keeping us healthy and letting discover heritage. The ability of smartphones to be used in conditions and at an environment of the users' choice opens up new possibilities for the communication of cultural content to support engagement with heritage and learning at different levels, and, as scholarly researched has proven, establishing a link between the heritage organisation and its users that can extend beyond marketing purposes.<sup>14</sup>

---

<sup>11</sup> Gerard Goggin, "Adapting the mobile phone: The iPhone and its consumption," :*Continuum: Journal of Media & Cultural Studies* 23, no. 2 (April 2009).

<sup>12</sup> Goggin, *Going Mobile*, 182.

<sup>13</sup> Eric Gordon and Adriana de Souza e Silva, *Net Locality: Why Location Matters in a Networked World* (Oxford: John Wiley & Sons, 2011). <https://doi.org/10.1080/10304310802710546>.

<sup>14</sup> Economou, *Heritage in the Digital Era*.



Cultural heritage institutions are now increasingly using smartphones to deliver audio or audio-visual tours of exhibitions and collections, that today are enhanced further with rich media and interactive content.<sup>15</sup> This process has been strongly facilitated by the already “mobile” nature of the practices of heritage interpretation. From a historical perspective, the first mobile heritage experiences were tours. Beginning with the Stedelijk Museum’s radio tours in the 1950s, mobile engagement with heritage developed through the audiocassette tour, the CD tour, the PDA tour, and through to the mobile phone-based tour.<sup>16</sup> Since their early days, audio guide has been seen as an indispensable part of the museum programme when it comes to the types of supplementary material offered to the visitor<sup>17</sup>, and still are recommended amongst best practices for interpretation by major heritage institutions<sup>18</sup> since surveys of handheld technology users in museums have found that visitors spend longer in galleries when using audio guides.<sup>19</sup> As Barrett argues:

‘Clearly the evidence points towards mobile as a natural fit, not just for extending the cultural heritage experience, but also as a tool that connects directly with the nature of museum curation, and importantly its familiarity with museum audiences.’<sup>20</sup>

---

<sup>15</sup> The New Media Consortium, *NMC The Horizon Report: 2010 Museum Edition* (Austin, Texas: The New Media Consortium, 2010), accessed May 13, 2023. <https://www.learntechlib.org/p/182019/>.

<sup>16</sup> For a comprehensive review of the history of mobile interpretation, see Barrett, *The Phenomenalisation of Heritage*.

<sup>17</sup> John F. Falk and Lynn Dierking, “Enhancing visitor interaction and learning with mobile technologies,” in *Digital Technologies and the Museum Experience*, eds. Kevin Walker and Tallon Loic. (Lanham, MD: AltaMira Press, 2008), 20.

<sup>18</sup> Heritage Lottery Fund, *Interpretation guidance*, accessed November 29, 2023. <https://www.heritagefund.org.uk/funding/good-practice-guidance/interpretation-guidance>.

<sup>19</sup> Nancy Proctor and Chris Tellis, “The State Of The Art In Museum Handhelds In 2003,” (paper presented at Museums and the Web 2003, Toronto March 19-22, 2003). <https://eric.ed.gov/?id=ED482157>.

<sup>20</sup> Barrett, *The Phenomenalisation of Heritage*, 99.

As smartphones became widespread amongst the public, this familiarity with mobile devices has led many museums to move away from bespoke audio tours on rented devices shifting towards the provision of mobile applications using personal devices. The bring your own device approach (BYOD), a term coined by Intel in 2010<sup>21</sup>, offers obvious practical benefits for heritage sites, namely avoiding the costs involved to install, maintain and regularly replace costly hardware.<sup>22</sup> In a survey commissioned by the Victoria and Albert Museum in 2012 to gauge the scale and nature of the pervasivity of mobile technologies amongst its visitors, the results show that more than 70% of them own a smartphone, and use it for enhancing their cultural visits, preferring them in comparison to rented devices for several reasons, including the convenience of already possessing “in their pocket” an interpretation tool.<sup>23</sup> Smartphones represent then, as Petrie highlights, the natural ‘opportunity to leverage existing behaviours’<sup>24</sup> and in turn developing practices that improve, extend or piggy-back on this activity.

In the earliest days of mobile interpretation, audio was the only medium that could reliably deliver that kind of narrative content in a small, portable package. The majority of the apps developed had the form of enriched audio tours, in some cases following the model of traditional tours (linear exploration, use of reference images of the work with audio commentary)<sup>25</sup>. This raised initially concerns about the novelty of BYOD tours since ‘they follow the same model: the visitor goes from location to location and

---

<sup>21</sup> The New Media Consortium, *NMC Horizon Report*.

<sup>22</sup> Droitcour Smith, *The Digitized Museum*, 78.

<sup>23</sup> Andrew Lewis, “What do visitors says about using mobile devices in museums?,” *The V&A* (blog), March 13, 2013, <https://www.vam.ac.uk/blog/digital/museum-visitors-using-mobile>.

<sup>24</sup> Matthew Petrie, “Dear museums: the time is right to embrace mobile,” *Guardian*, May 31, 2013, <https://www.theguardian.com/culture-professionals-network/culture-professionals-blog/2013/may/31/museums-mobile-visitors>

<sup>25</sup> Economou, *Heritage in digital era*.

receives content at stops'<sup>26</sup>. Back in 2011, Economou surveyed the mobile apps available for art and cultural heritage sites and concluded that:

Although the technology has changed, the mentality related to the design of the experience appears in many cases to have remained the same to the one which produced the acoustic tours.<sup>27</sup>

However, while the traditional mobile tour is still in effect, smartphones 'challenge us to think at these experiences beyond the audio tour and our silolike approaches to digital initiatives.'<sup>28</sup> The rapid advancement in the computing capability and tech affordances of smartphones, namely in terms of computing capabilities, have allowed to increase exponentially the media content and the interaction with them, especially with the Augmented Reality affordance. This has allowed to 'shift from the approach that the device determines the content, to a new approach, where the device is a medium in the process of creating content'<sup>29</sup>. This has radically transformed the mobile media content, expanding the range of interactive methods of cultural heritage engagement.

In just over ten years from the release of the Apple and Android app stores in 2008, the possibility of smartphones to trigger by walking situated knowledge 'in actual and relevant contexts'<sup>30</sup> has been extensively exploited, supported by the increased familiarity with the device, both as personal devices and interpretation tool, and the

---

<sup>26</sup> Barrett, *The Phenomenalisation of Heritage*, 13.

<sup>27</sup> Maria Economou and Elpiniki Meintani, "Promising beginning? Evaluating museum mobile phone apps," (paper presented at Rethinking Technology in Museums 2011: Emerging experiences, University of Limerick, Ireland, May 26-27, 2011). <http://eprints.gla.ac.uk/104173/>

<sup>28</sup> Barrett, *The Phenomenalisation of Heritage*, 13.

<sup>29</sup> Koven Smith, "The Future of Mobile Interpretation," in *Museums and the Web 2009. Proceedings*, eds. John Trant and David Bearman (Toronto: Archives & Museum Informatics, 2019).

<sup>30</sup> Brett Oppegaard and Michael Rabby, "The App-Maker Model: An Embodied Expansion of Mobile Cyberinfrastructure," *Digital Humanities Quarterly* 10, no. 3 (2016), 623. <http://www.digitalhumanities.org/dhq/vol/10/3/000267/000267.html>.

willingness and strive to experiment with increasingly novel forms of audience engagement with the device. In her article *Immersive Heritage*, Jenny Kidd explores the latest “immersive turn” of heritage practices, and posits three main stages in the conceptual evolution of mobile app design for audience engagement:

Firstly, a narrative turn, one consequence of which has been a broader range of digital and other media utilized in museums, and which has included attempts to diversify the types of voices and stories represented within heritage contexts. Secondly, an affective turn focused on understanding better how museums make us feel, and the conditions under which those feelings translate into real world actions (or not). Thirdly, there is also evidence of a ludic turn within museums, characterized by increased interest in the application of play and game mechanics across a range of activities.<sup>31</sup>

We are now deep into the fourth turn of “immersive heritage”, which sees the adoption of smartphones, alongside other more advanced technologies such as Mixed Reality devices, for engaging new audiences through more immersive situated storytelling<sup>32</sup>. With the “immersive turn”, we are now assisting at a growing scholarly interest in immersive and interactive storytelling in heritage contexts.<sup>33</sup> Paired with other cues – spatial and environmental, storytelling in its aural form allows ‘embodied meaning-making’<sup>34</sup>, potentially taking audience emotional engagement to another level.

---

<sup>31</sup> Jenny Kidd, “‘Immersive’ heritage encounters,” *The Museum Review* 3, no.1 (2018), 5. <https://orca.cardiff.ac.uk/id/eprint/110788>.

<sup>32</sup> For further works on immersive situated storytelling and mixed reality theatrical experiences, see Kidd, “‘Immersive’ heritage encounters,”; Steve Poole, “Ghosts in the Garden: locative gameplay and historical interpretation from below,” *International Journal of Heritage Studies* 24, no. 3 (2018). <https://doi.org/10.1080/13527258.2017.1347887>.; Gabriella Giannachi, “Lost Origin and Beyond. Towards a design framework for mixed reality theatrical experiences”, *Body, Space & Technology* 22, no.1 (2023). <https://doi.org/10.16995/bst.9674>.

<sup>33</sup> Daniela Petrelli, “ Making virtual reconstructions part of the visit: An exploratory study,” *Digital Applications in Archaeology and Cultural Heritage* 15 (2019). <https://doi.org/10.1016/j.daach.2019.e00123>.

<sup>34</sup> Areti Galani and Jenny Kidd, “Evaluating Digital Cultural Heritage ‘In the Wild’: The Case For Reflexivity,” *Journal of Computing and Cultural Heritage* 12, no. 1, article 5 (February 2019). <https://doi.org/10.1145/3287272>.

Location-based storytelling, in its multiple modalities of fostering audience engagement has been extensively investigated. Indeed, smartphones allow ‘layering multiple or competing narratives, playing with narrative conventions and structures, or positioning audiences more dynamically and consequentially within an experience’.<sup>35</sup> Terms such as “spatialised narrative”<sup>36</sup>, “locative narrative”<sup>37</sup>, and “ambient literature”<sup>38</sup> highlight the possibility of rich interactions between story, tech, people and place. As it will be further discussed, attention has been also given to the ability of these experiences using smartphones to open a ‘dialogical approach’ enabling audiences to navigate pathways through historical content, and freeing themselves from ‘authoritative third-party commentary’.<sup>39</sup>

The different turns attested within the mobile heritage practices are imbued and strongly rooted in the growing emphasis on cultural heritage as a political, cultural and social phenomenon. This claim is at the core of critical heritage studies (CHS), a term first coined around the turn of the millennium, to describe a growing body of scholarship which seeks to move beyond the traditional focus of heritage studies on technical issues of management and practice.<sup>40</sup> Critical heritage studies is a reaction against the ‘authorised heritage discourse’ (AHD), and argues for a broadening of

---

<sup>35</sup> Kidd and McAvoy, *Immersive experiences*.

<sup>36</sup> Rieser, Martin. “Locative Media and Spatial Narrative,” (paper presented at REFRESH conference. First International Conference on the Media Arts, Sciences and Technologies, Banff Center, September 29 to October 4, 2005). [http://95.216.75.113/bitstream/handle/123456789/304/Martin\\_Rieser\\_refresh.pdf?sequence=1&isAllowed=y](http://95.216.75.113/bitstream/handle/123456789/304/Martin_Rieser_refresh.pdf?sequence=1&isAllowed=y). Rob Kitchin et al., "Smart cities, urban technocrats, epistemic communities and advocacy coalitions," SocArXiv Article rxk4r (2017). <http://doi.org/10.31219/osf.io/rxk4r>.

<sup>37</sup> Kim Jong-Hyeong and Ritchie Brent, “Cross-Cultural Validation of a Memorable Tourism Experience Scale (MTES),” *Journal of Travel Research* 53, no. 3 (2014). <https://doi.org/10.1177/0047287513496468>.

<sup>38</sup> Tom Abba, Jonathan Dovey, and Kate Pullinger. *Ambient Literature: Towards a New Poetic of Situated Writing and Reading Practices* (London: Springer international Publishing, 2020).

<sup>39</sup> Poole, *Ghosts in the Garden*, 306.

<sup>40</sup> Rodney Harrison, *Understanding the Politics of Heritage* (Manchester: Manchester University Press, 2010).

heritage analysis which takes as its starting point the understanding that heritage 'does' things in societies. It requires embracing the dissonant, and not simply acknowledging the multiplicity of values and cultural meanings that heritage places and practices may have, but also understanding their wider social consequences and ideological significance.

Earlier scholarship conducted within the confines of the authorised heritage discourse, has been dominated by narrow perceptions and approaches to heritage that stress the inherent value, meaning and materiality of heritage; and that the interests of both heritage, and future generations are best served by the neutrality and objectivity of heritage professionals.<sup>41</sup> Advocates of CHS, instead, contend that the discourses that frame our understanding of heritage are a performance in which the meaning of the past is continuously negotiated in the context of the needs of the present. This process is then used in a wide range of ways to stabilise or destabilise issues of identity, memory and sense of place, all of which have consequence for individual and collective well-being, equity and social justice. For Smith, heritage is redefined not simply as a thing or place, or even intangible event, but rather as a cultural process involved in the performance and negotiation of cultural values, narratives, memories and meanings.<sup>42</sup>

Whereas CHS has clear precursors reaching back to the 1950s, it became central to the development of heritage studies as a recognisable field of enquiry in the 1980 and 1990s. Intellectually rooted in the western Anglophone knowledge system, the

---

<sup>41</sup> Kynan Gentry and Laurajane Smith, "Critical heritage studies and the legacies of the late-twentieth century heritage canon," *International Journal of Heritage Studies* 25, 11 (2019).

<sup>42</sup> Laurajane Smith, *Uses of Heritage*, 1<sup>st</sup> ed. (London: Routledge, 2006); Laurajane Smith and Emma Waterton, "The recognition and misrecognition of community heritage," *International Journal of Heritage Studies* 16, no. 1-2 (2010).

discipline was initially eclipsed by the explosive growth of the sector on the technical 'doing' of heritage that dominated 1980s. This resulted in uncontrolled economic exploitation, and the increasing development of community-specific museums, eco-museums and heritage centres that challenged the traditional nationalising and citizen-making focus of larger museums. This diversification of the museum was often characterised simply as offering economic panaceas to de-industrialised and other economically and politically marginalised communities.

Between the late-1970s and the early-1980s, in the UK a number of incentive schemes were introduced in the UK to restart the economy and support the 'enterprise culture', and as a result, independent museum flourished. According to Smith and Gentry, the rise of independent museum was indeed strongly influenced by the 'spiralling unemployment and the death of the traditional industry that had themselves resulted from Thatcher's embracing of deflationary economic policies, trade liberalisation, and the push to diversify the economic base of the country.'<sup>43</sup> On a global scale, a number of scholars have noted how the selection processes of UNESCO's World Heritage List, and that one of Intangible Cultural Heritage, have increasingly been driven by countries' political influence and national strategic interests.<sup>44</sup> Increasingly, the heritage is 'being understood as an arena for playing out of conflicts and ideologies of the present'<sup>45</sup>, feeding the processes of 'heritagisation'<sup>46</sup> by which 'heritage and culture are resources that can stimulate local socio-economic development and that the

---

<sup>43</sup> Gentry and Smith, *Critical heritage studies*, 1152.

<sup>44</sup> Enrico Bertacchini, et al., "The politicization of UNESCO World Heritage decision making." *Public Choice* 167,1 (2016).

<sup>45</sup> Gentry and Smith, *Critical heritage studies*, 1152.

<sup>46</sup> Chiara De Cesari, and Rozita Dimova, "Heritage, gentrification, participation: remaking urban landscapes in the name of culture and historic preservation," *International Journal of Heritage Studies* 25, no. 9 (2019), 863.

creative classes foster creative economies that are locally-tuned and sustainable over the long term.’<sup>47</sup>

This in turn gave rise to growing academic attention in the 1980s to the increasing use of heritage and patrimony in underpinning UK Conservative social and cultural policies in what it has been defined as the ‘Disneyfication’ of the past. It was also this particular socio-political frame that dominated the perspectives taken by Robert Hewison, Raphael Samuel, and Patrick Wright, with Lowenthal’s seminal work *The past is a foreign country*, giving name to a particular critique that ‘saw heritage as a right-wing trend that had managed to dupe a gullible public.’<sup>48</sup> Although with almost polar opposite positions, their works led to establish what it is termed the 1980s Anglophone ‘heritage canon’, which went a long way in problematising and politicising the assumed neutrality of culture and heritage that had dominated the 1970s. Heritage centres and “popular museums” became central to the narratives and the critiques of CHS, described as “bogus history” by Hewison in his *The Heritage Industry*.<sup>49</sup> In the second half of the 1980s scholarly explorations such as Robert Lumley’s *The Museum Time-Machine* (1988) and the Peter Vergo’s *The New Museology* (1989) set the foundations for a ‘new museology’ which critically explore the purpose, politics, and values of museums and heritage institutions.<sup>50</sup>

The turn from heritage studies to CHS and “new museology” saw indeed a cross-pollination of heritage scholarship with other spheres of research and practice, in particular with the “memorial approach” of CHS which represents a starting point to

---

<sup>47</sup> Ibid., 2.

<sup>48</sup> Gentry and Smith, *Critical heritage studies*, 1151.

<sup>49</sup> Robert Hewison, *The Heritage Industry. Britain in a Climate of Decline* (London: Routledge, 1987), 84.

<sup>50</sup> Robert Lumley, *The Museum Time-Machine* (London: Routledge, 1988). Peter Vergo, *The New Museology* (Chicago: The University of Chicago Press, 1989).



chart out alternative expressions of heritage. Central to this process is the shift from a discussion of the past as a foreign country to one where heritage is understood, in the words of Beverly Butler:

‘as a powerful resource for ‘creating a future’ and to the recognition of how a fundamental reconceptualization of heritage is uniquely placed not only to address claims about identity, ancestry and cultural transmission but to engage with key moral-ethical issues to our times.’<sup>51</sup>

On 1 November 1999 at the national conference “Whose Heritage? The Impact of Cultural Diversity on Britain’s Living Heritage” that took place at G-Mex, Manchester, England, Stuart Hall in his speech suggests that ‘we should think of ‘The Heritage’ as a discursive practice. It is one of the ways in which the nation slowly constructs for itself a sort of collective social memory.’<sup>52</sup>

Yet, the “discursive construction” bears theoretical challenges and material consequences. These can be summarised with the questions, who should control the power to represent? And, who has the authority to represent the culture of others? These two major challenges ‘have resounded through the museum corridors of the world, provoking a crisis of authority.’<sup>53</sup> Indeed, efforts to address these questions have led to a major transformation in scholars and practitioners’ activity in constructing “heritage”. Firstly, the democratisation process. This entails recounting the lives and history of ordinary everyday people, in Samuel’s words the “popular heritage”, which more recently have been brought to the foreground as witnessed for example, by the

---

<sup>51</sup> Beverly Butler, “Heritage and the Present Past,” in *The Handbook of Material Culture*, ed. by Christopher C. Tilley, Keane Webb, Susanne Küchler, Michael Rowlands, and Patricia Spyer (London: Sage Publications, 2006), 463.

<sup>52</sup> Stuart Hall, “Whose Heritage? Un-settling ‘The Heritage’, Re-imagining the Post-nation,” in *Whose Heritage? Challenging Race and Identity in Stuart Hall’s Post-nation Britain*, ed. Susan L.T. Ashley and Degna Stone (New York: Routledge, 2023), 14. Smith, *Uses of Heritage*, 11–13.

<sup>53</sup> Hall, *Whose Heritage*, 18.

explosion of interest in the “history from below”.<sup>54</sup> It also implies therefore a democratisation of heritage practices, as the power of the “expert” is questioned, which creates openings for new heritage narratives and presentations that are shaped by people and communities rather than experts and traditional institutions. A second revolution that the new heritage canon has unleashed is the critique of West and western-oriented or Eurocentric grand-narratives, which has in the rising cultural relativism and the growing attention to themes such as colonialism and politics of recognition of social and ethnic minority communities, some of the most vivid expressions of the awareness about the constructed and thus contestable nature of the authority. This emerging viewpoint challenges not just the assumptions but also the practices of heritage. As Smith, Shackel and Campbell argue, this ‘opens up the entire heritage sector to more meaningful relations with subaltern groups, and demand that the unquestioned assumptions about class and national narratives are vigorously interrogated.’<sup>55</sup>

It is within these premises that scholars in mid-2000s started to recover the works by Samuel, Hewison and Wright, and expand on the concept of “Authorized Heritage Discourse” (AHD) first introduced by Laurajane Smith in her book *Uses of Heritage*. According to Smith, there is a hegemonic discourse that favours ‘monumentality and grand scale, innate artefact/site significance tied to time depth, scientific/aesthetic expert judgement, social consensus and nation building.’<sup>56</sup> In this sense, the AHD ‘focuses attention on aesthetically pleasing material objects, sites, places and/or landscapes that current generations ‘must’ care for, protect and revere so that they

---

<sup>54</sup> Raphael Samuel, *Theatres of Memory* (London: Verso, 1997).

<sup>55</sup> Laurajane Smith, Paul Shackel, and Gary Campbell, *Heritage, Labour and the Working Classes* (London: Routledge, 2011), 4.

<sup>56</sup> Smith, *Uses of Heritage*, 11.

may be passed to nebulous future generation for their 'education', and to forge a sense of common identity based on the past.<sup>57</sup> Furthermore, the AHD 'is also a professional discourse that privileges expert values and knowledge about the past and its material manifestations, and dominates and regulates professional heritage practices.'<sup>58</sup> Consequently, for Smith, the AHD is connected to inequality, to questions about what it means to be an 'expert' or 'professional', and to Foucault's concept of power/knowledge.

After the publication of Smith's book, the AHD became a widely used concept amongst the scholars of CHS in efforts to make cultural heritage more inclusive and participatory, and in critical publications regarding powerful institutions like UNESCO.<sup>59</sup> In 2010, the Association of Critical Heritage Studies was founded, and in 2012, the association published its "preliminary manifesto" in order to start a debate about its aims.<sup>60</sup> The manifesto engages with the AHD as follows:

'The old way of looking at heritage – the Authorised Heritage Discourse – privileges old, grand, prestigious, expert approved sites, buildings and artefacts that sustain Western narratives of nation, class and science. There is now enough sustained dissatisfaction with this way of thinking about heritage that its critics can feel confident in coming together to form an international organisation to promote a new way of thinking about and doing heritage – the Association of Critical Heritage Studies.'<sup>61</sup>

---

<sup>57</sup> Ibid., 29.

<sup>58</sup> Ibid., 4.

<sup>59</sup> Marc Askew, *The magic list of global status: UNESCO, World Heritage and the agendas of states* (London: Routledge, 2010).

<sup>60</sup> [www.criticalheritagestudies.org](http://www.criticalheritagestudies.org)

<sup>61</sup> Laurajane Smith and Emma Waterton, "Constrained by commonsense: the authorized heritage discourse in contemporary debates," in *The Oxford Handbook of Public Archaeology*, eds. Robin Skeates, Carol McDavid, and John Carman (Oxford: Oxford University Press, 2012).

Since then, the heritage sector have been relentlessly “digging beneath” the authorised heritage discourse. This has taken multiple forms, for example how the texts supporting art works and framing exhibits are written by museums in the attempts to make explicit the perspective which has governed the selection and the interpretative contextualisation, and by being generally more open to challenge and re-interpretation.

Mobile practices too, as one of the most popular heritage interpretative means, reflect this new approach to alternative heritage construction. Gaining great traction from the work of Smith, Shackel and Campbell on working class heritage, the GPS-based app, *Waterways Explorer*, for example, offers a counter-narrative of Manchester’s hidden minor waterways by exploring the people, communities, events and places that constitute the ‘uncomfortable heritage’ of the area.<sup>62</sup> Structured as a series of walk-to-unlock trails, the app has been constructed using an off-the-shelf pre-formatted platform which allows member of the local communities to engage with participatory storytelling, with the aim of give voice to the pluralistic working class cultures often victims of social and cultural inequalities in the contemporary heritage-led redevelopment of cities such as Manchester. A similar willingness to bring to the foreground underrepresented groups is attested in the mobile app developed at the New Philadelphia National Historic Landmark (Pike County Illinois, USA) for the African American community that lived there in the nineteenth century<sup>63</sup> Resulting from a collaboration between the USA National Park Service’s network, the Illinois State Museum, and the association of the community descendants, the app lets visitors walk

---

<sup>62</sup> Available at <https://izi.travel/en/search/waterways%20explorer>.

<sup>63</sup>Jonathan Amakawa and Jonathan Westin, ““New Philadelphia: using augmented reality to interpret slavery and reconstruction era historical sites,” *International Journal of Heritage Studies* 24, no. 3 (2017).

through the site of New Philadelphia, view digitally reconstructed historical buildings placed in their original locations, and learn about the history of the vanished nineteenth century American frontier community. Visual AR technology, paired with GPS capacity of the mobile phone, allows opportunities for interpreting lost historical locations, such as those of African Americans during the eras of Slavery and Reconstruction, ‘whose heritages have not been well served by traditional modes of preservation and interpretation.’<sup>64</sup> Heritage preservation in its broader term is one of the topics which is increasingly addressed by institutions and museums given the urgency of the impact of climate change. For instance, the Australian Museum has developed, in collaboration with a creative agency and the Bureau of Meteorology, Mt Resilience, an interactive webAR experience ‘that highlights community planning and climate change disaster preparedness.’<sup>65</sup> Authored by 35 experts from varying fields and lived experiences, including consultation with First Nations people, the app features over 20 minutes of interactive content all about showing people that there’s a way to survive what’s coming, also including first hand stories from *Big Weather (and how to survive it)*, showing how vulnerable we are to extreme weather.

These examples show how audience agency plays a critical role in the process of destabilise the authorized heritage debate while facilitating an heritage constructive discourse. By allowing underrepresented communities to be the narrative focus, and increasingly also the co-author, of a subaltern storytelling so far neglected, mobile heritage practices grant these audiences the opportunity of reclaim the right to a place or a narrative and open it up for different narrations to coexist. As in the words of Stuart Hall, in constructing heritage we are often ‘deeply embedded in specific “ethnic” or

---

<sup>64</sup> Ibid., 327.

<sup>65</sup> Available at <https://australian.museum/learn/climate-change/mt-resilience/>.

cultural meanings which give the abstract idea of the nation its lived “content” and ‘those who cannot see themselves reflected in its mirror cannot properly *belong*’.<sup>66</sup> Such observation, however, is often obscured, and perhaps actively forgotten, owing to the way heritage studies is constructed as field of enquiry. The intellectual frameworks which structure and define the field are far too much imbued of a belief in the legitimacy of the cultural work that heritage does. As Gentry and Smith argues, ‘heritage studies as a field of study is thus itself party to the cultural and political work that heritage does.’<sup>67</sup> Indeed, there’s a selective “canonisation” of who *belongs* or not to the national narrative, a process which is extremely difficult to shift or revise. However, by critically approaching heritage, the people has the power of reacting against the AHD by revisioning *who* is the heritage for, embracing and giving voice to the dissonant, in a cultural process that involves performance and negotiation of cultural values, narratives, memories and meaning.

The recent drawing of heritage into neoliberal governmentality has only complicated such challenges, with both states and corporations now commonly seeking to co-opt heritage to political and economic ends.<sup>68</sup> The increased interest and investment in heritage storytelling with mobile apps strongly relates to other concurrent developments attested within the cultural sector. Indeed, the enthusiastic adoption of mobile technology for heritage interpretation and audience engagement is ‘allied to the drive by many institutions to better position themselves within the ‘experience economy’<sup>69</sup>, whereby the heritage sector shifted from selling “products” to selling

---

<sup>66</sup> Hall, *Whose Heritage*, 14.

<sup>67</sup> Gentry and Smith, *Critical heritage studies*, 1149.

<sup>68</sup> Rosemary J. Coombe, and Melissa F. Baird, “The Limits of Heritage Corporate Interests and Cultural Rights on Resource Frontiers,” in *A Companion to Heritage Studies*, ed. by William Loga, Máiréad Nic Craith, and Ullrich Kockel (London: Wiley-Blackwell, 2015).

<sup>69</sup> Kidd, *‘Immersive’ heritage encounters*.

“experiences”. The next section will help us gain more clarity about this concept, by looking at the wider heritage landscape within which apps have been developed and the conceptual reframing that mobile media has generated within the heritage field.

### **1.3 Heritage in the era of the ‘experience economy’.**

In the past twenty years, there has been a shift in the marketing from selling products to selling experiences. The idea of the “experience economy” was first precited by Alvin Toffler in 1971, then recovered and rapidly popularized after the publication of Pine and Gilmore’s 1999 book on the subject in which they argue that in the experience economy, services and products are differentiated not by functionality but by the quality of experience they offer to the consumer.<sup>70</sup> In practical terms, the shift implies creating experiences generating positive feelings, memories and pleasures, that are perceived memorable by customer. Mobile applications, as any digital product, belongs to markets that serve this “experience economy”.

The response of tech industry to the shift is conceptualised in the “experience design”. The underpinning idea of this approach is to look less at the efficiency of execution and more into quality of experience, is perhaps the most employed by the creative industry generally in charge of the technical development of the mobile experiences. Within this approach, the main actor and end-goal is the user of the product.<sup>71</sup> The experience design approach has a specific technical history, and therefore it has been

---

<sup>70</sup> Joseph II Pine and James H. Gilmore. *The Experience Economy* (Boston: Harvard Business School Press, 1999).

<sup>71</sup> For an exhaustive overview of HCI, user experience and interaction design, see David Benyon, *Designing Interactive Systems: A comprehensive guide to HCI, UX and interaction design*, 3<sup>rd</sup> ed. (London: Pearson, 2013).

initially employed foremostly by creators of any medium<sup>72</sup>. In the literature there are various models of experience design advocated by different usability theorists, with the most popular of them being Don Norman, who is considered the “guru” of experience design for commercial products.<sup>73</sup> His theory has been critically appropriated and extended to digital interfaces by many Human-Computer Interaction scholars, whom have been vastly investigated how to design mobile applications, trying to pin down the most important dimensions for successful user experience (UX) for mobile experience<sup>74</sup>. Within these practices, the experience design approach has been rooted into design thinking, a subfield of interaction design which aims to generate innovative solutions based on the understanding of user’s needs and motivation.<sup>75</sup> This approach has been described as human centred, optimistic, collaborative and experimental because it is powered by a thorough understanding, via direct observation, of what people want and need in their lives and what they like or dislike about the way particular products are made, packaged, marketed, sold, and supported.<sup>76</sup>

For the cultural sector, and for heritage in particular, the shift generated by the ‘experience economy’ is the result of a combinations of effects such as heightened

---

<sup>72</sup> “The Definition of User Experience (UX),” Don Norman and Jakob Nielsen, accessed November 29, 2023. <https://www.nngroup.com/articles/definition-user-experience/>.

<sup>73</sup> Don Norman, *The Design of Everyday Things* (New York: Basic Books, 1988).

<sup>74</sup> Joseph Doolittle et al., “Building a Mobile Application Development Framework”, *IT@Intel Best Practices Cloud Computing and Compute Continuum* (blog), August 13, 2012, <https://www.intel.co.jp/content/dam/www/public/us/en/documents/best-practices/mobile-app-development-framework.pdf>. Tejas Vithani and Anand Kumar, “Modeling the Mobile Application Development Lifecycle,” in *Proceedings of the International MultiConference of Engineers and Computer Scientists, March 12 - 14, Hong Kong, vol. I*, ed. Sang I. Ao, Oscar Castillo, Craig Douglas, David Dagan Feng and Jeong-A Lee (Hong Kong: Newswood Limited, 2014). [https://www.iaeng.org/publication/IMECS2014/IMECS2014\\_pp596-600.pdf](https://www.iaeng.org/publication/IMECS2014/IMECS2014_pp596-600.pdf).

<sup>75</sup> Tim Brown, *Change by Design: how design thinking transforms organizations and inspires innovation* (New York: Harper Collins, 2009).

<sup>76</sup> Acumen Academy, “HCD Workshop (2013) - The Design Process,” accessed May 10, 2023. <http://blog.acumenacademy.org/design-process>.



competitive pressures, reduced public funding opportunities and the economic imperative of attracting and retaining a wide audience, which made customer experience becoming a critical success factor for cultural heritage organisations.<sup>77</sup> Accordingly, heritage institutions nowadays hope that experiences 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'.<sup>78</sup> Heritage sites are therefore to be regarded as experience-centric providers, and their challenge is to set the stage for the creation of experiences fulfilling all these expectations. These are the premises in which mobile apps made their first entry in the heritage scene.

Digital innovation with mobile apps has been enthusiastically welcomed by practitioners from the heritage sector, and mobile experiences have been immediately introduced as “touch points” for branding identity, generating ideas and storyworlds, as discussed in the previous section. One of the first pioneering experiments with locative-based storytelling is the ground-breaking *StreetMuseum*<sup>79</sup>, the Museum of London' AR app released to the public in 2010, which uses the smartphone to “open a window into the past” within the fabric of contemporary urban landscape, where the museum's collection is no longer locked within the walls of the museum, but it is spread in the everyday, across familiar streets and places. In facilitating the emergence of a “museum without walls”, a term first introduced by André Malraux in 1953, smartphones have revolutionised 'the way in which the cultural heritage sector engage

---

<sup>77</sup> Carmen Camarero and Jose Ma Garrido, “Fostering innovation in cultural contexts: market orientation, service orientation, and innovations in museums,” *Journal of Service Research* 15, no. 1 (2011), 2-12. <https://doi.org/10.1177/1094670511419648>.

<sup>78</sup> Kidd and McAvoy, *Immersive Experiences*.

<sup>79</sup> For further bibliography on the *StreetMuseum* app see Barrett, *The Phenomenalisation of Heritage*.

public audience, inspiring major changes in the way the heritage is communicated and experienced by visitors.<sup>80</sup>

At a time when cultural heritage institutions were highly aware of the possibilities afforded by the capabilities of smartphones, and many of them had already successfully introduced mobile applications, a new sensibility towards the challenges related to the adoption of these experiences is growing. There are indeed several barriers to the development of mobile apps: practical (copyright issues, lack of infrastructure such as Wi-Fi in the building), organisational (working in silos, lack of digital literacy) or financial. The latter in particular can be an issue since ‘a bespoke app won’t be cheap<sup>81</sup> and sites are seldom in the position of commissioning these experiences without strategic planning. Discussing the result of their workshop *Mobile Experiences: Cultural Audience (ME:CA)*, founders of the interpretation agency *Frankly Green*, Lindsey Green and Alyson Webb argue that for many heritage sites:

‘mobile is often an extra activity that is in competition for resources at a time when government funding to culture and the arts has been slashed and the recession has hit other income streams. But it isn’t just the level of funding that is proving challenging; funding structures are also an issue. Often funding is based around capital spending on technological innovation. These projects can be high risk, are often based on unrealistic assumptions and frequently lack a realistic operating budget.<sup>82</sup>

---

<sup>80</sup> Galani and Kidd, *Evaluating Digital Cultural Heritage*.

<sup>81</sup> Jo Reid, *How AR, apps and digital placemaking are driving innovation for heritage sites* (Bristol: Calvium E-book, 2021), 11. <https://calvium.com/free-e-book-how-ar-apps-and-digital-placemaking-are-driving-innovation-for-heritage-sites/>.

<sup>82</sup> Lindsey Green, Alison Webb, and Martha Henson, “Mobile culture: innovating the audience experience, not the technology”, *Guardian*, June 7, 2013. <https://www.theguardian.com/culture-professionals-network/culture-professionals-blog/2013/jun/07/mobile-museums-audience-experience-technology>.

There is indeed a general consensus amongst heritage practitioners about the economic and organisational impact of introducing new technologies at their site. The 2013 Heritage Lottery Fund's guidance on good interpretation practice states that:

'you should only use new technology if that is what an assessment of your aims, audience, messages and budget indicate. The use of new technology should not usually be the first option to consider, but can certainly be the best solution in some circumstances.'<sup>83</sup>

So, while mobile is a powerful tool for audience engagement, it is not 'a silver bullet that will enable visitors to engage by simply delivering more stuff'.<sup>84</sup> In the light of such reflections, it is inevitable that conversation needs to shift from enthusiastically embrace the technology, towards more sustainable approaches to organically integrate the (mobile) experience design in the heritage context. The urge is now to moving from designing mobile experience towards designing the whole experience of the site that the mobile app facilitates. Creating a mobile experience is a design activity which ought to take the context and audience into considerations.

Amongst the many questions that these considerations could raise, one summarises all the concerns related to mobile app introduction: how can we design successful digital products and services in complex organizations with multiple stakeholders who have different levels of comfort with innovation and risk? In the hope to find an answer to this, Mann and Grace suggest to think 'less about "products" and more about "services"'.<sup>85</sup> In their words, designing a service rather than a product will prompt us to look at this long standing issue from a new perspective. By stepping back from the

---

<sup>83</sup> Heritage Lottery Fund, *Interpretation guidance*.

<sup>84</sup> Green, Webb, and Henson, *Mobile culture*.

<sup>85</sup> "A new look to an old friend. Reevaluating the Met's audio-guide service," Laura Man and Grace Tung, , 2015, accessed May 13, 2023. <https://mw2015.museumsandtheweb.com/paper/a-new-look-at-an-old-friend-re-evaluating-the-mets-audio-guide-service/>.

specificities of the latest hardware features, service design allows museums to understand and design for the visitor experience as a whole. Service design approach, though well established in the commercial sector, is relatively new methodology in the museum field.<sup>86</sup> This approach entails the deliberate creation of experiences with the objective of effectively addressing visitor needs, necessitating a comprehensive comprehension of visitor needs throughout the entirety of their user journey, spanning from initial awareness to the guide's influence on the overall museum experience. By doing so, the design of visitor access to the service can be viewed as a way to consider a series of barriers or hurdles that need to be overcome for the service to function as a cohesive whole; if one of these barriers can't be crossed, then anything else that follows is rendered irrelevant.

The need of establishing some foundational approaches for visitor-focused design of an experience is a shared concern of heritage professionals, creative industry and arts and humanities scholars. The local and economic impact of these heritage experiences has led to governmental funded initiatives between the creative industry and academic institutions to define a new understanding of commercial and public value. According to recent research by the Royal Society of Art, the creative industries accounted for 2.3 million jobs in 2021 and their gross value added (GVA) increased by 41.4% in real terms between 2011 and 2019, more than 2.5 times that achieved by the UK economy as a whole. Furthermore the Creative PEC, funded in its first five years by the Arts and Humanities Research Council's £55 million Creative Industries Clusters Programme, was itself a beneficiary of this development. The accompanying £39.3 million UK Research and Innovation (UKRI) Audience of the Future investment

---

<sup>86</sup> Andy Polaine, Lavrans Løvlie and Ben Reason. *Service Design: From Insight to Implementation* (New York: Rosenfeld Media, 2013).

in immersive virtual, augmented and mixed reality technologies is now being succeeded by a £76 million public investment in the virtual production capabilities of the UK screen and performance industries.<sup>87</sup>

In the light of this consideration, a growing body of research, with particular reference to studies of the business of tourism, has focused then on the adoption of a customer orientation in the cultural sector, and accordingly it articulated “customer-oriented” frameworks to help shape the design of a visitor offer. In service management studies, for customer experience is intended ‘the customer’s personal interpretation of the service process and their interaction and involvement with it during their journey through a series of touchpoints, and how those things make the customers feel’.<sup>88</sup> Accordingly, the customer experience design describes the set of decisions that the provider - the site, has to consider in creating and managing the points of contact with the customer - the visitor, to support the realisation of a successful customer experience<sup>89</sup>. However, as recently highlighted by Ponsignon, Durrieu, and Bouzdine-Chameeva, often the site’s intention, so the intended experience, does not align with the customer’s perception of the actual experience, that is the actual realised experience. In their work on the experience design for a wine museum in Bordeaux, they argue that what is needed to structure the design is ‘a joint approach that simultaneously addresses both provider and customer perspective’.<sup>90</sup> Indeed, it is only by comparing these two experiences, the intended and the realised, that is possible to

---

<sup>87</sup> “The State of Creativity. Policy, Research, Industry. 2023,” NESTA, accessed November 29, 2023, <https://pec.ac.uk/research-reports/the-state-of-creativity>.

<sup>88</sup> Robert Johnston and Xiangyu Kong, “The customer experience : a road-map for improvement Managing,” *Service Quality* 21, no.1 (2011). <http://doi:10.1108/09604521111100225>.

<sup>89</sup> Iis P. Tussyadiah, “Toward a theoretical foundation for experience design in tourism,” *Journal of Travel Research* 53, no. 5 (2014). <https://doi.org/10.1177/0047287513513172>.

<sup>90</sup> Frederique Ponsignon, Francois Durrieu and Tatiana Bouzdine-Chameeva, “Customer experience design: a case study in the cultural sector,” *Journal of Service Management* 28, no. 4 (2017), 765. <https://doi.org/10.1108/JOSM-01-2017-0016>.

identify design characteristics that produce the desired effects on customers. The role of the organisation is 'to ensure the alignment between intended and realised experience to allow for the creation of a successful customer experience which translates into high levels of customer satisfaction and loyalty.'<sup>91</sup>

In other words, by gaining a profound understanding of visitors' needs and expectations, that is "knowing your audience", the site can then be empowered to make informed choices regarding the key aspects of the experience. This, in turn, enables the creation of sustainable and valuable experiences that benefit both the audience and the site. Exploring, observing and understanding experience design therefore involves taking an operations perspective focussed on addressing the question of how organisations can organise and orchestrate the tangible and intangible characteristics that are important to the visitor.<sup>92</sup> Those characteristics are a critical factor since, as Falk argues, the first point of engagement between visitors and the site 'begins with the public seeking leisure experiences that meet specific identity related needs'.<sup>93</sup>

Thinking at the design of a mobile apps in terms of a service offered to your visitors, helps also in overcoming issues related to the adoption of mobile apps at heritage sites. In particular, it helps find 'clarity in their identified purpose'<sup>94</sup> of the experiences,

---

<sup>91</sup> Ponsignon, Durrieu and Bouzdine-Chameeva, *Customer experience design*, 769.

<sup>92</sup> Madeleine Pullman and Michael A. Gross, "Ability of Experience Design Elements to Elicit Emotions and Loyalty Behaviors," *Decision Science* 35, no. 3 (2014). <https://doi.org/10.1111/j.00117315.2004.02611>.

<sup>93</sup> John Falk, "Understanding museum visitors' motivations and learning," in AAVV, *Museums Social Learning and Knowledge Producing Processes, Copenhagen, Danish Agency For Culture*, 106-127. Copenhagen: Kulturstyrelsen, 2013. [https://slks.dk/fileadmin/user\\_upload/dokumenter/KS/institutioner/museer/Indsatsomraader/Brug\\_erundersogelse/Artikler/John\\_Falk\\_Understanding\\_museum\\_visitors\\_\\_motivations\\_and\\_learnin\\_g.pdf](https://slks.dk/fileadmin/user_upload/dokumenter/KS/institutioner/museer/Indsatsomraader/Brug_erundersogelse/Artikler/John_Falk_Understanding_museum_visitors__motivations_and_learnin_g.pdf).

<sup>94</sup> Sylaiou Styliani et al., "Virtual museums, a survey and some issues for consideration," *Journal of cultural Heritage* 10, no. 4 (2009). <http://doi.org/10.1016/j.culher.2009.03.003>.

which sometimes sites lack. The question which is often oversight is: what are you uniquely placed to offer and how can this exude through an organisation? James MacQuaid, a visitor experience expert, in his 2014 article *Audience engagement in arts and heritage: the traps we fall into* explores how heritage can be still relevant and appealing to people in a world radically changed by digital technology. He states:

‘Interestingly, when an organisation is looking for growth in existing or new audiences, it often dances around the elephant in the room. It might look at brand, marketing, tone of voice; it might devise a campaign or set up a project designed to appeal to new audiences; it might even create project posts. The elephant in the room in this case is the actual culture and core activity of an organisation: how does it speak for you and to the audiences your wish to attract? How integrated and congruent does it feel? Will your audiences see themselves in your people and your messages?’<sup>95</sup>

Thanks to the ever growing capabilities and availability of immersive technologies such as AR and VR, the possibility that museums might be well-placed to cultivate engagement through emotions, and in turn speak to more audiences, ‘has become a seductive logic.’<sup>96</sup> However, mapping the terrain of emotion in the heritage and museum studies literature is quite complex, as when issues of emotion have been approached, it has been done so in a piecemeal and not entirely systematic way.

Formative works which set the field directions are Lowenthal’s *The Past is a foreign Country* published in 1985, which is perhaps the key work, and the collection by Chase and Shaw *The Imagined Past: History and Nostalgia* released few years later in 1989. Following studies eschewed emotion as entirely problematic, given the apparent view

---

<sup>95</sup> Jonathan MacQuaid, “Audience engagement in arts and heritage: the traps we fall into,” *Guardian*, October 6, 2014. <https://www.theguardian.com/culture-professionals-network/culture-professionals-blog/2014/oct/06/audience-engagement-arts-heritage-traps>.

<sup>96</sup> Kidd, *With New Eyes I See*, 57.

of emotions as a reactionary backwards glance to the past within a strongly nationalist approach towards heritage.<sup>97</sup> Criticism of nostalgia in particular was and continues to be rampant, and linked to ‘reactionary and conservative views, commercialization, sentimentalism and outright ignorance.’<sup>98</sup> Although there has been a sustained critique of this characterization of nostalgia both within and outside of heritage studies<sup>99</sup>, the idea of the “duped” public, consuming a sanitized and consensus national narrative via heritage and museum visiting, underwrote and continues to frame approaches to emotion in heritage and museum studies. In 2009, Smith and Waterton wrote there was an ‘elephant in the room of heritage and museum studies – that pachyderm is the recognition, or rather lack of recognition, of affect and emotion as essential constitutive elements of heritage making.’<sup>100</sup> Indeed, emotion was seen as somehow “dangerous” in achieving a balanced understanding of the importance of the past in the present. Empathy is questioned as ‘something that substitutes shallow identification for appropriately rigorous historical understanding.’<sup>101</sup> This is because emotions have also, especially in relation to individual and social memory, commonly been dismissed as subjective and unreliable<sup>102</sup>, although there is now a substantive literature that argues that reasoning, cognition and memory depend on emotion.<sup>103</sup>

---

<sup>97</sup> Hewison, *Heritage industry*.

<sup>98</sup> Laurajane Smith and Gary Campbell, “The elephant in the room: heritage, affect and emotion,” in *A Companion to Heritage Studies*, ed. by William Loga, Máiréad Nic Craith, and Ullrich Kockel (London: Wiley-Blackwell, 2015), 444. <https://doi.org/10.1002/9781118486634.ch30>.

<sup>99</sup> For extended critiques of this tendency, Smith, *Uses of Heritage*.

<sup>100</sup> Laurajane Smith and Waterton Emma, “Constrained by commonsense: the authorized heritage discourse in contemporary debates,” in *The Oxford Handbook of Public Archaeology*, ed. by Robin Skeates, Carol McDavid and John Carman (Oxford: Oxford University Press, 2012), 49. <http://hdl.handle.net/1885/26708>.

<sup>101</sup> *Ibid.*, 49.

<sup>102</sup> Sue Campbell, “Our Faithfulness to the Past: Reconstructing Memory Value,” *Philosophical Psychology* 19, no. 3(2006). <https://doi.org/10.1080/09515080600690573>.

<sup>103</sup> Ute Frevert, *Emotions in History - Lost and Found* (Budapest: Central European University Press, 2011). Margaret Wetherell, *Affect and Emotion: A New Social Science Understanding* (London: Sage, 2012).



The “immersive turn”, which sees increasing emphasis on sensorial and “hands on” experiences, electronically mediated by mobile applications and often co-authored by the communities they serve, has often been seen as populist and puerile by traditionalists. The growing number of mobile practices and participatory initiatives has harshened the debate over the validity of “value free” knowledge of expert in contrast to more emotional approaches. Such critical position has been reasserted also by more traditional heritage approaches, which privilege a certain mentality in the management of heritage and museums, which has played an important role in maintaining negative attitudes to emotion in heritage.

Nowadays, the connection between heritage and local communities is further reinforced and redefined by the revival of the 1960s urban design concept of placemaking, which has been recuperated by creative practitioners and the tourism sector for fostering public engagement at heritage sites.<sup>104</sup> With the aim of targeting local communities, this revival has been strongly leveraging mobile applications because these ‘can make the heritage, and any urban environments, more accessible to a diversified audience thanks to the capabilities of the app to provide a multi-layered experience with age-appropriated activities<sup>105</sup>. By fostering the user experience of a historical setting that is ‘memorable, evocative, and distinctive, an experience that results in engaging with space rather than observing it’<sup>106</sup>, practices of placemaking are encouraging more sustainable forms of connection with the heritage, which is even

---

<sup>104</sup> Greg Richards and Lian Duif, *Small cities with big dreams: Creative placemaking and branding strategies*. New York: Routledge, 2018.

<sup>105</sup> “What is digital placemaking?,” Bristol+Bath Creative R+D, accessed November 29, 2023, <https://bristolbathcreative.org/article/about-digital-placemaking>.

<sup>106</sup> Cameron and Kenderdine, *Theorizing Digital Cultural Heritage*, 175.

more relevant now in the wake of the ‘culture shock’ caused by the COVID-19 pandemic.<sup>107</sup>

We are indeed seeing cultural heritage sites feel the pressing need to undergo sustainable transformation and reorganization in order to cultivate cultural resilience during the post-COVID recovery period. The introduction of lockdowns has generally exacerbated the already stressed financial and operational structure of many heritage sites. Their inability to operate forces them to close, postpone, or cancel their services to their audiences, causing in turn loss of income of visitors and revenues. On the other end though, the pandemic has also highlighted the benefits of introducing digital technology<sup>108</sup> to cater for a general public re-evaluation of heritage sites’ value<sup>109</sup> and through museum of proximity<sup>110</sup>.

Overcoming the challenges imposed by the imperatives of the ‘experience economy’ and the recent pandemic, means putting at the core of the design the value proposition. Indeed, it is only by defining the value proposition and understanding what type of relationship exists or can be encouraged with outside communities, users or non-users, heritage organisations are enabled to enhance public engagement in a

---

<sup>107</sup> Pier Luigi Sacco and Ekatarina Travkina, “Culture Shock. COVID-19 and the cultural and creative sector,” (Paris: Organisation for Economic Co-operation and Development (OECD), 2020) [https://www.researchgate.net/publication/344191530\\_Culture\\_shock\\_COVID19\\_and\\_the\\_cultural\\_and\\_creative\\_sectors](https://www.researchgate.net/publication/344191530_Culture_shock_COVID19_and_the_cultural_and_creative_sectors).

<sup>108</sup> Ng, Wai-Kit, Hsu Fu-Tien and Chen Chung-Lian, “The Impacts of Digital Technology on Service Design and Experience Innovation: Case Study of Taiwan’s Cultural Heritage under the COVID-19 Pandemic,” *Systems*, 10 (2022). <https://doi.org/10.3390/systems10050184>.

<sup>109</sup> Joanna Sofaer, Ben Davenportb, Marie Louise Stig Sørensenb, Eirini Gallouc and David Uzzelld, “Heritage sites, value and wellbeing: Learning from the COVID-19 pandemic in England,” *International Journal of Heritage Studies* 27, no. 11 (2021). <https://doi.org/10.1080/13527258.2021.1955729>.

<sup>110</sup> Eleonora Lupo, “Design visions for the Cultural Heritage sector in the post-pandemic crisis: designing for ‘CH and museums of proximity,” in *In 14th International Conference of the European Academy of Design, Safe Harbours for Design Research, Blucher Design Proceedings*, ed. Leon Cruickshank et al. (São Paulo: Blucher Publishing House, 2021). <http://doi.org/10.5151/ead2021-121>.

resilient and sustainable manner. This entails that visitors themselves, who ‘represent the central element that is processed to create the service’, can eventually gain more agency both as users and actors.<sup>111</sup> In the next section, we will see how the analytics, generated by the tracking capability of smartphone, have been used to understand how visitors engage with heritage sites, by looking at some experimental examples to get a sense of the future directions of these computational approaches applied to research in digital heritage.

#### **1.4 Heritage in the computational age.**

In experience-centric design approaches, “knowing your audience” is the first step that site should take to initiate the process of designing a mobile app. However, the process of observing and listening to audience does not end with the delivery of the experience, rather it extends across all the different stages of the visit. “Remedial evaluation” and “summative evaluation” are two concepts heritage practitioners are familiar with, as they give them the opportunity to really understand if the design of the experience has been producing the intended experience aligns with the realised experiences.<sup>112</sup> Traditionally, initial visitor profiling is carried out by collecting data personally via surveys or by collating data from tracking visitor interactions with the site, for example through ticket sales, library cards, website analytics.<sup>113</sup> Similarly, post-visit visitors data

---

<sup>111</sup> Ponsignon, Durrieu and Bouzdine-Chameeva, *Customer experience design*, 779.

<sup>112</sup> Stephen Bitgood and Harris H. Shettel, “An Overview of Visitor Studies,” *The Journal of Museum Education* 21, no. 3 (1996). <https://doi.org/10.1080/10598650.1996.11510329>.

<sup>113</sup> Nicole Basaraba, Jennifer Edmond, Owen Conlan, and Peter Arnds, “A Data-Driven Approach to Public-Focused Digital Narratives for Cultural Heritage,” in *The Palgrave Handbook of Digital and Public Humanities*, ed. Ann Schwan and Tara Thomson (London: Palgrave MacMillan, 2022). [https://doi.org/10.1007/978-3-031-11886-9\\_18](https://doi.org/10.1007/978-3-031-11886-9_18).

are captured via surveys, either carried out on site, by phone and online, using questionnaires.<sup>114</sup>

The adoption of mobile apps as visitor however opens up a new array of possibilities by providing a further set of 'big data' that can be queried and processed to know your audience and understand what type of visitors' behaviours the mobile app triggers within and outside the physical space of the site. The interaction with mobile apps, thanks to the device's tracking capabilities, generate a wealth of information about user which are stored by corporate dashboards, with Google Analytics being perhaps the most popular example. These dashboards are used by millions of companies, non-profits (including universities), and individuals to understand what people say about them online, to compare themselves to competitors, and to research global conversations and posts about any keyword, URL, or brand. The widespread implementation of technologies such as AI and machine learning has seen a profusion of algorithmic mediations and all manner of AI smart data machines, which corporate sectors are using to profile users of digital products and evaluate their behaviours<sup>115</sup> and can offer an up-to-date knowledge of the app's public realm.<sup>116</sup>

These analytics dashboard have been increasingly used also as tools for 'cultural analysis' in relation to the types of data they capture, namely activities on social networks (following, sharing, liking, etc.) and text posts of blogs and websites.<sup>117</sup> While the use of research software is not new, the "computational turn", as termed by

---

<sup>114</sup> Falk, *Understanding museum's visitor*.

<sup>115</sup> Fiona Cameron, *The Future of Digital Data, Heritage and Curation in a More-than-Human World* (London: Routledge, 2011).

<sup>116</sup> Jo Morrison, "Digital Placemaking and user experience," in *Hidden Cities. Urban Space, Geolocated Apps and Public History in Early Modern Europe*, ed. Fabrizio Nevola, David Rosenthal and Nicholas Terpstra (London: Routledge, 2022). <https://doi.org/10.4324/9781003172000>.

<sup>117</sup> Lev Manovich, "The Science of Culture? Social Computing, Digital Humanities and Cultural Analytics," *Journal of Cultural Analytics* 1, no 1 (2016). <https://doi.org/10.22148/16.004>.

Berry<sup>118</sup>, in the humanities and social sciences has stimulated the use and development of these tools to aid and facilitate the research process.<sup>119</sup> 'As our archives and our social world as a whole became increasingly digitised'<sup>120</sup>, researchers too unsurprisingly began to record, measure, map, and capture data to investigate the emergent digital society.<sup>121</sup> However, as Cameron points out, 'such trends, as yet largely unacknowledged in the heritage field, have only started to be explored by some experimental approaches.'<sup>122</sup>

Despite the wealth of insightful analytics data generated by the heritage apps, heritage scholars have in fact only begun to leverage their potential.<sup>123</sup> Within tourism and visitor studies, there is a growing body of research on the potential of mobile experiences as tracking tool to manage visitors of museums and gallery.<sup>124</sup> The focus of these works is on the operational aspect of the experience, investigating the impact of mobile experiences on the overall experience of the site they facilitate<sup>125</sup>, with the aim to prove that digital innovation with immersive technologies, mobile apps included,

---

<sup>118</sup> David Berry, "The computational turn: thinking about the digital humanities," *Culture Machine* 12 (2011). <https://hdl.handle.net/10779/uos.23407976.v1>.

<sup>119</sup> Karin van Es, Mirko Tobias Schäfer and Maranke Wieringa. "Tool Criticism and the Computational Turn. A 'Methodological Moment'" *Media and Communication Studies* 69, no. 1 (2021). <http://dx.doi.org/10.5771/1615-634X-2021-1-46>.

<sup>120</sup> Van Es, Schäfer and Wieringa, *Tool Criticism*.

<sup>121</sup> Manovich, *The Science of Culture?*.

<sup>122</sup> Cameron, *The Future of Digital Data*, 22.

<sup>123</sup> Teresa Graziano and Donatella Privitera, "Cultural heritage, tourist attractiveness and augmented reality: insights from Italy," *Journal of Heritage Tourism*, 15 no. 6, (2020). <http://doi:10.1080/1743873X.2020.1719116>. Lena Liang and Eliot Statia, "A systematic review of augmented reality tourism research: What is now and what is next?," *Tourism and Hospitality Research*, 21, no.1 (2021). <https://doi.org/10.1177/2F1467358420941913>.

<sup>124</sup> Mariapina Trunfio, Salvatore Campana and Adele Magnelli, "Measuring the impact of functional and experiential mixed reality elements on a museum visit," *Current Issues in Tourism*, 23 no. 16 (2020). <https://doi.org/10.1080/13683500.2019.1703914>.

<sup>125</sup> Mariapina Trunfio, Maria Della Lucia, Salvatore Campana and Adele Magnelli "Innovating the cultural heritage museum service model through virtual reality and augmented reality: The effects on the overall visitor experience and satisfaction". *Journal of Heritage Tourism* 17, no. 7 (2021). <https://doi.org/10.1080/1743873X.2020.1850742>.

is generally deemed beneficial.<sup>126</sup> More experimental works have been looking at concept of 'visitor intelligence', a framework collating all the data streams generated by a visitor during a visit of the site - spanning from GPS tracking, eye-tracking sensors, text analytics and wearables, that heritage managers could implemented to better profile visitors' behaviours.<sup>127</sup>

Tracking data retrieved from mobile app as a result of their usage in urban heritage contexts have been largely exploited also to address issues related to smart cities and overtourism.<sup>128</sup> These issues are at the forefront of the agendas of major heritage organisations, whose recent programmes. For example, the UNESCO Creative Cities, aim to exponentially increase the number of initiatives looking at transforming cities into "creative cities"<sup>129</sup>, and in turn propel "creative tourism", through embracing technologies and computational approaches. In the attempt to find the right balance between promotion and management<sup>130</sup>, heritage sites all around the world are increasingly adopting 'smart' approaches to tourism destination management, especially in urban settings.<sup>131</sup>

---

<sup>126</sup> Elsa Gatelier, David Ross, Laura Phillips and Jean-Baptiste Suquet, "A business model innovation methodology for implementing digital interpretation experiences in European cultural heritage attractions," *Journal of Heritage Tourism* 17, no. 4 (2022). <https://doi.org/10.1080/1743873X.2022.2065920>.

<sup>127</sup> Smart et al., "A panoptic framework of visitor intelligence," in *The CAUTHE 2020. Vision: New Perspectives on the Diversity of Hospitality, Tourism and Events, Auckland, New Zealand, February 2020*, 301-304 (Auckland: Auckland University of Technology, 2020). <https://search.informit.org/doi/10.3316/informit.9780473509231>.

<sup>128</sup> Ulrike Gretzel, "Intelligent systems in tourism: A Social Science Perspective," *Annals of Tourism Research* 38, no. 3 (2011). <https://doi.org/10.1016/j.annals.2011.04.014>.

<sup>129</sup> Richards and Duif. *Small cities with big dreams*, 2018.

<sup>130</sup> Rachel Dodds and Richard Butler, "The Phenomena of Overtourism: A Review," *International Journal of Tourism Cities* 5, no. 4 (2019). <http://doi.org/10.1108/IJTC-06-2019-0090>.

<sup>131</sup> For an overview of other projects, Dimitrios Buhalis and Rosanna Leung, "Smart Hospitality – Interconnectivity and Inter-operability towards an Ecosystem," *International Journal of Hospitality Management* 71 (2018). <https://doi.org/10.1016/j.ijhm.2017.11.011>. Mariana Cavalheiro, Luiz Joia and Gabriel do Canto Cavalheiro, "Towards a Smart Tourism Destination Development Model: Promoting Environmental, Economic, Socio-cultural and Political Values," *Tourism Planning & Development* 17, no. 3 (2020). <https://doi.org/10.1080/21568316.2019.1597763>.

Listed World Heritage Sites have proactively tried to tackle common challenges of governance, population and tourism via satellite research-based initiatives in collaboration with academic partners and international funding bodies. In particular, the focus is on use of AI and big data using scholarly developed software.<sup>132</sup> The EU funded *Mediterranean Sustainable Tourism* programme, for example, has been supporting the development and implementation of a series of local projects for ‘smart city’ solutions, including but not limited to *Herit-Data* project for the UNESCO site of Florence. The main objective of the project is to use intelligent systems for tourists’ flow planning with the aim of alleviate tourist pressure on heritage cities. Their pilot monitoring dashboard, *Snap4City*, collects the tracking data from the Municipality of Florence app *FeelFlorence*, both mobile and web versions, and from a companion platform, *Twitter Vigilance Herit-Data Real Time* tracking the sentiment analysis of visitors’ tweets and retweets.<sup>133</sup> The projects so far mentioned are only few of the many converging now into a growing body of research in tourism studies using computational approaches to mitigate issues and address questions concerning the preservation and the promotion of heritage.

It is only in the past few years that there has been an interest towards the potential of investigating user-generated analytics data of mobile apps to understand the level of audience engagement with the location-based storytelling. Looking at mobile experiences for tourism, several clusters of research are observed which measure the

---

<sup>132</sup> Asterios Stroumpoulis, Evangelia Kopanaki and Sotirios Varelas, " Role of Artificial Intelligence and Big Data Analytics in smart Tourism: a resource based view approach," *WIT Transactions on Ecology and the Environment* 256, (2022). <http://doi.org/10.2495/ST220091>.

<sup>133</sup> "Snap4City," accessed November 29, 2023. <https://www.snap4city.org/dashboardSmartCity/management/iframeApp.php?linkUrl=https://www.snap4city.org/drupal&linkId=snap4cityPortalLink&pageTitle=www.snap4city.org&fromSubmenu=false>.

user experience, in particular in relation to visitor satisfaction and intention to revisit.<sup>134</sup> These works though tend to prefer a cross-sectional approach, intended as a study of aggregated data to a specific time-slice, to a longitudinal investigation of the datasets, and therefore provide a skewed understanding of the actual long-term impact of the mobile experience in terms of enhanced audience engagement. A first attempt in this direction is provided by an experimental article by Nevola, Cole and Mosconi on the analytics of *Hidden Florence* app, a geolocated tour for the city of Florence.<sup>135</sup> Whereas this work focuses on evaluating the use of mobile apps in relation to smart tourism strategies, the data analysis has also surfaced some initial reflections about the actual benefits and the limitations of using quantitative data to evaluate the qualitative aspects of the user experience, namely the effectiveness of situated storytelling for enhanced audience engagement with the site.

There is an emergent consensus that quantitative approaches, such as user behaviour tracking/analytics or Likert rating systems to evaluate user satisfaction ‘in themselves do not adequately capture the nuances of participation in such encounters.’<sup>136</sup> A widespread ambivalence emerged towards practices that push for new means to gather, quantify and analyse data solely on their own merits without a critical approach as to their uses, benefits and wider consequences. This has been voiced by debates in the field of cultural analysis, which assert that there are other ways of knowing, experiencing and describing the world beyond this that are themselves compatible with – indeed enabled by – networked objects operating as part of the Internet of the Thing. This new consciousness towards “tool criticism” echoes the one seen in the

---

<sup>134</sup> Liang and Stata, *A systematic review of augmented reality tourism*.

<sup>135</sup> Fabrizio Nevola, Tim Cole and Cristina Mosconi, “Hidden Florence revealed? Critical insights from the operation of an augmented reality app in a World Heritage City,” *Journal of Heritage Tourism* 17, no. 6 (February 2022). <https://doi.org/10.1080/1743873X.2022.2036165>.

<sup>136</sup> Galani and Kidd, *Evaluating Digital Cultural Heritage*.



past decade within the digital humanities, whose researchers were pioneers in the adoption of digital methods for research. Using big data analysis for cultural experiences, that is cultural analysis, have been extensively investigated in the field of digital humanities, where there is a critical and interpretive tradition in what has been termed critical digital humanities.<sup>137</sup> Amongst the concerns raised by researchers of cultural analysis there bias of representativity, ethical issues and in particular ambiguity, which refers to the aggregated nature of results which 'is openly in contrast with the 'particular, singular' approach typical of humanities.'<sup>138</sup> The aggregation and reduction to common is a paradigm borrowed from the history of statistics and computer science, which does not account for diversity, variability, and differences among behaviours, and individuals.

The situation has been further worsened by the introduction in May 2018, of the new privacy safeguarding regulation, the General Data Protection Regulation (GDPR) regulation, to whom third-parties are obliged to comply. This requires appropriate measures to be in place to ensure privacy via consent that must be obtained for the processing of data.<sup>139</sup> Whereas the GDPR has caused great stir among developers, it is important to highlight that also prior to this new privacy law, demographics and interests data may have only be available for a subset of users, and thus may have not represented the overall composition of app traffic. Such filtering approaches are part of what the tech communities refers to as 'data minimization' by which providers

---

<sup>137</sup> Lev Manovich, "Introduction to Info-Aesthetics," in *Antinomies of Art and Culture: Modernity, postmodernity, contemporaneity*, ed. by Terry Smith, Okwui Enwezor and Nancy Condee (Durham and London: Duke University Press, 2008). Rob Kitchin, *The Data Revolution: Big Data, Open Data, Infrastructures and Their Consequences* (London: SAGE).

<sup>138</sup> Manovich, *The Science of Culture?*.

<sup>139</sup> Department of Legislation - General Data Protection Regulation, 2016, accessed October 23, 2023, [www.legislation.gov.uk/eur/2016/679/contents](http://www.legislation.gov.uk/eur/2016/679/contents). Information Commissioner's Office - Privacy in Mobile Apps, December 2013, accessed October 23, 2023, <https://ico.org.uk/media/for-organisations/documents/1596/privacy-in-mobile-apps-dp-guidance.pdf>.

aim at safeguarding the privacy of their users by reducing the volume of data shared with public. However, this new GDPR privacy approach has significant (not necessarily positive) effects which go beyond the set of demographics data, but affect also the way in which a user location is provided. In the light of these changes to legislation, the review of the app analytics might be misleading, provide us a picture that is not representative of actual user behaviour, and thus not recount the actual real value of the app in terms of performance. Further work is needed involving the analysis of the use of the apps on-site, but also recording the views of both museum staff and users. In order to study the complex set of parameters involved, a wide range of methodological tools would be required, and in some cases, innovative approaches, while taking into account ethical issues, such as the need to respect user's privacy.

In drawing this chapter to an end, we can conclude that tracking analytics are ultimately 'active mediators'<sup>140</sup>, and should be treated as such by researchers. Because these tools do epistemic work of recording, filtering, and processing, therefore their premises and appropriateness for research purposes need to be critically evaluated. Researchers thus need to understand what arguments are possible and consider their limitation represented by the built-in assumptions and biases of the tool. In the words of van Es and Schäfer:

'this, for us, is key, to question the innocent, uncritical, and unreflective use of tools. Such "blunt instrumentalism" should be an important topic in critical conversations about the future of each field of research.'<sup>141</sup>

---

<sup>140</sup> van Es, Schäfer and Wieringa, *Tool Criticism*, 63.

<sup>141</sup> *Ibid.*, 64.

## **1.5. Conclusion.**

This chapter looked closely at the emergence of mobile apps, and the ways that cultural heritage sites have utilised this particular mobile platform in bringing together smartphone, heritage and situated storytelling. What we have seen thus so far is that mobile heritage apps have developed from a digital version of the traditional portable museum audio tour, towards 'in your pocket' immersive experiences that leverage the narrative potential of the tangible and intangible heritage. In achieving this the heritage sector has been supported by the rapid pace of the technological advancements, which have facilitated the development of increasingly interactive platforms that creative practitioners have been exploiting to deliver ever engaging activities for visitors. Whereas this has led to an unprecedented number of apps for the cultural heritage, which have been commercialised for multiple purpose, little attention has been given so far at these practices in terms of defining the design and narrative conventions which allow the sites to create an experience that is in line with their site characteristics. In order to address this gap, the next chapter will provide a timely revision of the app conventions, contributing to the current research by adding a new category of interest, the narrative strategies, accounting for emergent design approaches in the situated immersive storytelling.

Smartphones have changed the way in which people consume heritage, and this change, while enthusiastically welcomed, has also prompted discussions and investigations within both practical and academic contexts. As result of the hype of the first ground-breaking apps, within the heritage sector the debate has seen practitioners initiating a conversation about the after-math of this enthusiastic adoption. This led to the emergence of a new sensibility towards "the technology trap" and the need of more

organic mobile practices, ones that account for the audience's needs and desire, while being resilient in the respect of the value and mission of the heritage sites. While highly aware of the imperatives of the experience economy in its constant search of new audiences, the heritage sector started to reconsider the value of these mobile apps less in terms of fancy gimmicks to lure more visitors and more as a powerful element of a larger service that the site provide to the visitors to meaningful connecting with them. In doing so, the heritage sector has opened up a line of exchange with researchers and professionals from the creative industry seeking to find guidance on how best leverage smartphones for their missions. This is the time when the first design frameworks have been developed by scholars in the HCI field, with the objectives of defining a working model that allows to agile production, while making the most of the tech and software capabilities of the device to produce engaging experience. One of the pioneering and most investigated frameworks for app development is the 'Experience Design Framework', elaborated by Calvium researchers, which will be further investigated in the chapter 3 using as a case study an site-specific phone-based trail developed using this framework during my research-in-residency at the agency.

Academic research too looked in this direction, with trending works looking into experience-centric approaches toward the design of the experiences which give attention to the operational aspect of the site, pegging the research on seminal works on museum and visitor studies. Leading up to contemporary days, the shift towards more customer-oriented design led inevitably to thinking at the role of heritage in the UK economy, and how this leveraging on it could help heritage sites to be more economically resilient, a topic ever particularly relevant given the current struggling situation of some sites as the aftermath of the recent COVID-19 pandemic. Such

understanding is at the core of the business model of the project VISTA AR, whose mobile experiences will be the case studies investigated in chapter 4. The experience design proposed by this project advocates for the importance of defining a value proposition in order to understand how the site can benefit of introduction a digital experience. Key step for articulating is knowing your audience, with the goal of aligning their needs and wishes with a visitor offer that accounts for the organisational type of the site. The analysis of the case study focuses precisely on if and how the design of mobile apps shaped around the value proposition of the site impacts on the design of the user experience, and if the resulting experience is more organic and long-term resilient.

Within the current landscape, we have seen that methods for audience profiling have been expanded thanks to the introduction of the smartphone and their tracking affordance. Major heritage institutions, such as the UNESCO, have started to exploit these data, with the specific purpose of understanding and possibly change users' behaviours, mainly in response to issues of overtourism. Academic research in relevant fields has only been started to leverage the potential of these data, and the evaluation of the analytics of *Hidden Florence* app in chapter 5 represents one of the first attempt at exploring the use of this data set for a qualitative review of the user experience, while surfacing its potential for tourism strategies. In investigating this case study, this research warns about issues of blunt instrumentalism, and aligns with the broad current literature in digital humanities and media study in recognising the pressing need for more tool criticism and for research in innovative ways to evaluate the user experience of mobile apps for heritage.

Ultimately, this chapter has highlighted the strong dynamism and synergies that the introduction of digital technology imbue the digital heritage landscape, and in particular the smartphone, has facilitated in terms of practices of interpretation and dissemination of the cultural heritage. The history of digital heritage over the last few years is rich of methodological turns and conceptual shifting, the unravelling of which this chapter aimed at illustrating. Many stakeholders contribute to mobile heritage practices, and as a result, these resonate with ongoing dynamics of social, economic, and political transformation. In drawing this conclusion to an end, this research advocates for 'stop being socially naïve about what heritage is'<sup>142</sup> and start to reflect on the fact that current definitions of heritage are inadequate for understanding the multiple roles that heritage plays in contemporary societies. In acknowledging this, it is the right time now for a stronger conceptualisation of what heritage is, how it is used creatively, and how it can be sustainably innovated over time. As a result, mobile heritage apps assume a new meaning, no more a nice-to have gadget, but a sustainable mean for the heritage site to keep a conversation with the contemporary world, while reiterating the importance of heritage and its value.

It is with this renewed understanding of mobile practices that in the next chapter, this research charts the design and narrative conventions for the design of mobile apps and how these are creatively used for more resilient practices that respond to both users and site's needs. By doing so, it will be highlighted the increased importance of such creative practices in the development of more organic and sustainable experiences, which mix tech affordances and storytelling to recount alternative and

---

<sup>142</sup> "We need to stop being socially naïve about what heritage is," Celia Luterbacher, accessed October 29, 2023. <http://actu.epfl.ch/news/we-need-to-stop-being-socially-naive-about-what-he/>.

neglected narrative, bringing heritage into the contemporary broader socio-cultural discourse.

## **Chapter 2. Qualitative design conventions for mobile heritage experiences.**

### **2.1. Introduction.**

As we have seen in the previous chapter, the advent of BYOD tours on personal devices has replaced several of the rental devices traditionally provided by museums and heritage sites. This has led to the establishment of a new genre of interpretation, the mobile heritage apps. These experiences are designed around the combinations of the multiple dimensions defining the media: hardware affordances - such as GPS, interface, sensors and haptics, software affordances, namely the capability of apps to multilayer contents, and narrative conventions. Over the past decade, an array of mobile apps have been successfully introduced to heritage sites, and as at the “immersive turn” has just unleashed, we are seeing a growing number of sites engaging with location-based narrative.

As embedded practitioner, a first struggle that I have encountered working with heritage sites is that often they do not have a clear understanding of how to shape the user experience of an app, in particular which media content could be used, what are the tech affordances that could be exploited, and how others heritage creators were using them and for what purposes. So I started compiling my own baseline, annotating the features that characterised the apps I was experiencing, in order to help outline my work. In doing so, I followed the steps of many other researchers who, like me, wanted to get a better grasp at what an app can “contain” in terms of media content. The taxonomy proposed in this chapter is the result of my embedded research, of all the mobile AR tours that I experienced, as user and as creator. I need to cautiously remark that, at the pace by which apps are commercialised, it is difficult trying to stay



up-to-date, and perhaps by the time that this research is completed, other features might have come up and deployed. However, whereas a timely review is commended, the main goal of this classification is to show, by outlining the different tech and digital conventions, how an app can be more than a simple container of content, rather it can be an active mediator in conveying stories that engage users. In a time when, as we have seen, apps rarely get more than a 1,000 downloads, it is important to understand the reasons behind their poor performance and stimulate solutions to it.

The overarching aim of this chapter is therefore to outline the design conventions for mobile heritage applications in terms of technological and narrative affordances that smartphones allow for the creation of a mobile interpretation. In order to do, this research process started by looking at state-of-art of the academic research on current app classification. It will be seen here that several typologies of mobile heritage experiences have been elaborated, with the latest trend proposing classifications which focus foremostly on the media contents of mobile heritage applications. Having identified in one of these recent works a good framework of categories of interest, I have decided to adopt it to propose my classification. Critical literature review, paired with knowledge gathered as practitioner and observer of several heritage apps, has allowed me to expand the categories of interests, by introducing a new category, which I called “narrative strategies”. In simple terms, this category refers to well-established storytelling approaches adopted by heritage interpreters and curators to foster a cognitive and emotional engagement with the storytelling. Delving further into the analysis of this category, ultimately, we will see that narrative strategies have been successfully employed to as a mean to stimulate immersion and empathy with the situated storytelling, and strongly resonate with this research process of understanding how the design of mobile experiences can be more sustainable, avoiding quick

obsolescence, while ensuring that the message it conveys helps heritage discourses to remain relevant in a rapidly changing world.

## **2.2 Overview of the existing classifications.**

Since the early days of adoption of mobile devices for heritage interpretation, practitioners from the heritage sector and the creative industry have been designing and commercialising a growing number of mobile experiences. Yet, little scholarly research has been conducted so far to better understand current commercial practices. As cultural heritage is moving towards incorporating more diverse location-based narratives, there is an increasing urge of filling this gap by compiling a timely taxonomy of the design and narrative conventions for creating mobile experiences. The purpose of this section is to chart the development of current classifications of mobile applications created for cultural heritage sites, in order to understand the current academic guidelines available for producing mobile heritage applications.

Scholars have to date approached categorizations or typologies of locative media applications in many ways. In the literature, one of the key dimensions taken into account as starting point for classifying mobile applications is the locativity of the location-based experience, which is not surprising since one of the fundamental properties of mobile technology is to be “functionally bound to a location”.<sup>1</sup> As seen in chapter 1, in their pioneering research on “hybrid space” resulting by the use of locative media, Sutko and de Souza e Silva define mobile interfaces as “technological filters”<sup>2</sup>

---

<sup>1</sup> Rowan Wilken, “Locative media: From specialized preoccupation to mainstream fascination,” *Convergence: The international Journal of Research into New Media Technologies* 18, no. 3 (2012).

<sup>2</sup> Adriana de Souza e Silva and Daniel M. Sutko, “Theorizing Locative Technologies Through Philosophies of the Virtual,” *Communication Theory* 21, no. 1 (2011). <https://doi.org/10.1111/j.1468-2885.2010.01374>.

that support users to 'manage interactions with city space'.<sup>3</sup> Being the locativity – that is the device capacity of geolocating a user, perhaps the most revolutionary aspect of the first mobile phones, it has been a criteria used as proposed base for several types of classification. For example, seeking to find a common language for locative media scholars and users, Nitins and Collins have focused upon user activity as a way to define what locative media artifacts are what they should be.<sup>4</sup> They identify five main categories of use and purpose of the experience which are: social annotative, commercial annotative, navigational, and location-based services, and location-based gaming. Farman too looks at the type of user activities analysing them through the lens of mobile interfaces.<sup>5</sup> Framing the encounter using mobile media of the user-space-society in terms of “sensory-inscribed” body, Farman identifies an array of activities which echoes previously recognised mobile media practices, from mapping to location-aware social networks and locative games. Farrelly instead proposes a taxonomy of mobile applications which is still based on locality but focused more on the operational aspects of the application, and in particular on their geolocate functionality.<sup>6</sup> Looking at the modalities in which users interact with locative media within the hybrid space, he classifies applications by their capabilities of geolocated the user and spatially contextualise the information.

---

<sup>3</sup> Michael Saker and Jordan Frith, “From hybrid space to dislocated space: Mobile virtual reality and a third stage of mobile media theory,” *New Media and Society* (2018). <http://doi.org/10.1177/1461444818792407>.

<sup>4</sup> Tanya Nitins and Christy Collins, “Grounding the Internet’: Categorising the geographies of locative media,” *Media International Australia* 146, no. 1 (2013). <https://doi.org/10.1177/1329878X1314600110>.

<sup>5</sup> Jason Farman, *Mobile Interface Theory. Embodied Space and Locative Media* (New York and London: Routledge, 2012).

<sup>6</sup> Glen E. Farrelly, “Claiming Places: An Exploration of People's Use of Locative Media and the Relationship to Sense of Place.” (PhD diss., University of Toronto, 2017).

A similar attention to the capability of mobile media to situate knowledge by “walk-to-unlock” is at the core of the several works. This mobile ability of digitally augmenting the physical space until now has been mostly explored in location-based games<sup>7</sup>, everyday urban navigation<sup>8</sup>, performance<sup>9</sup>, art and literature projects<sup>10</sup>, and museums.<sup>11</sup> Eventually all the locative practices investigated in these works share a common ground in the idea that locality, that is location data, will ever play a vital role in the development of contextualised narrative across different practices.

Mobile applications have been extensively investigated also in terms of tech affordances.<sup>12</sup> One of the latest contribution in this direction is by Oppegard, who proposes a classification methodology based on non-functional requirements.<sup>13</sup> Common non-functional requirements are related to the mobile device characteristics (such as its small form factor), wireless technology usage and connectivity, security, privacy and interoperability considerations. Based on critical review of two cases studies of mobile applications for heritage sites, his work proposes a classification of apps structured around ten main concepts: user awareness, device awareness, location awareness, spatial awareness, contextual awareness, social capabilities,

---

<sup>7</sup> Farrelly, *Claiming Places*, 58.

<sup>8</sup> Tom Liao and Lee Humphreys, “Layered places: Using mobile augmented reality to tactically reengage, reproduce, and reappropriate public space,” *New Media and Society* 17, no. 9 (2015). <https://doi.org/10.1177/1461444814527734>.

<sup>9</sup> Jocelyn Spence, Adrian Hazzard, Sean McGrath, Chris Greenhalgh and Steve Benford. “The Rough Mile: Testing a Framework of Immersive Practice,” in *Proceedings of the 2017 Conference on Designing Interactive Systems-DIS '17 (2017)*(New York: ACM, 2017). <https://doi.org/10.1145/3064663.3064756>. Steve Benford and Gabriella Giannachi, *Performing mixed reality*. Cambridge, MA: MIT Press, 2011.

<sup>10</sup> Anders Loevlie, “Locative literature: Experiences with the textopia system,” *International Journal of Arts and Technology* 4, no. 3 (2011). <http://doi.org/10.1504/IJART.2011.041479>.

<sup>11</sup> Oppegard and Rabby, *Proximity*.

<sup>12</sup> Christos Emmanouilidis, Remous-Aris Koutsiamanis and Aimilia Tasidou, “Mobile guides: Taxonomy of architectures, context awareness, technologies and applications,” *Journal of Network and Computer Applications* 36, no. 1, (2013). <https://doi.org/10.1016/j.jnca.2012.04.007>.

<sup>13</sup> Brett Oppegard, “From orality to newspaper wire services: Conceptualizing a medium,” in *Communication and Technology*, ed. Lorenzo Cantoni and James A Danowski (Berlin-Boston: Walter de Gruyter Press, 2015).

search capabilities, hyperlinking capabilities, interactive capabilities, and analytic exhaust. Oppegaard argues that by addressing these questions, it is possible to determine how well an app takes advantage of mobile affordances and therefore inform a more detailed classification of the mobile applications which goes beyond the broad taxonomies organised around the potential uses of mobile media.

Whereas classifications solely based on tech affordances sets the ground for classifications that explore the full potential of mobile technologies, their sustainability is kerbed by the evolving nature of the mobile media. As Erdal *et al.* have described it, any attempt to approach classification by tech affordance would be as aiming at a 'dynamic and rapidly morphing target' while trying not to 'missing wildly'.<sup>14</sup> Within the media studies community, it is generally agreed that technology does not stand still. Here, it is important to briefly introduce the concept of tech obsolescence before looking at its effect on the mobile application content and the proposed solutions to it. In simple terms, technological obsolescence represents a devaluation of an item due to technological progress, and thus is usually happens when a new technology or product replaces an older one which need not necessarily be dysfunctional.<sup>15</sup> In other words, there is a difference between functional and technical obsolescence, with the former referring to loss of attractiveness of the product, while the latter refers to the loss of function due to the passage of time and the related tech advancement. Whereas technical obsolescence happens naturally over time, functional obsolescence results from an intentional decision by the manufacturer, often as a result of controversial strategy of planned obsolescence. Ultimately, while these works

---

<sup>14</sup> Ivar John Erdal et al., "Invisible Locative Media: Key Considerations at the Nexus of Place and Digital Journalism," *Media and Communication* 7, no. 1 (2019). <https://doi.org/10.17645/mac.v7i1.1766>.

<sup>15</sup> Mohamed Arezki Mellal, "Obsolescence – A review of the literature," *Technology in Society* 63, Article 101347 (2020). <https://doi.org/10.1016/j.techsoc.2020.101347>.

offer a great understanding of design possibilities with geolocated apps, they focus on classifying the apps by the type of activity you can do on site with them, as Farman states, these theoretical approaches privilege practice over specific devices.<sup>16</sup> However, ‘the need to clearly describe mobile app artifacts’<sup>17</sup> is a concern shared by many scholarly creators, and is one of the knowledge gap identified for current works so far mentioned which focus instead on ‘classifying potential courses of action’<sup>18</sup>, that is what type of action and how apps allow the users to do.

Only recently, scholars have been suggesting to fill this gap by approaching the classification using ‘a more clear-cut typology of mobile media content.’<sup>19</sup> This means creating a list of media content to outline conventions for the specific sector of heritage with the aim of supporting practitioners during the development of a mobile app. Using as case study a mobile guide for the tourism office of Malta, Boiano, Bowe and Gaia propose an often cited preliminary typology of mobile media content for heritage interpretation.<sup>20</sup> Pegging on previous research on app design by HCI principles, the parameters identified by this study aim at reducing the cognitive load and creating a seamless user experience. In summary, according to their research, a user-friendly app should feature an interactive map, clear audio file with little background music, small size downloading file, short videos if included to limit screen interference, social media share buttons and access to distributing platform analytics. Notwithstanding the non-exhaustive nature of their work in terms of elements composing a mobile heritage

---

<sup>16</sup> Farman, *The mobile Story*.

<sup>17</sup> Oppegaard, *From orality to newspaper*, 204.

<sup>18</sup> Basaraba et al., *Digital narrative conventions*.

<sup>19</sup> Erdal et al., *Invisible Locative Media*, 171.

<sup>20</sup> Stefania Boiano, Jonathan Bowen and Giuliano Gaia, “Usability, Design and Content Issues of Mobile Apps for Cultural Heritage Promotion: The Malta Culture Guide Experience,” in *EVA London 2012 Conference Proceedings, Electronic Workshops in Computing (eWiC)*, ed. Stuart Dunn, Jonathan P. Bowen and Kia Ng (London: British Computer Society, 2012). <https://doi.org/10.48550/arXiv.1207.3422>.

trails, it is important to highlight how this work laid the foundations of future research on the development of a typology for this type of experiences. The work by Boiano, Bowe, and Gaia has been recovered by another more recent work by Basaraba *et al.* which expanded the list of media content by deploying a novel approach to the compilation of the design conventions for mobile heritage trails.<sup>21</sup> Based on more than fifty commercial apps, their survey offers a valid baseline for defining some preliminary content and design conventions. In order to establish a baseline for these type of experience, the work approaches the analysis of the application using the technique of the “app walkthrough”.

A well-established genre of cultural practice, the walkthrough method is a classification approach extensively deployed within the industry to evaluate commercial products, and more recently it is emerging as a technique for critically analysing digital products and therefore also mobile applications.<sup>22</sup> It involves a systematic and meticulous observation and documentation of an app's interface, features, and activity flow. This process requires a deliberate slowing down of routine interactions to enable critical analysis. Through a careful walkthrough, the researcher simulates the everyday use of the app and makes note of technical aspects such as login requirements, the placement of icons, photos, and text, and other relevant design elements. Built on a scholarship in culture studies, namely the Actor-Network Theory (ANT), the walkthrough method focuses on how technologies shape culture while simultaneously being a product of it.<sup>23</sup> By critically examining the app as a sociotechnical artefact, the

---

<sup>21</sup> Basaraba *et al.*, *Digital narrative conventions*.

<sup>22</sup> Ben Light, Jean Burgess and Stephanie Duguay, “The walkthrough method: An approach to the study of apps,” *New Media & Society* 20, 3 (2018). <https://doi.org/10.1177/1461444816675438>.

<sup>23</sup> The ANT theory views user interfaces and functions in apps as non-human actors that can act as mediators. Although to the best of my knowledge this is a uncommon practice in the heritage sector, an example of this approach would see a heritage trail app tracking psychographic data, such as a user's affinity for organic food, in order to suggest nearby farms and cafès.

method reveals intricated details about the artefact in question, creating a narrative of use and allows for comparative analysis. Analogous approaches have been used in user experience design studies<sup>24</sup>, but what differentiates the app walkthrough approach is that it focuses on the connection between the context in which the experience is taking place and the app's technical interface.

By using the walkthrough approach, Basaraba *et al.*'s work aims to uncover which modalities are used, how they are integrated into the app from a design perspective, and how they communicate narrative content. Following the analytical framework of the walkthrough method, their research baselined over fifty apps, articulating the analysis of them around four distinct areas of an app: its vision, that is its intended purpose, potential uses, and target users; the operating model, including any underlying political and economic interests such as monetary exchange or personal data collection; governance, which defines the app's rules and guidelines in terms of types of activity and/or users); and a technical walkthrough of its features for critical analysis. The latter has been structured into three main categories based on their type: technical, sociotechnical, and content analysis. The technical category pertains to the technical nature of the app's design, including the usability of its interface, as well as the "mobility" aspects of locative media, such as location awareness and connectivity. The sociotechnical category, on the other hand, focuses on all the elements related to the overall vision of the app, including required login procedures, its operating model (such as the treatment of personal data and monetary exchange), and governance (including rules for branding and the purpose of the experience). The final category of content analysis focuses on the "embodied spatial experience" that

---

<sup>24</sup> For a review of the methods see Oppegaard, *From orality to newspaper*.



users have when interacting with locative heritage apps. This category places emphasis on the type of content that the application provides, such as audio and augmented reality (AR), as well as the overall purpose of the app, including whether it aims to educate users or engage them in a locative game. The findings of the technical walkthrough were in fact coded into four qualitative data categories of interest: usability (interface design and navigation), content modalities (maps, icons, text, audio, images, video and AR), narrative techniques (fictional content, gaming, and transmedia) and personalisation.

Of particular interest is the introduction of the category of narrative techniques which is relevant to the objective of this research on two levels. First of all, the choice of a technique is informed and in turn shapes the other categories. For example, in terms of the usability of the application, that is what type of interface design and navigation are best suited for this visitor offer, the choice of creating a game will privilege audio and visual prompts over text. As we will see in the next chapters, often, if not always, the type of narrative represents the cornerstone around which the design of the application is structured. Furthermore, the focus on narrative techniques allows to introduce within the classification a critical variable to the design of the mobile application, the location-based storytelling, which as it will be discussed later, it has been largely investigated in relation to heritage interpretation.

Yet, this classification presents some limitations too. With regarding to the mobile applications analysed, there is a bias in the choice of the survey criteria, namely in terms of the language used for the search of the apps (only English) and the query of only one distributing platform, Google Play. Furthermore, at a conceptual level, the quantitative nature of their work intended as a baseline means that the analysis under-

investigates more qualitative aspects of the mobile heritage trails. In particular, little attention has been given to the design conventions characterising the location-based storytelling, that is all the narrative strategies which are distinguishing traits of the genre of heritage interpretation using mobile devices.

In the next sections, the chapter delves into the classification, by describing each category of interests. Four main categories of design conventions will be described: usability of the interface, content modalities, narrative techniques, and personalisation. In doing so, examples of apps will be used to support the explanation. This chapter also addresses the qualitative gap identified in the work of Basaraba *et al.*, by critically expanding the classification including a new qualitative category of interest, termed as “narrative strategies”. This new category aims at providing an overview of the different affordances granted by the mobile device by which a narrative can be designed or enriched to deliver engaging experiences. The examples used to support the description of all the categories are AR mobile tours which I experienced over the time of my embedded research. By AR app here, it is intended any type of augmentation, sound and visual.

### **2.3. Usability of the interface.**

This first category of interest refers to the usability of the interface, that is the how elements of the interface, such as buttons and commands, are designed to be easily understood by users. Human-Computer Interaction experts and mobile application developers have always had a keen focus on interface design, prioritising usability and efficiency as key design objectives, in order to develop novel solutions to address flaws of the user-screen interactions. This approach, known as interaction design,

involves designing interactive and innovative products that cater to the needs of individuals in their personal and professional lives. The overarching goal of interaction design is to create a seamless and intuitive digital experience for users, driven by a comprehensive understanding of the underlying issues. This is too often an overlooked component of the design of mobile apps. However, as scholars are increasingly using apps for immersive experiences, this is a critical aspect to consider, especially in the light of the fact that researchers agree that generally the first challenge happens at the level of the tech.<sup>25</sup>

The design of mobile heritage app too includes attention to interface design, prioritising usability and efficiency as key design objectives. In particular, given the highly mobile nature of these experiences, typically involving walking, the prevailing trend has been to establish a system of cognition. This involves recognising that in any form of human-computer interaction, users will attempt to construct a mental model of the system to inform their interactions with it. This approach is especially pertinent in the context of location-based mobile experiences, where considerations such as user safety and the overall experience of the site must be taken into account in addition to the delivery of digital content.<sup>26</sup> Great emphasis has been given to reduce cognitive overload by providing task-relevant content, thereby minimising the number of required interactions and ensuring that the user's real-world navigation and awareness of their physical surroundings remain unimpeded.<sup>27</sup> Accordingly, scholars have been identifying specific design parameters to reduce cognitive load and create a seamless

---

<sup>25</sup> Kidd, *'Immersive' heritage encounters*.

<sup>26</sup> Michael Haahr, "Location-based augmented-reality games for cultural heritage," in *Serious Games. JCSG 2017. Lecture Notes in Computer Science, vol 10622*, ed. by Mariano Alcañiz et al. (New York: Springer, Cham). [http://doi.org/10.1007/978-3-319-70111-0\\_29](http://doi.org/10.1007/978-3-319-70111-0_29).

<sup>27</sup> Panos Kourouthanassis, Costas Boletsis and George Lekakos, "Demystifying the design of mobile augmented reality applications," *Multimedia Tools and Applications* 74 (2013). <http://doi.10.1007/s11042-013-1710-7>.

user-experience.<sup>28</sup> Generally, HCI researchers recognise in usability a factor that influences the measurement of the interaction and the overall user experience is the usability.<sup>29</sup> Usability is commonly understood as a qualitative attribute that assesses quality in-use, that is how easy application are to use. Scholars have identified few design golden rules which help users to engage into a smooth interaction with the device.<sup>30</sup> The evaluation metrics taken in consideration are several, including but not limited to responsiveness of the interface, easiness to use, efficiency of the digital solutions, and so on. For the specific case of mobile applications, practitioners generally recognise three main requirements for usability compliance: consistency of the interface, efficiency, and satisfaction.<sup>31</sup>

Consistency of the interface, generally considered one the most important rules, is an aspect that should be critically designed. This means that commands and mechanisms should provide always the same feedback. Similarly, the “look and feel” of the mechanisms, and generally of the interface, should be the same across the experience. Being a critical feature to help users master the interaction mechanisms to speed up the process of familiarisation, it has been largely investigated, mainly by creative industry and gaming experts. They have been looking at user leaning

---

<sup>28</sup> Reid et al., *Experience Design Guidelines*; Boiano, Jonathan, and Gaia, *Usability, Design and Content Issues of Mobile Apps*.

<sup>29</sup> Nielsen, Jakob, *Usability Engineering. In: What is Usability?* (London: Morgan Kaufmann, 1994).

<sup>30</sup> The ISO (International Standard Organization) presents a set of usability guidelines, Nielsen's guideline and Shneiderman's 'Golden Rules of Interface Design' being the most widely accepted in the specialised literature. See, Azham Hussain and Elaine Ferneley, “Usability Metric for Mobile Application: A Goal Question Metric (GQM) Approach,” in *Proceedings of the 10th International Conference on Information Integration and Web-based Applications & Services (iiWAS '08)*. Association for Computing Machinery (New York: Association for Computing Machinery, 2008). <https://doi.org/10.1145/1497308.1497412>.

<sup>31</sup> Danielly F.O. de Paula, Bianca H.X.M. Menezes and Cristiano C. Araújo, “Building a Quality Mobile Application: A User-Centered Study Focusing on Design Thinking, User Experience and Usability,” in *DUXU Part II*, ed.A. Marcus, (2014). John Gong and Paul Tarasewich, “Guidelines for handheld mobile device interface design,” In *Proceedings of the DSI 2004 Annual Meeting* (2004).

behaviours and realised that learning to become competent with the game interaction depends on how intuitive and consistent the interface is.<sup>32</sup>

Efficiency is all about reducing the cognitive load by providing an intuitive design. A first important step to take in this direction is minimising the short-term memory load by designing functional buttons, such as the home page or exit command, that are easily recognisable. The aim is to keep minimal the short-term memory load, relying instead on recognition of function choices instead of memorization of commands, because an efficient interface means user's satisfaction. Unlike with websites and static application, designing 'walk-to-unlock' apps means accounting for the safety of the users engaging with the app whilst walking. Therefore, one of the golden rules for mobile experiences is keep the need for screen-based interaction minimal. consistency means keep the way in which geofenced regions are consistent, in their inception and stop. Sound, haptics, and movement (in the case of GPS triggered apps) should be the principal means through which familiarity with the app is gained rather than extensively relying on visual instructions (cf. text or video). Using the same trigger sounds makes explicit to users the type of interaction they are supposed to engage with. For example, in the app Tower Bridge *Family Learning Trail* a background loop of footsteps played between sound files, while in *Hidden Florence*, a pseudo-historical jingle sets off alerting the users that they entered the geofenced areas and are approaching the point of interest. To familiarise the users to the mechanism of "walk-to-unlock" apps generally also feature a starting page in which users are given basic

---

<sup>32</sup> Brown *et al.* looking at immersion within computer games, recognise three stages of immersion: engagement, engrossment and total immersion. See Emily, Brown and Paul, Cairns, "A grounded investigation of game immersion," in *Proceeding CHI '04 Extended Abstracts on Human Factors in Computing Systems* (Atlanta, Georgia: DSI Georgia State University, 2004).

instructions to learn to use the different control and mechanisms and to practice the interaction.

Users' satisfaction with an interface design is generally measured by the overall ease of use the app. A first obstacle is generally the unfamiliarity of users to the type of application. Clearly outlining the different interface interactions can help too in fostering easiness to use. Interface design that remediates website designs are the easiest to use since allows users to translate their digital literacies from website to apps. The design of the home page with a simple bar menu including all the most important command (e.g., menu, information, tour, etc) provides clear indication of where to start exploring the app content. Another strategy is structuring the interface with content flexibility, that concerns the choice of information. The idea is that contents of the app should be organised in a 'top-down' way, presenting high levels of information and let users decide whether or not to retrieve further details. For example, *Hidden Florence* provides two layers of content - main audio track and 'discover more' track) in the format of a Chinese box, nesting the latter at the end of the track of the main narration.

Ultimately, the design of the interface needs to be intuitive and reduce the cognitive load in order for the users to become familiar with the apps. Familiarity with tech, as we have seen, is one of the main causes of "break" of the immersion with the experience, and this is therefore a critical aspect that should not overlooked. Having briefly looked at what are the interface design conventions for apps, in the next section we will look at the most popular contents of the apps.

## 2.4 Content modalities.

The design of mobile heritage experiences is defined by the presence of different content modalities such as maps, icons, text, images, audio, video, and AR. The design of the combination of these content modalities is strongly informed by good principles of HCI.

### *Maps and pin markers*

A content generally attested in all the mobile heritage experiences is the map<sup>33</sup>. Maps are indeed a good companion tool to GPS apps to aid user navigation of the trail and the point of interests (POI). Generally, the maps are retrieved from Google Maps for navigation, but some apps also use custom maps. For example, both the *Battersea Power Station Trail* and the *Climate Trail* feature maps are custom-made with a graphic style (e.g., colour palette and fonts) consistent with the branding and style of the commissioners (Figure 2.1). A unique example is offered by *Hidden Florence* which features as navigational map a detailed bird-eye view of XVI century Florence, superimposed to the base layer of the contemporary OpenStreetMap (Figure 2.2). Icons are a content extensively used within apps. Alongside being part of the interface navigation (e.g., menu and info), icons can be used to mark the location of the point of interest on the map. Three common icon styles for the pin markers are identified: numbered, non-numbered and custom icon pin markers. While generally the most common style is numbered pin marker since it guides users in wayfinding around the trail, sometimes they are branded to the application's logo for a homogenous style with

---

<sup>33</sup> Basaraba et al., *Digital narrative conventions*, 15.

the interface icons. For example, the *Climate Trail* app features a bright orange icon which echoes the website's colour palette of the site (Figure 2.1). Usually the pin markers are interactive and by clicking on them the users is led to the app page specific to the point of interest. In order to reduce the cognitive load, apps feature a change in the pin colour or shape after the users have interacted with it. For example, the icon in *Hidden Florence* changes shape from numbered dot to square (Figure 2.2). Despite not featuring a map, also the *Family Learning Trail* presents a change in the pin markers after the visitors have reached the POI. The user journey is visualised as a linear sequence of POI, and a tick icon changes colour from green to orange when users manually record the arrive at destination (Figure 2.3). The presence of feedback of the interaction with the pin marker is simple yet effective at providing the users with an intuitive mean of measuring their progress.

#### *Visual modalities (text, images, video and AR)*

All the mobile heritage apps contain visual content, being it a combination of text and images, or written information accompanying a AR reconstruction. Text is a fundamental component for apps, and it is used to provide instruction and (extra) information about the app and the trail. Even an app like the *Family Learning Trail*, which is designed to be predominantly image-based for greater accessibility (cf. children and non-English speakers), features some written content, offered to users in a non-intrusive "top-down" way (Figure 2.3). While text-based interfaces offer users access to information, they can also lead to frequent interruptions in the user's engagement with their physical environment. As mentioned before, one of HCI golden rules of interface design is keep the screen interaction minimal since the screen is generally considered a detractor to the immersion provided by the location-based



experience. On the other hand, providing text, including subtitles and transcripts, may be more suitable for users who prefer to consume information in written form, alongside making the app more accessible to hearing-impaired users. A solution increasingly adopted is to allow users personalisation of the content by de/selecting written information. The *Climate Trail* lets the users chose if they prefer enjoy the AR without extra information simply by closing the superimposed written layer (Figure 2.4).

Keeping the screen interaction minimal has a practical side too, that is to minimise the impact of weather and light conditions such as strong sunlight or rain when these trails are often consumed outdoor, or where there might be issues regarding the users' safety, for example with the uneven floor and steps of an ancient building. The increase use of AR solutions, which leverage the screen to trigger visual contents, represents a challenge to traditional good HCI practices about safety, as we have seen with the big debate about 'staying safe while playing *Pokémon Go*'.<sup>34</sup> Further research needs to be done in this sense in order to understand how to minimise risks, and for now, the solution is provide a 'warning statement' to users before starting the experience.

Images too, as could be expected, are extensively used in mobile heritage apps. They can be employed to complete a text in a format that remediates websites, and as visual support or replacement to POI. Three different layout styles have been identified: galleries, single photos at the top of a POI tab with text-based content, and embedded photos throughout the text within the tab. The *Battersea Power Station* app features a gallery of pictures relevant to the narration of the POI (Figure 2.5), while the *Family Learning Trail* uses images as POI icon with embedded text-based wayfinding

---

<sup>34</sup> "Staying safe while playing Pokémon Go," Ginsberg & O'Connor, accessed November 29, 2023, <https://www.ginsbergglaw.com/articles/staying-safe-while-playing-pokemon-go/>.

instructions (Figure 2.3). Since the images are often used with the purpose of providing an incentive for bonding with the narrative and as a further proof of its authenticity, the majority of the pictures included in the heritage trails are historical pictures, as seen in the *Battersea Power Station* app (Figure 2.5).

Videos are little attested in heritage apps. This is due to the difficulty of embedding high-quality videos without overloading or compromising the software performance of native apps (i.e. those apps that do not rely on real-time data streaming over a network). Nevertheless, in some cases, a video is the most appropriate choice to offer users with contextual information which any other format would not convey proficiently. The *Family Learning Trail* features an integrated video with text-on-screen to provide the instructions for the paper game of “Origami Boat” (Figure 2.6).

AR modality (cf. visual augmented reality), it is attested an increasingly growing number of heritage trails featuring this technology. After the *Pokémon Go* hype in 2016, rapid advancements in tech development are perfecting the technology and progressively lowering the production costs, granting access to the AR to the wider public. Indeed, both *Battersea Power Station* app and the *Climate Trail* features AR visual reconstructions to bring to life alternative views of the place (Figure 2.7). Key affordance of AR is the combining of physical and virtual objects in real time whilst minimising task-switching, hence allowing for continuous use<sup>35</sup>. Given this affordance, it is only matter of time before this technology becomes ubiquitous in mobile heritage experiences.

---

<sup>35</sup> Kourouthanassis, Boletis and Lekakos, *Demystifying the design of mobile augmented reality applications*, 73.

### *Sound modalities (sounds and audio tracks)*

Sound is a pervasive element in mobile heritage trails which is used for multiple purposes. Even before the inception of geolocated technologies, audio-based trails have been a staple medium for heritage sites. Sound is used for voice over narration, but it could also be present in the form of (historical) sound effects, and/or instructions for wayfinding or interface navigation. HCI scholars and sound designers have investigated the several applications of sounds deployed in mobile heritage experiences<sup>36</sup>. Starting from the study of auditory icons that are brief sounds used to monitor events in user interfaces, sonification sets now a clear focus on the use of sound to convey information, something which has been quite neglected in the brief history of computer interfaces.<sup>37</sup> Three main content modalities are identified: contextualising (i.e. wayfinding), alertness, and immersiveness.

A first important application of sound in mobile heritage trails is to help the users contextualise themselves within the wider environment where the activity is taking place by aural directional prompts. While traditional wayfinding solutions rely heavily on the physical features of already built environments to provide navigational cues, mobile apps offer a flexible and dynamic alternative to improve the experience of wayfinding using aural content. The hands-free characteristic of this functionality supports more agile and safe navigation within the urban space. Directional audio, achieved via binaural recording, appears to be the most intuitive solution for aural contextualising and it is now used alongside more traditional instructions. First

---

<sup>36</sup> For an overview of the scholarship, see Michael A. Nees and Bruce Walker, "Auditory interfaces and sonification," in *The Universal Access Handbook*, ed. Christos Stephanidis (New York: CRC Press, 2008).

<sup>37</sup> Gaëtan Parseihian et al., "The process of sonification design for guidance tasks," *Wi: Journal of Mobile Media* 9, no. 2 (2015). <http://wi.mobilites.ca/gaetan-parseihian-the-process-of-sonification-design-for-guidance-tasks>.

experiments with binaural recordings date back to 19<sup>th</sup> century, but recently there has been a revival of studies on binaural recording techniques and their mobile applications<sup>38</sup>. Binaural audio is a technique that uses miniature microphones placed in the ears of a person or dummy head. The result is an incredibly lifelike 3D reproduction of sound.

Whereas complex to design, directional sounds can be used to “direct” the user’s eye gaze, allowing intuitive navigation whilst limiting screen interactions. To achieve this objective, several techniques have been developed, including binaural recording. Binaural recordings are now the standard for audio for mobile audio trails and the reason for it is that can also help the users getting a deeper sense of spatial contextualisation. With this type of recording, it is possible to achieve directional sound by recording voices and sounds from different positions to simulated the illusion of someone speaking behind you or from far away<sup>39</sup>. For example, in the *Lost Palace* app, the voices of the characters can be ‘eavesdropped’ by pointing the phone towards the multiple POI integrated in a building façade. The closest POI would reproduce a clear voice, while points far away would return whispers. Similarly, the audio tracks of Giovanni in *Hidden Florence*, or the bird calls in the *Climate Trail* are binaural recordings. Nonspeech auditory displays is also being used to fill gaps in accessibility related to alerting or warning functions. During an audio trail, headphones and speakers to some extent insulate the users from the surroundings, impairing their safety. On the other side, sound can be designed to grasp the user’s attention. A person can easily choose not to see something; on the contrary, it is difficult to choose

---

<sup>38</sup> Paul Stephan, “Binaural recording technology: A historical review and possible future developments,” *Acta Acustica united with Acustica* 95, 5 (2009). <http://dx.doi.org/10.3813/AAA.918208>.

<sup>39</sup> Benjamin Bernschütz, “Microphone Arrays and Sound Field Decomposition for Dynamic Binaural Recording,” (PhD diss., Technical University of Berlin, 2016), vi.

not to hear something. While the listener may not necessarily act upon every change in the soundscape, the alert sounds display allows for ongoing monitoring and awareness of a changing situation.

Sounds convey information at a faster rate and through shorter messages. In a straightforward “museum” style information mediascapes, a sound effect can be used to alert the user that they have entered a media region or that they have left a media region. As mentioned earlier, the *Hidden Florence* app features a little jingle which sets off as soon as the user enters the geofenced area of the point of interests they are searching for. The jingle is not supposed to provide wayfinding, since the users are free to follow the suggested path on the map or take an alternative way. The main function of the jingles is instead to alert users they should start to pay attention to the surroundings as they are approaching the next POI of the trail. Sound can be therefore used effectively to guide the user as to what they need to do or help with user interface control, while avoiding that the alert does not become repetitive and annoying to the user.

Being an excellent way of building up atmosphere, creating suspense and shocking the user, sounds can also be used to foster immersion. Binaural recording in particular allows a deeper sense of spatialization of the sound and a metaphysical relation with the aural dimension, resulting in feelings of immersion within the experience. The *Climate Trail* app features binaural recordings of the bird calls for each of the species. The possibility of listening to changes in modulation of the birds’ calls in relation to the users’ position makes the experience of encountering the birds more realistic. With the same purpose, historical sounds too are largely employed in mobile heritage experiences. In particular for those trails providing historical reconstructions, the use

of environment sounds contemporary to the timeline of the narrative grants more authenticity at the experience. In *Lost Palace*, the use of a background loop of crowd cheering sound was an important factor in keeping people in the experience of assisting at the execution of the king. However, background sounds and music introductions should be used parsimoniously, since they can be distracting and bring easily the users to sensorial overload<sup>40</sup>.

Sensorial overload is a potential issue that happens when sounds are not accurately designed. While theories on attentive listening suggest that while we live in a world full of sounds we actively chose which sound ignore or not<sup>41</sup>, the general HCI recommendation is to find the right balance between sounds, place and movements. For the sake of a pleasant and safe experience, it is necessary to gather a good knowledge of the space and the type of physical constraints or facilities available there (i.e. busy roads, rain shelter, benches, and so on) prior to the design of the app content. One last issue often discussed for use of sounds is isolation. As mentioned earlier, headphones generally, and mobile audio trails in particular, can indeed isolate users from environmental sounds and therefore compromise their safety. This is why it is crucial following good HCI principles of familiarity and consistency whilst designing the experience soundscape. There have also been concerns regarding the individualism of the experience using earphones. Yet, several field studies on users' behaviours using audio guides have proven otherwise. Results show that similar behaviours between users of audio tours and not in terms of discussing the experience with fellow visitors during and after the visit.<sup>42</sup>

---

<sup>40</sup> Boiano, Bowen and Gaia, *Usability, Design and Content Issues*.

<sup>41</sup> Barry Blesser and Linda-Ruth Slater, *Space Speak, Are you Listening? Experiencing Aural Architecture* (Cambridge, MA: The MIT Press, 2007).

<sup>42</sup> For a recent case-based study, see Surya Poudel and Gyan P. Nyaupane, "The Role of Interpretative Tour Guiding in sustainable Destination Management: A Comparison between

## 2.5. Narrative techniques.

Recent taxonomies of the types of locative storytelling identify two main forms of narrative for heritage experiences, an overarching story connecting distinct places, and distinct stories of one place.<sup>43</sup> In locative storytelling, an overarching story is one that connects multiple distinct locations in a way that creates a cohesive and meaningful narrative. For example, a heritage trail of a city might use an overarching story to connect several historic POI, weaving together individual stories and facts into a larger historical context. This type of narrative form can help visitors to better understand the historical significance of each site, and how they fit into the broader story of the city or region. The majority of the apps considered so far belong to this category. In contrast, distinct stories pertain to a single location or site, offering a more focused and localised narrative experience. Often, a heritage trail uses distinct stories to provide detailed information about a particular event or topic, rather than trying to connect them into a larger narrative. This approach can be particularly effective for providing visitors with a deep and immersive understanding of a single location or theme.

Within this overarching narrative format, each story is characterised by their communication style. For mobile heritage experiences, the work of Basaraba *et al.* identifies a total six different primary communication styles: educational/descriptive, documentary, tour guide, journalistic style (i.e. reporting, interviews), location-aware

---

Guided and Nonguided Tourists,” *Journal of Travel Research* 52, 5 (2013). <https://doi.org/10.1177/0047287513478496>.

<sup>43</sup> Farman, *The mobile story*. Brett Oppegaard, and Daniel Grigar, “The Interrelationships of Mobile Storytelling,” in *The Mobile Story: Narrative Practices with Locative Technologies*, ed. Jason Farman (New York: Routledge, 2014).

content (i.e. fiction and games) and blog/informal.<sup>44</sup>

### *Descriptive/educational style*

The descriptive/educational style is the most common narrative style across the mobile heritage experiences. Using the third-person POV, this style is formal and commonly used in historical non-fiction depictions, remediating standard museum boards, placards and labels. An example of the descriptive style is offered by the app *Battersea Power Station* whose audio tracks provide a wealth of information about the site, in addition to “Fact” section where further stories and curiosities are recalled (Figure 2.8). Whereas the descriptive/education style is informative, is not innovative in the context of mobile content delivery but fits well the primary goal for cultural heritage narratives is often to inform visitors about the history<sup>45</sup>.

### *Documentary and journalistic style*

Whilst sharing the informative goal of the previous style, the journalistic and documentary style are generally less attested for mobile heritage experiences. Rather than structuring all the narration, the journalistic style is used for providing more informative insights. For instance, in the *Hidden Florence* app there are several interviews with experts, namely scholars, which have been paired with more engaging storytelling by a historical fictional character, to find a balance between the fiction and the academic accuracy. This style is based on reports and/or interviews of different speakers to be featured in audio and video files. The uncommon use of this style may thus be searched in the already mentioned difficulty of embedding multiple videos in the app, alongside with the complexity of create an overall storytelling using interviews

---

<sup>44</sup> Basaraba et al., *Digital narrative conventions*.

<sup>45</sup> Lombardo and Damiano, *Storytelling on mobile devices*.



only. The journalistic style has nevertheless the immediate benefit of offering the listener more historical context together with a further layer of authenticity for the narrative, which is often a watershed for the success of the heritage experiences.

### *Informal/blog style*

Another communication style that suits well heritage trail apps is the informal/blog style. Using a first-person POV to communicate in an informal writing style commonly seen in blogs, this style can convey scientific and serious content in a more casual tone. This style is adopted by the *Climate Trail* app, since it has the benefit of conveying to the users the pressing concerns about global climate change and its impact on the coast in a less authoritative tone, helping them in turn to bond with the message without missing on the urgency of the explanation.

### *Tour guide*

A widely attested narrative approach is the tour-guide style. Its popularity is due to the users' familiarity with the format which mirrors a live tour guide with an engaging guiding personality. Indeed, the tour guide apps seek 'to inform and engage their audience in their surroundings, often accompanied by a historical narrative.'<sup>46</sup> Apps like *Hidden Florence* app belong to this type of narrative, since it employs a fictional historical character to lead the storytelling of the trail.

### *Location aware narrative (fiction and games)*

This narrative approach overlaps and almost merges with the broader category of

---

<sup>46</sup> David Millard et al., "The balance of attention: the challenges of creating locative cultural storytelling experiences," *Journal on Computing and Cultural Heritage (JOCCH)* 13, no. 4 (2020), 62. <https://doi.org/10.1145/3404195>.

location aware fiction since the two definitions are very similar, focusing both on the “engaging” quality of the experience. While, by definition the storytelling of location aware fiction narrative does not necessarily have an historical framework, it is unlikely to encounter fictional narrative trails at heritage sites which do not refer to a past timeline. For example, the *Lost Palace* app, which echoes previous geolocated drama experiences<sup>47</sup>, is a fictional reconstruction of true historical events happened at the Banqueting House in Whitehall, London. The narrative type of location aware games, classified under the category of location aware narrative, also includes fictional storytelling elements such as characters, narrators, and fictitious storylines to engage users. Whereas gamification techniques in the form of quizzes/trivia and games are not a common feature for heritage apps trails, more recently there has been an increase in the use of these technique for heritage trails. The *Family Learning Trail* and *Battersea Power Station* app both feature interactive play for children. Whereas the latter provide a series of three chapters of “play-to-unlock-next-level” mini games (e.g. a Tetris-like puzzles through the power station and match the pairs style) as companion activity to the audio trail (Figure 2.9), the whole *Family Learning Trail* is structured around games, conveying the educational aspect via “learning by stealth” featuring only few written informative vignettes (Figure 2.10).

Whereas there are many examples of locative games developed by academics for cultural heritage, the scholarly debate is about the best app dimension for gamifying an experience. Some scholars suggest that the best locative game mechanics and gameplay for cultural heritage relate to physical navigation of the site and engagement

---

<sup>47</sup> The reference here is to the well-known drama experience *Riot!1831* which is one of the pioneering works of this genre. See Reid et al., *Experience Design Framework*.

with gameworld representations of objects of direct relevance to the site itself.<sup>48</sup> Heritage trails can feature a gamified app navigation as scavenger hunt, like the *Family Learning Trail*, which offers the users with a series of “rewarding badges” along the tour (i.e. checking into a point of interest and receiving a reward for the accomplishment)(Figure 2.10). Other scholars instead find interactive storytelling a more appropriate gamification approach, in particular if accurate historical contents are used<sup>49</sup>. These experiences generally are structured too as scavenger hunts but strongly based on storytelling articulated on accurate historical content as main gamific characteristic.

## **2.6. Narrative strategies.**

Having introduced the narrative techniques generally attested for shaping the journey of a mobile trail at heritage sites, this section introduces a new category of interest, the narrative strategies. The addition of this extra category is strongly informed by my embedded research, as player and creator, and from the review of the current literature review. Whereas the four main narrative techniques so far introduced (tour guide, educational tour, fictional and game) provide a basic guidance on the overall tone of the storytelling, they do not account for the way in which this storytelling is structured to foster an emotional response, encouraging immersion and/or embodiment with the experience. The emotional and sensorial aspect of mobile experience is a growing interest within the creative scholars, who increasingly use the

---

<sup>48</sup> Boaventura DaCosta, and Carolyn Kinsell, “Serious Games in Cultural Heritage: A Review of Practices and Considerations in the Design of Location-Based Games,” *Educ. Sci.* 13, 1 (2023). <https://doi.org/10.3390/educsci13010047>.

<sup>49</sup> Poole, *Ghosts in the Garden*.

design conventions here identified to engage the users at a more emotional and sensorial level.<sup>50</sup>

Whereas meaningful learning and didactic function have been traditionally the preferred outcomes also for museum visits<sup>51</sup>, since the release in 1957 of the seminal work of Freeman Tilden on principle of interpretation, *Interpreting our heritage: principles and practices for visitor services in parks, museums, and historic places*, the role of heritage interpreters have been revolutionised.<sup>52</sup> Two of the six principles of interpretation put forward by Freeman Tilden over 40 years ago surely presumed an affective component. Tilden argued that ‘the chief aim of interpretation is not instruction but provocation.’<sup>53</sup> How better to provoke than through addressing the affective side of the visitor’s personality? He also advocated that interpretation must ‘address itself to the whole man rather than any phase’<sup>54</sup>, meaning that this must include people’s feelings and emotions. His book became a pivotal influence when it was used to define interpretation across disciplines and across hugely different cultural heritage sites. Sam Ham agrees that the only true difference any of us is capable of making with interpretation comes from the thoughts we manage to provoke (stimulate, challenge or inspire) our participants to think, thoughts that if we are skilful can lead to the outcome of provocation on the theme we have chosen.<sup>55</sup> Building on this, David

---

<sup>50</sup> Galani and Kidd, *Evaluating Digital Cultural Heritage*. Sarah Kenderdine, “Embodiment, Entanglement, and Immersion in Digital Cultural Heritage”, in *A New Companion to Digital Humanities*, ed. Susan Schreibman, John Unsworth and Ray Siemens (London: John Wiley & Sons, Ltd, 2016). <https://doi.org/10.1002/9781118680605.ch2>.

<sup>51</sup> Russel Staiff, *Re-imagining Heritage Interpretation. Enchanting the Past-Future*, (London-New York: Routledge, 2016).

<sup>52</sup> Freeman Tilden, *Interpreting our heritage: principles and practices for visitor services in parks, museums, and historic places* (Chapel Hill, NC: University of North Carolina Press, 1957).

<sup>53</sup> *Ibid.*, 9.

<sup>54</sup> *Ibid.*

<sup>55</sup> Ham Sam, *Interpretation – Making a Difference on Purpose* (Golden Colorado: Fulcrum, 2016).

Uzzell introduced the concept of value based “hot interpretation” in contrast to non-political, neutral practice. He argues that:

‘Interpretation should be interesting, engaging, enjoyable, informative, and entertaining. But now and again it has to be shocking, moving and provide a cathartic experience. Tilden’s fourth principle of interpretation was that ‘the chief aim of interpretation is not instruction, but provocation’ He might equally have written that there is a need for ‘hot interpretation’’.<sup>56</sup>

Also with the rise of the New Museology of the 1980s<sup>57</sup>, practitioners and scholars started to pay increasingly more attention to the importance of examining more holistically the different ways the museum experience is affecting museum visitors has started being recognised.<sup>58</sup> Within heritage studies, interpretation approaches belonging to the “affective turn”, a term coined by Vanessa Agnew<sup>59</sup>, have been highly influenced also by the rise of “re-enactment studies”, in particular from the performance perspective. The great shifts in theorising of heritage performance over the past years<sup>60</sup> are brought to bear the question of affect, the role of the audience in producing meaning, and the ways in which the dramatic moment (or dramatised moment) interacts and intersects with time, linearity and historicity.<sup>61</sup> This has led, within the creative heritage community, to a growing understanding of the need to create emotionally engaging experiences for visitors in both cultural heritage practice

---

<sup>56</sup> David Uzzell, “The Hot Interpretation of War and Conflict,” in *Heritage Interpretation: Volume I: The Natural and Built Environment*, ed. David Uzzell (London: Belhaven Press, 1989), 36.

<sup>57</sup> John Howard Falk and L. D. Dierking, *The museum experience revisited* (Walnut Creek, CA: Left Coast Press, 2013). Bitgood, Stephen. *Attention and Value. Keys to Understanding Museum Visitors*. (Walnut Creek, CA, Left Coast Press, 2013).

<sup>58</sup> Emma Waterton and Steve Watson, "Methods in motion: Affecting heritage research," in *Affective methodologies: Developing cultural research strategies for the study of affect* (London: Palgrave Macmillan UK, 2015). [https://doi.org/10.1057/9781137483195\\_5](https://doi.org/10.1057/9781137483195_5).

<sup>59</sup> Vanessa Agnew, “History’s affective turn: Historical reenactment and its work in the present,” *Rethinking History* 11, no. 3 (2007). <https://doi.org/10.1080/13642520701353108>.

<sup>60</sup> Russel Staiff, *Re-imagining Heritage Interpretation*.

<sup>61</sup> Jerome de Groot, “Affect and empathy: re-enactment and performance as/in history,” *Rethinking History* 15, no. 4 (2011). <https://doi.org/10.1080/13642529.2011.603926>.

and research.<sup>62</sup> Anthony Jackson and Jenny Kidd's edited volume *Performing heritage* is the culmination of several years' work investigating the ways in which touristic sites and spaces of heritage enable meaning through different types of performance. They combine the interest of Museum Studies on new ways of thinking about the visitor with Performance models of iteration, audience and communication. As Jackson elaborates 'it has been instructive to discover just how willing visitors can be to become active, participating audiences, to be part of a negotiation of meaning in locations not usually associated with such dialogic processes.'<sup>63</sup>

The current context of global crises – humanitarian, health, environmental, racial and social justice, with the peak of the 2020 'perfect storm of Covid 19 and Black Lives Matter (BLM)<sup>64</sup>, has forced museums to deal to an unprecedented extent with situations and topics that engender a range of emotional responses, from anxiety to fear, despair, nostalgia, and hope. Curatorial practice is adapting rapidly by forging exhibition narratives that explicitly invoke vulnerability, resilience, and empathy, offering a roadmap with which to navigate the emotional volatility and uncertainty of our times.<sup>65</sup> Eliciting positive emotions such as empathy is no longer an incidental or secondary outcome, but has rather become the thematic fulcrum for large, radically innovative museum initiatives.<sup>66</sup> This is the case, for instance, of the Minneapolis

---

<sup>62</sup> Alys Cundy and Yvonne Pörzge, "Emotional strategies in museum exhibitions," *Editorial, Special Issue: Museums & Society* 14, no. 3 (2016). Smith and Campbell, *The Elephant in the Room*.

<sup>63</sup> Anthony Jackson and Jenny Kidd, *Performing heritage. Research, practice and innovation in museum theatre and live interpretation*, ed. Anthony Jackson and Jenny Kidd (Manchester: Manchester University Press, 2012), 24.

<sup>64</sup> Sandra Shakespeare, Malik Qanitah and Edem-Jordjie Edinam. "Whose Heritage? Deconstructing and reconstructing counter-narratives in heritage," in *Whose Heritage? Challenging Race and Identity in Stuart Hall's Post-nation Britain*, ed. Susan L.T. Ashley and Degna Stone (New York: Routledge, 2023), 96.

<sup>65</sup> Marzia Varutti, "The 'emotional turn' in museum practice," *ICOM Voices* (blog), September 14, 2022, <https://icom.museum/en/news/the-emotional-turn-in-museum-practice/>. Elif M. Gokcigdem, *Fostering Empathy Through Museums* (London: Rowman & Littlefield, 2016).

<sup>66</sup> Gokcigdem, *Fostering Empathy*.

Institute of Art (MiA), which in 2017 established a Center for Empathy and Visual Arts (CEVA) with the aim ‘to research and explore best practices for fostering empathy and global awareness through the power of art’.<sup>67</sup> In spite of the proliferation of museum initiatives activating visitors’ emotions, in the field of museology, it is only recently that emotions have become a prime area of investigation, in connection with the broader surge of interest for affect across the human and social sciences. Ground-breaking research on emotions in museums has addressed pedagogies – proposing for instance “pedagogies of feeling”<sup>68</sup> or investigate how awe affects memory<sup>69</sup> and visitors’ responses to traumatic topics and ‘difficult heritage’ such as war and colonialism.<sup>70</sup> Within digital heritage scholarship, as Kidd has noted, the “affective turn” across the Humanities has led to the exploration of varied uses of “affective design” that can be found within museum online games in particular<sup>71</sup>, while works such as the one by Galani *et al.* references the potentials of mobile applications in particular as means to facilitate empathy.<sup>72</sup>

In the museum and heritage literature, there is a large body of works investigating the dialogical approach to place, people and technology in museum, which had a particular rise in correspondence with the introduction of mobile practices, and now

---

<sup>67</sup> Centre for Empathy and Visual Arts, CEVA White Paper, 2019, accessed November 29, 2023, <https://images.artsmia.org/wp-content/uploads/2018/09/01101056/CEVA-White-Paper091318.pdf>.

<sup>68</sup> Andrea Witcomb, “Toward a Pedagogy of Feeling,” in *International Handbook of Museum Studies*, ed. Helen Rees Leahy, Kylie Message, Andrea Witcomb, Sharon Macdonald (Chichester, West Sussex: John Wiley & Sons Ltd, 2015).

<sup>69</sup> Price Aaron et al., “Awe & Memories of Learning in Science and Art Museums,” *Visitor Studies* 24, no. 2 (2021). <https://doi.org/10.1080/10645578.2021.1907152>.

<sup>70</sup> Smith Laurajane, Michael Wetherell and Campbell Gary. *Emotion, Affective Practices, and the Past in the Present* (London: Routledge, 2018).

<sup>71</sup> Jenny Kidd, *Representation*, (London-New York: Routledge, 2015). <https://doi.org/10.4324/9781315666785>.

<sup>72</sup> Galani Areti, Aron Mazel, Deborah Maxwell and Kate Sharpe, “Situating Cultural Technologies Outdoors: Empathy in the Design of Mobile Interpretation of Rock Art in Rural Britain,” in *Visual Heritage in the Digital Age*, ed. Eugene Ch’ng, Vincent Gaffney, and Henry Chapman (London: Springer, 2013).

with more immersive technology.<sup>73</sup> Experiences as such, and specifically museum experience, are seen as inherently conversational, that is dialogic.<sup>74</sup> Galani and Kidd 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. Building on Schraffenberger and van der Heide's concept of "multimodal AR"<sup>75</sup>, they understand this exchange as a form of 'multimodal imaginative investment' where sense-making spans 'visceral, social, and cognitive domains.'<sup>76</sup> Similarly, Luigina Ciolfi documents the emergence of human-centred computing for museums that includes 'a consideration for the body and the senses, the physical environment, and the social world', where visitors might be considered 'active agents in the process of interaction', 'embodied and situated.'<sup>77</sup> The visitor is now often understood as very much an embodied and active agent, whether online, offline, or moving between the two, and linking the site to the experience.<sup>78</sup>

---

<sup>73</sup> For further research on the subject, John McCarthy and Peter Wright, "Time, Place and Technology in Museums: A Dialogical Approach to the Experience," in *Interaction Design Centre 2005: Proceedings of the International Workshop "Re-thinking technology in museums: towards a new understanding of people's experience in museums"*. University of Limerick (Ireland), 29th-30th June, 2005, ed. Luigina Ciolfi, Katherine Scott and Sara Barbieri (Limerick: University of Limerick Press, 2005). [http://shura.shu.ac.uk/6583/1/Tech2011\\_final%282%29.pdf](http://shura.shu.ac.uk/6583/1/Tech2011_final%282%29.pdf). Philipp Schorch, "Museum encounters and narrative engagements," in *The international handbooks of museum studies. Volume 1*, ed. Kylie Message and Andrea Witcomb (London: John Wiley & Sons, 2013). <https://doi.org/10.1002/9781118829059.wbihms121>. Jennifer L. Bergevin, "Narratives of Transformation: Reframing and naming the impact of activist museum practice on visitors," (PhD Diss., Leicester: School of Museum Studies, 2019). <https://hdl.handle.net/2381/43381>.

<sup>74</sup> John McCarthy and Luigina Ciolfi, "Place as dialogue: Understanding and supporting the museum experience," *International Journal of Heritage Studies* 14, no. 3 (2008). <https://hdl.handle.net/2381/43381>.

<sup>75</sup> Schraffenberger and van der Heide, *Everything Augmented*.

<sup>76</sup> Galani and Kidd, *Evaluating Digital Cultural Heritage*, 13.

<sup>77</sup> Luigina Ciolfi, "Embodiment and Place Experience in Heritage Technology Design," in *The International Handbook of Museum Studies: Museum Media*, ed. Michelle Henning (Hoboken, NJ: Wiley, 2015), 420. <https://doi.org/10.1002/9781118829059.wbihms319>.

<sup>78</sup> Jenny Kidd, *Museums in the New Mediascape: Transmedia, Participation, Ethics* (Farnham: Routledge, 2014). Ross Parry, "The End of the Beginning: Normativity in the Postdigital Museum," *Museum Worlds* 1, no. 1 (2013). <https://doi.org/10.3167/armw.2013.010103>.



Whereas research into embodiment and place has gained traction in digital heritage research, investigation into the ways they intersect with debates about emotion and empathy is less well established although both have now become areas of concern for heritage and memory scholars.<sup>79</sup> Kidd, with the project *With New Eyes I See* (WNEIS), an itinerant digital heritage experience funded by the REACT Knowledge Exchange Hub for the Creative Economy, wanted to investigate in this direction<sup>80</sup>

The experience, which involved a printed map and a mocked up old military torch (cf. a prototype encasing a projector, speaker and smartphone which interfaced with RFID), took place in the civic centre of Cardiff, Wales, in occasion of the 2014 Centenary of the First World War. With the aim exploring how locative documentary techniques and gaming architectures could be combined to interpret museum content for a new audience, WNEIS was designed to create a uniquely social, immersive, temporal and emotive ludic space within the urban landscape that created new possibilities for remembrance.<sup>81</sup> The narrative pivoted around one man's experience of World War One and was partly scripted by the curators of the project, while the rest was the result of the participants' individual and collective encounters with the environment. Kidd's results of the work *With New Eyes I See* have also demonstrated that not only emotionally immersive experiences support a social construction of the heritage, but they have a crucial role in the definition of the heritage, one that is eventually truly objective, by encompassing *all* the narratives representing the society, also the so far neglected by the authorized heritage discourse. By introducing an emotional encounter with a subaltern story, the project has ultimately highlighted how 'WNEIS participants found themselves having to re-appraise their prior assumptions

---

<sup>79</sup> Gokcigdem, *Fostering Empathy*.

<sup>80</sup> Kidd, *With New Eyes I See*.

<sup>81</sup> *Ibid.*, 55.

about what museums themselves are and what they stand for. She has shown that emotional responses that are not heightened play a significant role in the performance of many heritage and museum visits, and have a central role in the emotional embedding of consensus nationalist and racial narratives, and deferential social attitudes.<sup>82</sup>

As in the words of Kidd, the participants were actively involved in a sense-making process that 'was informed by the ways space was experienced through the body; in walking, talking, listening, touching and through what might be termed the physiology of affect.'<sup>83</sup> Empathetic engagement and embodiment were key catalysts in those shifts, and in engendering a sense of autonomy'<sup>84</sup> in the reflections over social construction of the heritage. Experiences like WNEIS clearly point to the capability of museums to produce what Smith calls "transformative moments" or experiences for their visitors.<sup>85</sup> However, highly immersive and emotional experiences raise many questions which so far have remained not fully addressed.

Despite the many positive benefits of engaging with emotions identified by scholarly research, creative practitioners are somehow 'wary of employing hot interpretive techniques'.<sup>86</sup> As introduced in chapter 1, the debate over the validity of "value free" knowledge of expert in contrast to more emotional approaches has been harshened by the growing number of initiatives and projects engaging with emotions and body sensorial stimuli. There are several causes to this subtle scepticism, which mainly can

---

<sup>82</sup> Kidd, *With New Eyes I See*.

<sup>83</sup> *Ibid.*, 54.

<sup>84</sup> *Ibid.*, 64.

<sup>85</sup> Laurajane Smith, "Changing Views? Emotional Intelligence, Registers of Engagement and the Museum Visit," in *Museums as Sites of Historical Consciousness: Perspectives on museum theory and practice in Canada*, ed. Viviane Gosselin and Phaedra Livingstone (Vancouver: UBC Press, 2016), 114. <http://hdl.handle.net/1885/265122>.

<sup>86</sup> Uzzell and Ballantine, *Heritage that Hurts*, 12.

be identified in two broad areas of objectivity: objective interpretation as neutral and non-political, and objective interpretation as result of scientific and academic studies of authentic primary sources. With regard to the former, Uzzell and Ballantyne acknowledge that some scholars are concerned that hot interpretation might be used for propaganda purposes – to indoctrinate ideas, reinforce stereotypes, incite and encourage fear.<sup>87</sup> Smith and Campbell recognise as one of the cause of wariness towards emotional engagement in the tendency for market led research in museums and heritage studies, often fostered by tourism studies, to undertake quantitative visitor surveys and analyses of how affective responses could be used to increase visitor revenue.<sup>88</sup> This approach only cultivated suspicion by some that promoting affective responses through heritage and museum interpretations was part of the co-called “Disneyfication” or commodification of the past, and played on perceived nostalgic tendencies in the population.

In spite of the growing number of initiatives such as REACT that involve in a process of co-production academics and creative technologists, the objectivity of the scientific and academic background within which most interpretation comes from is often perceived in contrast with emotions, leaving with the unresolved question that permeates museum studies and critical heritage debate, does a quest for a more emotional or empathetic experience actually risk compromising historical objectivity? and if so, does it matter? This bias “emotions vs objectivity” has been strongly debated within the museum studies, heritage performance, and critical heritage studies. Uzzell and Ballantyne, while acknowledging the potential criticism towards hot interpretation, correctly point out how ‘no interpretation is value-free’, and even ‘simply ignoring the

---

<sup>87</sup> Uzzell and Ballantine, *Heritage that Hurts*, 12.

<sup>88</sup> Smith and Campbell, *The elephant in the room*.

emotions and the ethical issues [...] it is to exhibit a very real value position'.<sup>89</sup> According to them, the real question that we should be asking is how hot interpretation is done, how we structure it in the way that it may have a positive role to play in the society, to make sure that it encourages 'community development, [and, *nda*] it can bring together rather than be used as an instrument of division.'<sup>90</sup>

Objectivity in terms of perceived neutrality and authenticity of digital media communication has been thoroughly investigated also by sociology, visual culture, and screen media studies when investigating media representation and interpretation of the past.<sup>91</sup> Considering the nature of authenticity in respect to heritage sites, the definition of 'authenticity' is often contested<sup>92</sup> where 'confusion surrounds the nature and use of the concept'.<sup>93</sup> There is a general agreement that authenticity is not an absolute to be received, but instead 'a social construction to be negotiated'<sup>94</sup> and 'defined in the tourist's own terms'.<sup>95</sup> A recent fieldwork by medievalists Beavers and Warnecke looks at audience perception of historical authenticity in visual media and heritage experiences, proving that is 'material artefacts that visitors are most likely to cite as authentic in empirical studies of visitor perceptions of authenticity'.<sup>96</sup>

---

<sup>89</sup> Uzzell and Ballantine, *Heritage that Hurts*, 12.

<sup>90</sup> Uzzell and Ballantine, *Heritage that Hurts*, 12.

<sup>91</sup> Owen John Mackenzie, "Authenticity and Objectivity in Scientific Communication: Implications of Digital Media." in *Sign Here!: Handwriting in the Age of New Media*, ed. by Sonja Neef, José van Dijck and Eric Ketelaar (Amsterdam University Press, 2006). <http://www.jstor.org/stable/j.ctt46mzz3.6>.

<sup>92</sup> Gordon Waitt, "Consuming Heritage: Perceived Historical Authenticity," *Annals of Tourism Research* 27, no. 4 (2000): 2. [https://doi.org/10.1016/S0160-7383\(99\)00115-2](https://doi.org/10.1016/S0160-7383(99)00115-2).

<sup>93</sup> Konstantinos Andriotis, "Genres of Heritage Authenticity: Denotations from a Pilgrimage Landscape," *Annals of Tourism Research* 38, no. 4 (2011), 2. <https://doi.org/10.1016/j.annals.2011.03.001>.

<sup>94</sup> Gordon Waitt, *Consuming Heritage*, 846.

<sup>95</sup> *Ibid.*, 847.

<sup>96</sup> Sian Beavers and Sylvia Warnecke, "Audience perceptions of historical authenticity in visual media," in *The Middle Ages in Modern Culture: History and Authenticity in Contemporary Medievalism*, ed. Karl Alvestad and Robert Houghton (London: Bloomsbury Academic, 2021). <http://dx.doi.org/doi:10.5040/9781350167452.001374-89>.

Respondents to their qualitative survey made explicit comparisons between the historical narratives represented in digital media (TV, film, games, etc) with those seen in written texts. Some respondents stated that ‘a [movie] was authentic because of the extensive research undertaken by the original author<sup>97</sup> and because it was ‘based on a book into which a lot of historical research had gone.’<sup>98</sup> This clearly demonstrates how authenticity is often perceived in terms of fidelity to written texts and related (academic) research, supporting the quest of creative academics and practitioners to convey the historical objectivity that sits behind the more fictive representation of a subject. Nevertheless, in spite of these respondents identifying what they felt was (in)authentic and why, these perceptions of (in)authenticity did not seem to obstruct their engagement with or enjoyment of historical media, and ‘they considered historical authenticity to be largely inconsequential.’<sup>99</sup>

A similar outcome on perceived authenticity and objectivity is seen in Kidd’s post-experience survey of WNEIS. With regard to the fictional storytelling led by a real character, participants have been asked ‘If I called the experience a documentary, would you agree/disagree? Do you have thoughts on how authentic a narrative was presented here?’<sup>100</sup> Responses show that the link of the storytelling to an authentic historical persona and real world events was something that participants reflected was important, with one participant stating that had she ‘found out it was all made up [she] would have been distraught.’<sup>101</sup> Authenticity emerged as a significant point of discussion amongst respondents, and, as Kidd noted, it ‘may have refracted our own

---

<sup>97</sup> Beavers and Warnecke, *Audience perceptions*, 81.

<sup>98</sup> *Ibid.*, 81.

<sup>99</sup> *Ibid.*, 86.

<sup>100</sup> Kidd, *With New Eyes I See*, note 7.

<sup>101</sup> *Ibid.*, 61.

anxieties about the fictionalising potentials of our form.’<sup>102</sup> Nonetheless, participants evidenced a desire to embrace and experience the personal narrative, which is imbued of emotional cues that made them feel deeply empathic towards the character and generally involved and immersed in the storytelling. Kidd’s work proves that this desire ‘is not at odds with a respectful and engaging interpretation of a challenging heritage. Indeed, ambiguity itself was found to have great potential.’<sup>103</sup>

As we have seen so far, immersive experiences are based on narrative ‘intended to move participants to imagine themselves into the situation of this Other from the past.’<sup>104</sup> The aim of the storytelling is to encourage the users to “feel” themselves “into the consciousness” of the narrating character. However, this raises ethical questions. Despite being a debate that is often lacking in digital heritage work, ethics has been considered by few notable exceptions.<sup>105</sup> For instance, for the project WNEIS Kidd articulates some ethical issues with regard to how important is the “closure” of empathetic engagement, and to what degree is the manipulation of empathy ethically defensible. Acknowledging that these points remain unsolved, she recognises that the ‘direct appeals to empathetic engagement were not inconsequential, and that their use-value might turn out to be ambiguous at best.’<sup>106</sup> Indeed, when constructing empathic narratives, creative practitioners must be aware of the potential ethical concerns related to personal and ethnical representation. When recounting unheard voices and untold stories, ethics of representation is highly concerned with questions

---

<sup>102</sup> Ibid., 61.

<sup>103</sup> Kidd, *With New Eyes I See*, 85-86.

<sup>104</sup> Ibid., 59.

<sup>105</sup> Claudio Germark et al., “Robots and Cultural Heritage: New Museum Experiences,” *CITAR Journal* 7, no. 2 (2015). <http://doi.org/10.7559/citarj.v7i2.158>. Jenny Kidd and Rosie Cardiff, “A Space of Negotiation’: Visitor Generated Content and Ethics at Tate,” *Museum and Society* 15, no. 1 (2017). <http://dx.doi.org/10.29311/mas.v15i1.661>. Kidd, *Museums in the New Mediascape*.

<sup>106</sup> Ibid., 60.

such as: 'who is allowed to speak? Who do the stories belong to? Who is the intended audience? What are the consequences of telling the stories of others? And when does storytelling become an insidious 'narrative cannibalism'?'<sup>107</sup> Building on Hall's analysis of processes of representation as the 'symbolic power to order knowledge, to rank, classify and arrange'<sup>108</sup>, academic historian Leonie Wieser investigates the "discursive practice" of creating storytelling of past experiences of migration during her collaboration with academics, museum staff and a Black- led women's charity in the North East of England between 2015 and 2018.<sup>109</sup> Investigating about *by whom* and *how* representation of marginalised groups is done, in particular when first-person accounts may not be available, she recounts the exhibition curator acknowledging the problem of assigning a representative function to individual characters:

'I'm aware of that issue of – people see one story ... and that's the flipside of using personal stories to engender empathy that you risk people thinking, that is the experience of all people from that country or culture or what have you, and that's not the case.'<sup>110</sup>

Indeed, stories also have owners. In her doctoral thesis, ethnographic filmmaker Tina Gharavi examined the concept of 'story-thieves' or 'narrative cannibals', the 'suckers' who steal other people's causes as their own, often disempowering the subjects and misusing their power by colonising a space which is not theirs.<sup>111</sup> In her words, creative practitioners dealing with subjects as post-colonialism and ethnic minorities:

---

<sup>107</sup> Tina Gharavi, "Narrative Cannibals: Whose Story Is It Anyway? The Politics of Representation and the Veracity of the image in the age of digital Storytelling. The Cinema and Community Animations of Tina Gharavi," (Phd Diss., Newcastle: Newcastle University, 2013), 1.

<sup>108</sup> Hall, *Whose Heritage?*, 24.

<sup>109</sup> Leonie Wieser, "Historical methods implicated in the making of 'The Heritage'," in *Whose Heritage? Challenging Race and Identity in Stuart Hall's Post- nation Britain*, ed. Susan L.T. Ashley and Degna Stone (New York: Routledge, 2023).

<sup>110</sup> Leonie Wieser, *Historical methods*, 88-89.

<sup>111</sup> Gharavi, *Narrative Cannibals*.

‘must consider fully the ethical issues of representation to avoid becoming ‘story cannibals’. This is because, in the telling of other people’s stories, we risk consuming their voices, rendering them mute, and making their narratives our own.’<sup>112</sup>

Engaging with emotions is a problematic issue because of the potential ethical consequences, but also because there are no standard conventions on how to design or evaluate them.

As we have learnt to appreciate over the course of this chapter, storytelling has always been one of the main interpretative means employed in different ways in this direction to ‘bring displays to life’ and support, among others, affective outcomes.<sup>113</sup> Traditionally museums and galleries have privileged visual and textual resources, but, as Kidd and McAvoy state:

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’<sup>114</sup>

As seen in the previous chapter, in the last two decades of rapid technological developments, storytelling has been increasingly taking the form of digital expressions.<sup>115</sup> Thanks to recent technology advancements, the focus of the investigation into immersive digital heritage has shifted in past few years to augmented reality (AR) and virtual reality (VR) technologies as means to deliver “transformative moments” through emotional and “full-body” sensorial engagement.<sup>116</sup>

---

<sup>112</sup> Gharavi, *Narrative Cannibals*, 138.

<sup>113</sup> Leslie Bedford, “Storytelling: the real work of museums,” *Curator* 44, no. 1 (2001). <https://doi.org/10.1111/j.2151-6952.2001.tb00027.x>.

<sup>114</sup> Kidd and McAvoy, *Immersive experiences*.

<sup>115</sup> *Ibid.*

<sup>116</sup> Hanna Schraffenberger and Edwin van der Heide, “Everything augmented: on the real in augmented reality,” *CITAR Journal* 6, no. 1 – Special Issue (2014), xCoAx.



While this idea is a common assumption in the museums literature and practice, Smith points out ‘how these moments are set in motion and experienced, and what they mean for the visitor, are neither well documented nor satisfactorily theorised in the museums/heritage literature.’<sup>117</sup> One last unresolved issue this chapter aims to address concerns the methodology of creating emotionally engaging experiences using mobile application. Immersive storytelling is an ever evolving field and therefore there are few coherent or systematic frameworks for either creating or evaluating emotional engagement with cultural heritage.

In the effort of clarify how to use ‘hot interpretation’, Uzzell and Ballantyne recognise five factors which serve to influence our emotional engagement with either the heritage itself or its interpretation: time, distance, experiencing places, the degree of abstraction and management.<sup>118</sup> This evaluation approach structured around specific quantitative factors broadly echoes the categories currently used for mobile heritage trails classification, making Uzzell and Ballantine’s work one of the first attempt of defining a design methodology for immersive heritage experiences. Most relevant is the work of Petrelli *et al.* who have explored the relationship between interaction and technology to allow visitors to experience cultural heritage differently.<sup>119</sup> However, this work does not address visitors’ emotional state or reaction specifically. For instance, as Kidd remarks, ‘which voices, spaces, or other prompts best facilitate empathetic engagement? Have we got an adequate lexicon for asking about and articulating

---

<sup>117</sup> Ibid., 115.

<sup>118</sup> David Uzzell, and Roy Ballantyne, “Heritage that Hurts: Interpretation In A Post-Modern World,” in *Contemporary Issues in Heritage and Environmental Interpretation: Problems and Prospects*, ed. David Uzzell and Roy Ballantyne (London: The Stationery Office, 1998), 153.

<sup>119</sup> Daniela Petrelli et al., “meSch – Material Encounters with Digital Cultural Heritage,” in *Digital Heritage. Progress in Cultural Heritage: Documentation, Preservation, and Protection. EuroMed 2014. Lecture Notes in Computer Science, vol 8740*, ed. Marinos Ioannides et al. (Springer, Cham, 2014). [https://doi.org/10.1007/978-3-319-13695-0\\_53](https://doi.org/10.1007/978-3-319-13695-0_53).

empathy within digital heritage research; most crucially here within live and immersive events?’<sup>120</sup>

In order to address this gap, scholars have been developing frameworks for the design and evaluation of such experiences. For instance, the three-year (2016-2019) EU-funded Research and Innovation EMOTIVE project aims to research, design and evaluate methods and tools that support cultural heritage and creative industries in creating digitally-mediated experiences that draw on the power of emotive storytelling, the storytelling that can trigger visitors' emotions.<sup>121</sup> One of the outputs of the project is the experience *Ebutius's Dilemma*, a mobile application for the interpretation of the Antonine Wall display at the Hunterian Museum Glasgow, whose design has been structured around a conceptual framework and guide specifically developed for the project.<sup>122</sup> The storytelling has been designed with the purpose of encouraging empathy and emotional engagement with the collection, as well as to challenge the stereotypes about the Roman colonial and military nature of the site. Some specific strategies have been introduced by the EMOTIVE project to particularly stimulate the emotional engagement using digital storytelling in various forms. Economou describes the storytelling of the experience as focused on underlying universal themes such as work, love, and family and linking them with the narrating character Ebutius' personal story.<sup>123</sup> One particular interpretative strategy adopted is the labelling of the museum

---

<sup>120</sup> Kidd, *With New Eyes I See*, 64.

<sup>121</sup> “EMOTIVE Project”, accessed November 29, 2023, <https://emotiveproject.eu/homepage/.html>.

<sup>122</sup> Maria Economou, Hilary Young and Emilia Sosnowska, “Evaluating emotional engagement in digital stories for interpreting the past. The case of the Hunterian Museum’s Antonine Wall EMOTIVE experiences,” in *3rd Digital Heritage International Congress, San Francisco, CA, USA, October 26-30, 2018* (San Francisco, CA, USA: IEEE). <http://doi.org/10.1109/DigitalHeritage.2018.8810043>. Perry, Sara et al., “Moving Beyond the Virtual Museum: Engaging Visitors Emotionally,” in *23rd International Conference on Virtual Systems & Multimedia (VSMM), Dublin, 2017* (New York: IEEE, 2017). <https://doi.org/10.1109/VSMM.2017.8346276>.

<sup>123</sup> Economou, Young and Sosnowska, *Evaluating emotional engagement*.

objects encountered within the app narration in accordance to the emotional relevance or significance they hold for narrating character. For example, a Roman distance slab is linked with “His life’s work” or a pair of children’s shoes with “My dear sweet child”. By using emotive language and labels in this way, the experience encourages visitors from the beginning to foster a connection and empathy with the characters and the story. By doing so, Economou *et al.*’s research has highlighted how the visitors not only felt emotionally engaged during the experience but felt that through it they could explore and learn more about the objects on display.<sup>124</sup> The resulting educational engagement with the material culture, even if not necessarily researched, has been a warmly welcomed outcome of the experience. The survey findings also show that the app provoked strong engagement and emotional responses from the users, revealing a high degree of immersion in the experience based on the character development.<sup>125</sup>

According to the authors, overall these emotional responses were elicited by a combination of factors including: writing the story in the first person while looking back in time; the way the story was linked with physical objects on display; the final decision that users had to make for the main character of the story which gave an element of drama and engaged users from the beginning of the narrative, and the voice over used to narrate the story. The EMOTIVE project’s findings seem to point towards the assertion that creating an entertaining and emotional experience does not preclude the possibility of delivering professionally researched historical knowledge nor its consequent learning outcome. Rather, it is in such processes that the sense of emotional engagement becomes possible, and the new category of narrative

---

<sup>124</sup> Economou, Young and Sosnowska, *Evaluating emotional engagement*.

<sup>125</sup> *Ibid.*, 6.

strategies which will introduced in the next section aims at outlining the way practitioners use them for achieving it.

The methodological research underpinning the emotive project represents the territory in which also the narrative strategies from my embedded research come from. Indeed, the EMOTIVE app was designed using several of the standard design conventions identified within this chapter, both in terms of content modalities. Furthermore, some of their design elements coincide with the narrative strategies identified in my embedded research, further remarking how their introduction is timely to offer creative practitioners a set of tools they can use to foster emotional engagement with the experience.

The next part of this section explores these design strategies, which are introduced as set of four narrative approaches that creative practitioners currently use for achieving more emotional storytelling with mobile heritage experiences.

#### *Self-contained vignette stories*

One overarching strategy, strongly informed by the geolocating affordances of the “walk-to-unlock” trail, is the design for non-linear storytelling. Whereas geolocated technologies are indeed “freeing” storytelling from linear order and mono-vocal perspective, as seen so far, mobile devices’ unique capabilities and constraints have a major impact on how a story is told, distributed, and experienced. Indeed, the same navigational affordance of GPS enabled devices limits the narrative possibilities.

Generally, the standard modality of delivering narration of these apps is “walk-to-unlock”, as users are expected to walk into the specific geofenced areas to trigger the audio track. With some degrees of freedom, users are indeed expected to follow a

precise visitor journey predefined by the author, for which generally audio or visual navigational instructions are provided. Unfortunately, this is not always the case and visitors are often take “personalised” journey, proceeding in a randomly customised order. Ideally, the story ought to dynamically adapt to these random trajectories followed by the visitor. Interactive storytelling (IS) offers in principle a solution to it. Born within the field of pervasive games and HCI where it has been successfully implemented for virtual games, interactive storytelling has been applied to cultural heritage mostly in research context.<sup>126</sup> This storytelling technique allows users to personalise their journey by choosing a custom order of the point of interest. The software provides basic elements of the story, such as characters and events, but the sequencing of events, and therefore the generation of the resulting story, relies on the user input<sup>127</sup>. Unfortunately, interactive storytelling relies on complicated algorithms and, as proved by the numerous case-based studies, there is still some way to go before achieving a reliable computational approach.<sup>128</sup> Although interactive storytelling would allow greatest user engagement, yet its performance is too unreliable and thus difficult to adopt for a product marketed outside research contexts. Therefore, given the current state of the technology, implementing a meaningful linear narrative that follows the free roaming of visitors is more than a challenge, it is simply not possible.

---

<sup>126</sup> Lombardo and Damiano, *Storytelling on mobile devices*. Deborah Tuck and Iryna Kuksa, "Virtual Heritage Tours: Developing Interactive Narrative-Based Environments for Historical Sites," in *Interactive Storytelling. ICIDS 2009. Lecture Notes in Computer Science*, edited by Ido Iurgel, Nelson Zagalo and Paolo Petta Nicola (Berlin, Heidelberg: Springer, 2009). [https://doi.org/10.1007/978-3-642-10643-9\\_43.interac](https://doi.org/10.1007/978-3-642-10643-9_43.interac).

<sup>127</sup> Marc Cavazza and Micheal Young, "Introduction to Interactive Storytelling," in *Handbook of Digital Games and Entertainment Technologies*, ed. Ryohe Nakatsu, Matthias Rauterberg and Paolo Ciancarini (Singapore: Springer, 2017). [http://doi.org/10.1007/978-981-4560-52-8\\_55-1](http://doi.org/10.1007/978-981-4560-52-8_55-1).

<sup>128</sup> The discontinuous algorithms of place that inform the architecture of most locative media systems hinder the perception of narrative patterning and flow across more extensive spaces. In other words, the app may fail to link the individual pieces of information about each POI into a cohesive whole that allows you to understand the larger narrative of the experience. For some suggested frameworks and case-based studies of non-linear storytelling, see Cavazza and Young, *Introduction to Interactive Storytelling*.

This is because there are certain users' expectations that need to be met to allow the listeners to understand a story and get a sense of closure.

In interactive storytelling, stories are organised around a dominant narrative schema of "beginning, middle and end".<sup>129</sup> Users will thus expect to find in the narrative this linear structure because it allows them to make sense of the action of a story and generates for them certain expectations as to what might happen next.<sup>130</sup> Until the development of more intelligent computational tools, any linear approach of the narrative will clash with the non-linear randomness of the user journey as shaped by the "walk-to-unlock" delivery modality of geolocated experiences. Since when the first pioneer geolocated audio walks were released, the preferred way of organising the storytelling has been following a non-linear unfolding of the narrative. By introducing self-contained vignette stories, mobile practitioners can overcome issues related to the randomness of the users' trajectories in the space.<sup>131</sup> These vignettes, while retaining a narrative linearity familiar to the users (beginning-middle-end of the story), are completely independent one from the other, and therefore they can be experienced separately without disrupting the overall storytelling of the experience. Regardless of the chosen communication style of the narrative, all the apps so far presented follow this narrative approach.

#### *"Bottom up" storytelling approach*

The affordance of the apps of layering multiple content and voices suits well the "bottom up" storytelling approach. Mobile technology offers a unique opportunity to

---

<sup>129</sup> AJ Greimas and Catherine Porter, "Elements of a Narrative Grammar," *Diacritics* 7, no. 1 (1977). <https://doi.org/10.2307/464872>.

<sup>130</sup> Jerome Bruner, "The Narrative Construction of Reality," *Critical Inquiry* 18 (1991). <http://www.jstor.org/stable/1343711>.

<sup>131</sup> Farman, *The mobile story*.

break free from “grand narratives” and promote a more decentred and subtle narrative. Storytelling is a powerful way to bring back to life past stories, and the use of historical documentary sources is at the foundation of many of the mobile storytelling available. This “bottom up” approach, also called “interpretation from below”<sup>132</sup>, entails recounting non-normative stories of the society, focusing on individuals and local groups, to then raise “up” the gaze towards histories of regional groups and, eventually, the human population. This approach has been associated to microhistory which, similarly, focuses on the “micro” level of social activities and cultural meaning, stressing the agency of people that lived in the past.<sup>133</sup> These alternative characters are designed to give voice to historical fictional narratives. The app *Hidden Florence* features two different journeys both led by the fictional character of Giovanni, a Renaissance wool-worker living in Florence at the time of the Medici who takes visitor around Florence showing them his community in the neighbourhood and offering vignettes on his personal life.<sup>134</sup> Often these fictional characters, as in the case of Giovanni, are scripted using scholarly sources.<sup>135</sup> In other words, their traits are not speculative, but based on academic research of recognised broad historical social figures, which have inspired the profiling, with different degrees of fictionalisation, of these leading characters.

The choice of designing fictional narratives using the “bottom up” approach is informed by the specific characteristics of this approach. Alongside adding a layer of (popular)

---

<sup>132</sup> Poole, *Ghosts in the Garden*.

<sup>133</sup> Christopher DeCorse, *Small Worlds: Method, Meaning, and Narrative Craft in Microhistory* (Santa Fe, NM: School for Advanced Research Press, 2008).

<sup>134</sup> The description of the app here used is based on the content of the first version of the app.

<sup>135</sup> Fabrizio Nevola and David Rosenthal, “Locating experience in the Renaissance city using mobile app technologies: the ‘Hidden Florence’ project,” in *Mapping Space, Sense, and Movement in Florence: Historical GIS and the Early Modern City*, ed. Nicholas Terpstra and Colin Rose, (London: Routledge, 2016), 196. <https://doi.org/10.4324/9781315639314>.

cultural content to existing heritage sites, the “bottom up” narrative is ‘appealing to the general public, it is realistic, it conveys personal experience and it is capable to be extended into an almost infinite ramification of further researches.’<sup>136</sup> Moreover, approaching the narration of historical facts using the “bottom up” approach fits well with the discourse of socially constructed spaces of locative media practices, which is amongst core objectives of the agenda of both digital placemaking and Cultural Heritage.

### *Magic moments*

The narrative strategy of creating “magic moments” is a well attested approach for designing a memorable mobile experience. In HCI studies, the intersection of these two worlds is referred to as “coincidence” and “magic moments”, while locative media scholars call it “magic circle” and “third reality”.<sup>137</sup> Despite the heterogeneous terminology, scholars agree on achieving them through emergence and ambiguity, which have been successfully implemented also in pervasive games.<sup>138</sup> One of the modalities deployed for mobile audio trails to create a magic moment is overlapping the virtual soundscape and narrative with the physical environments.<sup>139</sup> The aim of these magic moments is to alternate between immersive and non-immersive states, which from an HCI perspective are critical to obtain a smooth interactivity with the

---

<sup>136</sup> Jason Farman, “Storytelling with Mobile Media,” in *The Routledge Companion to Mobile Media*, ed. Gerard Goggin and Larissa Hjorth (New York-Oxford: Routledge, 2015).

<sup>137</sup> Montola refers to them as coincidence, while Reid et al. as ‘magic moments’ and Farman uses the term ‘magic circle’. See respectively, Markus Montola, “A ludological view on the pervasive mixed-reality game research paradigm,” *Pers Ubiquit Comput*, 15 (2011). <https://doi.org/10.1007/s00779-010-0307-7>. Reid et al., Magic Moment. Farman, *Storytelling with Mobile Media*.

<sup>138</sup> Neil Dansey, “Facilitating apophenia to augment the experience of pervasive games,” (paper presented at *Breaking the magic circle seminar University of Tampere*, 2008). [https://researchportal.port.ac.uk/portal/files/94490/Neil\\_Dansey\\_Tampere\\_Paper.pdf](https://researchportal.port.ac.uk/portal/files/94490/Neil_Dansey_Tampere_Paper.pdf).

<sup>139</sup> Reinis Indans, Eva Hauthal and Dirk Burghardt, “Towards an Audio-Locative Mobile Application for Immersive Storytelling,” *Journal of Cartography and Geographic Information* 69 (2019). <https://doi.org/10.1007/s42489-019-00007-1>.



design. Observing the physical space where the experience takes place is critical to create magic moments. It means noticing and recording any landscape feature and social pattern which are peculiar of the place to “orchestrate” the happening of a coincidence, which is actually a planned event. HCI designers therefore recommend to include in the storytelling references to things that users are likely to see in order to increase the likelihood of a co-incident magic moment.

A first and less employed strategy for creating a magic moment is mixing ambient environmental sounds with the recorded digital soundscape, in order to create a ‘synaesthetic confusion caused when you are not sure if a sound is real or virtual.’<sup>140</sup> For example, if the location of the experience is a square, it is likely that users will hear pigeons cooing, cars honking and passers-by chatting overt the phone. Therefore, to create a magic moment that blurs the real with the virtual worlds, the app soundscape should include pigeons cooing that users may not immediately understand to which world the sound belongs. A second way to achieve a magic moment is shaping the narrative content to create physical and virtual collisions. These collisions happen when there are points of unexpected connection between the physical and the virtual worlds. Such as talking in the storytelling of a nun and coincidentally seeing one walking down the street. Mostly these collisions are obtained using common elements of a particular environments, for example seagulls at the seaside and “a lady in a red coat” for urban experiences.<sup>141</sup>

Authenticity and resonance with the setting are too powerful triggers of ‘magic moments. This works particularly well with fictional-historical storytelling. In *Hidden*

---

<sup>140</sup> Reid et al., *Magic Moments*, 291.

<sup>141</sup> Ibid.

*Florence* for example, the fact that the events the lead character talks about actually took place where people are standing is an important factor in the enjoyment of the experience. It gives a sense of history coming alive and allow people to see a (familiar) place in a new way. Although this kind of phenomenon is initially perceived as disturbing rather than pleasant, the sensation is very memorable and frequently recounted, transforming thus the little coincidence into a “magic moment”.

### *Haptic feedback*

The last narrative strategy identified as an increased trend amongst mobile apps focus on way in which a storytelling can be enriched leveraging the hardware affordances of the smartphone in an unusual way, stretching the materiality of the media and the space in the process of make the users physically “sensory-inscribed”.<sup>142</sup> Although haptic feedback have long been a standard feature of smartphones, it is only more recently with the “immersive turn” that it has been increasingly used for narrative purposes. Using a mixed approach of narrative content (such as images and sound) and haptic feedback, this strategy searches for pervasivity of the real and virtual worlds *through* the phone, with the goal of fostering embodiment with the storytelling.

Whereas the use of haptics as narrative technique for mobile heritage trails has not yet reached its full potential, the creative industry has used them for few years, in particular for serious games. Haptic output is when a device uses vibration, motion, or applies force to the user. These technologies are a well-known gaming non-visual strategy for augmenting the narration with a further sensorial level.<sup>143</sup> Indeed, game

---

<sup>142</sup> Farman, *Mobile Interface Theory*.

<sup>143</sup> Liarokapis Fotisardissar et al., “Multimodal Serious Games Technologies for Cultural Heritage,” *Mixed Reality and Gamification for Cultural Heritage* (2017). <http://doi.org/10.1007/978-3-319-49607-8>.

developers have long been playing with the haptic affordances of mobile devices as a mean to blur the distance between the real and the virtual world.

One example of use of haptics within the storytelling of a historical situation is the locative aware fictional app *Lost Palace*. With the aim of achieving dramatic user embodiment, in one of the final POI of the tour, the users are listening to King Charles who recalls his emotion while walking into the Horse Guard Parade to be publicly executed. Once arrived in the POI geofenced areas, the pathos of the audio narration is accompanied by haptic feedback of the phone, which starts emitting increasingly fast rhythmic vibrations of the device, which simulate the racing heartbeat of the king. As in the case of magic moment, at first the “intrusiveness” of the haptics may seem unpleasant and disconnected from the narration, yet as the audio track goes on describing the violent emotions possessing the mind of the king, the feeling of holding in your hand the king’s racing heart foster a growing sense of empathy. Given the strong emotional response that can provide, haptic feedback is a powerful yet still under investigated narrative strategy which, if properly crafted, can elevate the overall experience design.

## **2.7. Personalisation.**

One last qualitative category attested for mobile heritage trails is the personalisation of the experience. For mobile experiences, customisation is a growing area for several reasons. Firstly, the tech capability of storing and accessing to larger quantities of content that cannot be experienced in one usage session. Moreover, visitors of heritage sites are highly heterogeneous, require different types information, and are

often first and short-time visitors to an unknown place.<sup>144</sup> Personalisation of the overall user experience involves different types of customisation of the app features. The most common is the selection of language in the style of more traditional audio guides. Creation of a favourites list and accessibility options (e.g. change of settings such as font, colours, etc) too are personalisation choices often seen in heritage apps.<sup>145</sup>

In terms of personalising the content delivery, the most straightforward technique attested is the selection of trails and starting point of the tour. The latest version of the *Hidden Florence* app has a list of six trails which users can decide to download according to their preferences and needs (i.e. temporal and spatial length, topic, location of the POI) (Figure 2.11). The *Family Learning Trail* instead allows customised start of the tour (i.e. entrance at North Tower or at engine room) (Figure 2.12). Thanks to the multi-content affordance of the software, often mobile heritage trails offer the possibility of selecting the depth of engagement and learning for the single POI. In the same fashion of Chinese boxes, multiple content can be nest to provide the users with further information. With the purpose of explaining the academic research behind the creation of the storytelling, the app *Hidden Florence* includes also a series of 'Discover More' tracks, in which users can found short scholarly commentaries to the topics discussed by Giovanni in the main audio tracks.<sup>146</sup> The aim of these expert insights is to target more traditional tastes in terms of interpretations. With particular reference to historical fictional storytelling, field research shows how some users reported that they would have want more of an overview of the whole event, as well as a better setting

---

<sup>144</sup> Liliansa Ardissono, Tsvi Kuflik and Daniela Petrelli, "Personalization in cultural heritage: the road travelled and the one ahead," *User Model User-Adap Inter* 22 (2012). <https://doi.org/10.1007/s11257-011-9104>.

<sup>145</sup> For heritage mobile applications, "in terms of personalising the user experience, 31% [of apps] offer customisable user experiences". Basaraba et al., *Digital Narrative Conventions*, 22.

<sup>146</sup> "Hidden Cities", accessed May 15, 2023, <http://hiddencities.org>.

of the context, history and overall story.<sup>147</sup> In many respects what the visitor is looking for in these digital tours is the equivalent of a knowledgeable human guide, who can show them around a city and tell them about the things they are seeing, but also someone who is aware of their preferences, and tailors the stories to the listening audience. With the same objective, the AR app *Climate Trail* provides the users with the option of enable/disable written and audio content accompanying the AR reconstruction, to cater for that audience in need of factual description to the visual augmentation (Figure 2.4).

Whereas mobile heritage experiences would highly benefit from the possibility to offer customisable content and the user journey, personalisation is still a under-utilised technique, although it could potentially represent a way of having more people engage and mitigate issues of obsolescence. However, further research in this direction is needed in order to understand to how to integrate more extensively this feature in mobile heritage experiences without compromising the overall user experience.

## **2.8. Conclusion.**

This chapter looked at the compositional nature of mobile heritage apps by exploring the different dimensions constituting these apps. The main purpose of this analysis is to outline the common features for the design of mobile heritage app, in order to inform a basic understanding of the current design conventions prior to the investigation in the next chapters of the commercial and scholarly approaches for the development of mobile heritage experiences. Using the framework identified by the work of Basaraba *et al.*, this chapter has explored the qualitative categories of interests that define the

---

<sup>147</sup> Reid et al., *Experience Design Guidelines*, 34.

design of a mobile app. On theoretical ground, by introducing new case studies, it has been possible to include an additional category of design conventions for mobile heritage experiences, the 'narrative strategies', expanding therefore the current taxonomic literature.

Narrative strategies are critical to design a storytelling that trigger an emotional response, because they can change the pace of an experience and activate the dynamic and emotional engagement. These strategies broaden then the possibility of digital storytelling, whether 'enhancing experiences, challenging conventions or giving users a more active role to play'<sup>148</sup>, allowing the sites to construct narrative that are resonating with broader sociocultural discourse, and in turn granting resilience to the experience. As a result, creative scholars and practitioners are increasingly using these new narrative strategies such as haptics and interpretation from below to create more emotional experiences. Experiences like *Lost Palace*, *Climate Trail* and *Hidden Florence*, through the use of these narrative strategies, are aimed in a (not so) subtle way at encouraging participants to imagine themselves into the situation of this "other" from the past. Nevertheless, from the embedded research of standard design conventions, it seems that creative practitioners are still somehow cautious at engaging with highly immersive narrative approaches.

As mentioned earlier in the chapter, scholars have identified on possible reason of it in a gap of the current literature about 'which voices, spaces, or other prompts best facilitate empathetic engagement? Have we got an adequate lexicon for asking about and articulating empathy within digital heritage research?'<sup>149</sup>

---

<sup>148</sup> Kidd and McAvoy, *Immersive experiences*.

<sup>149</sup> Kidd, *With New Eyes I See*, 64.

The introduction of the narrative strategies offers a preliminary answer to those questions by providing a first tentative set of parameters that creative practitioners can use to design an emotionally engaging experiences. From my embedded research experience, the use of narrative strategies like magic moments and haptics, allows the user to mentally and physical getting immersed in the storytelling and embodied within the physical space. The use of a “bottom up approach” paired with self-contained vignettes foster the ability of the narrative to “unlock imaginative leaps” which encourage the users to reflect critically or to imagine new or “transformative moment” and ways of understanding the past.<sup>150</sup> This echoes the findings of Gottlieb on “interactive adventures” which demonstrates that users who used interactive and sensorial guides were seen to show more interest and remember more facts about exhibitions than those who participated in traditional guided tours.<sup>151</sup>

Laurajane Smith, quoting Denis Byrne, also notes that objects can engender empathy through a visitor’s sensory engagement with them, and that it is ‘the preparedness to imagine the situation of others, which establishes the possibility of community.’<sup>152</sup> As seen, Economou *et al.*’s survey highlighted how emotionally engaging experiences encourage social interactions, providing strong indications of the potential for emotionally connecting visiting audiences with the distant human past, alongside to develop emotive group experiences. This is clearly what motivated the choice of reconstructing elements of the landscape, such as the local birds, using Augmented Reality in the *Climate Trail* app. The visual reconstructions and the description of the impact of climate change on Slapton Sands’ coastline and natural habitat are

---

<sup>150</sup> Smith, *Changing Views*, 4.

<sup>151</sup> Halina Gottlieb, “Interactive Adventures,” in *Digital Technologies and the Museum Experience: Handheld Guides and Other Media*, ed. Loic Tallon and Kevin Walker (Lanham: AltaMira Press, 2008), 169.

<sup>152</sup> Smith, *Changing Views*, 14.

functional to provoke, in a pure Tilden's approach, an empathic reaction of the visitors, to help them imagine how the lives of the local community will be dramatically changed by the global climate hastily deteriorating situation.

As we have seen over this chapter, an increased use of more sensorial stimuli, as granted by Augmented Reality, Virtual Reality and haptics, is attested within the heritage sector, with several sites adopting these technologies to encourage an emotional connection with the past<sup>153</sup> This is consistent to a more general interest towards these technologies to convey traumatic and conflicting narratives to the general audience. Virtual Reality has been described as the "ultimate empathy machine"<sup>154</sup> thanks to its use for delivering multi-sensory experiences that are evocative and present heart-wrenching stimuli. For instance, *1000 Cut Journey* is a VR experience which allows viewers to become Michael Sterling, a Black man, and encounter racism as they try to complete everyday activities<sup>155</sup>, while *Clouds over Sidra* immerses the user in 360-video as they follow a day in the life of 12-year-old Sidra who lives in a refugee camp.<sup>156</sup> These experiences have been encouraging the rise of several tech-led initiatives, such as "VR for Good", an 2016 initiative by VR

---

<sup>153</sup> Jenny Kidd, "Public heritage and the promise of the digital," in *The Oxford Handbook of Public Heritage Theory and Practice*, ed. Angela M. Labrador and Asher Silberman, Neil, (Oxford: Oxford University Press, 2018). <https://doi.org/10.1093/oxfordhb/9780190676315.001.0001>. Nicole Basaraba and Thomas Cauvin, "Public history and transmedia storytelling for conflicting narratives," *Rethinking History* 27, no. 2 (2023). <https://doi.org/10.1080/13642529.2023.2184969>.

<sup>154</sup> Milk Chris, "How virtual reality can create the ultimate empathy machine," March 2015, video, 10:16, [https://www.ted.com/talks/chris\\_milk\\_how\\_virtual\\_reality\\_can\\_create\\_the\\_ultimate\\_empathy\\_machine](https://www.ted.com/talks/chris_milk_how_virtual_reality_can_create_the_ultimate_empathy_machine).

<sup>155</sup> Courtney D. Cogburn et al., "1000 cut journey," in *ACM SIGGRAPH 2018 Virtual, Augmented, and Mixed Reality (SIGGRAPH '18)*, Article 1, 1 (New York, NY, USA: Association for Computing Machinery, 2018). <https://doi.org/10.1145/3226552.3226575>.

<sup>156</sup> "Clouds of Sidra. Empathy and Immersion in VR Storytelling," Xifei Lu, accessed November 29, 2023, <https://medium.com/@irenelu728/clouds-over-sidra-empathy-and-immersion-in-vr-storytelling-fc2c107147fe>.



giant Oculus to incentivize designers to create prosocial content<sup>157</sup>, or the HTC VIVE \$10 million “VR for Impact” program announced in 2018.<sup>158</sup> Regardless to recent research that seems to point towards low-tech evocative storytelling as a better mean to yield emotional empathy compared to VR<sup>159</sup>, the rapid development and enhancement of Mixed Reality environments and AI technologies, paired with the increased use for them for digital storytelling, would likely see further research in this direction and, most likely also an expansion of the category of narrative strategies identified in this chapter.

In spite of great advancements in critical heritage research which validate the benefits of more emotional approaches, the bias about strong emotional experiences still influences current practices. As discussed, tackling the question “emotion vs objectivity” is clearly not an easy task given the strong background legacy in authorised interpretation, nor something that can be expected to be resolved any time soon, regardless to the research proving otherwise. The case studies presented in this chapter strongly resonate with it. They show that a general wariness, or perhaps a “fear of missing out”, persists when choosing highly emotional storytelling in favour of more objective and academically sound communication to the audience of the scholarly research behind the experience, in an effort to counterbalance more fictional approaches to the narration. In my embedded research, this influences the way in which the overall narratives are structured, often taking the hybrid form of fictional

---

<sup>157</sup> “Oculus announces VR for good initiative to help students and non-profits capture community life,” Lucas Matney, accessed November 29, 2023, <https://techcrunch.com/2016/05/16/oculus-announces-vr-for-good-initiative-to-help-students-and-non-profits-capture-community-life/>.

<sup>158</sup> “HTC VIVE And World Economic Forum Partner For The Future Of The “VR/AR For Impact” Initiative,” accessed November 29, 2023, <https://www.vive.com/us/newsroom/2018-01-22/>.

<sup>159</sup> Sara Ventura and Alison Jane Martingano, “Roundtable: Raising Empathy through Virtual Reality,” in *Empathy. Advanced Research and Applications*, ed. Sara Ventura (London: Intechopen, 2023). <http://doi.org/10.5772/intechopen.109835>.

storytelling accompanied by more objective information, namely the material culture of the site (e.g. archival sources) and all the academically authorised contents related to it (e.g. experts extracts). For instance, the *Hidden Florence* app features alongside the narration of the fictional character, a set of audio tracks in which academic researchers, in their capacity of experts, explore further the subject introduced by the fictional narrator. The *Climate Trail* app, despite providing a storytelling using a less authoritative voice, the narration in is highly permeated by scientific research, which is often referenced within the audio scripts. In both Tower Bridge *Family Learning Trail* and *Battersea Power Station* app, the general more ludic tone of experiences targeting young families with children is counterbalanced by the educational component and a more authorised narration which are conveyed in the form of pop up text windows with curiosities and facts about the site, alongside the use of archival images. Also for the *Lost Palace* immersive theatrical experience, even if only within the promotional video, the need of communicating to the audience the background academic research onto which the storytelling has been constructed, takes the form of the use of archival sources, such as historical maps, photos and artworks which constitutes the primary sources that informed the scripting of the mobile drama.<sup>160</sup>

These case studies demonstrate overall how a clear intent of communicating to the public the use of academically authored contents is deemed critical in both the development and the promotion of mobile heritage practices. Despite (or perhaps precisely because) some of the apps discussed in the chapter have been developed within innovative knowledge-exchange based projects, the desire of conveying more experimental forms of emotional engagement is still to some extent constrained by the

---

<sup>160</sup> Historic Royal Palace, "The Lost Palace," August 8, 2016, video, 01:09, [https://youtu.be/QzfC\\_se0wPU?si=Zv3FMCJHqw4URk7M](https://youtu.be/QzfC_se0wPU?si=Zv3FMCJHqw4URk7M).

quest of historical objectivity, at least in terms of source authenticity. The introduction of the new category of narrative strategies aims precisely at supporting creative practitioners in reconciling the emotional aspect of the storytelling with more traditional forms of educational communication, also providing future creators with first mean. Nevertheless, more research would need to be carried out to evaluate their validity “in the wild”. As clearly pointed out by Economou *et al.*, ‘finding the right balance between engaging storytelling and communicating archaeological evidence/historical facts and integrating these effectively is challenging and there is no single approach which would fit all heritage contexts.’<sup>161</sup>

For the case studies here mentioned, unfortunately no qualitative post-visits surveys have been carried out which could have validated the actual capacity of an approach using a combination of these new strategies. Regardless of it, also findings about other experiences using these strategies such as the *Ebutio’s Dilemma* and *With New Eyes I See*, while pointing to positive outcomes, are described by the researchers as ‘tentative, making this exciting but daunting terrain, not least in terms of methodologies for evaluation and research.’<sup>162</sup> As further discussed in chapter 5, more research is therefore needed to establish and define best evaluation methods of emotional engagement, in order to understand the actual capacity of these narrative strategies and encourage the expansion of this new category of design conventions.

Before drawing to the end of this chapter, it is valuable to remark that the purpose of this new taxonomy for this research is foremostly a practical one, to outline which are

---

<sup>161</sup> Economou, Young and Sosnowska, *Evaluating Emotional Engagement*.

<sup>162</sup> Kidd, *With New Eyes I See*, 56.

the digital components of an app, empowering creators in the process of designing experiences that responds to the sites' needs and messages, while delivering an engaging experience that will attract (new) audiences. Kidd, quoting Pedersen *et al.*, states 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'.<sup>163</sup> As seen in the chapter, there are many factors that can jeopardise the experience, but using as a guidance these categories allows to have an informed understanding of how HCI principles can help mitigate technical issues. Furthermore, a good experience design can also help manage the expectations of users by defining what it is expected of them, or by offering them the option to choose a trail depending on the time and preferences they have.

Designing an experience to manage users expectations is key to (continuous) engagement with the app, but also for addressing issues of institutional onboarding, making the sites feel more confident in creating and promoting the app, and by doing so supporting a longer engagement with the experience. In the next chapters, we will be looking how the creative practitioners and scholars are using these narrative conventions to create experiences that engage users while listening to the site's needs.

---

<sup>163</sup> Kidd, *Immersive encounters*.

## Chapter 3. The industry approach to the design of mobile heritage experiences.

### 3.1 Introduction.

The rapid uptake of BYOD mobile apps for heritage sites has been accompanied by the creation of several experience design frameworks to provide a guidance to developers and creators during the design phase of the experience. Scholars from different fields of study have largely investigated user-centric designs for the development of mobile experiences at cultural heritage sites and, as a result crafted their own frameworks. Digital heritage scholars have been creating frameworks to investigate the parameters that 'grant efficacy of the apps and its usability, and learning affordances'.<sup>1</sup> HCI research has focused instead on designing frameworks to mitigate the impact of some factors, such as interface usability, on the user experience of the apps, with recent studies pointing towards the technology used that can become a distraction, the inaptness of them for certain type of collection, and the tech literacy barrier for older users.<sup>2</sup> Within the field of digital performance, design frameworks have been developed for the design of immersive mixed-reality experiences that use narrative strategies from theatrical performances to further engage the audience.<sup>3</sup>

---

<sup>1</sup>Guido Bozzelli, Antonio Raia, Stefano Ricciardi, Maurizio De Nino et al., "An integrated VR/AR framework for user-centric interactive experience of cultural heritage: The ArkaeVision project," *Digital Applications in Archaeology and Cultural Heritage* 15 (2019), 127. <https://doi.org/10.1016/j.daach.2019.e00124>.

<sup>2</sup> Respectively Liam Betsworth, Huw Bowen, Simon Robinson and Matt Jones, "Performative technologies for heritage site regeneration," *Pers Ubiquit Comput*, 18, (2014). <https://doi.org/10.1007/s00779-014-0766-3>. Cristina Fenu and Fabio Pittarello, "Svevo tour: The design and the experimentation of an augmented reality application for engaging visitors of a literary museum," *International Journal of Human-Computer Studies* 114 (2018). <http://doi.org/10.1016/j.ijhcs.2018.01.009>.

<sup>3</sup> Giannachi, *Lost Origin and Beyond*.

Little attention has been given instead to the majority of the market available mobile apps for heritage sites which have been produced within commercial settings using standard industrial design frameworks, and in particular to how these frameworks address issues such as obsolescence and sustainability.

To help fill this research gap, this chapter investigates the development of the case study of the *Family Learning Trail*, a mobile app developed by Calvium for the heritage site of Tower Bridge, London using their own commercial framework based on industry standards for user experience design of mobile products. The experience has been developed during my research-in-residency at the agency, and therefore this investigation benefits from insight collected by direct participation at the development of the app, in particular having co-led the two phase of user testing sessions, with staff and with visitors.<sup>4</sup> Methodologically, the case study has been critically reviewed using a ethnomethodological step-by-step approach, following the whole life-cycle of the development process, with the goal of answering some preliminary questions: what are the industry standards for the design of a user friendly experience? What stages of the development are critical to the delivery of such experiences? Which design conventions are used? Are practices of sustainability of the experience accounted for, and if so, how?

The “co-creation journey” design approach that Calvium adopts, has been highly informed by the intersection of industrial standards with scholarly research in the different fields of study, such as HCI study, creative media and digital economy

---

<sup>4</sup> For the evaluation process of the *Family Learning Trail*, I have designed a specific questionnaire and an observation checklist, which have been used for tests on site with staff and users. The survey results have then been processed in a document which I have used to help Calvium and Tower Bridge in the adjustment of the user experience design. See Portfolio, “Tower Bridge User Testing Questionnaire”, “Tower Bridge User Testing Observation Checklist”, and “Tower Bridge *Family Learning Trail* User Trials Feedback Statistics”.

researchers. As it would be further discussed in the chapter, Calvium has taken part to the previously mentioned REACT hub project which aimed at broad, collaborative approach to the development of networked devices by investing £2.86 million across nineteen companies, including those from the private sector. The underlying scholarly enquiry line was to understand what meant for universities, researchers and creatives to co-produce work in this way. The project articulated a series of questions, including ‘could we reach out across our partner universities and engage their traditional research communities with new patterns of creative economy? Could we persuade creative businesses, start-ups and innovators that historians, literary scholars and musicologists had something interesting and productive to say to them?’<sup>5</sup>

The co-production of 53 experiences within the time frame of the project (2012 – 2016) highlighted, amongst others, two main areas in which the introduction of R&D from arts and humanities have benefit the creative sector: narrative and experience design. Indeed, a foundational awareness of narrative at many levels makes arts and humanities researchers good partners for creative projects. This is because those scholars share an awareness of the importance of stories in shaping our experience of the world. This has been demonstrated by one of the REACT projects introduced in chapter 2, *Ghost in the Garden*. There, UWE Bristol historian Steve Poole brought vital knowledge of narrative history into an heritage game for Bath’s Holborne Museum developed by the creative agency Splash and Ripple Ltd.<sup>6</sup> Alongside inspiring a critique of more traditional heritage interpretation practices, the immersive geolocate experience shows that the collaboration has impacted positively both the

---

<sup>5</sup> Dovey, Moreton and Hargreaves, *REACT Report 2012–2016*, 11.

<sup>6</sup> “Ghosts in the Garden: REACT Heritage Sandbox,” UWE, accessed November 29, 2023, <https://www.uwe.ac.uk/research/centres-and-groups/regional-history/projects/ghosts-in-the-garden>.

'public' and the industry, resulting in a co-designed, non-linear, playful, affective and experiential group learning. While digital technologies have indeed opened up extensive possibilities for the presentation of immersive experiences through games, media effects and other creative techniques, it is only by understanding some aspect of the nature and history of human experience that experiences become capable of both mobilize and support the plurality of opinions at play when engaging with in complex, interactive, social and cultural activities.

Arts and Humanities researchers often specialise in understanding the way audiences respond to cultural experience, meaning they have valuable knowledge about audience behaviours. This is why the art and humanities scholars' contribution have played a pivotal role in shaping a new way of conceiving the user experience design. For instance, in the REACT Object Sandbox project *Curpanion*, sought to strengthen the bond between a user and a particular collection, namely the Horniman Museum and Gardens, through user directed acts of curation that can span beyond institutional practices, encouraging participatory forms of engagement with the heritage.<sup>7</sup> Focusing the user experience design on magic moments, *Reflecting the Past*, a collaboration between the historian Tim Cole (University of Bristol) and the creative agency Interactive Places, shows the strong synergies emerged between the arts and humanities partners and design professionals around the exploration of new forms of UX, namely AR projecting screens, often limited by commercial pressures.<sup>8</sup> New experience evaluation methods also have been at the core of REACT projects. The previously mentioned *With New Eyes I See* project, a partnership between Cardiff-

---

<sup>7</sup> "Curpanion," REACT, accessed November 29, 2023, <http://old.react-hub.org.uk/objects-sandbox/projects/2014/curpanion/>.

<sup>8</sup> "Reflecting the Past. Pioneering the use of augmented reality 'mirrors', to create interactive heritage experiences," REACT, accessed November 29, 2023, <http://www.react-hub.org.uk/projects/heritage/reflecting-past/>.



based academic Jenny Kidd and creative marketing agency yello brick, aimed at testing the audience engagement at the intersection of embodiment, empathy and silence of a theatrical and immersive encounter located in the civic centre of Cardiff.<sup>9</sup> The examples here mentioned contributed to support REACT's legacy towards an alternative "knowledge common" where collaboration is conceived as a journey, as promptly embedded by Calvium in their experience design framework.

By investigating the case study, it will be shown that this collaborative experience, paired with cross-disciplinary practices, has positively affected Calvium's UX design methodology by instilling more attention in the experience design phase to site onboarding, sustainability and upkeep, challenges which this thesis claims should be amongst the main priorities of the app design from the outset of the development.

### **3.2 Theoretical background of the experience design method.**

There are several experience design approaches developed by practitioners following HCI principles, but amongst them, the Experience Design, an approach that looks less at the efficiency of execution and more into quality of experience, is perhaps the most employed by designers from creative industry to develop digital products, including mobile applications.<sup>10</sup> As previously mentioned, the Experience Design approach has a specific technical history, but generally it refers to a field in design that can be applied

---

<sup>9</sup> "With New Eyes I see. A site specific documentary using torches, projection and RFID to unlock Cardiff's WW1 past," REACT, accessed November 29, 2023, <http://www.react-hub.org.uk/projects/feasibility/new-eyes-i-see/>.

<sup>10</sup> For an exhaustive overview of HCI, user experience and interaction design, see David Benyon, *Designing Interactive Systems: A comprehensive guide to HCI, UX and interaction design*, 3<sup>rd</sup> ed. (London: Pearson, 2013).

to any medium.<sup>11</sup> Experience Design has its own roots into Design Thinking, a subfield of Interaction Design which aims to generate innovative solutions based on the understanding of a real problem.

In the literature there are various models of design thinking advocated by different usability theorists. The most popular of them is Don Norman, considered the *guru* of experience design for commercial products, whose theory has been critically appropriated and extended to digital interfaces by many HCI scholars.<sup>12</sup> Design Thinking (DT) is an human-centred approach, characterised by an optimistic, collaborative and experimental approach.<sup>13</sup> In all the phases of designing, the main actor and end-goal is the user of the product, and therefore the focus is on gaining a deep understanding of their needs and motivations. Unlike previous design processes contemplating a predefined series of orderly steps, the DT is an interactive model usually visualised as a circular process structured around iterative cycles of the design steps (Figure 3.1).

The rationale behind the rigorous use of Design Thinking is the fact that the absence of such a process might lead to failure of a project. Innovation is the fuel of Design Thinking and it is powered by a thorough understanding, via direct observation, of what people want and need in their lives and what they like or dislike about the way particular products are made, packaged, marketed, sold, and supported. Therefore, this design method has been structured as cycles of prototyping, testing, and refining the products until it is overall flawless. While this method has been initially used as

---

<sup>11</sup> For an historical review of the concept and related discipline, see “The Definition of User Experience (UX)”, Don Norman and Jakob Nielsen, accessed November 29, 2023. <https://www.nngroup.com/articles/definition-user-experience/>.

<sup>12</sup> Norman, *The Design of Everyday Things*.

<sup>13</sup> Acumen Academy, “HCD Workshop (2013) - The Design Process,” accessed May 10, 2023. <http://blog.acumenacademy.org/design-process>.

general rules for designing products, services, and production process, it is 'a way of describing a set of principles that can be applied by various people for a wide spectrum of problems.'<sup>14</sup> Accordingly, HCI scholars and practitioners creating mobile experiences have been adopting it to help shape their own Experience Design frameworks.

The core element of any design method is the Double Diamond model, launched in 2004 by the Design Council.<sup>15</sup> The process is structured around four distinct phases Discover (market research, user research, managing information and design research), Define (project development, project management, project sign-off), Develop (multi-disciplinary working, visual management, development methods testing) and Deliver (final testing, approval, launch, evaluation and feedback). The model has a circular but not a linear development, allowing in this way for iterative testing and scaling, which is crucial for any product design, and in particular for digital ones.<sup>16</sup> This approach 'enables designers to gain an understanding of their audience's engagement throughout the experience.'<sup>17</sup> By doing so, rather than designing and producing all content at the beginning, a selection of the content (and story) is produced as a rough-cut segment, which could then be experienced 'in a mock-up of the location to see if the interaction, subject matter and intended designs work together.'<sup>18</sup>

---

<sup>14</sup> Brown, *Change by Design*.

<sup>15</sup> Design Council, "Framework for Innovation," accessed November 29, 2023. <https://www.designcouncil.org.uk/our-resources/framework-for-innovation>.

<sup>16</sup> Acumen Academy, "HCD Workshop (2013) - The Design Process," accessed May 10, 2023. <http://blog.acumenacademy.org/design-process>.

<sup>17</sup> Giannachi, *Lost Origin and Beyond*.

<sup>18</sup> Reid et al., *Experience Design Framework*, 7-8.

### 3.3 Calvium and its “co-creation journey” approach.

Leaders in geolocated audio trails, Calvium Ltd. is a Bristol-based mobile app development agency. Founded in 2009 by a team of experts previously belonging to the research group at Hewlett-Packard Labs, Texas Instruments and Xerox, Calvium is a company that was among the first pioneers to develop mobile audio tours before the mass spread of the GPS enabled devices. To spatially track users the agency used a backpack containing a satellite kit (cf. an iPAQ, headphones and a GPS unit). Their mobile application *Riot!1831*, released in 2004, is the world’s first GPS-enabled outdoor drama. Calvium was also one of the first companies to provide users with a *Mobile Bristol Authoring* tool, later called *AppFurnace*, an open-source software ancestor of contemporary DIY Content Management Systems (CMS) which allowed users to create free geolocated audio tours. Unfortunately, due to changes to the requirements from the publishing platforms and the restrictions imposed by the new GDPR privacy law, the platform was shut down in 2018.

Grounded in industrial best practices, the design approach elaborated by Calvium has been strongly informed by academic works in the field of HCI and Computer Science. Alongside work collaborations with industries from different sectors, heritage included, Calvium holds a strong background within research, having partnered for several initiatives with the University of Exeter, University of Brighton and the Digital Cultures Research Centre, UWE. The current co-creation journey is based onto the first design framework developed by Calvium (Figure 3.2). First elaborated in 2005, the framework offered the initial working methodology for designing locative experiences delivered via first geolocated devices, to provide guidance to professional and amateurs who wanted to develop mobile Calvium’s *Mobile Bristol Authoring* tool. This original design

framework has been then released within a journal article *The Experience Design guidelines*, published in co-authoring with researchers at the University of Bristol, which included guidelines to develop a mediascape, a term coined by the agency to describe any mobile experience, ‘tours, situated plays, games, augmented attractions and wearable applications’ which entails ‘the user experience of walking through the physical world and triggering digital media which has been situated in that place for a particular reason by the mediascape designer.’<sup>19</sup> Based on standard HCI principles, the guidelines focus on the design of the user experience, providing dedicated sessions containing a list of possible issues possible related to the interface and content design paired with recommendations on how to avoid or solve them. For its intuitive and comprehensive nature, the guidelines and the framework to which they relate, have been largely investigated by scholars and still used as reference for current works on design frameworks.<sup>20</sup>

In particular, the framework and related working approach have been critically investigated and expanded during two interconnected AHRC Creative Economy Hub REACT projects at the University of the West of England (UWE), to which Calvium participated as creative industry partner from the Pervasive Media Studio.<sup>21</sup> The project, with the objective of examining the materiality of the interactions between people and digital media, conducted a series of workshops to investigate common practices of designing the user experience of mobile app and locative projects, and

---

<sup>19</sup>The original version can be found in Reid et al., *Experience Design Guidelines*, Figure 2.

<sup>20</sup> Chiara Rossitto, Louise Barkhuus and Arvid Engström, "Interweaving place and story in a location-based audio drama," *Personal and Ubiquitous Computing* 20, no. 2 (2016). <http://doi.org/10.1007/s00779-016-0908-x>. Spence et al., *The Rough Mile*.

<sup>21</sup> The two AHRC projects are the *Experience Design Frameworks for Digital Economy* (2002-2012) and the *Knowledge Transfer Fellowship* (2010-2012). For further information, "Pervasive Media Fellowship," UKRI, accessed November 20, 2023, <https://gtr.ukri.org/projects?ref=AH%2FH016821%2F1&pn=0&fetchSize=10&selectedSortableField=title&selectedSortOrder=ASC>.

was conceptualized through observation of users and producers of games and other digital media.<sup>22</sup> Based on several case studies from the creative industry, the *Pervasive Media Cookbook*, published in 2014<sup>23</sup>, has been described by the authors as the world's first "how-to" guide for digital media producers to support them in the creation of mobile media projects.<sup>24</sup> Compared to Calvium's guidelines, the Cookbook provides a finer granularity of the dimensions, expanding for example the dimensions of "time" and "content", in accordance to advancements of the research in the HCI field (Figure 3.3). By doing so, the Cookbook offers to future creators a more refined and efficient tool for defining the design of the interface as well as the salient traits of the experience. Ultimately, the Cookbook version is less about hands-on design and tech instructions, and more focused on providing a best practice for media producers embracing location-based technologies.

The design approach of Calvium has been strongly informed by the Cookbook and the underpinning scholarly research from which it resulted. This has encouraged the agency to refine the framework, by expanding it into a larger design approach, now called co-creation journey. This revisited version encompass also two further phases of the development journey previously not accounted by the framework, the "Discovery" and "Delivery". The former in particular has been strongly informed by the scholarly input about the need 'to ground your project'<sup>25</sup>, which echoes contemporary academic trends urging for a better understanding of the value proposition of the digital

---

<sup>22</sup> For an overview of the project specifications, objectives and outputs, "Pervasive Media: building a new digital world," UWE Bristol, accessed November 29, 2023. <https://www1.uwe.ac.uk/research/researchimpact/pervasivemedia.aspx>.

<sup>23</sup> Jon Dovey and Constance Fleuriot, *The Pervasive Media Cookbook* (Bristol: DCRC Press, UWE Bristol). <https://pervasivemediacookbook.com>.

<sup>24</sup> Jon Dovey and Constance Fleuriot, "Dimensions of Mobile Media Design," in *The Mobile Audience*, ed. Martin Rieser (London: Rodopi, 2012).

<sup>25</sup> Dovey and Fleuriot, *Pervasive Media Cookbook*.

innovation using mobile apps. Similarly, in the past few years Calvium has been rebranding the co-creation journey as “digital placemaking”. As discussed in Chapter 1, over the past few years there has been a growing association between the idea of placemaking and the use of mobile app. This is because these apps can make the heritage more accessible to a diversified audience thanks to the capabilities of the app to provide a multi-layered experience with age-appropriated activities. In response to this placemaking revival, Calvium has been revisiting its co-creation journey using the lens of the eleven key principles. The focus is now being shifted towards experience design as a mean to encourage community participation and user understanding.<sup>26</sup>

Having established a background understanding about the agency and its working ethos, the further discussion provides a detailed description of the co-creation journey, by analyzing the phases constituting the design approach. In doing so, it will be shown that the core area of activity for Calvium rests in the central portion of the journey, the Agile Development. Furthermore, this description will allow us to better frame the investigation of the case study in the next sections.

Calvium’s co-creation journey is a working approach based on five linear steps of the development process (Figure 3.2).<sup>27</sup> These main phases are: Discovery, during which the agency interact with the site to define objectives, identify personas and user stories; Experience Design, during which a draft of the user journey is outlined and initial concepts are developed; Agile Development, during which these concept are rapidly prototyped in mock-ups; User Testing, when the mock-ups are tested by a selected sample of users, to be then refined and test again until satisfied, and then the

---

<sup>26</sup> Reid, *How AR, apps and digital placemaking*.

<sup>27</sup> For some examples of different working approaches, see Doolittle et al., *Building a Mobile Application*, and Vithani and Kumar, *Modeling the Mobile Application*.

last phase of Delivery, which sees the full and final development of the mobile application for public or private distribution, and plan for (long-term) maintenance. The three central steps, Experience Design, Agile Development, and User Testing, have been grouped by Calvium under the term “Agile Development”. For this portion of the journey, Calvium envisions instead a circular model, which highlights the iterative nature of the test and refine process of the design of the mobile app and its contents. In the following description, it will be shown what this Agile Development phase entails in more detail, in order to highlight its relevance for the overall success of the co-creation journey.

### *The Experience Design*

The Experience Design represents the first section of this phase, and it is a circular model structured around two levels, referring to two distinct phases of the development of mobile experiences, the user experience design and the working methodology (Figure 3.4). The outer circle focus on the four main components of the design of user experiences, that are user, context, content, and interaction. These four quadrants are conceived as an overarching structure to the development of the app, which aim at addressing a crucial question, “why do I need an app for the message I want to share?”, in order to understand if the app is a good fit given your audience, your interpretation message, your site, and the type of interaction you want your visitors to have with the site. The inner portion of the framework provides instead guidance on the working approach towards the actual development of the mobile applications. Here, there is a set of three main actions to be taken in consideration during the production of the experience, which are develop, test, refine. Both the inner and the outer portion are visualised and envisioned as iterative processes.



According to standards for design thinking, the whole framework is not a linear or cascade design model, nor it is meant to be cyclical and non-linear. Each section interacts with and has impact on the others, yet all the segments of the diagram need to be addressed in any design. However, Calvium in its guidelines proposes some specific preliminary reflections and questions to be addressed before starting the development the project. A first aspect to consider is the purpose of the experience. Calvium identifies two main motivations leading to the choice and design of a mobile app: extrinsic, the reason why a mobile experience is developed, and intrinsic, what the designer wants the users to get from the experience. While the intrinsic motivation drives ‘the needs for the experience design’<sup>28</sup> more attention should be given to the extrinsic motivations since the purpose of deployment of the app alters significantly the design strategies.

Calvium recognises four primary extrinsic reasons related to the type of activities that the mobile apps will be used for: research, art/exhibition, commercial, and personal, each of them entailing their own considerations. For example, if the primary motivation behind the experience is research then design research methods need to be selected that are appropriate for the context and the intended users. On the other side, if the primary reason for the experience is an artistic ‘installation’ then the design should be giving more attention to the interaction, to create a novel and compelling experience. To support the definition of the motivations, it is fundamental to understand the peculiar traits of the heritage site, their audience and their resources in terms of staff, time and budget. Outlining these characteristics helps defining their strength within the design “creative tension”, which provides the ultimate shape of the experience (Figure

---

<sup>28</sup> Reid et al., *Experience Design Guidelines*, 11.

3.7).<sup>29</sup> In other words, it is necessary to understand how much influence these factors have on the design of the new experience. Factors like severely limited budget, time and resource ineluctably restrict the degree of risks and creativity of the experience. It is interesting to note that little attention has been given to the intrinsic needs that motivate the purpose, that is the actual value proposition of the experience. This is an attitude that is seen also for immersive experiences developed by the creative industry, and whereas conversations ‘are no doubt taking place between researchers and users, but they have not been addressed as research questions and in the literature.’<sup>30</sup>

Once the experience design is completed, the next phase is represented by Agile Development. This loop approach, referring to the intermediate phase of software development, is strongly informed by Design Thinking principles, and refers directly to the Double Diamond design. The method stresses the importance of progressing with the design through continuous iterations of design prototypes, and it is one of the most commonly used approaches by software developers since it helps ‘mitigate against large scale investment over the wrong solution and delay high cost setup.’<sup>31</sup> The interest towards the methodology of agile development, originated in 1970s following critical reviews of the pioneering “waterfall method” by Winston Royce, found its apex in the *Agile Manifesto*, written in 2001 by a group of independent-minded software practitioners.<sup>32</sup> Following the release of the manifesto, a wealth of research has been

---

<sup>29</sup> Reid et al., *Experience Design Guidelines*, 10.

<sup>30</sup> Kidd and McAvoy, *Immersive experiences*.

<sup>31</sup> Calvium Ltd., “People Power: enable transformation with mobile innovation. WEAFF presentation,” July 9, 2020, video, 41:16, <https://vimeo.com/436770250>.

<sup>32</sup> Walter W Royce, “Managing the Development of Large Software Systems,” in *Proceedings of IEEE WESCON Volume 26* (New York: Institute of Electrical and Electronics Engineers, 1970). “Manifesto for Agile Software Development,” Beck Kent et al., accessed November 29, 2023. <http://agilemanifesto.org/>. For an historical overview of the research on the agile approach see Jalil

carried out on the best practices to apply the core 'four values' at the organisational level (Figure 3.6).<sup>33</sup>

Calvium approaches agile development focusing on rapid prototyping using the "wizard of oz" method. A popular type of prototyping amid app developers, the term was coined by Jeff Kelley in the early 1980s to describe an iterative work process which calls for simulated user-based evaluation of unimplemented technology within laboratory settings.<sup>34</sup> This prototyping method sees testers interacting with a rudimentary model of the completed product, a prototype. This prototype has to be quite simple, using basic interactions which are representative of some of the performing tasks the finished working product would perform. The tests are performed by following a sequence of iterations, each of them providing anecdotal feedback which helps improve the next round of development, until reaching a design that is satisfactory.<sup>35</sup> The method is extensively employed in the tech industry to test the usability of any digital interface which calls for human-computer interaction. Whereas a time consuming process, citing Nielsen *et al.*, 'it's worth the hassle'<sup>36</sup>, since rapid prototyping allows to cut time and efforts in creating a product which may not fit the purpose or function properly, while enables deep understanding and controls of the

---

Abbas, "Quintessence of Traditional and Agile Requirement Engineering," *Journal of Software Engineering and Applications* 9, (2016). <http://dx.doi.org/10.4236/jsea.2016.93005>.

<sup>33</sup> Abbas, *Quintessence*.

<sup>34</sup> John F. Kelley, "An iterative design methodology for user-friendly natural-language office information applications," *ACM Transaction son Office Information Systems* 2, no. 1 (1984). <https://doi.org/10.3758/BF03204642>.

<sup>35</sup> Andrew Finke, "Lake: A Digital Wizard of Oz Prototyping Tool." In *Proceedings of CHI Conference on Human Factors in Computing Systems Extended Abstracts* (2019). <https://doi.org/10.1145/3290607.3308455>. Yang Li, Jason Hong and James Landay, "Design Challenges and Principles for Wizard of Oz Testing of Location-Enhanced Applications," *IEEE Pervasive Computing*. 6 (2007). <http://doi.org/10.1109/MPRV.2007.28>.

<sup>36</sup> Christian Monrad Nielsen et al., "It's worth the hassle!: the added value of evaluating the usability of mobile systems in the field," in *Proceedings of the 4th Nordic conference on Human-computer interaction: changing roles*. ACM, (2006). <https://vbn.aau.dk/da/publications/its-worth-the-hassle-the-added-value-of-evaluating-the-usability>.

many variables (e.g. the environment, the target audience, the desired interactions) that may negatively influence any preliminary conceptual design. Given the benefits in terms of time and resources savings, rapid prototyping is unanimously considered an essential phase of the mobile application production and an essential feature of the agile development.

The last, but not least, phase is user testing. This a well-established code of practice for digital products, including mobile apps, which is essential to the correct unfolding of the agile development. The user testing unfolds on two levels: the testing of the usability of the interface, and the testing of the user experience, that is how the users' engage with the content of the app. An important distinction needs to be further reiterated here. Whereas user experience and usability are often equated, the two concepts differ by virtue of their objectives. While, as Economou points out, the relationship between usability and user experiences remains 'ambivalent'<sup>37</sup>, however usability is part of one metric measurement, while user experience is 'a person's perception and responses that result from the use and/or anticipated use of a product, service, system, or an object'.<sup>38</sup> This is the reason why researchers agree that evaluating the user experience of mobile apps, in particular when these call for immersive and affective response, is challenging, and that '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.'<sup>39</sup>

---

<sup>37</sup> Economou, *Heritage in digital era*.

<sup>38</sup> International Organization for Standardization, *ISO 9241-210: 2019. Ergonomics of human-system interaction, Part 210: Human-centred design for interactive systems* (Washington, DC: American National Standards Institute ANSI, 2019), accessed November 29, 2023, <https://www.iso.org/standard/52075.html>.

<sup>39</sup> Kidd and McAvoy, *Immersive experiences*.

By further investigating the structure of the co-creation journey as designed by Calvium, this section highlighted few key elements of the working model. Firstly, the centrality of the Discovery phase, which helps at establishing the value proposition of the experience, and thus choosing accordingly the design conventions which better fit the target audience. Furthermore, the co-creation journey strongly relies on the agile development phase, and in particular the user testing of the prototype, not only because it allows to keep the tech development running, but also because it allows to capture screenshots of the performance of the app in terms of audience engagement before full development. Lastly, the Delivery phase also accounts for planning the type and length of the post-delivery maintenance of the apps. This generally refers to time-capped software updates and review of the analytics, to prevent obsolescence, which is an often overlooked feature in non-commercial developments. As it will be shown in the next sections, all these considerations have concurred in the shaping of the final design of the mobile app.

### **3.4 'Discovering' Tower Bridge.**

The *Family Learning Trail* is a published mobile application developed by Calvium for the heritage site of Tower Bridge, London. Released in May 2016, the app is compatible with both iOS and Android operated smartphones, and it is available for free download from the main app distributing platforms.<sup>40</sup> The app has been developed over a time frame of ten months, from the start of the contract in September 2015 to the publishing on main distributing platforms in May of the next year. Since then, the

---

<sup>40</sup>For Android version the app is available from the Play Google platform, at [https://play.google.com/store/apps/details?id=uk.gov.cityoflondon.towerbridgefamilytrail&hl=en\\_GB](https://play.google.com/store/apps/details?id=uk.gov.cityoflondon.towerbridgefamilytrail&hl=en_GB). For the iOS version is available on the Apple Store see <https://apps.apple.com/gb/app/tower-bridge-family-trail-app/id1096071473#?platform=ipad>.

app has been downloaded more than ten thousand times and has been recently granted the endorsement of educational app by the *Google Suite for Education* for younger users. As introduced on the official website of the Tower Bridge, the app 'has been designed for you and your family to work together to unearth amazing stories from the Bridge's history as well as discover the way Tower Bridge functions.'<sup>41</sup>

Tower Bridge is an heritage site that has multiple destinations of use, being at the same time a working bridge, a Grade I listed monument, and an events and exhibition space since the early 1980s. After hitting almost 700.000 visitors in the period 2014/2015 (Table 3.2), the site realised that it was no longer possible to rely on past interpretative assets to cater for the growing audience, more demanding and varied in their background. This led the site to carry out a visitor survey in summer 2015, with the aim of profiling their audience and develop accordingly a new interpretation plan. The results of the visitor research showed that more than half of the visitors come from abroad, many of them are first (and only) time visitors, and there is a large proportion, growing during high season, of families and groups. Their two main audience segments are domestic audience, made up by families and groups with 5-11 years old children, and international tourists on their tour of the highlights of London.

Accordingly to the results of the audience profiling, the site decided to compile a new Interpretation Plan<sup>42</sup>, where the objectives and the overall strategy of the new plan have been clearly outlined in the following points: provide an overall experience that is enthusiastic, engaging, informative and welcoming; improve the understanding and appreciation of the various aspects the Bridge embodies: historical, architectural,

---

<sup>41</sup> "Family Trail App," Tower Bridge, accessed November 29, 2023, <https://www.towerbridge.org.uk/familytrailapp/>.

<sup>42</sup> See "Tower Bridge Proposal" in Portfolio.

technical, aesthetic, social, and so on; deliver interpretation that is audience-focused, inclusive and layered; develop an experience that is coherent and consistent; and use modern and lively, but timeless approaches for the delivery and design of the interpretation. Furthermore, the site has been very specific also regarding the main criteria around which the new interpretation should be designed: knowledge, how much the interpretation facilitate learning about history, construction and operation of the Bridge; emotion, how much the users are engaged with and inspired by the experience; attitude, how much the interpretation supports visitors in recognising and appreciating the Tower Bridge not only as iconic landmark but also as working site, fruit of the hard labour and creativity of the British people; skills, how much the interpretation helps visitors to understand the engineering mechanism of the bridge; and behaviour, how much the interpretation provides an enjoyable time as a family or a group and it is not impacting negatively the dwell time of other visitors. Amongst the key requirements of the brief, the new interpretation would need to integrate the existing on site digital interpretation, a mobile app for the Glass Floor section. While targeting the designated audience, the new experience should also account for more practical needs of the site, which still maintains its operational role. Overall, the aim of the new digital innovation is to generally attract more visitors at the site, but in particular to a detached area from the bridge, the Engine Room, which is less visited despite its historical relevance.

Given the thoroughly defined value proposition for the new visitor offer, the Discovery phase for the mobile apps has been relatively short, since the intrinsic motivation for why an application is the best tool was already outlined by the specs of the interpretation plan. Therefore, Calvium organised at Tower Bridge a one day kick off meeting in October 2015 during which the site described its premises, and internal

organisation, while also sharing with the developers its idea of the interpretation and the message they want to communicate to its audience. At this stage, with the purpose of providing the site with a specific and in depth explanation of how the co-creation journey unfolds, Calvium has divided the overall projects into nineteen smaller work packages (WP)(Figure 3.6).<sup>43</sup> Each work package focuses on particular aspects of the deliverables, providing appropriate touch points for interaction with the site staff. The WP have been grouped into three main categories echoing the three stages of the co-creation journey, Discovery - Agile Development – Delivery.

In the light of the specific site requirements for the new interpretation, Calvium proposed the *Family Learning Trail*, a smartphone-based BYOD audio tour, based on interactive games in both digital and analog version to offer more inclusivity (in particular for younger audience). The games would encourage learning-by-stealth about the relevance of the building as iconic landmark for the city of London, but also as an engineering excellency. The following section investigates the modalities by which Calvium has been shaping the experience design of the app in accordance with the value proposition elaborated by Tower Bridge.

### **3.5 Designing for the target audience.**

This section offers a deeper understanding on the modalities by which design conventions related to usability and narrative are employed within commercial context, which is one of the questions this chapter aims at addressing. In the description that follows, the different steps taken to the definition of the characteristics of the app have

---

<sup>43</sup> See “Consultancy, Design and Production of a Digital Family Learning Trail for Tower Bridge” in Portfolio.



been structured following the same approach used by Calvium, by which the construction of the experience is based onto identify and address the potential issues related to each dimensions composing the experience itself. Therefore, the discussion will touch the four main dimensions previously introduced: user, context, content, and interaction.

### *Users*

The first dimensions considered by Calvium to define what type of experience is the user, 'that is who the experience is for and what particular traits or characteristics will be influential on the design.'<sup>44</sup> In terms of audience segmentation, thanks to the extensive visitor survey carried out by the site in the summer before commissioning the new experience, the Tower Bridge had identified families with young children as the target audience for the new interpretation plan. Using one of the best HCI standard for experience design Calvium proceeded with outlining examples of user personas which create some user model, in order to help shaping the specific characteristics of the experience.<sup>45</sup> A first example of user persona is a family of four, with young children (4 and 8 years old), coming from abroad and staying London over the weekend, which have planned among their busy sightseeing schedule to pay a visit the Tower Bridge for its historical relevance but in need of some on-site activities to keep the children entertained during the visit. Another crafted persona is a single parent with a 7 years old child spending a day out in London who would like the kid to learn more about the site but in a fun and engaging way. Given the young nature of the visitors and the limited time length of the visit, the design issues identified for the Tower Bridge are

---

<sup>44</sup> Reid et al., *Experience Design Guidelines*, 16.

<sup>45</sup> Basaraba et al., *A data-driven approach*.

mostly related to social protocols, and the impact of the app users' behaviour on the visitors' flow and general user experiences of the non-users.

For social protocols, Calvium refers to the rules of social engagement that have to be respected when using an app in a shared space, by which for example apps 'do not need to intrude on the surrounding environment anymore than pedestrians do.'<sup>46</sup> As a result, if the app visitor journey is not properly designed, the engagement with the app might disrupt the visit flow of all the other visitors who are not using the app. This is still an under investigated theme within the relevant literature where the focus instead is on social protocols for using social media within the premises of the museum and heritage site.<sup>47</sup> Furthermore, it is only more recently that researchers have started to investigate the impact of mobile apps in visitors' movement patterns, circulation, timing or social interaction, showing how self-guided tour apps can actually slow down the pace of engagement, causing potential bottleneck in the visitors' flow.<sup>48</sup> A similar issue was identified also for the Tower Bridge. This is particularly problematic given the outline of the building footprint, characterised by two relatively narrow one-way walkthroughs that usually shape the visitor flow in a loop. Furthermore, the site raised the issue that tourists visiting the Tower Bridge mostly spend their time in the east walkway of the bridge peering down the glass floor, installed in 2014 and soon became the most appealing attractions of the site. Since the glass floor offers an unusual forty metres bird-eye view of river Thames, this walkway spot is particularly appealing to tourists. Everyday a crowd stands there, enjoying the view and waiting to see the

---

<sup>46</sup> Reid et al., *Experience Design Guidelines*, 16.

<sup>47</sup> Daniel Pett, "Use of social media within the British Museum and the museum sector," in *Archaeology and digital communication: Towards strategies of public engagement*, ed. Chaira Bonacchi (London: Archetype, 2012).

<sup>48</sup> Joel Lanir et al., "The Influence of a Location-Aware Mobile Guide on Museum Visitors' Behavior," *Interacting with Computers* 25, no. 6 (November 2013). <https://doi.org/10.1093/iwc/iwt002>.

bridge's bascules lifting and allowing the passage of the boats. This often results in a bottleneck caused by people waiting to see the spectacle of the operating bascules. In order to resolve this issues, in occasion of the opening of the glass floor section the site commissioned an Augmented Reality mobile application 'Raise the Bridge' thanks to which tourists could watch a simulation of the bridge in operations.

As a result of these considerations, the user journey of the app has been designed to unfold in a linear sequence, with the point of interactions spread away from areas where visitors might be looking at the fixed interpretation. As a result, the touchpoints of the app concentrate more the visitors' attention towards the outside landscape, to explore what you can see in the city landscape from on the walkways and items that would not naturally be a long dwell point in the engine rooms. Given the existing bottleneck issue in the visitors' flow at the Glass Floor area, here Calvium decided to keep the moment of engagement with the app minimal with the aim of avoiding any further stress to the already confined space. The new games developed for that area, while conceptually linked to the area, are designed so that there is no actually need to stay at the glass floor section and block the space for other visitors if trail users want to play longer than a few minutes.

Furthermore, attention has also been given at the impact on social protocols that the introduction of an app may have on site logistics. Given the high volume of yearly visitors at the Tower Bridge, it would not have been possible to offer the app using rented devices. Ideally, this would have allowed to provide more inclusivity, offering the opportunity to experience the app also to visitors without smartphones, for example in the case of mono-parental families which only has one smartphone to share. However, in the light of the high costs this would have entailed in terms of initial

investment, long-term maintenance and staff logistics, the app has been designed as BYOD app to be used on personal devices, paired with its analog version in the form of a printed leaflet. Although paper booklets are dispendious for the site, this hybrid approach of combining a mobile app with its paper version ensures that the experience is accessible to all family groups and make it easier for all members to participate and to share the experience. Despite the addition of the leaflet, the impact on the staff's duties remains minimal. On arrival in the North Tower reception, families are made aware of the free Family Learning trail via posters and the lobby staff. There, whilst lining up for admission they can connect to the free Wi-Fi and easily download the app, and receive the paper version of the trail.

### *Context*

This section looks at the design constraints that might arise in relation to the context, the physical space in which the experience with the apps is taking place. One evident issue at Tower Bridge, already identified by the staff, is the fact that the site spreads over two distinct buildings, the actual bridge and the engine rooms. Despite the bridge being a popular destination for tourists, only few of them visit the engine rooms, a place of great historical significance for the bridge, and more generally for the its being a masterpiece of Victorian engineering. The engine rooms is less than 100 meters away from the bridge, yet there is no direct internal connection with the bridge. To reach the engine rooms, visitors have to exit the bridge, and follow the public footpath and take a staircase towards the bank level of the river passing under the bridge (Figure 3.10). Furthermore, the current signposting does not clearly indicate where the engine room is, and how to reach the building, therefore often visitors do conclude

their visit exiting at the South Tower. As a result, the engine rooms see a significant lower number of visitors compared to the bridge.

To direct the visitors' flow at the engine rooms, two solutions have been identified: personalisation of the user journey, and a more intuitive wayfinding within the broader physical space of the Tower Bridge that signposts visitors towards the engine room. The former, user journey personalisation see the option to choose the start point of the trail by accessing at either building (i.e. North Tower and engine rooms), as well as providing an option between 'take the stairs' and 'take the lift' is offered for visitors starting the journey at the North Tower (Figure 3.8). This has been paired with a clearer signposting, visually signalling step-by-step the path that users need to take when leaving the bridge to reach the engine room. While initially it was considered to include a map, which is one of the design conventions for navigation with mobile trails, this idea has been quickly discarded. The journey from the bridge to the engine rooms is not particularly straightforward, including staircase and lift access, the description of which might have jeopardise the overall ease of use of the navigation system. To encourage visitors towards the engine rooms, half-way-through the journey leading towards engine rooms the app offers a "spot-the-object" game, which in principle should attract more users to continue the tour at the engine room.

### *Content*

Being the target audience the age group of 6-12 years old, and considered the learning objectives of the new visitor offer, Calvium proposed the creation of location-based games. There are two different sets of games. One set is composed of games which are accessible only within the app, and a set of games offered within a printed pocket-

size booklet. The latter is intended mostly for visitors who do not have access to a smartphone, as well as the less 'tech-literate' age group (under 5 years old). The decision to include a printed set of mini games responds to the desire of the site to allow access to the ludic activities to families to the greatest number of visitors as possible. The games offered digitally via the app are: Steer Boat, Bridge Builder, Match Skyline, Match the Plaques, Stoke the Boiler, Oil the Engine, Fix the Engine (Figure 3.11). Structured as some of the most classic games, these see a great variety of interactions with the device. Visitors can manoeuvre a ship through the bascules, reconstruct the bridge crumbled into pieces, match objects, spot the differences and identify some of the views.

To encourage more active engagement with the games, Calvium has developed an overarching treasure-hunt game intended as a reward for completing the games and the overall tour. This game allows the users to collect a series of twelve sounds every time they successfully complete a game. For example, for successfully completing the Steer the Boat competition, users are rewarded with the clanking sound of the lifting mechanism of Tower Bridge opening to allow boats through (Figure 3.13). The full set of them offers to the users a sum up of all the sounds which are characteristics of the multiple identities of the Tower Bridge (3.14). Offer encouragement through incentives and rewards is an increasingly trend for locative games, but often 'this is gaming in the service of widening participation, but not necessarily in the service of historical understanding.'<sup>49</sup> However, in the case of this game, the rewards are not collecting simply by observing the landscape, they are obtain only after having complete a challenge, therefore avoiding any passive visitor experience.

---

<sup>49</sup> Poole, *Ghosts in the Garden*, 307.

All the games are highly interactive and extensively leverage the use of the haptic functionalities of the phone and the touchscreen (Figure 3.15). This a significantly innovative approach to design of mobile app, Calvium was starting to master and is the use of the microphone to manoeuvre the ship in the game Steer the Boat, where users are meant to blow into the microphone to simulate the wind that sail the boat across the bridge. The fact that the site wanted the app narrative to unfold mostly via seven small interactive games meant designing for several different users' mechanical interaction (e.g. blowing, tilt to tighten the screw or filling the oil can). To facilitate the familiarisation with the interactions, the app provides precise instructions, via graphic tutorials and on-screen prompts to guide the user throughout the tasks.

According to the site interpretative requirements, these activities are designed to foster a different way of engaging with the site. For example, the boat and skyline game provide opportunities to surface the tradition, long life and work of London Bridge Trust and the Corporation of London. The games invite the users to concentrate more on what you can see outside on the walkways for spotting details and cues to solve the games, and in turn supporting the users to relate more effectively with the landscape surrounding the building. With the goal of helping the youngest audience to engage recreationally with the architectonic features of the bridge, as well as with its surrounding city landmarks, the games call for active exploration of the site. For example, the four 'match-the-pair' games ask visitors to find specific architectonic features, such as Match the Plaques, as well spot the iconic buildings characterising the London skyline from the Tower Bridge, like in the case of the game Match Skyline.

These activities have been designed with an educational objective. The site wanted an experience allowing the youngest visitor to "learn by stealth" about the history,

construction and operation of the Bridge. Maximising the use of mobile haptics for broader engagement, users need to simulate skills of control, design, attention to detail in mastering the games and appreciate how they were applied to the Bridge. With particular reference to the app section referred to the engine rooms, users can learn about the operations behind running the engine, with games that ask visitors to use “fix the engine” by using the mobile phone as a spanner (Figure 3.11). To further the learning, during the visit of the site, some educational information are offered in the form of curiosity facts, for example about the number of workers needed to build the bridge, or the number of rivets and bricks used to build the Tower Bridge (Figure 3.12).

The actual learning outcomes through locative games are a largely debated topic, which divides the scholarly community and locative storytelling practitioners<sup>50</sup>, with many works pointing towards the fact that, as Steve Poole points out in the words’ of Carrie Kotcho, ‘until you actually do history, you’re really not learning what history’s all about.’<sup>51</sup>. Accordingly, the extensive use of haptics in the games, which taps upon some ‘neglected sensory modalities’<sup>52</sup>, paired with the challenge of completing the games to obtain a rewards, suggests that the design strategy of situated games allow ‘contextual learning to be a natural outcome of engaging with researched content.’<sup>53</sup>

---

<sup>50</sup> Mortara et al., “Learning cultural heritage by serious games,” *Journal of Cultural Heritage*, 15 (2014). <http://doi.org/10.1016/j.culher.2013.04.004>.

<sup>51</sup> Poole, *Ghosts in the Garden*, 305.

<sup>52</sup> Jeff Malpas, “New Media, Cultural Heritage and the Sense of Place: Mapping the Conceptual Ground,” *International Journal of Heritage Studies* 14,3 (2008), 207. <https://doi.org/10.1080/13527250801953652>.

<sup>53</sup> Poole, *Ghosts in the Garden*, 309.



## *Interaction*

Unlike the majority of the apps developed by Calvium, this app is not geolocated and the navigation and the content are manually triggered. The choice of not using any locative media has been dictated by the physiognomic of the site, as well as the hybrid outdoor-indoor nature of the trail. Proximity technologies, for example i Beacons, were not an option either for two main reasons. Alongside their frequent need of maintenance, it is worthwhile to consider that the user journey unfolds over two main places, the walkways and engine rooms, which sees the users exiting the bridge and walking in the street to reach the second space. Leaving the building signifies losing the i Beacons signal and calling for an alternative mean of navigating the visitors. To minimize the tech hustles and flaws of combining different type of geolocation, it was decided instead to opt for an intuitive visual design of the wayfinding system.

In order to provide users with simple and intuitive navigation, the design of the wayfinding has been strongly based on good HCI practices and design conventions. In order to facilitate the navigation within the buildings, Calvium has visually rendered the user journey as a series of touchpoints connect by a white lines that flows seamlessly from one building to the other (Figure 3.9). Relying on the already discussed practices of “direct eye gaze” and “use physical markers”, the task of navigation is provided by universally recognised symbols (e.g. directional arrows) paired with an image of the point of interest and a text-embedded description (Figure 3.9). With the same objective of familiarisation with the navigation mechanics, the interaction has been kept consistent throughout the app and the user journey is visually rendered as a linear sequence of point of interests, identified by a picture, a

short text label and with a tick button to tap when the destination is reached (Figure 3.9).

As specifically asked by the site, the storytelling has an overall light-touch, child-friendly approach. This is conveyed not only by the games, but also by the extensive use of audio inputs. Sounds represent an important component of the *Family Learning Trail* app. Not only they are used for navigation and feedback, but learning about the historical and the peculiar soundscape of the Tower Bridge is part of the educational objectives identified by the site. As mentioned, sounds are also used to help the visitors in wayfinding as well as feedback mechanism to understand the success or failure of a task. As mentioned before, due to structural limitations of the Tower Bridge, it was not possible to provide a geolocated navigation of the site. Instead, it was chosen to provide users with a manual triggering which meant a constant need to check the phone to allow proper wayfinding in the building. While Calvium strongly advocates to 'limit the need for screen based interaction'<sup>54</sup>, the lack of automated content triggering, meant that visitors would have to regularly check their phone to understand if they are going in the right direction, as well as for accessing the contents at the different touchpoints. To mitigate the screen interference, the navigation strongly relies on visual cues by using a picture of the location where the activity was supposed to take place, paired with a simple check in button and jingles of footsteps to indicate when it is time to walk towards the next point of interest. As we have seen for design conventions, the use of images together with sounds and haptics are a well-known way to facilitate the navigation, even when this one is automatically triggered by geofenced areas.

---

<sup>54</sup> Reid et al., *Experience Design Framework*.

Following the principles of good HCI design, the audio feedback is consistent throughout the app, with different sounds connected to specific tasks to help the user cognition system to quickly familiarise with the interface as recommended by HC principles. For example, when clicking on the directional green arrow a sound of footsteps alerts the users they are supposed to walk towards the next point of interest. The systematic use of audio responses is functional to keep the experience user-friendly, suited to non-specialist, non-technical audiences, with a relevant component of children and non-English speakers visitors, who need an app easy enough to be understood, played and enjoyed.

The design of the interface too keeps the logic simple. Consistency in the design of the buttons, paired with the use of universally recognised symbols, prompts intuitive understanding of the function of the button and immediate feedback on the next task to accomplish. For example, the icon turns from yellow to green once the visitors are ready to move on to the next point of interest. At the same time, a pair of googly eyes prompts the user to watch out for the detail in the picture to find the right location (Figure 3.12).

### **3.6 Prototyping and testing the Family Learning Trail.**

Once the experience design was progressed enough, Calvium started with the development of a first prototype to be then tested firstly by the site staff and then later with a sample of visitors. This coincides with the beginning of the Agile Development phase. Despite the name that cues to speed and rapidity, agile development is the most time-consuming phase of the development. To help the site understand the different tasks involved in the phase and how these would have impacted in terms of

prompt feedback or access to resources, a clear plan of the development pipeline including a tentative timeline and outline of the different responsibilities (Table 3.3).<sup>55</sup>

As discussed before, testing is a mandatory step of the agile development for ensuring a successful app development process. The app has been tested using a three-fold approach: the experience design and interface usability tested firstly with the site staff, and then by visitors, and finally the software quality assurance (QA) to stress-test the usability and functionality tested. The “in the wild” user testing with the site staff first, and then with a sample of visitors are happening at the early stages of the production, so that any change resulting from the feedback can happen before the QA test session is carried out by developers within the premises of the agency’s office.

To check if the drafted design experience reflected the expectations of the site, the first testing session has been carried out with the staff. A round of preliminary tests was organised in November 2015 with selected members of the Tower Bridge staff, namely the Education Office team, the Marketing team, and some floor stewards. The purpose of this session was to assess and feedback the interpretative offer proposed by Calvium for the two versions of the Family Learning Trail. The test session with the site staff did not involve the use of an actual mobile app prototype, but rather realistic paper mock-ups of the games proposed by Calvium for both the mobile application and the companion booklet. At this stage, four mini games were designed (cf. paper boats, skyline building, engine maze and spanner word search) that mimic the type of interactions and tasks users are expected to perform. During staff trial, questionnaires and discussion feedback forms were used to make improvements to the experiences prior to the public user trial. The testing phase was recorded via video and using a

---

<sup>55</sup> See “Consultancy, Design and Production of a Digital Family Learning Trail for Tower Bridge” in Portfolio.

behaviour observation checklist especially compiled for the session.<sup>56</sup> The questionnaire aimed at understanding how the staff felt about the level of engagement of the proposed games, but also in terms of user journey (cf. “how do you envision visitors will experience the trail across the bridge and into the engine rooms?”) and usability (cf. “are the style and content right? do you need more instructions to complete the tasks?”).<sup>57</sup> The findings show that the staff generally found the app and the paper games fun and easy to play. This allowed to sign off the experience design and proceed with the second planned phase of user testing with on-site visitors.

In December 2015, the working prototypes have instead been tested with visitors of the Tower Bridge. Both tests followed the same format. Families were engaged at the Ticket Office and offered a free entrance if willing to participate. Provided with Calvium’s test devices and copies of the companion booklet, visitors were monitored via direct observation using the behaviours observation checklist and their visit recorded using a GoPro camera. Further feedback was collected via a questionnaire and interviews post-visit. The findings from this extensive user tests, which collected over fifty responses, were analysed and discussed at a following workshop with the site staff, whose feedback informed the final design of the experience. The user test in December 2015 was carried out over a time span of a week, including the weekend, to better cover the wide variety of the site visitors. The method used is the “walkthrough” testing, where nine family groups were shadowed as they took part in each of the already developed activities of the *Family Learning Trail*. At the end of their visit, they were given questionnaires followed by a short interview session with the team.

---

<sup>56</sup> See “Family Learning Trail Behavioural observation Checklist” in Portfolio.

<sup>57</sup> See “Tower Bridge Users Tests Questionnaire” in Portfolio.

Preliminary findings of this user test show that generally children were excited and wanted to play the games more than once. They were attentive and determined to accomplish the task, and proud when successful. In terms of social interactions, generally younger children were co-operating with peers or adults, while as expected, older kids tend to be focused solely on the activity. Generally, the experience has been judged both by children and parents a fun activity they would recommend to other visitors, with a particular emphasis on the interactive games of the app, which were amongst the favourite games.

The number of participants at the visitor tests is relatively small, and this is due to some challenges encountered in the onboarding process. For instance, many families invited to participate at the test had already pre-booked tickets, or did not speak fluent English so were less enticed to engage. Furthermore, walkthroughs were taking longer than expected. It was then decided to change the onboarding process, by switching to “on-the-spot” testing, where suitable families were asked if they would like to try some activities being designed *in situ*, and were involved in about three activities each, on average. A total of 42 children participated, and after their experience, they were asked to rate the games as “Good”, “OK”, or “Bad”, as many visitors didn’t speak enough English to participate in more in-depth discussion. These on-the-spot tests were conducted in different areas of the bridge, presenting different games in each, depending on context and availability of participants and space at the time of testing. The results of this on-the-spot testing show that generally kids have rated more positively the games they experience at the beginning of the visit. Here too, less challenging games (e.g. Draw the Skyline) have scored lower than more engaging games (e.g. Steer the Boat).

Thanks to the questionnaire and the behaviours observations, some preliminary qualitative findings were gathered.<sup>58</sup> The overall feedback from children and parents was positive, with the latter stating to be grateful their children had activities to do and games to play, keeping them occupied and making their experience of Tower Bridge more fun than they expected, without which the children would probably be bored. Everyone loved the “you win” screens at the end of the games as it gave them validation and also, a sense of accomplishment. The biggest challenge for the app was to navigate and attract visitors towards the engine rooms. Preliminary findings highlighted that the introduction of games at the engine rooms attracted more visitors there.

Some weaknesses too were identified. Alongside some design flaws in the game, mostly in terms of prompting mechanisms and more instructions, the main recognised issues concerned the impact of these games on the site, and their abilities to provide a coherent user journey. Throughout the game playing, one quickly identifiable pitfall was where and how the children might play the games - particularly the paper games. Many children sat or lay on the floor, which though fine when the bridge was quiet, became quite difficult when it was busy and crowded, causing some bottlenecks in the visitor flow. In order to solve this issue, Calvium decided to simplify the tasks of some of the paper games to allow quicker accomplishment of the games and cut time the users spend in the walkways. Timing the length of the users’ engagement with the activity is one of the biggest challenges when designing for game-based experience for young children. The site initially stated that the app should have engaged visitors for half an hour to a maximum of 45 minutes. Whereas Calvium tried to accommodate

---

<sup>58</sup> See “Tower Bridge Family Learning Trail User Trials Feedback Statistics” in Portfolio.

the time request, having designed a set of seven app games and an overarching treasure-hunt style sound collection, the overall estimate time of engagement is more realistically set around one hour and an half. In response to the issues flagged by the visitors' testing, Calvium proceeded with simplifying some games in order to cut the time to complete the tasks and avoid bottlenecks in the visitors' flow.

Furthermore, it was shown that there was an "engagement gap" between the games of the second walkway and the engine rooms, leaving some respondents unsatisfied after doing so many games in the walkways. To make the user journey more coherent, it was suggested to introduced an extra app halfway through the journey from the bridge to the engine room. An additional game was then developed, which calls for visitors to spot some urban features positioned along the footpath that leads from the bridge to the engine rooms. In doing so, the two buildings were conceptually connected, encouraging greater engagement with the engine room, as well as the overall narrative of the app.

The pitfalls identified during the user testing session were then addressed in the full development of the app. Following the initial in-studio simulations of the user tests, the prototypes are turned into final designs to develop the complete experience. This phase has been identified by Calvium with twelve work packages (WP 8 to 19). As the amount of work packages assigned to this phase hints, the 'Delivery' is a lengthy process, taking up half of the time of the whole 'co-creation journey'. The phase includes several tasks to be accomplished before the delivery of the app. A particularly time-consuming work package is the actual development of the final version of the app for both operating systems, iOS and Android. Alongside developing the interface



graphics, the companion booklet, and text copy, prior to submission to the distributing platform the app is stress-test in its functionality by the developers.

The majority of these tests instead have been carried out at the Calvium office. For assessing the Quality Assurance (QA) of the mobile product, Calvium uses the so-called 'wizard of oz' approach, which as discussed earlier, calls for simulated in-studio user-based evaluation of unimplemented technology. From April 29<sup>th</sup> to May 5<sup>th</sup> 2016, assessments were made to verify that the software application performs and functions correctly according to design specifications. Then on 11<sup>th</sup> and the 12<sup>th</sup> of May, tests were carried out to verify that errors identified in previous tests were rectified and the software application would be ready to be published. As mentioned before, sometimes the Delivery phase is slowed down by scope creep, or by last minute changes to the experience design. For example, during the final stages of the production, a game initially discarded (cf. Oil game) was then included into the design, calling for further functionality tests, from 2<sup>nd</sup> until 6<sup>th</sup> and from 17<sup>th</sup> to 21<sup>st</sup> of June 2016, and therefore a first update on the platform just over a month from the public release. Despite this last issue, thanks to the thorough agile approach of testing and developing, the originally planned deadline of end of June has been respected.

### **3.8 Conclusion.**

Using an ethnomethodological approach, this chapter has investigated the life-cycle of the development of the *Family Learning Trail* mobile application for Tower Bridge. The step-by-step analysis of the different phases has highlighted some preliminary considerations, how the approach of the design by using standard protocols for the development of mobile application is a successful strategy for creating an experience

design that addresses both the need of the site and the urgency of delivering an engaging user experience.

The iterative cycle of design-test-refine as structured in the agile development has been proven to be critical to the successful delivery of this experience. This approach captures snapshots of the audience engagement before the final development, and by doing so it grants the opportunity to refine the experience by addressing the issues promptly. Key to this process has been the testing phase. The time spent on site by the Calvium team to understand the context, testing out the user experience with the staff and visitors, to get an idea of if and how the experience was aligning with the intended design, has been crucial to solve the challenges encountered in the prototyping phase. The modularity and scalability of the development methodology has granted robustness to the approach allowing considerably short turnaround time for the experience. Indeed, the technical development unfolded in an (almost) straightforward manner, and, despite some setbacks towards the end of the project, the delivery was carried out within the planned timeframe.

The design of the *Family Learning Trail* has been a complex one for Calvium. With regard to the type of user experience, the final design of the *Family Learning Trail* strongly resonates of the collaborative approach of the 'co-creation journey'. It has been mentioned at the beginning of this chapter how the *Family Learning Trail* in its being interactive game was to some extent, a novelty approach for Calvium, more familiar to standard geolocated audio trails. The choice of this format has been highly informed by the active collaboration with Tower Bridge. The diversity of the site's interests, namely the learning-by-stealth approach towards the novel interpretation, required a broader approach to the design of the mobile application, which took the

form of a set of several interactive mini games. This in turn compelled the design of the mobile app to open up to more complex operations beyond the simple “walk-to-unlock”, finding in the combination of haptic stimulation and storytelling the way to generate a rich sensory engagement. The decision of deploying haptics for enhance interactivity, has, to some extent, stretched the boundaries of the agency’s comfort zone that was just starting to exploit such hardware affordance. The resulting more intangible and harder to design UX highly benefitted by the encounter of Calvium with the agenda of Tower Bridge, as previously suggested by the results of the impact of wider art and humanities on the co-creative process as highlighted by REACT project.<sup>59</sup>

This allowed to sign off the experience design in a relative short time frame, granting more time for further stress-testing the mechanics of the games. The relatively quick definition of the interface and narrative conventions for the app has been greatly facilitated by the fact that Tower Bridge had commissioned the project at a stage in which all the “background” work of audience profiling and definition of the value proposition had already been carried out. In highlighting this aspect, this chapter wants to stress the importance of knowing your audience and plan the value proposition accordingly, to avoid any otherwise inevitable technology-centric approaches.

The choice of developing a series of mini games has also been informed by the desire of Tower Bridge to foster learning about the engineering of the site in a less authoritative way. The games use haptics to simulate the mechanics of the different tools employed for the construction and maintenance of the site, which despite being

---

<sup>59</sup> Timothy J. Senior, Simon Moreton and Jonathan Dovey, “Working Paper: The Arts and Humanities in the Internet of Things” (working paper, REACT Hub, Bristol, 2015), <http://www.react-hub.org.uk/sites/default/files/publications/AH%20in%20IoT.pdf>.

explained on the walls at the engine they often go unnoticed. Within the literature there are discordant opinion about the effectiveness of game to learn history, however, it has been suggested that learning can be prompted by 'new ways to enter into existing places - often by drawing upon neglected sensory modalities or by bringing to the fore aspects of the place that may otherwise go unnoticed or be difficult to access - that look to enable new modes of engagement between users or new forms of collective activity'.<sup>60</sup> The resulting experience is highly interactive and therefore it called for a series of prototype testing to understand the usability and effectiveness of the game-based storytelling. Participants have generally reported feelings of excitement, enthusiasm and a sense of being stimulated to think creatively about the game itself or the topic that involved. This preliminary findings seems to point in the same direction of the previously discussed results of Economou's survey for the EMOTIVE project. Here at Tower Bridge, it is possible to appreciate how emotionally engaging experiences, namely in the form of an highly interactive UX, encourage social interactions, providing strong indications of the potential for emotionally connecting visiting audiences with the distant human past, alongside to develop emotive group experiences.<sup>61</sup> In acknowledging the fact that games are encouraging an active connection with a less conventional narrative of the site, this research contributes to the current scholar knowledge on learning with mobile-based game with a novel example.

From a development perspective, the overall project management approach is another aspect of the 'Agile Development' which is important to highlight here in relation to this research's aim of understanding which are the sustainable practices of design that can

---

<sup>60</sup> Malpas, *New Media*, 207.

<sup>61</sup> Economou, Young and Sosnowska, *Evaluating emotional engagement*, 8.

be implemented. Calvium informs the site about the respective responsibilities and tasks from the outset of the project. It is often underestimated the amount of inputs and time that the site commissioning a mobile experience is required to dedicate to the development of the app. As a consequence, often the development process slows down, the overall turnaround time greatly expanded, and, in the worst case scenario, the app never sees the light. To mitigate potential pitfalls, Calvium usually includes amongst the specs of the work packages two important parameters, the inputs needed for the site and the expected output for the work package. For instance, the WP1 Discovery, which is the moment in which Calvium work with the site to finalise their requirements, has amongst the “inputs from you” time and ideas with the expected outputs to gather all the required documents to start draft the experience design. Setting tasks and responsibilities since the beginning of the project allows both the site and Calvium to understand the amount of time and resources needed to ensure a smooth development of the experience, facilitating the process of onboarding and uptake of the experience, avoiding professional identity and legitimacy problems. Such issues are clearly not attested for the case study of the *Family Learning Trial*, which was strongly desired by the site managers and welcomed by the staff. However the active involvement of the staff from different levels during the stages of the development helped with the process of familiarisation with the new tasks required by the digital addition (for example explaining how to download the app or how the apps works), generally mitigating any feeling by the staff of being “destitute” by the introduction of the app. Facilitating the process of uptake, onboarding and upkeep, are challenges, as we have seen, which so far have not been addressed properly, and this research aims at contributing at the discourse by recommending this organisational approach.

Furthermore, the addition of the label “inputs from you” also adds in the equation another parameter, the location, providing information on where the task of the work package is going to be carried out. Whereas a big portion of the total time is spent in the studio for software development, a good amount of the production is actually taking place at the site. User testing and design specifications always call for the site to be available in terms of accessing the premise and allocating resources (namely staff and facilities) to allow Calvium to proceed with the specific tasks. This highlights how even the creation process of the more technical aspects is strongly impacted by the active engagement of the site than originally expected. In fact, only a small portion of tests, namely the functionality of the software can be carried out off site, since it does not required a direct liaise with the physicality of the space in which the experience is taking place.

One potential flaw to the user experience that this review of the case study has surfaced is the little attention at catering all the components of the target audience. As requested by the site, the app is not linked to the existing interpretation, aside from providing the link to the previously developed Augmented Reality app for the Glass Floor area. Accordingly, the app narrative targets specifically the children, by focusing on games and curiosities as primary mean of engaging with the site. Furthermore, the app has been designed to detour the users away from areas where the interpretation boards are located. However, during the testing one of the issue reported is that children were independently engaging with the games for long spans of time, and parents were seeking some activities to distract themselves. Therefore, it would have been appropriate to consider an alternative layout of the user journey, for example by locating few games of the app closer to the several interpretation boards distributed along the Bridge, or providing families with some further interpretation material.

Further research will have to be carried out to understand also how visitors without children are engaging with the app, and how their engagement with the site is impacted by the *Family Learning Trail*. The investigation of the app analytics may offer a first, even if not granular, understanding at the current practice of engagement with the app, helping the site addressing promptly any sign of lower satisfaction with the experience. Analytics and long-term updates are two means by which Calvium helps the site with avoiding issues of quick obsolescence of the app. Whereas these alone are not enough to understand which are the flaws that can lead to a drop in the audience engagement, however they provide the site with a preliminary understanding of the performance of the app, allowing to quickly address any issue.

In drawing to an end this conclusion, it is worthwhile to briefly reflect on a more ethical aspect of this design approach, that is the sustainability of overall developing process. A proof of the sustainable design approach of the co-creation journey is embedded in its name. The approach has proven successful in delivering an engaging experience, because it kept open a continuous line of communication with the site. Whilst the site needed to rely on the technical expertise of the creators from the media industry to create the app, developers alone cannot deliver a successful product without the collaboration of a site to provide knowledge, contents and granting access for test the several facets of the digital solution in the actual context where the experience will take place.

As advocated by co-production models such as the one of REACT, in this regular exchange of information and knowledge lies the real potential for creating a sustainable experience, once that is organically shaped by different sets of knowledge that compensate each other. Perhaps, it is in this understanding that lies the biggest

learning from my embedded research at Calvium, and one that this thesis claims to be the ultimate mean for sustainable forms of mobile engagement with the heritage.



## **Chapter 4. Research-based approaches to the design of mobile heritage apps.**

### **A practitioner perspective.**

#### **4.1 Introduction.**

Within the academic research community, technological innovation is generally deemed beneficial, but only recently more attention has been given to the sustainable adoption of these technologies, by exploring the impact of new technological uses by visitors (e.g. mobile applications) on the site, in terms of its organisation and capacity load to sustain the digital innovation. In the previous chapter, we have seen how digital heritage scholars share concerns about the sustainability of these mobile apps, especially the most immersive ones, and how a more holistic value proposition is needed to integrate them coherently in the operational fabric of the heritage sites. Thinking at the design of mobile heritage applications in terms of designing a 'service model' calls for cross-disciplinary research that taps into management and operations scholarly knowledge. It is within these premises that the Business Model Innovation (BMI), a methodology for digital innovation of cultural heritage sites, has been developed by the European funded research project VISTA AR – University of Exeter.

Over the course of this thesis, we have learnt to appreciate how, in response to some of the challenges faced by the heritage sector and given the perceived potentials of the smartphone, the interest in mobile practices within the context of museums and heritage has expanded beyond the heritage sector to involve the creative industries and academia. Increasingly, the digital innovation has been led by the creative industries together with academic institutions, whose practices have been progressively seen as a driving force in capturing new audiences and contributing to

the UK, as it has been suggested in the Industrial Strategy and the Creative Industries Sector Deal.

The BMI as methodology is intended to be the result of ‘the co-production of knowledge and ideas, not simply their exchange’<sup>1</sup> between the several project partners. However some initial collaborative difficulties made immediately clear that without sustained and long-term relationships with the people in our network, ‘participants and institutions would revert to old ways very quickly, and practitioners would be stuck in their academic and creative silos.’<sup>2</sup> Previous collaborative projects, such as REACT, have identified in the Creative Producer a core component of their methodology. This professional figure is a ‘creative, administrative, diplomatic and brokering force holding the collaborations together, whilst also helping to develop levels of ambition in terms of markets, products and creative practices.’<sup>3</sup> The project consortium decided then to appoint me in a role similar to the one identified for the REACT project. Amongst other responsibilities, during my embedded research at VISTA I was mainly in charge of the curation and management of the design of mobile experiences using the dedicate methodology. My role gave me the opportunity to get a solid understanding of how the business model works, and what are its strengths and limitations. Therefore, the next sections investigate from an autoethnographic perspective the design process of the mobile heritage experiences for the VISTA AR project using the guidelines provided by the BMI.

This chapter looks specifically at the use of the BMI as experience design framework resulting from business model for digital innovation, in order to see how scholarly

---

<sup>1</sup> Dovey, Moreton and Hargreaves, *REACT Report 2012–2016*, 10.

<sup>2</sup> *Ibid.*, 19.

<sup>3</sup> *Ibid.*

approaches are addressing issues of sustainability of mobile heritage practices. Based on the analysis a set of three immersive experiences, this chapter critically reviews the different steps of design, implementation and delivery of three mobile heritage experiences, developed for three different sites. As embedded researcher of the user experience design of the apps, the research looked into addressing preliminary questions, how the design of the experience can meet proficiently the site's performance criteria whilst still adhering to the digital narrative conventions for mobile heritage experiences? What are the benefits and the challenges of using the BMI for shaping the mobile experiences? And lastly, can the design approach informed by the BMI become a valid alternative to industry experience design frameworks so far developed?

The following sections use an auto-ethnographic approach to describe the whole life-cycle of the development of these experiences, from initial design of the apps in accordance with the sites' value proposition, to delivery of the experiences.

## **4.2 Shifting from “experience design” to “business model”. Digital innovation practices for cultural heritage sites.**

The impact of the augmented technologies on the visitor experience has been widely studied in terms of technical challenges<sup>4</sup>, visitor satisfaction<sup>5</sup>, alignment with the target

---

<sup>4</sup> Dai-In Han, Timothy Jung, and Alex Gibson, “Dublin AR: implementing augmented reality in tourism,” in *Information and Communication Technologies in Tourism 2014: Proceedings of the International Conference in Dublin, Ireland, January 21-24, 2014*, ed. Zheng Xiang and Lis Tussyadiah (London : Springer International Publishing, 2015). [https://doi.org/10.1007/978-3-319-03973-2\\_37](https://doi.org/10.1007/978-3-319-03973-2_37).

<sup>5</sup> Joachim Scholz and Andrew Smith, "Augmented reality: Designing immersive experiences that maximize consumer engagement," *Business Horizons* 59, no. 2 (2016). <http://dx.doi.org/10.1016/j.bushor.2015.10.003>. Mariapina Trunfio et al., "Innovating the cultural heritage museum service model through virtual reality and augmented reality: The effects on the overall visitor experience and satisfaction," *Journal of Heritage Tourism* 17, no. 7 (2021). <https://doi.org/10.1080/1743873X.2020.1850742>.

audience<sup>6</sup> and a learning/educational tools.<sup>7</sup> Mobile heritage experiences have been investigated also in terms of the sustainability effect that this type of storytelling can prompt towards the heritage kept by museums (in different ways according to their size and popularity), showing how they could offer an alternative mean to foster familiarity with the collection, as well as the building, whilst promoting a greater bonding with the site's cultural mission.<sup>8</sup> Whereas the benefits and the limitations of mobile heritage experiences have been largely explored, only recently the research focus is shifting towards understanding how the introduction of these experiences affects the recipient site.<sup>9</sup> That is, how digital innovation, and mobile heritage experiences in particular, are successfully introduced at heritage sites?

Over the past few years, scholarly efforts have been directed towards rethinking at the role, competences and modes of operation and collaborations of museums, cultural institutions and organisations, as well as of the whole ecosystem of stakeholders and infrastructures of cultural heritage in an innovative and long-term perspective.<sup>10</sup> A proposed solution to address this issue is reframing the introduction of digital experiences in terms of a business model.<sup>11</sup> The suggestion is that in order to maintain the functions and generally increasing access to cultural heritage sites, more attention should be given at the benefits and limitations of the introduction of digital innovation, for example on the quality management of museums and cultural heritage

---

<sup>6</sup> Namho Chung et al., "The role of augmented reality for experience-influenced environments: The case of cultural heritage tourism in Korea," *Journal of Travel Research* 57, 5 (2018). <http://doi.org/10.1177/0047287517708255>.

<sup>7</sup> Natasha Moorhouse and Timothy Jung, "Augmented reality to enhance the learning experience in cultural heritage tourism: An experiential learning cycle perspective," *eReview of Tourism Research* 8 (2017). <http://doi.org/10.1016/J.JDMM.2017.03.002>.

<sup>8</sup> Kalliopi Kontiza et al., "How Technology-Powered Storytelling Can Contribute to Cultural Heritage Sustainability," *Sustainability* 12, no. 1666 (2020). <http://doi.org/10.3390/su12041666>.

<sup>9</sup> Trunfio et al., *Innovating the cultural heritage*.

<sup>10</sup> Karol Borowiecki, Neil Jan Forbes and Antonella Fresa, *Cultural Heritage in a Changing World* (Springer Open: Switzerland, 2016).

<sup>11</sup> Elsa Gatelier et al., *A business model innovation*.

attractions<sup>12</sup>, but also at building for resilience<sup>13</sup>, through assessment of the innovative capacity.<sup>14</sup> Accordingly, designing an experience means therefore accounting for all the dimensions defining the site in terms of business operations, that are the general organisation (e.g. the reception staff), the modalities by which the visitor offer is provided, and the broader tourism system to which the site belongs.

Looking at business models for heritage sites, limited methodological theory or design practice tailored to this sector has emerged or been tested. The recently proposed business model digital innovation (BMI) for heritage sites developed by the VISTA AR project aims at bridging the gap from theory to practice, by providing a systematic and modular tool to guide site managers through the different stages of the digital innovation using immersive technology. Intended for multiple heritage sites of different nature, the BMI features a defined set of questions which aim at facilitating the design of the user experience by accounting for several parameters (cf. staff organisation, space curation and visitors' offer across the different stages of the visit). The project is based on a holistic design-driven approach of 'action-research', a practice based research pursued thanks to a set of design experimentations that could become replicable as design formats.<sup>15</sup> Alike more commercial methods, the BMI guidelines structures the design around a series of key constructs, such as persona, phases of the journey, decision making and touchpoint modality.

---

<sup>12</sup> Fabio Carbone et al., "Extending and adapting the concept of quality management for museums and cultural heritage attractions: A comparative study of southern European cultural heritage managers' perceptions," *Tourism Management Perspectives* 35 (2020). <https://doi.org/10.1016/j.tmp.2020.100698>.

<sup>13</sup> Borowiecki, Forbes, and Fresa, *Cultural Heritage in a Changing World*.

<sup>14</sup> Pier Luigi Sacco, "Culture 3.0: Building competitiveness and innovative capacity through culture," (paper presented at A vision for European digital cultural heritage 2025. Varna 28 and 29 May 2018). <https://www.slideshare.net/Europeana/culture-30-building-competitiveness-and-innovative-capacity-through-culture-by-pier-luigi-sacco-a-vision-for-european-digital-cultural-heritage-2025-varna-28-29-may-2018>.

<sup>15</sup> Gatelier et al., *A business model innovation*.

The following step-by-step description of the design process is offered using three case studies which allows to outline the benefits and challenges of this design approach when applied to heritage sites with different characteristics and missions, while highlighting the flexibility of BMI as design method. The aim is to understand if the BMI can be considered an alternative design approach for developing a tech-powered experience that is, in principle user-friendly, cost-effective, and grants future resilience for the experience.

#### **4.3 The VISTA AR business innovation model (BMI) for heritage sites.**

Housed at the new research Centre for Simulation, Analytics and Modelling (CSAM) within the Business School, University of Exeter, the VISTA AR project is a European funded Interreg France(Chanel)England programme. The project started in July 2017, and it was originally due to conclude in Spring 2021, but was extended to December 2021 in the light of the COVID-19 pandemic. The Interreg VISTA AR project consortium is composed by a total of eight partners - six academic institutions and two heritage partners, located in France and the UK, and four cultural heritage sites as deployment sites.<sup>16</sup>

Considering the significant economic challenges heritage sites are facing in today's climate, the purpose of the project is to increase the tourism revenue of these sites, via a rise in visitor numbers. The goal of the project is to create new visitor experiences by adopting advanced digital (AR/VR) technologies at partner cultural and heritage sites. In line with the objectives of the programme, the VISTA AR consortium selected three sites from the UK who had identified the need to improve visitor satisfaction and

---

<sup>16</sup> "VISTA AR Interactive Workbook," VISTA Project, accessed November 29, 2023, <https://www.VISTA-ar.com/en/>.

experience by adding digital interpretation to the visitor journey. To establish it, the heritage sites were selected through desk research (e.g. heritage tourism media) and a snowballing approach (using existing contacts in heritage tourism), representing a diverse sample in terms of heritage type, size, digital technology implemented, and location.

The three sites selected for digital innovation in the UK are Exeter Cathedral, also designated as experimentation site where on-going “in the wild” tests would have been carried out, and the two deployment sites of the National Trust site of Botallack and the site of Slapton Sands of the South West Coast Path (SWCP) National Trail. At these three sites, the VISTA AR project has implemented a total of eight immersive experiences. These experiences are: three Virtual Reality experiences (a VR tour of the roof top of the North Tower and VR experience of the Choir singing at Exeter Cathedral, and a VR historical reconstruction of the interior of a mine in Botallack), two AR mobile applications published on main distributing platforms (an AR outdoor app offering the historical reconstruction of the Exeter Cathedral façade, and an AR geolocated outdoor trail at Slapton Sands) and three indoor apps offered on rented devices - two apps at Exeter Cathedral, one audio tour and an AR animation of the Minstrels’ Gallery, and an AR historical reconstruction of the 1860s mining landscape at Botallack.

For the overall process of business innovation of these three sites, three main phases are identified: Phase 1 Analysis, Phase 2 Design, and Phase 3 Evaluation (Figure 4.1). The three phases outline the working pipeline for the development of mobile experiences. In Phase 1, sites are supposed to evaluate the current state of the business to elaborate a value proposition, which constitutes the starting point for

innovation. Then, in Phase 2 the potential state of business as shaped by the digital introduction is comparatively reviewed with the “as is” state of business to understand the impact of digital innovation. Lastly, Phase 3, Evaluation, sees the test of the new business model of the site and amendments to maximize impact. Each stage is structured around a set of questions elaborated starting from the business model for digital innovation (BMI).

The Business Model Wheel is the working model for business innovation, which organises the design of the experience through five main linear steps representing the core elements of the process of creating a business model: value proposition, storytelling, digital equipment, delivery, and value capture (Figure 4.2). The first step is value proposition, the moment in which the site should pondering why introducing a tech-powered experience is the solution to attract more visitors, for example by filling gaps in the visitor offer, or enhance the current interpretation. The underpinning concept here is that the value proposition is fundamental to responds to the ‘several type of needs of the audience’<sup>17</sup> as identified in visitor’s motivation surveys. In order to choose the best digital innovation for the sites, the site interpretative offers also undergo a critical review, with the objectives of identifying lacks and discrepancy with the themes that potentially could attract. The results of this review ought to strongly informed the proposition of the new digital solutions, for example in these case studies the use of location-based Augmented Reality mobile applications.

One of the main arguments in favour of the introduction of digital solutions at heritage sites is the improvement to the visitor experience, despite the fact that often sites have

---

<sup>17</sup> John Howard Falk, *Identity and the museum visitor experience* (San Francisco: Left Coast Press, 2009).



only a piecemeal knowledge of their visitors.<sup>18</sup> Central to the structuring of the value proposition is therefore the notion of “visitor intelligence”.<sup>19</sup> Focusing on collecting visitors’ data from a multitude of sources (e.g. surveys, eye-tracking, etc), this approach grants the site managers the possibility of a comprehensive view of the visitors’ relationship with the site and their experience of the it. From a methodological perspective, to investigate the digital innovation of a site more holistic methods are implemented. This mixed-method approach ought to combine both quantitative and qualitative research methods, such as surveys and interviews with staff managers, in order to gain a more complete understanding of the impact of the technology on cultural heritage tourist destinations. Holistic approaches allow researchers to gain a better understanding of the technical and logistical aspects of introducing mobile experiences in heritage sites, as well as the cultural, emotional, and sensory impact that the technology has on visitors. This information can then be used to inform the decision-making process of the experience design, while improving the overall quality of the experience for visitors.

Once the value proposition is identified, technical and content decisions are made, that is the digital equipment and the type of storytelling are chosen. At this stage, the site should be thinking about what message/story they would tell and identify the point of interest that need curation. Accordingly, the digital technology is chosen, and the interface, media content and trigger modality identified. For example, looking at the technology, reflections should cover the compliance of the technology with the site’s value proposition (cf. site mission statement) and the target audience, but also which tool can more easily integrate the current interpretation or if a new visitors’ offer has

---

<sup>18</sup> Gatelier et al., *A business model innovation methodology*.

<sup>19</sup> Smart et al., *A panoptic framework*.

to be developed. As for the storytelling, questions to be addressed in the design phase are those related to the capacity of the narrative to convey the site's message and the best suited type given the target audience (e.g., tour guide or locative game).

The last two stages are delivery and evaluation. In preparation for the delivery stage, staff and operational aspects are considered. Particular emphasis is given to pinpoint which visitors' actions would be triggered by the digital technologies, for then planning accordingly the introduction of new services and activities necessary to run the visitors' offer. Whereas during this stage organisation planning is covered to ensure the technology developed is aligned with the available resources, it is during the following and final stage that it is possible to test the robustness of the methodology. The final stage, the value capture, is based on collection and analysis of visitor data using three different methods to capture audience's feedback. Alongside qualitative methods such as surveys and interviews, two computational tools have been created by the project for measuring and evaluate the impact of these immersive experiences. A geospatial tracking app has been developed and embedded in the rented device for the AR experience, with the goal of tracking the user journey enabled by the experience, as well as capturing visitors' behaviour. These data are then collected into a monitoring dashboard, which collates and visualizes those data, together with data retrieved from online reviews (namely, visitors' feedback from TripAdvisor) which are processed using Natural Language Processing (NLP) and Sentiment Analysis (SA) to reveal patterns in visitor interactions and experience.

To facilitate the unfolding of the work pipeline, the BMI wheel has a companion interactive book, which contains a set of questions that should be answered in order to articulate the design (Figure 4.4). These questions are a checklist that site

managers should use to gather an holistic view of the storytelling, operational and technological aspects of implementing digital experiences at heritage sites. These questions should be used to by site managers to compile a pre-formatted sheet for outline the visitor journey for each of the different experiences. The questions identified for the five phases can be summarized as follows:

- Value proposition, that is who are the site visitors, what the site is currently offering them and why they need a mobile experience?
- Storytelling, what message the site wants to convey to the visitors and how?
- Digital equipment, that is which is the best technology to deliver the message and how this would integrate within the existing interpretation?
- Delivery, which new activities, procedures and resources would be needed to implement and deliver the new interpretation?
- Value capture, how the site would measure the success of the new interpretation and capture the desired value (financial, visitor satisfaction, etc)?

Having outlined the basics of the process of digital innovation, the chapter can now move on to look in more detail at the way in which the experiences have been designed using the business model wheel. The overall analysis of the case studies has been organised around the three steps of the BMI process – analysis, design and evaluation (Figure 4.1). For the step Design, the description of the process of design of the user experience has been articulated using the components of the business model wheel corresponding to the design phase: digital equipment, storytelling, and delivery. Since no user testing have been yet carried out with the final version of the experiences, in the following description, the analysis of the ‘evaluation phase focuses on how the on the parameters that can be investigated in the user experience for future evaluation.

To provide a deeper understanding on how this methodology has been applied to the creation of digital experiences, the next sections recount step-by-step, with an auto-ethnographic approach, the development of mobile experiences for three VISTA AR heritage sites.

#### **4.4 The case study of Exeter Cathedral.**

Located in the heart of the city of Exeter, Devon in South West England, Exeter Cathedral is an Anglican church, seat of the Bishop of Exeter. One of the finest examples of Gothic architecture, the Medieval foundations of Exeter Cathedral dates back to the 11th century. The current Gothic style belongs to a second phase of construction during the 13th century, when the Norman foundations were replaced by Gothic structures. Alongside its foremost religious vocation, the cathedral is the top attraction of the city with over 100.000 visitors every year. Since 2007, Exeter Cathedral charges an entrance fee for those visiting the Cathedral as an attraction, while admission to pray or for a service remains free to everyone.

##### **4.4.1 Analysis.**

For Exeter Cathedral, an extensive visitor survey carried out in 2018 shows that the current audience is mainly to be identified as visitors who 'are motivated to escape from the busy daily lifestyle and have a peaceful experience'<sup>20</sup>, while the new audience segment which should be attracted are families with children. This was expected given the current visitor offer. The visitor offer at Exeter Cathedral is predominantly self-guided. A free general leaflet with the floorplan of the Cathedral and a list of highlights of the building is given to visitors at the entrance. Free guided tours run by volunteers

---

<sup>20</sup> See "Exeter Cathedral Visitor Survey 2018 Report" in Portfolio.

and former staff of the Cathedral are offered during the opening time on a quite regular basis (three times a day subject to availability). These are dedicated tours of areas usually off limits to visitors, for example the roof top and the private gardens of the Bishop of Exeter. During special occasions, more paid tours were organised, for example in the evening and in December when the Cathedral organises a Christmas market in the area surrounding the building. At extra cost, an audio tour, narrated by actor John Nettles, expands the proposed visitor journey suggested by the free leaflet. The audio guide offers a general presentation of the Cathedral, providing visitors with short descriptions of a variety of features and points of interest of the building. A video room has been installed within one of the chapels on the side of the Quire (cf. St. Catherine's Chapel) where a TV screen projects on loop a five minutes circa video, which offers a broad overview of the Cathedral's history, architecture and liturgical activities. Since 2017, two desktop-based 360 degrees views (i.e., the interior of the Cathedral and from the top of the North Tower) are available on the website to promote the site to prospective visitors.<sup>21</sup>

Despite the visitor offer being quite variegated, the current interpretation is patchy. While there are a number of elements of interpretations on offer, these are often missed out or (worse) not offered by the reception staff, decreasing the potential value of a visit. On self-guided visits, the quality and depth of interpretation available is very limited and is also almost entirely verbal. Whereas results from the survey show that the average visit length is 45-60 minutes circa, indicating general good levels of satisfaction, visitors do not report about many stand out peculiar features to visit on site, nor particularly memorable experiences to do.

---

<sup>21</sup> "Exeter Cathedral Virtual Tour," Exeter Cathedral, accessed May 21, 2023. <https://www.exeter-cathedral.org.uk/our-building/virtual-tour/>.

A second issue is the fact that the Cathedral relies heavily on volunteers for interpretation and visitor services (e.g. welcome and floor assistance). Whereas this is not uncommon within heritage attractions, it does mean that without an adequate number of volunteers and without a comprehensive training for them, the quality of these services to visitors - and in particular, of the interpretative offer, cannot be assured. Moreover, the last guided tour of the day ends at 2:30pm, while the Cathedral remains open until 5pm, leaving a good portion of the afternoon visitors uncatered.

From the results of the visitors' survey, some discrepancies between the visitors' interests and the subjects of the current interpretation have been identified. These are mainly three. A focus on human stories about the lives of those involved and connected to the Cathedral over the past 900 years is completely lacking within the current interpretation, which instead is directed more on the historical value of the Cathedral as heritage building. At the same time, due to accessibility issues, access to key features of the Cathedral, such as close view of the Minstrels' Gallery, is not possible to the majority of visitors and the interpretation does not fill this gap. Similarly, no attention is given to provide visitors with information about the historical changes of the building architecture, in particular by focusing on lost or destroyed features of the Cathedral, for example the long-gone colours of the Medieval façade. Lastly, whereas music is at the heart of the life of the Cathedral, this aspect is not made generally available to the visitors. Occasionally, visitors could attend to Choir's rehearsals, but the current interpretation does not highlight the significance of music across the history of the Cathedral.

Overall, the interpretation was deemed to generally lack any emotional engagement with the visitors, that could be encouraged instead by recounting stories and significant

themes which could bring the Cathedral “to life”. Hence, it became pretty clear that the visitor offer would clearly benefit of an audio and visual augmentation, which enriched the current interpretation by including these missing themes.

#### **4.4.2 Design.**

##### *Digital Equipment*

The choice of implementing location-based Augmented Reality experiences at the Cathedral has been informed by three main characteristics of the current visitors’ model of the site: the volunteer-based nature of the visitor offers, the identified missing themes in the current interpretation, and the new target audience. Since the Cathedral almost entirely relies on volunteers to deliver on-site interpretations, self-guided visits were considered the best solution. This has been strongly informed by the willingness stated by the site manager to avoid any further overload of the site’s organisational plan of the staff and volunteers. By providing visitors with rented devices, the working load of the entrance staff consists mostly in proposing the experience at visitors and handing over the tablets. The introduction of mobile experiences therefore has minimally altered the staff workload compared to the previous visitor offer of audio guides. As a result, the site management and organisational operations of the services of the Cathedral are impacted only marginally. Despite the extra care tablets require (cf. tech update and overnight charging) compared to traditional audio guide devices, their affordances in terms of aurally and visually augmenting the space is the second reason for which AR heritage apps has been chosen as the most appropriate interpretative solution.

The current interpretation lacks references to intangible heritage (i.e. music and socio-cultural value of the Cathedral) and any reference to no longer visible architectural elements of the building is not compellingly conveying to visitors the relevance of the site transformation. Therefore, it became clear that to fill these narrative gaps it was necessary to find a technology which allow to include these themes by introducing a multi-layered storytelling alongside to visually-rendered reconstructions of the lost features of the Cathedral. Moreover, by adopting mobile AR technology, the interpretation benefits from some elements of interactivity which allows to bring ‘to life’ the history of the Cathedral, while at the same time attracting a new audience segmentation. From the results of the visitor profiling, it has been highlighted how a not well represented segment is families with young children, looking for activities to do on ‘a day out’. This segment is also the one which is least satisfied with the current interpretation offer.

Given the target audience, the choice of a mediation tool easily fell on mobile AR experiences. Innovating the interpretative offer by introducing interactivity with the site through AR technology allow to introduce a “wow factor” to surprise and engage all kind of visitors. This is particularly crucial to attract families with children, whose familiarity of devices like tablets and smartphones as entertaining and educational tool is likely higher than what attested for other segments. Other audience segments can also benefit from the opportunity provided by apps to offer a more complex narrative compared to traditional methods.

In terms of the design of the software, the AR experiences are developed using a native app, developed by the academic team in France, which has been used for all the mobile experiences developed within the VISTA AR project. The software offers a



simple interface, with three main functionalities which allows to interact with the 3D reconstruction in different ways, bird-eye view, manual pedestrian view, and automated showreel.

### *Storytelling*

Choosing an AR experience means being able to introduce multiple layers of visual and aural augmentation to the physical world. Given the amount of unseen and lost features of the Cathedral, the first step has been selecting the specific points of interest (POI) which would be then augmented, visually and/or aurally. The findings of the audience survey showed that themes like architectural changes over time, the importance of music, and the stories of the people that made the Cathedral a heritage landmark are currently underexploited by the existing interpretation. According to the visitors' expectations, three main interpretative themes and related points of interest were chosen.

The first point of interest is the façade of the Cathedral. Currently strongly weathered, in medieval times the façade was completely painted with bright colours and enriched with shining gold leaves. The stunning impact that the façade still retains is nothing compared to what would have meant for Medieval people. It was immediately clear that by using augmented reality, visitors will have the possibility of admiring how the façade would have looked like in past times. The AR app allows visitors to trigger the coloured façade from the square in front of the Cathedral. Using the app, visitors explore the AR reconstruction and enjoy a short animation in which the statue of St. Peter descending from the façade landing in front of the users to welcome them and invite them to go inside explore the Cathedral (Figure 4.5). To ensure accuracy and

authenticity to the augmentation, the overall development of the digital reconstruction has been overseen by the curator, who had a life experience on reconstructing the original Medieval colours. Using a digital interface to reconstruct past architectural features has complications though. The colours are shown in the app are the closest as possible to the original, yet not identical. The reconstruction of the missing elements of statues of the façade (e.g., body parts and clothes details) can only be hypothetical. Therefore, it has been decided to include within the app also some further explanations, in the form of audio and written information, describing the work behind the digital reconstruction and its limitations, namely, the uncertainty of the statue reconstructed. While providing the means to discover a lost feature of the Cathedral, the AR app has also the purpose of attracting new visitors to come inside and explore the building. The initial plan was to deliver this app using the rented device that the Cathedral owns. However, this would not have helped the site in reaching new visitors, therefore it was decided to publish the experience as a free app that people visiting Exeter could download in front of the Cathedral using their free Wi-Fi.<sup>22</sup> To further, push the marketing, the app includes a short introductory promotional video about the new immersive experiences available, inviting tourists in Exeter to enter the Cathedral and discover the wonders awaiting them inside.

A second feature selected for digital augmentation is the Minstrels' Gallery. Standing at 10 metres on the left-hand side in the middle of the Nave, this architectural feature is often overlooked by visitors walking down the aisle focusing their attention to the vault of the ceiling. Yet, the Minstrels' Gallery is of significant importance for the music tradition of Exeter Cathedral. This is a stone balcony carved with representations of

---

<sup>22</sup> Available for Android OS devices only. Play Google. "West Front AR," Play Google, accessed November 29, 2023, <https://play.google.com/store/apps/details?id=com.DPN.Westfront&gl=GB>.

angels playing instruments, which is currently used by choristers to sing during the Evensong on the afternoon of Christmas day. The uniqueness of the balcony is its carvings, featuring accurate reproductions of medieval music instruments, some of which are no longer existing. Unfortunately, due to location of the Minstrels' Gallery, located high above the central aisle, it is difficult for visitors to appreciate the details from such a long distance. Augmented Reality here represent the perfect match, as it allows to "bring down" the Minstrels' Gallery at floor level (Figure 4.6). The initial plan for the AR experience contemplated only a visual animation of the angels playing the instruments. Yet, after discussion with the Cathedral, the general consensus was that the app was focused too much on the entertainment aspect of the experience, while the site wanted to convey some learning within it. Therefore, the new proposed storytelling included aural augmentation of the experience. Audio tracks, paired with transcripts, were introduced to let the visitors learn about the Minstrels' Gallery. Moreover, in collaboration with the Director of the Music at Exeter Cathedral, a medieval tune was selected and readapted for modern instruments to be used to accompany the animation of the angels. Using the Cathedral's tablet, visitors can now explore the 3D reconstruction, and discover more about the long tradition of the music at Cathedral.

The third and last mobile experience developed for the Exeter Cathedral is a tablet-based audio tour, *Pilgrim's Tour*. The purpose of this experience is to offer a new tour of the Cathedral, touching a theme not yet explored by the previous interpretation, while harmoniously collates the other two AR experiences into an holistic user journey for the visitors. The app features a simple and interactive interface, with a map of the building showing the location of the eleven different point of interests (Figure 4.7). All the point of interests features some degree of augmentation, mostly in the form of

audio tracks, except for the two above mentioned visual AR experiences. Since the experience is not GPS triggered, to facilitate the wayfinding within the building, each point of interest on the map features an image representing the feature the visitors have to look out for before manually triggering the related track.

The overall user journey is structured as non-linear journey. Whereas on the map the location of the point of interest are provided with a progressive numerical order, the experience is designed as non-linear, to allow personalisation of the visit. In the original plan the user journey would have unfolded in a clock-wise direction, however that had to be adjusted in accordance with some operational changes of the visitors' flow due to COVID-19 restrictions. Whereas the user journey was planned to unfold as a loop inside the Cathedral, when the "one-way" visitor flow was implemented to comply with distancing rules, the journey was rearranged accordingly by reorganising the order of the points of interests. Another issue that had to be addressed was to provide the visitors taking the audio tour with the possibility of exploring the app of the façade without exiting the building. Despite the concerns about the conceptual inconsistency of triggering the exterior façade indoors, it was decided to accommodate that by integrating the app within the tablets, so that visitors can prompt the experience indoors. However, doing so called for changes in the user journey in order to make conceptually relevant the digital augmentation. Therefore, a new POI was introduced and it was proposed to locate there a scaled 3D printed model of the Cathedral, which visitors could use as AR trigger. The storytelling too was modified there to justify the introduction of a new POI.

In terms of storytelling, the audio tour gave the possibility of expanding another unexploited theme, the lives of people that contribute to keep the Cathedral alive over

the past 900 years. One of the aspects which is not particularly known by visitors is the importance of Exeter Cathedral as pilgrimage destination since the Medieval times. This became the focus of the narration of the audio guide, a tour led by a female pilgrim which takes visitors around the medieval Cathedral and shows them the most important stops for pilgrims. Since some of the point of the tour touches the existing interpretation, it was decided to organically integrate it, by making clear reference to it in the audio tour. For example, at the Bishop Lacy's tomb, there is some permanent tactical interpretation with replicas of the *ex voto*, which the visitors are invited to engage with in the Discover More track. The choice was informed by the desire of interweaving the new digital offer with the existing interpretation to mitigate any potential feeling of drastic intrusion of the app within an established system of interpretation. Furthermore, the opportunity of blending digital and analog might result into a more interactive and sensorial experience.

To ensure accuracy and authenticity of the storytelling, it has been organised a workshop with scholars in Medieval studies at University of Exeter, the Cathedral Visitor Experience staff and VISTA AR team. Using as reference features of the Cathedral linked to the pilgrimage, the workshop resulted into an agreed user journey touching twelve stops were are most representative of the history of pilgrimage at the Cathedral. In accordance with the audience target (cf. family with children), the narration called for a style that could be entertaining, while delivering some learning about the Medieval phase of the Cathedral. The suggestion of designing the storytelling as a fictional personal recount of a medieval pilgrim was particularly welcomed by the Cathedral, which scripted the character of Joan, a Medieval pilgrim visiting Exeter Cathedral for praying at the tomb of the "miraculous" Bishop Grandisson. The choice of a female leading voice has been informed by the

willingness of the Cathedral of proposing an alternative narrative viewpoint that have been so far neglected by the site interpretation. To foster a sense of belonging to new interpretation and avoid any issues of professional legitimacy, the scripts of the single audio vignettes has been authored by the Cathedral volunteer guides, with the final revision of the content by scholars for accuracy and authenticity.

To cater for that audience segment willing to have more factual information about the single point of interest, the experience also provides an additional series of audio tracks where experts offer insights on features or topics introduced by the fictional character in the main tracks (Figure 4.7). Also, these tracks have been authored by the Cathedral volunteers and staff, who draft the scripts and lent their voices for the recording. The inclusion of these extra tracks gave the opportunity to the staff to contribute with their professional knowledge to the app, reinforcing the understanding of the new interpretation offer as an integrated tool within the structured interpretative system.

### *Delivery*

Despite the many benefits entailed to the introduction of mobile AR apps at the site, there have been issues and constraints related to the nature of the experience, that ultimately shaped the format of the apps. Initially, the site was keen to propose the new experiences also as bring-your-own-device apps to avoid any responsibilities whilst offering rented devices. However, the research software, after some initial tests with most popular smartphones, triggered a series of errors and system crashes, that ultimately led to the choice of offering rented tablets, which also has the benefit to allow greater performance of the 3D models of the AR reconstructions.

As a result, staff and volunteers training has to be organised to provide guidance on short and long maintenance of the devices (cf. software updates and overnight charging). Whereas the Cathedral has a dedicated IT external provider who can help the site with major emergency device problems, the visitor experience team needed initial training to address everyday issues with the devices. A clear set of instructions had to be provided about how to care for the tablets, with particular attention to overnight charging, checks for updates, and making sure that the tablets are disconnected from the internet so no apps can run in the background disturbing the visitors during the experience.

Additionally, a set of procedures about the site logistics had to be set up to allow the staff to take optimal care of the tablets. Alongside a document explain how and when charge the devices, charging storage unities were installed at the reception desk and required a custom-made cabinet. As often happens in protected heritage sites, installing technological equipment is subject to restrictions and third-party approval. The cabinets were specifically designed and manufactured to blend in with the architectural style of style as regulated by the Exeter Cathedral Fabric Committee, the board which supervise and authorised any physical alterations or additions to the building. On a side note, the impossibility of altering the physical look of the Cathedral informed the decision of using as trigger for the AR ground scanning rather than more robust physical markers (e.g. QR codes).

Since the tablet-based experience entails potential hazards, such as tripping over whilst looking at the screen, the Cathedral drafted a new document on the Health and Safety while using the devices, as well as mitigation actions for risk of breakage and

theft of the devices to be handed over as training material to the reception staff offering the experience to visitors. Since the tablets have to be held for the entirety of the experience, to avoid accidentally damaging them, these were encased in sturdy coloured covers with lanyards. The choice of unbranded colours for the tablet cases (green, pink and yellow) is also functional to mitigate the risks of theft helping the staff easily spotting them when there is a crowded flow of visitors.

#### **4.4.3 Evaluation.**

Both AR apps of the Minstrels' Gallery and the exterior façade, contain interactive touchpoints which provide audio information and their transcripts for audience wanting more information as well as hearing-impaired users. These interface touchpoints, while offering insights on the visual reconstruction, provide some tracking data which can be used to measure the users' engagement with the experiences. Combining those data with the ones from the geolocated tracking app embedded on the tablets, it would be possible to establish the most and least user journey and point of interests, as well as gather temporal information about how much and for how long visitors interacted with the content. The purpose of this data collection is to highlight any gaps or issues in the new overall interpretation available at the Cathedral and accordingly modifying the experience(s) to ensure its longevity. The option to monetise the experiences has been also investigated through a "willingness to pay" survey, during which visitor were offered a demo of the experiences, and then ask to provide an estimated price ticket they would have pay if the site had such interpretation. Whereas the site has no as current intention to charge visitors for the new experiences available, this research has provided some insightful preliminary view of the possibility of



generating income from these experiences, which is consistent with the growing interest about the return of investment.

Overall, the defined value proposition of the site, paired with a detail audience profiling, has allowed to the Cathedral to pinpoint overlooked interpretative themes, and design accordingly a new interpretation fit the target audience of families with young children. Even if some technical issues meant that the site had to provide rented devices for the experiences, the choice of AR app as digital equipment has been informed by the site current capability of services and facilities. Indeed, the site cannot currently cater for an interpretation of specific space and topics given the difficulty of accessing some areas like the Minstrels' Gallery, and given the volunteer based nature of the staff. In terms of impact on the site operations, the apps are supposed to add minimal stress to the current operation plan, facilitating institutional onboarding. However, there have been some constraints to the design and delivery of the apps. One aspect that was not properly accounted by working model is the time and inputs needed from the site, which has signified that Exeter Cathedral has not always been very responsive in providing the media contents needed to develop the experiences. As mentioned with regard to the case study of Calvium's co-creation journey, the development production generally goes smoothly when since the beginning of the project it is clearly outlined which inputs are needed from the site, while also specifying the amount of time and resources that the site had to commit for the project. We have seen that this is a critical factor for fostering in the site the proper attitude towards onboarding and upkeep. Furthermore, the constraints of the COVID-19 pandemic have precluded the possibility of carrying out some prototype testing of the experiences, while slowing down the development pipeline. As a result, by the end of the project it has been possible to deliver only advanced prototypes, rather than the full developed experiences, which

the Cathedral is currently not offering. A user testing has been carried out in August 2021 with the advanced prototypes, with the preliminary results indicating an overall higher user satisfaction in visitors that have been using the apps and the other digital solutions.<sup>23</sup>

#### **4.5 The Tin Coast site of Botallack, National Trust.**

The site of Botallack is under the care of the National Trust and Cornwall Council and it comprises seven miles of the Tin coast, Cornwall. Key centre for the hard-rock mining from Bronze Age until 1990, the mining landscape of Botallack has been listed amongst the World Heritage Sites in 2006. Now an landscape of idyllic beauty, Botallack welcomes 300.000 visitors every year, also as a result of the TV exposure as the location for the popular BBC series *Poldark*.

##### **4.5.1 Analysis.**

The visitors' profile at Botallack is heterogenous, yet an audience segment which is currently uncatered by the existing interpretation is families with children. The main visitor offer is provided inside the Count House, an historical building adjacent to the ruins of the mining landscape. The space has predominantly the destination of providing basic facilities for visitors, with a small café and toilets. The site also hosts the offices for the on-site staff. The space for the visitors' interpretation offer is limited to the main room at the ground floor of the building, with a small dedicated space in one corner and the short walls of the building at the left-hand side of the entrance. A site survey shows that visitors spend circa 20-30 minutes on site, yet the length of the

---

<sup>23</sup> See "Evaluation of Visitor Experience and propensity to visit" in Portfolio.

visit is completely unrelated to the interpretation and dictated instead by the extent of use of the facilities of visitors and by the weather conditions (e.g. visitors tend to stay longer inside the Count House during raining days). The current visitor offer is minimal and entirely self-guided. Two interpretative panels and a video showreel of the Tin Coast provide some basic information about the mining activity at the site and some reproductions of the machinery used. The two-minutes video offers a short description of the site, explaining the relevance of Botallack as touristic destination for the beauty of its natural landscape and with special references to the fundamental role of the National Trust in preserving the site. The promotional style of the interpretation does not target any specific audience, and overall the quality and depth of interpretation available on site is very limited.

Despite the extent of the historical mining site of Botallack spread over few miles of the Tin Coast, at the site there is no map outlining the overall archaeological area. Visitors can only guess the extent of the area by referring to the several ruins scattered across the coast alongside and few of the mining buildings still standing, for example the Engine Crown House. Acknowledging the overall minimalism of the interpretation, the National Trust team has recognised the need to update their visitors' offer, in line with the objectives of the newly revised strategy plan. In accordance to it, more attention should be given to 'telling the history in a complete, balanced and accurate way.'<sup>24</sup> Even if no longer being visible, the mining activities had a massive impact on the landscape which was brutally scarred by the intensive exploitation of the site. Back in the heyday of the mining activities the ground surrounding the Count House, the cliffs and the portion of sea of Botallack, were extremely polluted by the extracting

---

<sup>24</sup> "For everyone, for ever: our strategy to 2025," National Trust, accessed November 23, 2023, <https://www.nationaltrust.org.uk/who-we-are/our-strategy>.

activities, such as the remanence of the ores crushed on site and the smog from the chimneys of carbon-fuelled mining machineries.

Another particular aspect of the history of Botallack which does not surface within the current interpretation is the high relevance of mining activities for the local community in terms of economic and socio-cultural aspects. During the peak of 1860s, the whole community of the Tin Coast was involved in the mining activities directly or as satellite service providers. With the closure of the mines in the 1920, the local economy shuttered and a good portion of the locals left the country, exporting their technological knowledge all around the world. This is still a sensible topic for the local community, which often feels their stories are neglected in favour of a more romantical image of the place as unspoiled natural beauty.

#### **4.5.2 Design.**

##### *Digital equipment*

The lost mining landscape and the related intangible heritage of the local community of Botallack highly benefitted from the introduction of a tablet-based AR application triggered using as marker a scaled stone model of the site landscape. Three main motivations led to choose an AR app for a physical model. Firstly, the AR app allows to overlay to the modern landscape a digital animated reconstruction of the past, for example by representing a working day at Botallack in 1860s. Moreover, the affordance of the mobile devices to delivery simultaneously multiple narratives allows the exploration of different mining features which have defined the story of the place. Indeed, alongside to the accurate reconstruction of the surface landscape, the use of AR allows to offer to the visitors a complete and accurate reconstruction of the intricate

network of underground mining tunnels. These are off limits areas for visitors, most of them have been permanently closed with the end of the mining activities and have only been identified by investigation with Lidar scan. Another argument in favour of choosing a tablet-based experience is the size of the app. Since the app software is the same used for Exeter Cathedral, also at Botallack the only option for delivering the reconstruction in a performative manner was to use a tablet. Lastly, the use as AR trigger of a scaled stone model representing a squared kilometre of the Tin Coast where Botallack stands, has the dual benefit of acting as a map of the site, as well as letting the visitors appreciate the extent of the mining area.

### *Storytelling*

According to the National Trust's mission statement of telling the history in a complete, balanced and accurate way, the AR experience has mainly two interpretative objectives: provide the visitors with an authentic reconstruction of the landscape of Botallack as it would have been looking back in the 1860s, and allow users to visually explore off-limits areas, such as the network of underground mining shaft running below the surface of the site. Triggered on the scaled model of the landscape of Botallack, the *Mining at the Edge of the World* AR app virtually reconstructs the mining landscape, aiming at showing the grittiness of the historical mining landscape in open contrast with the current look (Figure 4.8). The animated scene depicts a day in the life of the mining community during the heyday of activities. Set in a rainy day, with the sky covered by the clouds of the smoke from the chimney of the machineries working full steam, the overall animation includes a series of vignettes related to the specific mining activities. For example, in the areas where the ore is crushed, the stamping

machines work uninterruptedly, while women and men collect and discard the leftovers by loading them on a water-powered convey belt.

To ensure accuracy and authenticity of the contents, the VISTA AR team has engaged in a strong collaborative relation with the National Trust archaeologists. For example, after consultation with the experts, it was suggested to reconstruct the portion of cliff and sea below the mining area by adding a red hue caused by the discharge of the mining material directly onto the sea, which back in 1860s would have been visible. A link has also been established with the Education office, in order to make sure that all the socio-cultural dimensions were captured within the virtual reconstruction. For example, the National Trust suggested to include amongst the workers, women and children to offer the visitors a complete history of the site. A similar approach has been used for the reconstruction of the underground network of mining shafts. The original digital file recovered from a previous Lidar scan of the area was included as extra tab in the AR application interface (i.e. no AR triggering of it). Despite some initial difficulty, it was possible to align the 3D model of the ground surface with the file of the underground tunnels, providing the visitors with an accurate visual reconstruction of a no longer visible feature of the landscape.

Since the overall experiences strongly relies on visual inputs, to minimise screen overload, it was decided to use only audio for any information. Within the virtual reconstruction, there some touch points through which users can trigger short audio tracks describing the POI selected. The style of the content is mostly journalistic (i.e. purely informative) and the voice selected for it is a male with an authoritative tone. Great attention was given to reconstruct the authentic historical soundscape. Original archival records of the machineries at work were included in the soundscape,

alongside accurate reproductions of the overall background sounds of the animated elements (e.g., miners, horses and seagulls, sea waves crushing on the cliff). The introduction of relevant sounds within the virtual reconstruction allowed also to convey to visitors another important message for the National Trust, the relevance of Botallack as cornerstone of the state-of-art of the mining technology back in 1860s.

### *Delivery*

For Botallack, the choice of using the AR technology has brought some operational and logistics considerations. Staff and volunteers needed a training that provided them guidance on short and long maintenance of the devices (cf. software updates and overnight charging). On top of software related issues, the use of the stone model led to further constraints and considerations on the curatorial of the space where the experience happens. During the prototype tests, it was soon realised that the light conditions of the space in which the model sits were impairing the correct functioning of the app. The direct light coming in through the windows creates deep shadows that impair the triggering of the 3D model. Since it was impossible to move the physical model given its weight and the limited space at the Count House, it was recommended to the site to alter the light scheme of the room by including some curtains that could occlude the strong light and provide a consistent lights system. Another problem is the fact that the model is made out of stone and thus particularly heavy, but despite so pretty fragile. Indeed, during the transportation to the site, all the four corners of the model were chipped off. It was then recommended to encased the plinth and proceed with the application of a coating to seal the surface to prevent further damage, also in consideration of the fact that visitors might touch it leaving stains. This would have

meant further expenses for the site, and it was decided to not proceed with the extra work.

The layout of the room in which the model stands has strongly informed the user journey of the AR app. Being the physical model located in a small room, two main constraints at the visitors' flow arose. Firstly, the distribution of the interactive point of interest within the digital reconstruction had to be carefully evaluated to avoid queuing and overcrowding the space with too many users simultaneously using the app and thus blocking access. Moreover, further room curation was needed in order to mitigate any potential hazards. In fact, the room where the physical model is located can be accessed via few steps and therefore a warning sign was put in place to avoid the potential risks of visitors falling down the stairs. Despite those practical issues which burdened on site operations more than anticipated, during the initial tests it has been possible to observe that the AR feature was welcomed enthusiastically, with visitors wanting to engage with the augmentation for more than 20 minutes. Whereas this preliminary response is positive, it also needs careful monitoring to make sure that such engagement does not cause logistic issues.

#### **4.5.3 Evaluation.**

Since the app uses the same software implemented at other VISTA AR sites, also the Botallack experience entails interactive touchpoints which have the double functionality of offering insights on the visual reconstruction, whilst acting as means to track users' engagement with them and therefore being able to understand the most and least accessed point of interests, as well as the duration of the interaction. The goal is data collection to provide the site manager with an up-to-date understanding



on how the visitors engage with the experience, with the aim to tackling promptly any gaps or issues in the new overall interpretation available.

Overall, the use of an AR app at Botallack offers the visitors an engaging experience which provides an alternative and unexpected view of the landscape, in line with the site's mission of telling the history in a complete and accurate manner. The choice of the stone model has caused several operational and design issues, entailing further reflections and changes on the user journey, as well as on the delivery of the experience at the site. In terms of impact on the site logistics, since Botallack had only self-guided interpretation on site, the introduction of the AR experience meant a change into the daily operations of the site, with volunteers now trained to look after and offer the tablets to visitors. Despite being given extra task, the volunteers at the café welcomed enthusiastically the new interpretation. From conversations with them, they felt somehow relieved of having the app which could providing information about the site, task with which they felt slightly uncomfortable not being trained guides.

#### **4.6 The SWCP trail at Slapton Sands.**

Nested within 630 miles of path along the coast of south England, the site of cultural heritage site of Slapton Sands is a popular destination for over 8 million visitors walking the overall path each year. Traversing the coast of four counties, the Exmoor National Park and several Areas of Outstanding Natural Beauty, the path has been listed as national trail in 1978 and is currently under the protection of the South West Coast Path Association, in joint partnership with the National Trust and Natural England.

#### **4.6.1 Analysis.**

The chosen location for digital innovation is Slapton Sands, a stretch of 4 miles of the South West Coast Path (SWCP) trail in proximity of the village of Torcross. The site does not provide any interpretation nor any type of visitors' offers. Given its location on a small stretch of the path running between a ley and the shoreline, the only facilities available are located in the village and privately organised (such as cafes, restaurants, shops). Since the site is a popular touristic destination during the spring and summer months, the area has been equipped with three car parks. One of these is under the care of the SWCP Association, which was used to retrieve a tentative baseline of the visitors on site by counting the number of cars accessing it. The only interpretation panel available is located in the main car park on the high street of the small centre, where a board next to viewpoint on the Slapton Sands ley provides visitors with some information about the local biodiversity. Along the path, there are mileage markers and signposting for hikers but it does only provide basic wayfinding on the possible routes to take and nearby facilities. The only way by which the site is recognised as cultural heritage site under the care of the SWCP Association is the presence of the association logo.

Despite the volume of hikers arriving every year at Slapton Sands for walking the path or families spending a day out at the seaside, the Association has discovered that only a small percentage of them are aware of the risks incumbent to the area as result of the climate change. Due to the global warming, the worldwide sea level is rising and at Slapton Sands this means that the road running between the ley and the sea is regularly destroyed every few years. Alongside the costs of road repair and the inconveniences that the temporary closure of the road signifies for the locals, the

impact of the climate change goes beyond it. The destruction of the road, which is the only physical barrier left between the sea and the ley, is causing relentless changes to the biodiversity of the local ley ecosystem, and many bird species are now under protection as at risks of extinction. Whereas the locals and the SWCP Association are aware of the urge of actions against the climate change, the same urgency is not perceived elsewhere nor by visitors. To help spread awareness, the Association has been looking into providing visitors with digital solutions which can convey the message without being physically intrusive in the already delicate landscape.

#### **4.6.2 Design.**

##### *Mediation tool*

The site is completely unstaffed, and therefore the only feasible non-intrusive visitor offer had to be a self-guided BYOD app. This app would have to navigate the visitors towards some specific areas of particular interest for the site's mission as currently endangered by the climate change. A geolocated mobile app using AR technology has been chosen as the best option to trigger the reconstruction of the future damage on the landscape. Unfortunately, the research software developed by VISTA AR could not cater for geolocated technology, and the development of the app had been to externally commissioned. However, the possibility of distributing the experience via main app platforms allows also for reaching remotely a wider audience. Published apps can be designed also for "armchair" use, reaching therefore also remote visitors, as well as providing them with the opportunity to continue to engage with the experience once back home. This is crucial for the site since they aim at increasing awareness about the dangers impending on the site to a broader audience. The BYOD

experiences have also little to none impact on the operational organisation of the site, making them the perfect mediation tools for cultural heritage sites with no staff, as in the case of Slapton Sands.

### *Storytelling*

Whereas generally AR is used for reconstructing past landscape, interestingly at Slapton Sands the AR also offers a window into the future. In accordance with the site's desire to find an impactful while engaging way to spread awareness about the impact that in the near future the climate change would have on the site. Organised as a walking tour touching four different stops along the coast, the AR *Climate Trail* app leads the visitors on a journey from Torcross, passing by the ley to end at one viewpoint circa four miles away from the starting point (Figure 4.9)<sup>25</sup>. The interface, branded to the SWCP website in terms of colours and font, has only one master view which help to keep the app user-friendly and intuitive. The opening page provides users with the choice of on-site or remote view (cf. off-site). The following landing page features a map with numbered pin-markers indicating the location of the four stops (listed from A to D), accessible by clicking on the letter icon. The app uses GPS to “walk-to-unlock” the content of the experience, helping the visitors in the wayfinding, while limiting screen interaction. Anyhow, a map is provided, with the purpose of offering the users a mean to have a general overview of the location of the points of interest.

---

<sup>25</sup> “The Climate Change Trial”, Play Google, accessed November 29, 2023, <https://play.google.com/store/apps/details?id=com.SouthWestCoastPath.TheClimateChangeTrail&hl=en&gl=GB>. “The Climate Change Trail,” Apple apps, accessed November 29, 2023, <https://apps.apple.com/au/app/the-climate-change-trail/id1582174503>.

The overall narrative focuses on explaining to the visitors how global warming and climate change are already having an impact locally. At Slapton Sands, the increasing of the sea level, paired with more extreme storms and less predictable weather patterns are causing steady erosion, which in turn leads to road collapse and endangers local bird species, alongside disrupting the regular business of the local community. Along the path, visitors are offered a series of four audio and visual vignettes, describing for each POI the impact that climate change would have on that spot of the trail. Three point of interests offer an overview of the landscape transformation over a long span of time, up to almost one hundred years from now. Whilst enjoying the 360 degrees virtual reconstructions, users can switch between timelines using a slider of the right hand side of the screen. For example, at Point A the app offers a visual reconstruction of how the coast from Torcross would have changed by 2050 and 2100 DC if the global warming is not stopped by then (Figure 4.9). One point of interest instead, the Point C, features instead AR reconstruction of six different species of birds living in the ley, who represent the local fauna and are currently endangered by the climate change (Figure 4.9). For each stop, short audio tracks (2 minutes circa) describe how the climate change is impacted the related viewpoint, directing the visitors' sight to specific features in the landscape. Several pieces of scientific information are provided, the accuracy of which has been signed off by the SWCP Association in collaboration with the Field Study Centre, a research institute specialised in climate change impact in the South West of England.

The audio storytelling is informative with a first-person POV (cf. 'we') which help users connect to the focus, while lightening the tone of a serious explanation.<sup>26</sup> The overall

---

<sup>26</sup> "Journalists as Characters: Using First-Person Narration to Drive Stories," Knvul Sheik, accessed November 29, 2023. <https://www.theopennotebook.com/2019/04/30/journalists-as-characters-using-first-person-narration-to-drive-stories/>.

tone though is informal, recalling the writing style commonly seen in blogs. Accordingly, the female voiceover is fresh and young, which evokes Greta Thunberg, the young climate activist of the *Fridays for Future*, a figure familiar to the younger generation. The choice of this type of voice and narrative style respond to the willingness of the site to appeal the general public, encouraging them to join the younger generations in the battle to save the planet, and the site in particular.

### *Delivery*

As mentioned, the app has been developed for both on site and remote use in response to the value proposition identified by the site. Given the desire of the SWCP team to reach as many users as possible, it was suggested to allow users to engage with the AR reconstructions also off-site. There was initially some concern about the effectiveness of the immersive experience with the remote use. The level of immersion with the AR reconstruction can be only fully reached when experiencing the app on site, in particular for the Point C where the AR triggers the birds in their natural habitat. On the other end, the armchair modality allows to engage the visitors through the three different phases of the visit, pre, during and post, which is generally agreed to be an important step for nurturing the bond between the visitor and the site.<sup>27</sup> In terms of site resources and activities necessary to provide the service, the BYOD solution has, whereas minimal, an impact once published on the platforms. While these apps require little to none attention by the site staff on a daily basis, however they needs frequent updates therefore long-term planning needs to be put in place to guarantee

---

<sup>27</sup> Falk, *Identity and museum visitor experience*. Piera Buonsignori and Alessandra Marasco, "Enhancing Cultural Heritage Experiences with Smart Technologies: An integrated Experiential Framework," *European Journal of Tourism Research* 17 (2017), 85. <https://doi.org/10.54055/ejtr.v17i.295>.

to the commissioner(s) access to developer accounts and source coding in order to run updates or fix errors after the end of the project. This calls for further considerations on software copyright and distribution to third-party, in particular if the Association does not handle this process internally with their IT team but subcontract it to an external supplier.

#### **4.6.3 Evaluation.**

Being the experience a published app on major distributing platforms, the app benefits from access to the analytics of each proprietary platform, such as Apple and Google Analytics. Alike the data collected for the other VISTA AR experiences, also the data for the *Climate Trial* app are supposed to be collected and analysed using the monitoring dashboard. Whereas the data retrieved from the published platforms might not provide the same granularity of details provided by the tracking app developed by VISTA AR, nevertheless they will gather information about the number of download, the location and time of it, as well as user retention which can provide insights on the users' behaviours (e.g., how long they engage with the app, and at what stage of experience progress they decided to drop out).

Overall, the development of a BYOD app for the SWCP allowed to proficiently target the value proposition outlined by the site. In terms of target audience, publishing the app allowed to reach audience segments not usually represented at the site. The fresh first-person style of the storytelling, paired with appealing virtual reconstructions and AR features, aims at giving voice to all the young people caring for the planet, with the hope that their message is embraced by a larger audience. Given that the site is unstaffed, a self-guided BYOD tour is the most sustainable mean to provide an on-site

interpretation offer which have minimal impact on the site's financial and operational resources, while being little intrusive to an already fragile and endangered environment.

#### **4.7. Conclusion.**

Reaching towards the conclusion of this chapter, this section draws together the key strands of each case study, in order to provide some final reflections which the descriptive approach has surfaced. We have seen that introducing immersive experiences at heritage sites is a complex process that involves both technological and organisational flexibility. According to the BMI, to ensure visitors' satisfaction and appropriate fit of the new offer, the design of these experiences needs to be conceived more as a service model, accounting for several factors, such as the visitors' expectation, the impact of such innovation on the site's organisational structure and how to capture the value generate by these experiences. The business model wheel has been drafted specifically for helping creators to identify which are these factors and how you should address them.

In terms of sustainable mobile practices, the biggest benefit of the BMI is the great emphasis of the 'Analysis' phase, during which a holistic understanding of the site's profile is outlined. In doing so, it has been possible to gain an understanding of who are their visitors, the message the site wants to convey them, and what is their capacity in terms of staff and facilities. The introduction of a "visitor intelligence" analysis allows meticulous profiling of the visitors, with particular attention to their motivation of the visit and their expectations towards the interpretation.



The thorough attention given to the phase of “knowing your audience” and tailor the whole experience to their needs may have the further benefits of enhancing the emotional response of the visitors with the on-site interpretation. Laurajane Smith points out that, too often the visitor’s emotions and motivation towards visiting a site have been neglected, while heritage and museum visitors’ experiences can only be explained if the emotional aspects of their visit are taken in to account.<sup>28</sup> Previous research in this direction was done by Smith and Campbell, who have been researching how emotions work to frame the staging and experience of heritage and museums.<sup>29</sup> Measuring different levels or registers of engagement, they revealed the limitations of much of the heritage and museum interpretation literature that draws on educational studies that argue deep engagement is more significant than shallow engagement. Indeed, they point out how:

‘Some visitor engagement can be quite shallow, banal even, but nonetheless this form of engagement does important cultural and political work, while some deep engagement can generate a lot of emotional feeling, but does not necessarily go far in developing critical insight for the visitor.’<sup>30</sup>

Indeed, their work shows how affective responses do not just happen spontaneously and uncontrollably but ‘occur through the ability of the visitor to both desire, seek out and mediate that response.’<sup>31</sup> In other words, it is a contextual response, depending not only on the site/exhibition, but the visitors relationship to it, their own political and social contexts, and their own skills at recognizing and working with their emotional

---

<sup>28</sup> Laurajane Smith, *Emotional Heritage: Visitor Engagement at Museums and Heritage Site* (London-New York: Routledge, 2021).

<sup>29</sup> Smith and Campbell, *The elephant in the room*.

<sup>30</sup> *Ibid.*, 4.

<sup>31</sup> *Ibid.*

responses. This is strictly inherent to visitor's motivations for museum and heritage sites visits, as previously theorised by works of Falk, onto which the BMI is rooted.<sup>32</sup>

A further benefit of the BMI can be recognised by defining from the outset of the current state of the business, empowering the site to make an informed decision about the value proposition for the introduction of immersive experience. For example, for Exeter Cathedral, having identified a gap in the visitor offer in relation to the theme of lost past features, the choice of leveraging the AR technology as best way to open the window on the past almost came spontaneously. An articulated understanding of the audience at the beginning of the experience development means that the site can proactively support 'the alignment between an organisation's design intention (i.e. intended experience) and the actual experience of customers (i.e. realised experience).'<sup>33</sup> This has been proven at Exeter Cathedral, where the immersive experience of the façade has been warmly welcomed, resulting in a prompt onboarding with the production of the content of the *Pilgrim Tour*. Unfortunately, an extensive post-delivery survey has never been carried out to evaluate if the user experience as designed by the site actually engage the public audience. The first round of user experience evaluation seems to point in that directions, with results showing that visitors that engage with the digital solutions rated the overall experience at the site higher than the visitors that did not use the apps. However, further longitudinal research is needed to understand how much outlining a value proposition helps in delivering an engaging experience for end-users. This could also help the organisations feeling more comfortable with the experience being produced, and therefore confident and coherent in promoting it.

---

<sup>32</sup> Falk, *Identity and the museum*.

<sup>33</sup> Ponsignon, Durrieu, and Bouzdine-Chameeva, *Customer experience design*, 763.

Throughout this thesis, it has been highlighted that there are some areas in heritage interpretation which have a strong affective and emotional impact on people. Interpretation touches on personal memories, and equally have resonance at a collective level. This is clearly the case of the *Pilgrim Tour* of Exeter Cathedral, where the first person storytelling of a Medieval woman recounts personal stories and evokes past moments that she had lived at the Cathedral as member of the community. Likewise, emotional responses could be fired through interpretation related to issues which evoke strong ideological beliefs and convictions, such as the protection of a rare bird or plant species, as seen in the case study of the *Climate Trial* app. The desire of provoke by telling an uncomfortable story is what motivates the choice of the storytelling of the case studies here considered.

As seen, subaltern, hidden and “dissonant” histories are increasingly the central focus of practices that aim at ‘embracing the dissonant, and ‘not simply acknowledging the multiplicity of values and cultural meanings that heritage places and practices may have, but also understanding their wider social consequences and ideological significance.’<sup>34</sup> The impact of these critical heritage practices have a strong resonance on the choice of the narrative subject of the case studies which constitute my embedded research. At Botallack, the previous interpretation was void of people and class struggle. The new one instead aims at stressing not only the physical fabric and the technology, but also the social relations of production, labour process and class conflict. Mobile heritage practices here allow historically significant landmarks that have traditionally fallen outside of the notion of authorised heritage discourse – but which are no less important – to be brought into the fold of public consciousness

---

<sup>34</sup> Smith, Shackel and Campbell, *Heritage, Labour, and the Working Classes*, 4.

through a new means of experiencing the past. At Tower Bridge and Exeter Cathedral instead, the interpretation was mainly invested into the grand-narrative of remarkable historic and ecclesiastic buildings which represent ‘the best of the past’, “the” heritage, and therefore are very popular and constantly attract great number of visitors.<sup>35</sup>

The introduction of a mobile application instead has allowed both sites to highlight the lived experience of the place. At Tower Bridge, shifting the narrative focus from the architecture to the hidden engineering allows visitors to discover and learn about a so far neglected yet crucial aspect, the building as working site. At Exeter instead, the choice of a female pilgrim as narrating character has given voice to the people who over the centuries, granting the church, both as community and building, to stand the test of time. Lastly, the *Climate Trail* app challenges the authorised heritage discourse by introducing an uncomfortable narrative of the South West Coast path. The countered narrative is quite dissonant with the idyllic beauty of the landscape but it allows to look back at the past to raise consciousness about the future of the site. As Smith, Shackel and Campbell write, heritage is ‘concerned with “a certain way of knowing” the past and of mediating that past so that it can do “work” in the present’.<sup>36</sup>

One further methodological question this chapter wanted to address is understand to what extent the design of experiences has been facilitated or perhaps constrained by the “imperative” of introducing digital technology as dictated by the research focus. Given the objective of the project research to stress the success of empowering the site through digital innovation, at times it felt as if the use of technology was, and to

---

<sup>35</sup> Smith and Waterton, *Constrained by Commonsense*. 1155.

<sup>36</sup> Smith, Shackel and Campbell, *Heritage, Labour, and the Working Classes*, 9.

some extent it was true, an obligation rather than necessarily the easiest option for the site. For example, the decision to include the AR reconstruction of the façade indoors has been mostly tech-driven, with the purpose to not miss out the opportunity to show a fancy feature to visitors. Also in this case, further research would be needed to test if the use of AR in this specific case, and generally to all the other apps, is encouraging greater engagement with the site.

Whereas it might be tempting to think that a more “intermediate users’ focused” approach is the solution for issues such as onboarding, and upkeep, nevertheless there had been technical and logistic challenges that the BMI model does not account for in its theoretical layout. First of all, little attention is given to the agile development of the mobile applications. Despite the fact that the app development plays a critical role, the BMI does not stress enough the importance of the design-test-refine process. The research nature of the project, which aimed at be self-sufficient in the software development, and extensively relied on quick student internship, has led not only to the lack of consistency of the quality of the work, but also at the impossibility to establish a constant flow of ideas and update. This in turn has led to a patchy, and sometimes difficult, communication with the tech partner, and ultimately jeopardised the possibility of testing mid-journey the experience design.

Moreover, the many episodes of difficulty of communication between the France-based developer team, in charge of creating the app software, and the experience designers in the UK, further aggravated and slowed down the tech development resulting in a technically patchy product. The proof of it lies in the fact that, despite the efforts and commitment invested in designing the experience, by the end of the project

the applications were not publicly distributed. Furthermore, the platform we developed has minimal software capability, and does not allow for great flexibility in terms of catering for different way of interaction. Designing apps with a non-industrial software is challenging, and it has surely taught a lesson about blunt instrumentalism, and how, the desire to test “in the wild” research-lab born software should be have been evaluated more carefully, especially given the high expectations of the site. The lack of an understanding by the sites of the commitment requested in terms of time and resources impacted the design of the user experience, and to some extent the delivery of the experiences. On several occasions, we had to accommodate last minute changes to the content of the narrative or the type of the interaction the site wanted to have, because no time was taken by the site to sign off the design advancements and many details have been overlooked. It has been discussed how often these projects are not fully integrated within the sites’ agenda, and this means that the time given to the project is only what left after other more urgent tasks have been carried out. That is why it is significant to pinpoint since the outset of the project which contributions to the project is expected from the site. This is functional to allow the development to proceed smoothly, and to foster a sense of ownership and thus onboarding of the site staff with the project.

In spite of the issue encountered, the case studies discussed within this chapter, and more generally in the whole thesis, are strong examples of how co-creation approaches can pull the user, both in its intermediate (cf. the site) and the end-user form, back into an open and active interaction with the site and the creative world rather than eliminate them from it. The case study of the Exeter Cathedral *Pilgrim Tour* is a significant example. Alongside scholars, site managers, and creative designers

the co-creation of the app involved a fourth player, the site volunteers, which here acts both as informal staff and regular church goers. Representing the community that keeps alive the Cathedral, they are the authors of the contents of the whole narrative, both the main storytelling and the extra tracks, which is strongly rooted in less known stories, such as tradition of pilgrimage site of the Cathedral often neglected in favour of more grand narratives about the architecture. In doing so, we see the user shaped as an active agent, one that is responsible, accountable and deeply involved in opening up their own possible future trajectories.

Overall, from my perspective of user experience embedded researcher, shifting the focus from designing primarily for engaging end-user experiences to design also for intermediate-users, that is the site, presented some challenges, highlighting how there is still some way to go for immersive experiences before 'organizations are comfortable with the experience being produced, and confident – and coherent – in their promotion of it.'<sup>37</sup> Nevertheless, the BMI methodology has a great potential in creating sustainable mobile practices that could be unleashed by activating its value as 'co-production of knowledge and idea' which is intrinsic to the STEAM based nature of the VISTA AR project.

---

<sup>37</sup> Kidd and McAvoy, *Immersive experiences*.

## Chapter 5. Measuring the performance of mobile heritage experiences.

### 5.1 Introduction.

In the previous chapter, the design of mobile heritage experiences developed using the research-based business model has been explored in terms of benefits and difficulties. Amongst the latter, the biggest pitfall has been not being able to implement fully developed apps, and therefore not having been able to access the analytical data generated by these apps. As mentioned in chapter 1, a wide range of immersive digital technology is now available to cultural heritage sites and with much of it, comes additional help in terms of evaluation of data on the visitor experience. Indeed, any user activity that passes through a computer or a computer-based media device automatically leaves traces which is captured and recorded to allow to detailed analysis of the actions taken by users. To process the huge volume of data that we (un)consciously produce using more media it is necessary to borrow methods from the science, in particular statistical science. Manovich calls this paradigm “the science of culture” which has in cultural analytics its methodological approach. As by his definition, cultural analytics is ‘the analysis of massive cultural data sets and flow using computational and visualizations techniques.’<sup>1</sup>

For mobile heritage experiences, cultural analysis is still an approach in its embryonic stage, however app analytics are becoming one of the most popular means to gather information about how many visitors engaged with the app, where, and for how long. These data are generally a good indicator about the popularity of the app, since a

---

<sup>1</sup> Manovich, *The Science of Culture?*, 1.



drastic drop in the number of downloads may suggest that the novelty of the experiences has worn off. The industry is already using extensively statistical and computational approaches to process billions of user-generated data to keep the performance and longevity of the products high and guarantee non-stop customer engagement. Similarly, since the development of the first geolocated experiences, the creative industry has been offering the heritage sector the possibility of tracking the performance of the experience. With the same objective of generating continuous visitor engagement with the site, there is an increase in scholarly interest towards looking at collecting these data of these heritage practices to make informed decisions about which aspects of the experience should be improved through technology, what visitor segment should the digital experience be designed for, or which site services can be improved upon. Yet, the effectiveness of using app analytics for measuring the performance of heritage experiences in terms of longer-time spans is still under-investigated.

Aiming at filling this research gap, this chapter looks critically at the user-generated data for the *Hidden Florence* app. Using a longitudinal approach, the analysis expands the existing literature to cover the whole lifecycle of the app, using analytics data from the app public release up to pre-pandemic months, as well as data sets from the app social media ecology. The data analysis of this chapter expands a previously studied data set with an unpublished set, with the goal of surface improvements or worsening in the app as a consequence of the update of the app, whose data have never been investigated. The purpose of this investigation is to highlight the multiple benefits and the limitations that data processing has for measuring the performance of the app, whilst shedding lights on the implication that this data have on audience engagement,

scholarly research and the wider tourism system in which the mobile heritage experiences sits.

Some preliminary questions around which the analysis of this case study is structured are as follows. Which are the benefits and limitations of using data analysis to investigate situated experiences? How computational approaches can facilitate or at least mitigate the challenges of translating a research-based app into an operational product? From an academic point of view, what changes to traditional research methods these operational products are spurring? And finally, which are the future directions and perspectives that data processing opens up for the field of study of mobile practices? These are only few of the questions that the discussion of this topic might raise, nonetheless the hope is for them to be a starting point for further conversations about current directions the field of digital heritage is taking and try to shed light on which future perspectives are lining up for it.

## **5.2 Measuring the performance of apps. The case study of *Hidden Florence* app.**

Measuring the performance of a mobile app means investigating the data that results from the interaction with the device, namely with the GPS tracking feature and the content of the software. The evaluation approach provided by analytics is a purely quantitative one, based on metrics that extrapolate measurable data which can then be linked to the performance of the app, e.g. number of downloads, number of returning users, and so on. Therefore, this type of analysis does not account for more granular aspects of the qualitative engagement of the users with the experience. More qualitative approaches are needed to understand, for instance, what type of emotions has the experience trigger? To which extent did you feel connected with the

storytelling? Did you find yourself anytime uncomfortable with it? Museum studies have been thoroughly investigating the use of emotional strategies within permanent and temporary exhibitions, and as these have emerged as an area of interest for practitioners and scholars alike, so too have they become a subject for debate.<sup>2</sup> As previously mentioned in chapter 2 with regard to mobile immersive experiences, this type of practices is an emergent field and therefore there are few coherent or systematic frameworks for either creating or evaluating emotional engagement with cultural heritage.

To the date, one of the most comprehensive works looking into understanding the potential for emotionally connecting visiting audiences with distant human past is the one by Economou et al.'s with the EMOTIVE project. The resulting experience *Ebutius's Dilemma* has been motivated by the research of creating emotional connection using storytelling, as mentioned in chapter 2. To do so, the researchers used a variety of methods have been implemented with the aim of developing a holistic, triangulated and multi-level approach to evaluation.<sup>3</sup> For the evaluation of *Ebutius's Dilemma*, Economou and al. used a mixed-methods approach, employing both qualitative and quantitative techniques. Economou et al.'s overall evaluation is primarily qualitative, focusing mostly on the user experience in terms of psychological/emotional engagement and social interactions facilitated by the app.<sup>4</sup> Methods deployed for the qualitative evaluation are: post-experience postcards for comments, a semi-structured questionnaire, and a specifically designed observation sheet to track verbal and non-verbal behaviours (e.g. facial and vocal expressions as indicators of attention, arousal,

---

<sup>2</sup> Cundy and Pörzgen, *Emotional Strategies*.

<sup>3</sup> Economou, Young and Sosnowska, *Evaluating Emotional Engagement*.

<sup>4</sup> Ibid., 8. The main question the authors aimed to address is: 'do the new added media components and/or functionality support emotional engagement with the specific collection, period in the past, site, objects.'

and engagement). Within the questionnaire, the authors integrated an existing post-experience evaluation tool “Where in your Body?” section with a human body graphic, asking visitors where they felt the experience most in their body and why.<sup>5</sup>

The use of embedded self-evaluation tools has been previously explored as an alternative means to face-to-face interviews or post-visit questionnaires. There is a general interest amongst creative practitioners towards the introduction within the design of the app of tools for immediate qualitative evaluation which can be provided directly by the users while engaging with the app. For instance, the PEACH project curated by Alelis et al. in 2013 for Italy’s Buonconsiglio Castle investigates the way in which a visit can be personalised through the interpretation of visitor’s feelings.<sup>6</sup> The mode for emotional input they selected is one that gives visitors two-degrees of freedom, either positive or negative, by requiring them to indicate their “degree of interest” through the movement of a slider either to the left towards a sad face icon or the right towards a happy face icon. While this tool allows users to easily express their approval, it is bound by fixed selection choices, and as the authors state ‘a better system would acknowledge the breadth and depth of potential feedback by accommodating a more unrestricted yet streamlined form of participation.’<sup>7</sup>

Examination of the “design for emotions” within immersive mobile application in terms of testing the usability of the interface and its cognitive easiness is a largely investigated topic in fields of research such as education and tourism. Emotions have

---

<sup>5</sup> As the authors specify, ‘Where In Your Body?’ (WIYB) is a post-experience evaluation tool designed by Matthew Reason to capture online audiences’ kinesthetic responses to dance. Ibid., footnotes 29-30.

<sup>6</sup> Genevieve Alelis, Ania Bobrowicz, and Chee Siang Ang, “Exhibiting Emotion: Capturing Visitors’ Emotional Responses to Museum Artefacts,” in *DUXU/HCI 2013, Part III, LNCS 8014*, ed. Aroon Marcus (Berlin-Heidelberg: Springer-Verlag, 2013).

<sup>7</sup>Ibid., 431.

been mostly research in terms of motivational<sup>8</sup>, attitudinal<sup>9</sup>, and other psychological benefits, for example “sense of place”<sup>10</sup>, when using mobile applications. Recently, Harley has proposed to structure the measurement of emotions directed around different aspects (*object foci*) of the location-based application: the app (technology-directed emotions), learning about the historical location (topic emotions), and the guide (social emotions).<sup>11</sup> Technology-directed emotions have been mostly investigated outside the museum setting, in particular within emotion-capturing HCI research. One aspect increasingly investigated by psychologists is the critical associations that emotions have with learning when using mobile AR interfaces.<sup>12</sup>

Emotions as educational outcome of the interface design have been studied also by Pekrun and Perry, who have been grounding their analysis of fostering emotions around the central tenet of the control-value theory of achievement emotions (CVT).<sup>13</sup> According to this theory, appraisals of control and value play the crucial role of being proximal antecedents of emotions. More broadly, appraisals of control target one’s beliefs concerning the causal influence they exert (agency) over actions and outcomes (controllability). For example, apps providing user-directed navigation (e.g.,

---

<sup>8</sup> David Furio et al., “Mobile Learning vs. Traditional Classroom Lessons: A Comparative Study,” *Journal of Computer Assisted Learning* 31 (2015). <https://doi.org/10.1111/jcal.12071>.

<sup>9</sup> Kun-Hung Cheng, “An epistemic curiosity-evoking model for immersive virtual reality narrative reading: User experience and the interaction among epistemic curiosity, transportation, and attitudinal learning,” *Computers & Education* 201 (2023): 104814. <https://doi.org/10.1016/j.compedu.2023.104814>.

<sup>10</sup> Ning Chris Chen, Michael Hall and Girish Prayag. *Sense of place and place attachment in tourism*. London-New York: Routledge, 2021. Yu-Lien Chang et al., “Apply an augmented reality in a mobile guidance to increase sense of place for heritage places” *Journal of Educational Technology & Society* 18, no. (2015). <https://www.learntechlib.org/p/158888/>.

<sup>11</sup> Harley, Jason. “Measuring Emotions: A Survey of Cutting-Edge Methodologies Used in Computer-Based Learning Environment Research,” in *Emotions, Technology, Design, and Learning*, ed. Simon Tettegah and Michael Gartmeier (Cambridge, MA: Elsevier Academic Press, 2015).

<sup>12</sup> Chai Tyng et al., ‘The Influences of Emotion on Learning and Memory,’ *Frontiers in Psychology* 8 (2017). <https://doi.org/10.3389/fpsyg.2017.01454>.

<sup>13</sup> Reinhard Pekrun and Raymond Perry, “Control-value theory of achievement emotions,” in *International handbook of emotions in education*, ed. Reinhard Pekrun and Lisa Linnenbrink-Garcia (New York: Taylor & Francis Group, 2014).

choice in what learners paid attention to, for how long, and in what order), could enhance their perceptions of control by supporting autonomy, pacing, and self-directed inquiry. As previously discussed, apps are generally designed for minimal cognitive load by leveraging users' previous experiences of similar and familiar technologies (e.g., Google Maps). Subjective value is the second core appraisal dimension outlined in the CVT. Pekrun and Perry define subjective value as the perceived importance of an activity or its outcome(s) to oneself (goal relevance), combined with the perception that an action or outcome is positive or negative in nature (goal congruence - event supports or hinders goal attainment). As discussed in chapter 2, the design of the *Hidden Florence* app is strongly based on minimal cognitive load, as recommended by standard design conventions, and this has clearly enhanced the usability of the app by facilitating the learning process of the "walk-to-unlock" mechanism, crucial point for the successful functioning of the app (and, as we will see within the data discussion, is reflected in the high number of download and returning users).

In the next sections, the chapter explores the case study of the analytics of the app *Hidden Florence* as quantitative measurement tool to gauge the performance of the app in terms of evaluate the user experience and the level of the engagement of the audience with the media content. The description of this case study has been structured as follows. After a brief description of the research-based project, with a particular focus on the chronological developments of its main public-facing aspects (i.e. its social media ecology), the chapter contextualises the app within the broader interpretative offer for visitors of Florence, giving attention to the strategies implemented by the city for visitor management. This will allow this research to investigate not only the benefits and limits of the quantitative analysis for evaluating the user experience, but also to understand how these data can potentially trigger

more sustainable visitor behaviours, when applied to the study of broader heritage themes, such as overtourism strategies and smart cities.

### 5.21 Background.

*Hidden Florence* is a mobile GPS-based audio trail aimed primarily for visitors of the city of Florence. Produced by Calvium Ltd., the app is available for free download on the two major publishing platforms, the App Store for iOS devices and Google Play Store for Android operating system devices.<sup>14</sup> The app invites users to experience Renaissance Florence along six trails, whose storytelling is delivered by contemporary fictional characters recounting anecdotal stories about their lives and their time in the city. In its original version, the app featured only one character and was structured around two distinct journeys, a central walk, covering most of touristic spots in the centre of Florence, and a walk in the neighbourhood of Sant’Ambrogio (Figure 5.1). In 2019 a major update of the app has been released, offering visitors four new walks expanding the total count of the tours to six, each of them led by its own character (Figure 5.2). Each walk unfolds along several points of interest featuring two audio tracks (Figure 5.3). These are: a *circa* two minutes long main track led by the fictional historical voice, and an additional track referred to in the reports as ‘Discover More’ track, containing short expert talks offering insights related to the topic discussed or raised in the main track.

While interfacing the users with a fictionalised historical voice, the storytelling is grounded in academic research. The app *Hidden Florence* has been formally launched

---

<sup>14</sup> “Hidden Florence,” Apple apps, accessed November 29, 2023, <https://apps.apple.com/gb/app/hidden-florence/id896723912>. “Hidden Florence,” Play Google, accessed November 29, 2023, <https://play.google.com/store/apps/details?id=uk.ac.exeter.hiddenflorence&hl=it&gl=US>.

in 2014 as a collaboration between two public history scholars as the result of a follow-up funding for an AHRC funded research on social use of taverns<sup>15</sup>. The app is the practical outcome of the research grant from the Arts and Humanities Research Council (AHRC) in the United Kingdom (2012–2014) and subsequently with funds from the University of Exeter Innovation, Impact and Business Directorate (IIB Centre) Higher Education Innovation Fund<sup>16</sup>. Contemporary to the app development, a companion WordPress website has been created to offer, in the form of blog posts, the ‘behind the scene’ of the content in development while awaiting to the public release. In the first version, the website also hosted the web format of app content (audio tracks and their transcripts) alongside further readings and information about the project. At the same time, a YouTube channel and a Facebook account were set up. Three features were initially added to the YouTube channel: a documentary on the app project; a promotional film for Hidden Florence; and a shorter 30-second edit. Facebook and Twitter accounts were created shortly after. The latter was initially a semi-official account under the profile name of “@Giovanni1492”, and later in 2019 substituted by the “@hiddenflorence” profile. An Instagram account too was created shortly after (“@hiddenflorence”). The YouTube was the main promotional window for the upcoming app release, representing the first marketing move of the project towards creating a social media footprint for the app. In December 2016, the app received an unexpected publicity when the Channel 4’ show *Travel Man: 48h in...:Florence* showed Rebel Wilson, the celebrity guest accompanying the host of the show, using *Hidden Florence* for visiting the city.

The year 2019 saw major interventions in the project. An updated version of the app

---

<sup>15</sup> <https://tavernsproject.wordpress.com>, accessed November 23, 2023.

<sup>16</sup> As part of the latter funding, the project also included the investigation of the analytics of the app discussed in this chapter.



was released expanding the number of tour walks from two to six. The website too underwent content renovation. While the style and the structure of the blog remained the same, the overall content load changed slightly, getting rid of the option of downloading the tracks and read their transcripts to accommodate short extracts providing in an academic tone further information about topics discussed within the audio tours. Simultaneously, a marketing strategy was put in place. The ecology of the app grew to include accounts on all the most popular contemporary social media platforms. For a short-time period in 2019, roughly coinciding with the months from June to August, the Instagram account was administered by a student involved in an internship aimed at increasing the social media footprint of the new version of the app via active curation of the profile and regular posting activity.

Moreover, a dialogue with the municipality and the local UNESCO World Heritage Management Team led to the inclusion of the app amongst the sponsored touristic activities. A promotional leaflet advertising the app was included within the *Firenze Card* package, a 72 hours tourist pass with discounted entrance at several city museums, particularly popular with international visitors and families. Following the app inclusion in the *Hidden Cities* initiative, some of the social media accounts of Hidden Florence have been translated and embedded under the new project account. The original Instagram account @hiddenflorence has been linked to the newly created profile for the *Hidden Cities* project (@hiddencities). The Facebook account too has been incorporated and renamed *Hidden Cities Apps*.

### **5.2.2 Context.**

For centuries, the city of Florence has been an attractive touristic destination. One of the designated cities of the *Grand Tour* from the 17<sup>th</sup> century onward, the city in 1982

has been listed among the UNESCO World Heritage Sites.<sup>17</sup> Its reputation as *the cradle of Renaissance* has been attracting for centuries visitors fascinated by its nature of outdoor living museum. As a result, Florence is constantly battling to find a solution to understand its capacity load and relieve the stress on it. Nowadays the city attracts a massive volume of visitors with figures in the order of several million visitors a year, with more than an half of these staying overnight<sup>18</sup>. The geographical composition of the visitors is broad, comprising tourists from United States, China, and many European countries, including but not limited to Germany, the UK, France and Spain<sup>19</sup>. Figures like these immediately suggest the extent of the issue of overtourism for Florence, which present daily challenges to the logistical organisation and management of the city.

Of these challenges, perhaps the most evident is the overcrowding of some central areas where the impact of the tourist flow is higher and not without consequences on the local population in terms of daily activities and housing problems. Alike many other historic centres, in Florence the situation is further complicated by the typical size and configuration of the old town, which sees a great concentration of major touristic attractions within a limited geographical space. Most of the city popular attractions are in fact located in the historic centre, the Quartiere 1. To name few of these attractions, the Uffizi Gallery, the Duomo (cathedral) and the Piazza della Signoria are placed within a radius of half kilometre from the Ponte Vecchio, the world-famous bridge over the river Arno. To further complicate the situation, the majority of these visitors are

---

<sup>17</sup> Firenze Patrimonio Mondiale, *The management plan of the Historic Centre of Florence. UNESCO World Heritage* (2016) accessed August 27, 2023. <http://www.firenzepatrimoniomondiale.it/wpcontent/uploads/2015/12/Pianogestione-en-web.pdf>.

<sup>18</sup> Jon Henley, "Overtourism in Europe's historic cities sparks backlash," *Guardian*, January 25, 2020, <https://www.theguardian.com/world/2020/jan/25/overtourism-in-europe-historic-cities-sparks-backlash>.

<sup>19</sup> Firenze Patrimonio Mondiale, *The management plan of the Historic Centre of Florence*.

'excursion tourists' staying in the city only for a few hours at a time. Accordingly, they tend to spend their time in Florence mainly in the historic centre. It is evident that given the figures of daily visitors, the central area of Quartier 1 has become extremely congested taking a toll on the local residents. A second, but not less critical issue connected with the overtourism is the current status of liveability, commerce and residence in the historic city. Despite excursion tourists making limited contributions to the visitor economy their impact on the quality of life of the locals is huge.<sup>20</sup> As seen for other UNESCO World Heritage sites, the exponential growth of the tourism is proportionally linked to the rise of Airbnb accommodations, which in turn causes property market shifts, and eventually the pricing-out of local residents from the central area.<sup>21</sup> Alongside to it, there have been frequent complaints about anti-social behaviour (e.g. littering and petty crime), especially in peak season.<sup>22</sup> This is a persistent reason of concern for the municipality who is continuously trying to find a way of harmoniously balancing the needs of the tourists with the ones of the local residents.

With the scope of addressing these issues and by virtue of its designation as World Heritage Site which oblige the city to have a management plan in place, the municipality of Florence started to design a plan by compiling several reports on the state of conservation of the city monuments. With the creation of the UNESCO office in 2005, the municipality have been working together with the UNESCO team on finding best practices to tackle, or at least mitigate these challenges. This collaboration has brought to the publishing of the first management plan for Florence in 2006, to

---

<sup>20</sup> Firenze Patrimonio Mondiale, *The management plan of the Historic Centre of Florence*, 43.

<sup>21</sup> Julia Buckley, "Venice and Florence demand a curb on Airbnb," *CNN Travel*, March 25, 2021, <https://www.cnn.com/travel/article/venice-florence-airbnb-restrictions>.

<sup>22</sup> Monika Popp, "Positive and negative urban tourist crowding: Florence. Italy". *Tourism Geographies* 14 , no. 1 (2021). <https://doi.org/10.1080/14616688.2011.597421>.

which followed two other updated versions respectively in 2016 and 2021. The purpose of a management plan is to ensure the effective protection of the nominated property for present and future generations. The 2016 Management plan identified six main threats to the World Heritage area, including the ‘impact of mass tourism’ and the ‘collapse of monumental heritage’.<sup>23</sup> The first step in this direction has been acknowledging the need of constant anthropic pressure borne by the Municipality of Florence by creating a buffer zone around the core zone to safeguard and to ensure the integrity of the site. Despite the historic centre of Florence was inscribed in the UNESCO World Heritage List in 1982 under the name *Historic Centre of Florence*, the final approval of the buffer zone was made only in 2015, with a further extension of its perimeter in 2021.<sup>24</sup> Currently, the boundary of the core zone largely follows what was the line of the ancient fourteenth-century walls around the medieval urban core (Figure 5.4). Identifying as priority the load capacity of Florence, the 2016 Management plan also tackles the decentralisation of touristic flow by dispersing visitors from the mere centre core zone to less central areas of the historic centre. Accordingly, the revised town planning regulations proposes further curation of historic public spaces to facilitate liveability for local business and residents.<sup>25</sup> To this objective can be ascribed the several works at historic public spaces, like the Piazza of SS. Annunziata in front of the Ospedale degli Innocenti, as well as requalification of residual spaces and the *piazze minori* (secondary squares).

---

<sup>23</sup> Firenze Patrimonio Mondiale, *The management plan of the Historic Centre of Florence*, 46.

<sup>24</sup> Marco Bini et al., “Buffer Zone – l’area di rispetto per il sito UNESCO Centro Storico di Firenze. The safeguarding area for the Historic Center of Florence, UNESCO site, Firenze, DIDA - Dipartimento di Architettura - Università degli studi di Firenze (2015)”. [https://issuu.com/dida-unifi/docs/buffer\\_zone](https://issuu.com/dida-unifi/docs/buffer_zone).

<sup>25</sup>Ibid., 39.

As introduced in chapter 1, within the agenda of the management plan, there was also the creation of *ad hoc* projects knowledge-exchange initiatives to address these issues, the purpose of the majority of these being tackling the impact of mass tourism. To support the decision-making process and facilitating the implementation of these initiatives, in 2015 a specific research centre has been created, the HERE-Lab – Heritage and Research Lab (formerly Heritage\_CITYlab), in collaboration with the University of Florence.<sup>26</sup> This lab has the overall responsibility of coordinating the research on the heritage impact assessment of the several initiatives. Some of these latter look at better management of the tourism system with the aim of enhancing the liveability, commerce and residence in the historic city. For example, the ‘Heritage Florence Data’ project aims at developing a GIS database for the analysis, monitoring and management of buildings and outdoor spaces of the historic centre of Florence<sup>27</sup>. The project ‘Florence Heritage’ instead looks at the best uses of new interactive technologies and mobile applications for the promotion of the historic and cultural heritage of the city. These are just some of the satellite initiatives implemented, all of which have as core objective the design of alternative strategies based on innovative tools for information and tourist programming’, a context well suited to projects like the *Hidden Florence* app.

### **5.2.3 Data sources.**

The analytical data observed are respectively related to the years 2017-2018 and 2018-2020. Accordingly two unpublished reports have been produced. The aggregated data for the first are available in the report. The 2021 report collates the

---

<sup>26</sup> Firenze Patrimonio Mondiale, “HeRe\_Lab – Heritage Research,” accessed November 29, 2023, [https://www.firenzepatrimoniomondiale.it/here\\_lab-heritage-research/](https://www.firenzepatrimoniomondiale.it/here_lab-heritage-research/).

<sup>27</sup> Firenze Patrimonio Mondiale, *The management plan of the Historic Centre of Florence*, 86.

results of the observation of the analytical data for the time period of 2018-2020 and is currently under revision. For the sake of clarity, within the following description I refer to them respectively as first report (2017-2018) and second report (2018-2020).

Both of the reports investigate user-generated data collected from several channels.

The 2017-2018 report collates data originated from three channels. These are:

- the two distribution platform (iTunes and Google Play) and the analytic platforms Google Analytics, which combines data from the two independent publishing platforms,
- the WordPress website, and
- the YouTube channel.

The 2018-2020 report instead collates data originated from the two channels investigated in the first report (distributing platforms and WordPress website), with the addition of user-generated data from the social media accounts associated with the project. These are:

- the Facebook account Hidden Florence,
- the Twitter account @hiddenflorence, and
- the Instagram account @hiddenflorence.

Therefore, the second report includes a total of seven sections, respectively looking at data available from the app platforms, Google Play Console and iTunes (Section 1), and Google Analytics (Section 2), the WordPress website 'hiddenflorence.org' (Section 3), and the social media accounts, Facebook (Section 4) Twitter (Section 5) and Instagram (Section 6). The final section (Section 7) reports the press coverage of the app during its lifetime, and it is still a work in progress.

It is worth striking a note of caution about the nature of the data investigated in both reports. Given the pre-aggregated manner in which the publishing platforms elaborate and distributed data, they have to be regarded as secondary data. Data are provided in automatically generated groups, organised by categorical value as imposed by the third-party providers. One particular aspect that dictates this custom data processing approach is privacy safeguarding regulation third-parties are obliged to comply. As we have seen in chapter 1, the General Data Protection Regulation (GDPR) regulation implemented by the European Union in May 2018 requires appropriate measures to be in place to ensure privacy and that consent is obtained for the processing of data<sup>28</sup>. For GDPR compliance though, the collection and distribution of demographics data are regulated respectively by consent and a pay-wall.<sup>29</sup>

#### **5.2.4 Data time frame.**

The first report looks at the data available for the time span cover there is 8<sup>th</sup> January 2017 and 31<sup>st</sup> January 2018. For the data of the app usage, the report also includes an historical overview of metrics related to the type of audience of the app from April 2015 to January 2018. This report was produced by the app developer company and only gathered data from the two platforms, iTunes and Google Play. The second report generally covers the data for the period from February 1, 2018 to June 30, 2020. This is the time span considered for the app platform iTunes (iOS), the WordPress website

---

<sup>28</sup> Department of Legislation, General Data Protection Regulation, 2016, accessed October 23, 2023, [www.legislation.gov.uk/eur/2016/679/contents](http://www.legislation.gov.uk/eur/2016/679/contents). Information Commissioner's Office, Privacy in Mobile Apps. December 2013, accessed October 23, 2023, <https://ico.org.uk/media/for-organisations/documents/1596/privacy-in-mobile-apps-dp-guidance.pdf>.

<sup>29</sup> For example, the "App Tracking Transparency" policy of Apple see the obligation of developers to inform app users and asked them for consent prior to collect data such as screen name, handle, account ID, assigned user ID, customer number, or other user- or account-level ID. "About privacy information on the App Store and the choices you have to control your data". <https://support.apple.com/en-gb/102399>.

and the Facebook account. For some channels, it was possible to interrogate data for extended time periods. For example, the section on data from the platform Google Play Console (Android OS) refers to the period between July 2014 to June 2020 since each platform allows retrieving data from distinct time spans. For other channel, access was restricted to a shorter time frame. This is the case of the data platform Google Analytics (Android, iOS and other operating systems related to them) which cover only thirteen months (January 1, 2019 - January 31, 2020) and the Instagram account whose section only covers one year (July 1, 2019 - June 30, 2020). The differences between the time spans which can be interrogated reflects the variety of statutory time frames of the single data providers. For example, Google Analytics allows tracking the overall lifetime of the app, while Instagram instead grant backtracking of data for a max of 12 months. While the inclusion in the second report of the analysis of data already considered in the first report may raise perplexity, the decision has been informed with the aim of providing this research with the longest longitudinal view of the performance of the app and its social media ecology.

#### **5.2.5 Data quality and analytical choices.**

The analysis of the data has been carried out using a descriptive method involving basic statistical techniques. They both follow the same cross-referenced analysis of several metrics extrapolated from different sources (app platforms, website, and social media). With regard to the data retrieved from the app usage, specific metrics have been selected in the expectation that they would provide information regarding the type of audience and the user behaviour. These include but are not limited to new vs returning users, language, number and location of downloads, session duration, share, and content engagement.



Data retrieved from the social media platforms have been too interrogated to find questions related to the volume and type of engagement with the website and the social media. To an extent this choice of the metrics has been dictated by the nature and characteristic of the data set as provided by the distributing platforms (i.e. pre-processed aggregated approach). Despite the curated cross-referencing of the chosen metrics in the attempt of extrapolating as much insightful information as possible, results do have a basic level of granularity. For example, the geographical location of the download as provided by the platforms is coarse, meaning that its level of precision is not as accurate as expected, unless permitted by the user.<sup>30</sup> This also explains the large volume of downloads which have not been assigned a geographical position. While this is not the appropriate space for discussions on ethical implications of precise location nor about its benefits and disadvantages, it is important to reiterate that the data as provided by the distributors may not be highly granulated and in turn, any analytical insights ought to acknowledge possible issues such as bias, skew or representativeness.

### **5.3 Data Analysis.**

#### *Data from app distributing platforms (iTunes and Google Play Console)*

Overall, the app was installed 7,621 times in total from its release on major distributing platforms in May 2014 to June 2020 (included)(Table 5.1)<sup>31</sup>. Google Play Console (6102 ‘acquisitions’) was a more popular platform than iTunes (1519 ‘installations’).

---

<sup>30</sup> In accordance with data minimization, app distributors have been implementing a policy of access by consent to precise location to safeguard users’ privacy. See, Joseph Green, “How Will iOS 14 Affect the Location Data Industry?,” *xmode* (blog), <https://xmode.io/how-will-ios-14-affect-the-location-data-industry-2/>.

<sup>31</sup> The total amount of downloads (app acquisitions/installations) for both platforms has been calculated using the metric ‘unique device’ and ‘unique user’.

Compared to data acquired in the first report (2014-2018), Google Play is still the most popular platform, with the number of downloads of the app incrementing also up of the 137% (Table 5.2).

Looking at the semesterly distribution of the downloads, it is possible to observe a cyclical peaks of downloads during the high season (i.e. June to August) and two major spikes up in December 2016 and June 2019 (Figure 5.5). These correspond respectively to the TV coverage on Travel Man and the release of the new version, suggesting immediate and beneficial effects of marketing interventions. The effects of seasonality seem to impact more Google Play acquisitions, which shows a more complex pattern than iTunes installations (Figure 5.5). While the installations for the latter increases in a modest yet steady manner over time, the Google Play acquisitions seems to be more influenced by the starting of the touristic season and less from the TV exposure. Indeed, the number of acquisitions generally increase with the summer and the high touristic season and declines during the winter months.

For both of the platforms, the greatest variations are seen with positive numbers in correspondence of the update release, and with a negative figures coinciding with the beginning of the lockdown associated to the COVID-19 pandemic. The pattern of semesterly distribution of the active devices shows the same behaviours attested for other metrics, showing peaks consistent to the update release, and a massive drop caused by the travel restrictions caused by the pandemic.

The geographical distribution of the app units shows generally a steady distribution of app units, with exception from China users<sup>32</sup>, whose numbers picks up during the first

---

<sup>32</sup> Figures for China users are no longer considered from this moment onwards given the erratic nature of the data as retrieved from the distributing platforms.

half of the 2017, then drop down to be consistent with other countries' numbers. In terms of app engagement, the impact of the pandemic has been strong. Despite some engagement in its "armchair modality", the app sees from January 2020 a drastic drop in the number of downloads. Looking at how visitors find the Hidden Florence app, the most popular way is by direct app store search, yet many first time downloaders find the app by direct search on the App Store, although there is an overall increase of the app search starting from the first half of 2017 (Figure 5.6). Among the app referrers, since its creation in Summer 2018 the most popular is Instagram (Figure 5.7). The app is very popular with Italian and USA users, while the UK users seems to prefer direct search on the search engine Google (Figure 5.7). The most popular web referrer instead is the app dedicate website ([hiddenflorence.org](http://hiddenflorence.org)), in particular for USA and UK users (Figure 5.8).

For what concern the geographical distribution of the users, overall the most represented countries are Italy, UK, and USA (Figure 5.9). The period from 2014 to 2018 see the UK see the majority of the new device acquisitions, with a consistent high volume starting from Summer 2016 and lasting throughout mid 2018, a phenomenon consistent with the TV appearance of the app in December 2016 (Figure 5.9, 5.10). For the period 2018-2020 instead, while English-speakers countries are still the most represented countries (UK, USA, and Canada together represent the 48% of the total installations), visitors from Italy represent the 45% of the total installations (Figure 5.11). This is surely linked with the *Firenze Card* promotional strategy during Summer 2019, proving the overall effectiveness of this intervention. Interesting is the fact that also for the first time, users from Spain make it to the top five represented countries (Figure 5.11), suggesting a new trend of Spanish visitors in Florence.

### *Data from Google Analytics*<sup>33</sup>

Compared to the proprietary distributing platforms, Google Analytics surprisingly provides data with a higher level of granularity of the metrics for deeper and cross-referenced data processing, allowing for a more detailed user profiling in terms of type of users and behaviours<sup>34</sup>. Data retrieved from Google Analytics have been used to filter data by cities, in order to better appreciate the diversity in users' type and behaviours between visitors using the app in-situ (i.e. in Florence) and users access the app remotely. A first metric interrogated is the total number of sessions by unique users, which accounts to 2299 sessions from January 2019 to the end of January 2020. Compared to the period 2014-2018, there has been a huge drop of sessions (-96%)(Table 5.3). Proportionally correlated to it, there is a great increment of the average session duration (+45%)(Table 3). In fact, it is possible to see that the time of continuous engagement with the app increases from 7 minutes to almost 13 minutes. Of particular interest is the usage pattern suggested by the length of the sessions (Figure 5.12). Generally, the majority of the users engaged with the app for less than three minutes for quickly browsing the app, with a slightly better performance for the period 2018-2019 (57% vs 68% of the totality attested for the previous period), while a third of the users instead engages with the app between 3 and 10 minutes. The number of sessions of more than 30 minutes though is higher for the period 2018-2020 (329 sessions, 14% of the totality) compared to the previous period (252 session, equal to the 6% of the totality)(Table 5.4). This can be consistent with users accessing external contents on the website and/or doing multiple walks. On the other side, new

---

<sup>33</sup> It is important to bear in mind that during the period considered in 'Data from Google Analytics', the app has undergone an important change with the addition in May 2019 of four additional walks.

<sup>34</sup> Google Analytics collates data retrieved from both the Google Play Console for Android users and iTunes for iOS users.

users tend to spend less time engaging with the app compared to returning users (Figure 5.13).

Overall, longer lengths of engagement suggest that there is an increased propensity among users that already knew the original version app to navigate deeper the newer version by accessing further contents. A further level of granularity which can be applied to location metadata is the filter by 'city', which allows to distinguish between those using the app in Florence (i.e. in-situ) and elsewhere (i.e. remotely). By applying the city criteria, it is possible to establish that, for the years 2018-2020, the number of Florence users represent the 35% of the totality of users (Figure 5.14).

For the same years (2018-2020), the distinction between new and returning users for Florence and elsewhere offers an important insight on users' behaviour. The percentage of returning users in Florence (30%) is higher than the percentage of new users (25%)(Figure 5.15). Generally, the figures for new users prove the validity of marketing strategies to attract new audience. The higher volume of returning users, together with the fact that longer time of the sessions is attested, indicates great satisfaction with the app and the visitors' propensity of continuous engagement with the app, most likely for experiencing the new walks. Also the events related to the start and finishing of the download have been interrogated by location. For the period of 2018-2019, it is interesting to note that in percentage more users in Florence complete the download compared to users elsewhere (Figure 5.16), suggesting that in-situ users are keener at using the app than users accessing it elsewhere. It also hints at the fact that there are no major issues in terms of network coverage and data roaming for users downloading the app in Florence as previously hypothesized.

The number of total events generated outside Florence is overall more than three times the number of users *in-situ* (Figure 5.17). Nevertheless, it is interesting to note that there is no difference between users in Florence and outside it in terms of rate of users engaging with the walk after landing on the main page (Figure 5.17), meaning that remote users are engaged in the same way as the users on site. Unfortunately, this might be seen as a detractor to the effectiveness of location-based storytelling. Generally, users outside Florence engage more with the expert tracks than users *in-situ* as demonstrated by the higher volume of remote access to them (Figure 5.17). This suggests that people have been actively engaging with the app remotely, in its “armchair modality”, using it as an alternative for in-person visits to Florence.

### *Walks Performance*

The following sub-section looks at the analysis of the data for visitors in Florence for the period from the update release in May 2019 to January 2020 (included). The aim is to understand the overall performance of the new version of the app and establish a baseline for future data investigation. Out of the six tracks of the new app version, five are available to visitors for download, while the Giovanni’s walk ‘Politics and the people’ is now a core part of the app and therefore offered to visitors without download. The content of this latter walk and the one of the ‘Neighbourhood Walk’ (former S. Ambrogio walk) are the same as in the older app version.

The overall most engaging of the six walks in Florence is ‘Master of Florence’, which represents 25% of the totality of the events, shortly followed by ‘Politics and the people’ with 23% (Figure 5.18). The least represented walk is ‘Neighbourhood Walk’, whose events are represent only 9% of the totality (Figure 5.18). The three other new walks have a good performance too, sharing similar results in terms of user’s engagement.

The difference between the rate of engagement of the walks can be explained by the so called “distance decay” effect. Despite the introduction of new walks, those in ‘closer proximity to, and more conceptually connected with, the city’s marquee attractions<sup>35</sup>’ are more popular. This is proven also by the difference of engagement rate between the main and expert tracks. The least two engaging walks, ‘Neighbourhood Walk’ and ‘Saints and Sinners’ lead the visitors to explore or approach an area in proximity of the buffer zone (Figure 5.19 and 5.20). Indeed, the ‘Neighbourhood Walk’ is structured as a series of eight stops moving as a loop around the Piazza San Pier Maggiore. While being in an area close to the centre, just over half kilometre from the Duomo, the walk is taking place in the San Pier Maggiore residential area which is on the outskirts to the core zone and does not feature any touristic landmarks. The ‘Saints and Sinners’ walk too has as final destination Piazza San Pier Maggiore and accordingly sees a low rate of engagement compare to more central walks. In contrast, the journeys of walks with higher engagement rate touch many central touristic points such as the cathedral (Duomo), Palazzo Medici, Ponte Vecchio and Piazza della Signoria (Figure 5.2).

Amongst these walks, it is interesting to note the rate of engagement for the ‘City of Women’ walk (Figure 5.18). Unlike the other two fellow walks, this walk starts off at Ospedale degli Innocenti, an historic building couple of blocks away from the Duomo. Whereas the first five stops of the tour take visitors away from any major touristic spots, the last stops redirect them towards the Duomo ending the tour nearby Piazza della Repubblica. The approach of first moving tourists out towards less popular spots and

---

<sup>35</sup> Nevola, Cole and Mosconi, *Hidden Revealed*, 382.

then retracing them back to the centre, has surely helped in terms of avoiding the distance decay effect.

Overall, the engagement rate of the new walks is not surprisingly high given the thorough planning by which users are taken in loops around the main landmarks of Florence that was expected to be more appealing to visitors. A reason may be found in the fact that only few of POI of these walks are linked to most popular buildings. While a modest attempt, this is surely beneficial to the city plan of taking off the touristic pressure to some of the most popular buildings or urban features of Florence. It is interesting to observe the difference of engagement with main tracks for the 'Politics and people' walk. Despite ranking second for number of events – figures consistent with the fact that the walk is pre-downloaded, the way in which visitors approach this walk is very particular (Figure 5.21). The events for first two POI, Ponte Vecchio e Piazza della Signoria, are more than double than the events for the third and fourth POI, Canto del Bargello and San Martino. Engagement rate goes back to better figure from the fifth POI (Orsanmichele) to the eight POI Piazza della Repubblica, to then drops again at the last POI of Palazzo Strozzi. Given the centrality of the walk, this is quite an unusual pattern for which there is not an evident explanation, the most plausible being a file bug in recovering data for these two POI.

Generally, for walks is observable the same distance decay effect pattern, with less engagement towards the end of the walk, regardless of the distance covered by the walk or the overall time needed to complete it (Figure 5.22, 5.23, 5.24, 5.25, and 5.26). It also important to point out that, even though a numerical order is provided for each POI of the walks, the tracks can be accessed without following the order suggested. This was expected to attract more visitors than attested, since the users may not be



aware of it. Users engage with contents in a linear sequence as suggested by the numeration.

Two broad patterns can be recognised for type of engagement with the walks' stops. A first pattern concerns the walks whose see a decreasing of engagement in accordance with the ascending numerical order of the POI which lead the visitor outside the core zone or end at less know touristic attraction. For these walks, generally the last POI have a third of the events than the first POI. This is the case of the following walks: 'Politic and People', 'Crime and Punishment', and 'Neighbourhood Walk' (respectively Figure 5.21, 5.24, and 5.26). A second pattern is recognised which see initial high figures for the first couple of POI, decreases in the middle and then bounces back towards the end of the walk. This is the case for three walks, 'Master of Florence', 'City of Women' and 'Saints and Sinner' (Figure 5.22, 5.23, and 5.25). The explanation for the former two is likely to be found in the (semi)circular shape of the journeys. Following this shape, the walks detour for few POI in the middle of the walk towards less popular spots, to then led visitors back to more famous landmarks. In the case of 'Master of Florence', its last three POI which point back to the cathedral piazza, with the very last POI being the Duomo north door, while for 'City of Women' the tour ends at Onestà, nearby the Piazza della Repubblica. The wavy pattern of the events is visible also for the walk 'Saints and Sinners'. This walk follows a liner journey towards Piazza San Pier Maggiore, that is the outskirts of the core zone. Despite so, its last two POI, the piazza and the church of San Pier Maggiore, have a greater number of events than generally expected with the distance decay effect. The reason behind it might be found in the fact that the Hidden Florence 3D app is available at the POI of the church of San Pier Maggiore as independent app. This is just an assumption though, since no data for the Hidden Florence 3D are available to understand the

actual visitors' engagement with it, nor a similar beneficial effect is attested for the 'Neighbourhood Walk', which stops at the same locations.

The ranking of the six walks by engagement with expert stories follow obviously the one with the main tracks, since there is no possibility of accessing the 'Discover more' without accessing first the main track page. Comparing the events of the main track with the one for the 'Discover more' expert tracks of each walk, it is possible to observe that generally just over half of visitors that listen to the main track also listen to the expert track (Figure 5.27). The same pattern of distance decay effect is generally attested also for the 'Discover more' expert tracks. Accordingly, the most engaging 'Discover More' track is 'Politics and the Piazza' which is related to the POI 'Piazza della Signoria', the second tour stop of the Giovanni's walk 'Politics and People'. The least accessed tracks instead are 'Tavern Tales' and 'The apothecary's shop', which with equal number of events, represent respectively the expert tracks for the third to last POI 'Volta di San Piero', and the last POI 'Canto alle Rondini' of the least central walk, the 'Neighbourhood Walk'.

A final remark here has to be made about the engagement with the audio tracks in Italian. Despite the surge of users from Italy attested in summer 2019, surprisingly the tracks in Italian are extremely unpopular (Figure 5.28). Looking at the interface of the app though, it is possible to notice that there is no evident indication of the possibility of accessing contents in Italian, aside from a small icon with the Italian flag next to the walk profile picture. The interface is entirely scripted in English and it does not feature any text, button or pop up message acknowledging the possibility of listening to some tracks in Italian. This design flaw might be the also be the reason why only half of the

visitors from Italy that downloaded the app made it to the next step of playing the tracks, maybe discouraged by the English language of the tour (Figure 5.16).

### *WordPress website*

For the first five years since its first appearance (May 2013 to March 2018), the WordPress site attracted 38,052 views from 14,426 visitors. By the end of January 2020, the website has reached 48,106 views from 31,957 visitors. A comparative analysis of the variation rate of the number of views sees an increase of 78% from 2018 to 2019, which is consistent with the increment in the number of visitors (+80%). Figures drop drastically for the 2020, with an increment of only 1% of the views compared to the previous year, and a plunge in terms of visitors (-6%). Despite these broad fluctuations, the general trend over the period is modest growth in total users, with a degree of variability for monthly and quarterly data that echoes the variations in number of users for the app. Similarly, it is possible to note a pattern of cyclical effects associated with seasons (greater engagement with the website during spring and summer months) and with marketing actions (the release of first version and subsequent update, and the TV exposure).

To investigate the type of audience, the geographical distribution of the user is the only metric it was possible to evaluate. In both of the reports, the website audience is dominated by the English-speaking world. In the first report these accounted for four of the top-five countries (64% of the total views) with the exception of Italy in the last position (19%). For the following two years instead is attested an increase of users from Italy which feature in third (2019) and then fourth position (2020), representing respectively 21% (2019) and 9% (2020) of the total views. This rise of Italy-based

users is consistent with the wider publicity the app received locally when featured within the *Firenze Card*.

In terms of type of engagement with the website, metrics considered are: most and least popular pages, search terms, referrers and landing pages. The combination of these metrics is useful to appreciate how the audience find the website and with which contents they engage most (and least) with. For the period 2013-2018 when only two walks were available, data for page views were divided in three main categories corresponding to standard website pages (e.g. home page, about, contact)(Group 1) and two web sub-sections where users could find the expert audio tracks and transcripts of the two walks, 'Central Walk' (Group 2) and 'Neighbourhood Walk' (Group 3). Aside from the home page which for its nature always shows the highest volume of engagement (50% of total page views), for the years 2013-2018 a popular page in Group 1 is 'Stories' (18%), which is the one the main website sections where the description the two walks 'Central Walk' and 'Neighbourhood World'. In third position there is the 'Downloads' page, representing the 8% of total views. Surprisingly, for Group 2 the most accessed page is the one relative to the expert track on 'Crime and Punishment', which is not the first track visible in the related landing page, shortly followed by 'Sex and the City' and 'Bridging the Arno'.

Two observations can be made about it. The first, is that the use of catching words in the titles clearly attracts more users. The second is that the rate of engagement with these might be somehow orchestrated by search optimization of the main search engines, like Google, redirecting users searching for these terms on the internet to the app webpages featuring them. To prove this supposition, it would have been useful access and analyse further metadata related to specific page searches, but

unfortunately the pre-processed report does not allow this level of granularity. For example, temporal metadata might have told if these page searches have been carried out when the online app footprint was higher following major marketing campaign (i.e. release of the update or TV exposure) which would have listed the website amongst the first addresses when looking on search engines for words such as “city” and “crime” for example. Similarly, in Group 3 the most clicked page is ‘Neighbourhood Madonna’, shortly followed by ‘A slice of piazza’, both featuring in their title words that it might be assumed resonate to an international audience as somehow representing popular key terms when exploring Italian (Renaissance) urban and social culture. As a first general observation, it is possible to state that choosing the right words can be extremely influential and can impact the overall app visibility and discoverability by online users.

The release of new walks in 2019 coincides with an update of the website to include them, causing here too a cumulative effect to some data sets. Currently, the ‘Stories’ section feature for each walk a short explanation of the story relative to the stop written by an expert, it is not possible to make a direct comparison with the grouping results of the first report. In terms of user engagement, the most popular page is Giovanni’s story with 1446 views (27%), the second most visited page is Marietta’s with 1087 views (20%) shortly followed by Cosimo’s (988 views, 19%). Moreover, the number of views of Giovanni’s story is skewed given that data are offered cumulatively from previous years’ engagement. Therefore, it is most likely that the actual number of page views of Giovanni’s story is not that high for the period 2018-2020, meaning also that probably the engagement with Marietta’s and Cosimo’s stories is in percentage greater than currently represented. Another effect of the cumulative data approach can be seen in the larger volume of views of the expert stories of ‘Sex and the City’ and ‘Crime

and Punishment'. Generally though, the trend of engagement with pages of the experts' insights is steady, with a proportional rate of engagement by which the last story offered is the least visited. This echoes the 'distance-decay' effect already attested for the engagement with the tour stops.

Alongside the inclusion of new walks, the 2019 update also involved some website changes, the most important being the removal of the walk tracks available for download on the website. Whereas this choice seems to be to some extent in contrast with the high traffic on the downloads attested in the first report, it is actually strongly informed by this number. The authors' assumption is that the more users download the audio tracks via the website, the less they are likely to download the app to access them. To investigate the veracity of it, I interrogated data of the 'clicks', that is the landing pages after website visits, relative to the first period and compared them with the ones from the second report. The most visited landing page for the year 2013-2018 is the media section for the website older version. In the second report instead the most popular websites visited after leaving the Hidden Florence WordPress are Twitter (2018) and iTunes for app download (2019 and 2020). This proves that the strategy of precluding the download of the tracks from the website has resulted in more app downloads, reiterating the importance of the design of digital products accompanying the app.

Other two metrics can offer an insightful view on the type of user behaviours when interrogated. The first is the search term indicating the ways in which a user found the website while browsing on search engines. For the years 2013-2018, the most used terms are "renaissance", "crime", and "punishment", while for the following years these are "hidden florence", "hiddenflorence", and "amazon". On one side this shows that,

thanks to a stronger marketing campaign, the app and its academic background is now more popular and users search for it in a direct way using its name or they are redirected here when looking for related products, most likely the author book(s) talking of the project. On the other side, this might also signify that users are less likely to find the app “by chance”, thus precluding the acquisition of new audience segment(s).

The last metric which can be used to corroborate the marketing effects on the user behaviours is the referrers or ‘links’, that are the webpages which redirected the user to the Hidden Florence website. For the years 2013-2018 the biggest referrer was the media section of WordPress (40% of total links), which means that users found online and clicked an image of the app and they were redirected to the website. For the following years instead, the main referrers are search engines, represented almost equally over the years (2018 at 78%, and 2019 and 2020 at 76%), with users nearly unanimously using Google to find the website (2018 at 95% and 2019-2020 at 96%). Surprisingly, referrers by social media are almost not attested for 2018 (1%), while in 2019 and 2020 they represent 8% of the total of sharing tools. Of these sharing tools, the most utilised are Facebook (54%) and Twitter (34%). This highlights that, despite the marketing campaign on these social media platforms (or perhaps precisely in virtue of the target audience of it), users tend not to visit the website after interacting with its social media accounts. This reiterates the potential of accessing demographics data in order to organised marketing strategies accordingly.

## 5.4 Conclusion.

By investigating the analytics of *Hidden Florence* app, this chapter explored the benefits and limitations of measuring and evaluating the performance of the mobile app. Expanding the longitudinal data analysis of the app has offered significant insights on this matter. Starting with the most basic metric for rating the visitor engagement (i.e. the number of downloads), for the period of 2018-2020 the app downloads have doubled figures in half of the time for the period previously considered (2014-2018). Moreover, figures for returning users in Florence indicate a high level of satisfaction with the app with visitors that, having trying the old version, return to try the new walks. Whereas those figures still remain modest compared to the number of visitors that Florence welcomes every year, the rate at which the app has been downloaded is to some extent a good indicator of the growing appeal that the app had over time. When contextualising such growth, it is easy to make a correlation between the doubling number and the release of the new app version. The flexibility of the narrative design of the app has allowed to scale up the experience, addressing the first sign of drop in the interest seen some months before the release of the update.

By updating the interpretative offer with new stories, the app was able to cater for a wider audience as the number of downloads proves. This is also confirmed by data on the performance of each walk. All the new walks have similar figures in term of events (i.e. how many times the track has been played), suggesting, with a note of caution given the small figures, that the variety of stories is compatible with the overall audience composition of the visitors of Florence. Amongst the on-site users there are indeed more “returning” users, meaning that when the app has been used as interpretative tool in Florence, visitors are more likely to engage again with, by



exploring new trails. The narrative approach adopted for the app seems to be overall successful. The choice of continuing offering a location aware fictional storytelling has been positively welcomed by users. Downloads figures are growing, as it is the length of time that users engage with the app. The update version generally engages users for longer time slots, with the average session duration extended to almost thirteen minutes (i.e. five minutes more than the previous year). Whereas this is consistent with the increase of the trails count, it may also suggest that there is a rising propensity at navigate deeper the app by accessing further contents whenever provided. To a greater extent, also the choice of narrative strategy of the interpretation from below may play a role in changing users' behaviours. The bottom-up approach used for the narrative of the walks facilitates the detouring purpose of the app. The choice of telling an alternative story of the city of Florence inevitably leads to engage with less popular areas of the city. However, these data can tell us little about how and why some walks perform better than other. A qualitative understanding of the capacity of such storytelling to arouse an emotional response in terms of immersion or sense of presence is constrained by the nature of the data itself.

As seen, the *Hidden Florence* app sought to mainly enhance appraisals of educational value by providing historical information about real-world settings. Furthermore, a certain degree of emotional engagement is also pursued by introducing the scholarly drafted content in a more personally relevant manner to users using narrative strategies such as the bottom-up approach and magic moments. Unfortunately, given the current state of art of data analytics, the measurement of the performance of neither of these two objectives is currently possible. Given the increasing number of emotionally engaging experiences in the heritage sector and particularly outside of it, there is growing interests towards developing quantitative and qualitative data

analysis to study the impact of these experiences on audiences.<sup>36</sup> The related research is usually based on bio-feedback and relatively new to the museum environments.<sup>37</sup> However, over the past decade major advancements have been done in the use of artificial intelligence for the heritage sector, for instance in the form of mixed reality (MR) experiences, delivered using Microsoft Kinect and Magic Leap Motion Controller.<sup>38</sup> Increasingly, body motion interaction, such as gestures, speech, touch, and vision, are used for design and evaluate audience engagement<sup>39</sup> In particular within VR and Mixed Reality environments, AI technology is used for capturing biometric data, tracking the physiological signals of the body sensorial responses to stimuli, as in the case of the Galvanic Skin Response sensors that can measure the level of immersion and engagement of the audience and the presenter.<sup>40</sup> It is thus most likely that in the (very) near future it would be possible to integrate more organically this technology to mobile devices and digitally track visitors' verbal and non-verbal behaviours (e.g. facial and vocal expressions) as indicators of attention, arousal, and engagement). Furthermore, in the era of burgeoning AI capabilities, the capacity of algorithms to swiftly assimilate and construe extensive datasets in real time heralds a transformative juncture. AI is currently largely used within artistic environments to empower digital interfaces that are responsive to their

---

<sup>36</sup> [https://www.projectempathyvr.com/#original-content\\_](https://www.projectempathyvr.com/#original-content_) accessed November 29, 2023.

<sup>37</sup> Smart et al., *A panoptic framework*.

<sup>38</sup> Giannachi, *Lost Origin and Beyond*.

<sup>39</sup> Diana Domingues et al., "Embodiments, visualizations, and immersion with enactive affective systems," in *Proceedings SPIE 9012, The Engineering Reality of Virtual Reality 2014, 90120J (28 February 2014)*, ed. Margaret Dolinsky and Ian E. McDowall (San Francisco, California: SPIE Electronic Imaging, 2014). <http://dx.doi.org/10.1117/12.2042590>. Thuriid Vogt et al., "Real-time vocal emotion recognition in art installations and interactive storytelling: Experiences and lessons learned from CALLAS and IRIS," in *Proceedings of the 2009 3rd International Conference on Affective Computing and Intelligent Interaction and Workshops, Amsterdam, The Netherlands, 10–12 September 2009* (Washington, DC: IEEE Computer Society, 2009). <http://dx.doi.org/10.1109/ACII.2009.5349501>.

<sup>40</sup> Weidi Zhang, Donghao Ren, and George Legrady, "Cangjie's Poetry: An Interactive Art Experience of a Semantic Human-Machine Reality," *Proc. ACM Comput. Graph. Interact. Tech.* 4, no. 2 (July 2021). <https://doi.org/10.1145/3465619>.

surroundings, adeptly catering to individual participants' intricate emotional and cognitive spectra. Current research investigates how leveraging algorithms to measure the emotional responses to interactive and immersive art installation<sup>41</sup>, and it is just a matter of time before AI will find its way also within heritage practices as a mean to design and measure the (emotional) engagement of the audiences with the experiences. Alongside further research into the application of state-of-the-art technologies such AI and its prowess to empower design and evaluation of immersive experiences, a more developed theorisation of the nature of the relationship between heritage, emotions and mobile practices and of the responsibilities of those creating experiences and initiatives when negotiating the volatile intersection between them.

An interesting aspect which the quantitative analysis has highlighted is that overall number of remote users, who are circa three times the total users in Florence. As data show, the armchair access is therefore an important modality of user interaction with the app, even if the coarse nature of the data does not allow us to establish if the same user that downloaded the app remotely has then used the app also on site, or *viceversa*. So, the effectiveness of the app in terms of engaging the visitors pre-during-post visit, as advocated for the best interpretative practices, cannot be excluded. The armchair use of the app is nurtured by the link to the website, where users keener of discovering more about the characters and the stories can find additional information. Data for the website, and generally of the social media ecology, indeed show a growth of user engagement which is temporally consistent with the app, meaning that users that have engaged with the app also accessed and navigated the content of the website. The extensive remote access to the app though cannot be considered an

---

<sup>41</sup> Xiaowei Chen and Ibrahim Zainuddin, "A Comprehensive Study of Emotional Responses in AI-Enhanced Interactive Installation Art," *Sustainability* 15, 22 (2023). <https://doi.org/10.3390/su152215830>.

indicator of the app's negative performance *at priori*. Whereas the app has been designed to be used on site, the educational vocation of the app, designed by scholars with a research objective, encourages off site interactions both with the app and with the companion website.

Remote engagement is one of the primary means by which users engage with the app, in particular with expert tracks, which are mostly accessed in an armchair modality. This is the intended purpose of the app which has been encouraged also within the update version. The decision of continuing to provide further content, such as expert-led tracks and links to short essays on the website, is strongly informed by primary objectives of the app. The app was born as an output of a research project investigating the use of locative media for the study of historical urban dynamics. Whereas the app has lent itself well to more trivial purpose, the educational nature is still the most important aspect of the app. This is proven by the fact that the project has expanded to include further academic collaborations across Europe with the *Hidden Cities* app. Furthermore the recent addition of a companion content management system, which is used by the researchers and the students as a research tool, confirms that fact that the app never really had any claim of providing an immersive experience, nor being a pivotal tool of touristic strategies.

Focusing more on the effectiveness of mobile heritage practices to address broader issues of visitor management, data analysis shows many limitations. Whereas as discussed, the decentralising aspect happened to be coincidentally in line with touristic strategies of the city, the app has been welcomed by the local community as a potential mean of solving the issue of the overcrowded city centre, with all the problems that this entails for the local citizens. While acknowledging that the app has never had the

ambition nor the means of acting as solution for the overtourism of the city, data show that in terms of capability of dispersing visitors away from “honey-pot sites” the app provides a modest contribute in this direction. Whereas the location of the points of interest for the new walks take visitors to less-popular locations, their overall journey is still mostly based within the very core zone of Florence. Moreover, generally there is a consistent difference in the volume of events between the less-known points of interest and the more popular ones, even within the same walk. The distance decay effect attested across all walks, further jeopardises any attempt to decentralise visitors. Generally, the farther away the walk goes from the centre, the fewer are the visitors experiencing it. It is clear from the analysis of the tracking data that a single app alone cannot drive drastic visitors’ behaviours. The ‘decay effect’ is most likely due to more practical considerations, such as the limited time available to visitors, but also the fact that more decentralised areas lack touristic facilities. This highlights how apps might have an impact in informing more sustainable touristic practices, but these efforts need to be accompanied by broader politics of the local and regional governments to provide decentralised areas with ‘infrastructural carrying capacity’<sup>42</sup> to cater for and, in turn, to attract visitors in a more organic way.

The biggest lesson that this case study is teaching here is about the importance of a value proposition to create experiences that are engaging, while standing the tests of time. The failure of the app as driver of new touristic behaviour is the result of the fact that the app was never intended as a means to drive visitors away from overcrowded area. Vice versa, its success has to be found precisely in the fact that this has been designed as a mean for researchers to stress their research questions, and as such it

---

<sup>42</sup> Philipp Namberger et al., "Overcrowding, Overtourism and Local Level Disturbance: How Much Can Munich Handle?," *Tourism Planning & Development* 16, no. 4 (2019), 456. <http://doir.org/10.1080/21568316.2019.1595706>.

has been expanded, collating new stories with which users have been increasingly engaging.

A widespread ambivalence emerged towards practices that push for new means to gather, quantify and analyse data solely on their own merits without a critical approach as to their uses, benefits and wider consequences. This has been voiced by debates in the field of cultural analysis, which assert that there are other ways of knowing, experiencing and describing the world beyond this that are themselves compatible with – indeed enabled by – networked objects operating as part of the Internet of the Thing. The case study of the data analysis of the *Hidden Florence* app instead, whilst acknowledging the limitation of pure quantitative approaches towards more hued expressions of (emotional) user engagement, validates both the strategic relevance of the value proposition, and the potential of combining technical capabilities, namely the app as mobile interface and related data tracking, with research methods borrowed from art and humanities.

## **Conclusion.**

Mobile practices are clearly having an impact on the ways in which heritage is encountered, understood, and consumed. In drawing towards the end of this thesis, it is important to understand where this research has led with all the case studies investigated. Mobile heritage practices lie at the intersection of heritage, research and technology and are an important driver of creative innovation and creative economy.

Throughout this thesis, the central focus has been on the design of mobile apps as a pivotal tool for driving a new cultural understanding of the value and the potential of heritage. By undertaking this endeavour, the aim has been to demonstrate the transformative potential of mobile apps as catalysts for more sustainable practices, which drives the continual expansion of the digital realm within cultural heritage sites. This is achieved through their critical design as tools that harmonise various experiential components such as location-based storytelling, technological innovation, awareness of the site's needs and values, and the end-user experience. This delicate balance among these elements is the result of the simultaneous active engagement of many stakeholders, heritage institutions, creative media industry, and transdisciplinary academic research in the shaping of the understanding of the past. In doing so, the resulting experiences are innovative, engaging, and sustainable, enabling the site's values to align with the ones of its audiences, helping heritage remain relevant to the society, in line with the thesis's assertion regarding the primary mission that the heritage sector should prioritise in an age shaped by digital advancements, socio-cultural, and environmental changes.

In unpacking this concept, I began this thesis with an investigation of mobile media practices within the heritage sector, following the evolution of mobile practices. This has allowed an analysis of how the shifting dynamics of the current era, along with the technological resources available to us, have imbued a strong sense of dynamism to the modalities by which the mobile interpretative process has been structured and, consequently, helped to shape our perception of cultural heritage. At the heart of the extensive adoption of mobile apps, there is the familiarity which heritage sites and their visitors had with portable audio guide. The rapid advancement in the computing capability and tech affordances of smartphones, namely in terms of computing capabilities, have allowed to shift from a device as deterministic factor of the type of interpretation of these experiences, to a new approach where the device becomes the medium that supports and facilitates the creation of engaging situated narratives. This has radically transformed the mobile media content, expanding the range of interactive methods of cultural heritage engagement, and opening up the scene for mobile apps to be extensively employed.

In just over ten years from the release of the first smartphone, creators from the heritage sector, the creative industry and the academia have been increasingly using mobile apps to promote an understanding of heritage, as well as encouraging users to value and appreciate heritage. As a result, the literature review has shown that the progressive adoption of mobile apps is a dynamic process characterised by a series of shifts and turns, encouraged not only by the progressive advancements in the technology, but also by broader cultural and economic changes in the way the society sees and relates to the heritage. Overarching economic factors and cultural changes, played a crucial role in outlining the actors involved in shaping the heritage landscape of the 21<sup>st</sup> century. Smartphones entered the heritage scene in a moment when a



general marketing shift towards the experience economy was taking place, which in turn strongly influenced the design of mobile apps as strong and memorable experiences rather than simple digital products. Accordingly, over time, we have assisted at an organic growth of the modalities by which creators developed mobile apps, propelling a series of turns from a more narrative style, to affective, and then ludic. As we have just recently assisted at the immersive turn, within this thesis it has been highlighted how the development of mobile heritage apps stands at the convergence of many forces stretching and reshaping their design accordingly.

Mobile heritage practices have been, and are influenced by the agendas of several stakeholders. Heritage institutions have increasingly adopted mobile apps in the hope of attracting new audiences and increase their revenue, with the aim of nurturing the bond between society and heritage. Creators from the creative media industry, pioneers in the adoption of this technology, have been engaged with these apps pushing the boundaries of innovation, playfully exploiting state-of-art tech affordances in the constant quest towards finding ever more innovative and engaging solutions. Academic researchers from different fields have been approaching the development of mobile apps as testbeds for their research in preservation, management and dissemination of knowledge related to tangible and intangible cultural heritage. This has often been carried out in joint efforts and funding with heritage organisations at local and regional levels and governmental institutions, with the objectives of testing “in the wild” their enquiry lines and potentially translate the results into operational products.

In acknowledging the broad array of mobile practices for the heritage resulting from the heterogeneous development, this thesis addresses a gap attested within the

relevant literature by employing a scholar-practitioner perspective in order to expand the current methodology for classifying mobile media content. In further adding to the existing literature on digital heritage, chapter 2 charts the current design conventions of the mobile media content, and proposes their review by adding a novel category, termed “narrative strategies”. Through the active research employed in the production of this thesis, and the testing of several apps with which I personally engaged as participant and design curator during my research-in-residency, this thesis identified and demonstrated the four key narrative strategies which are currently deployed for the design of mobile storytelling to encourage active engagement via immersion and empathy with the situated narrative. Self-contained vignette stories are a well-known narrative strategy for location-based storytelling, which allows for non-linear user journey, and as it has been shown, is a growing research trend as narrative strategy for interactive storytelling. The “interpretation from below”, also referred to as “bottom up approach”, has been extensively used in on-site re-enactment and game-based storytelling, but it is increasingly used for location-based narratives too, since it has been proved to foster audience engagement and connection with the story stirring empathy with the character(s). Similarly, “magic moments” are a highly exploited strategy in situated narrative, because it leverages the alignment of the storytelling with the physical space, strongly enhancing the connection between the narration and the site. Lastly, “haptics” are an alternative phone-based narrative way which takes advantage of the hardware of the smartphone, namely the sensors, and are for now mainly used for more experimental forms of immersive and theatrical mobile apps for their ability of provide a deeper sense of immersion with the storytelling.

In seeking to advance the field of heritage study, the investigative chapters have demonstrated that the use of these narrative strategies is vastly attested amongst

commercial apps, in particular nowadays with the recent “immersive turn” of mobile storytelling. These strategies increase the potential for exploring the various heritage phenomena by allowing more personalisation and personal involvement of the visitors with the situated narrative and, to a greater extent, to the museums and heritage environments. Furthermore, this new category of interests fits well with the assessment of practices in the cultural heritage sector that argues that more immersive and innovative ways to exploit the device are central to creating experiences that not only helps the visitors engage with the site, encouraging more immersion and empathy with the storytelling, but they also allow the site to find an alternative way to narrate often neglected stories. As we have seen in the case study of the *Family Learning Trail*, the haptic affordance of the smartphone to “animate” the device has been a great opportunity to convey to the visitors the principle mechanics of the historical tools that have been used to for the maintenance of the engines of the Tower Bridge. The original objects, displayed along the wall of the museum, are part of the site collection, however little attention has been given to them. The games of the app instead, finally grant the attention that they deserve, not only as pieces of the collection, but as objects that played a crucial job in keeping the Tower Bridge and its heritage alive for the past century.

Over the course of my embedded research, major UK heritage institutions started a massive revision of their current interpretation by funding projects that address issues of under and misrepresentation of audiences often neglected by the ADH. Historic England has recently funded 57 projects with their ‘Everyday Heritage Grants: Celebrating Working Class Histories’, while National Heritage Lottery Fund has been focusing on ensuring a wider range of people are involved in heritage by curating

projects which engage diverse ethnic communities.<sup>1</sup> English Heritage instead, in collaboration with a team of researchers, are re-writing the online interpretation of some of the country houses entrusted to their care and Britain's involvement in the transatlantic slave trade, and the associated links to the history of colonialism throughout the Caribbean region, continental Africa, and the wider British Empire.<sup>2</sup> Working alongside with museums sustain them in these initiatives, universities have been increasingly addressing issues of language/terminology used in both the classification process and the interpretative dissemination. Recently founded centres such as the Horniman's Rethinking Relationships helps researchers and communities in finding documentation and communication models that are 'non-hierarchical, non-Anglicised, less control-heavy, and more collaborative'.<sup>3</sup>

Reconciling the needs and expectations of audiences alongside the professional concerns of curators and business priorities of site managers is a delicate matter which calls for careful evaluation about how heritage can be 'both *in place*, in a physical and historical sense, and also *out of place* in terms of contemporary culture.'<sup>4</sup> This is particularly timely given the rise of placemaking activities in urban spaces which can led to a 'a new and potentially divisive form of heritage-led regeneration.'<sup>5</sup> Critical

---

<sup>1</sup> "Funding projects untold stories of working class heritage," Historic England, accessed November 29, 2023, <https://historicengland.org.uk/whats-new/news/funding-projects-untold-stories-working-class-heritage/>. "Investing in heritage of diverse ethnic communities," Heritage Fund, accessed November 29, 2023, <https://www.heritagefund.org.uk/our-work/investing-heritage-diverse-ethnic-communities>.

<sup>2</sup> Shakespeare, Malik and Edem-Jordjie, *Whose Heritage? Deconstructing and reconstructing counter-narratives. in heritage*. Further information on the project, "Slavery connections to English Heritage sites", English Heritage, accessed November 29, 2023, <https://www.english-heritage.org.uk/learn/research/slavery/>.

<sup>3</sup> Horniman, *Rethinking Relationships and Building Trust Around African Collections*, 2020, [www.horniman.ac.uk/project/rethinking-relationships/](http://www.horniman.ac.uk/project/rethinking-relationships/).

<sup>4</sup> Abigail Wincott, Neil Ravenscroft, and Paul Gilchrist, "Roses and castles: competing visions of canal heritage and the making of place," *International Journal of Heritage Studies*, 26 no. 8 (2020): 737.

<sup>5</sup> *Ibid.*, 737.

reflection is often lacking about how any heritage project is at the same time a social, cultural, as well as an economic phenomenon. This is to avoid that the novel interpretation of an historic building is no longer solely related to creating acceptable narratives of their former uses, but it extends to re-imagining - and repositioning, the very communities which these historic buildings formerly served.<sup>6</sup> Countered narratives are an increasingly used mean to confront and bring in place the uncomfortable heritage represented by local people and artefacts often out of place in new city images. The case studies discussed within the thesis explore various forms of tangible and intangible heritage which are presented to the public using alternative narratives. In doing so, they offer a way forward in these debates by exploring how themes often neglected by authorised heritage discourse, such as environmental changes and working class heritage, have been considered and enhanced by mobile practices, and how mobile practices constitute a knowledge-making mean of constructing an alternative to a structurally unequal present.

The efforts to reiterate the relevance of heritage in our era of fast broader cultural and society changes served to underline the way in which mobile practice within museums and heritage contexts can be seen as a mixed ecology, which has benefitted from a diverse array of players and investment, governmental and local, to varying level of institutional support. The newly assigned role of heritage as active contributor to the (local) economy, paired with the concurring shift towards an experience economy, saw the heritage sector seeking to proactively address these requests. In practical terms, for the heritage site this meant creating new interpretation in the effort of being more attracting, so to generate (more) revenue, both direct, in terms of more visitors, and

---

<sup>6</sup> John Pendlebury, Yi-Wen Wang, and Andrew Law, "Re-using 'uncomfortable heritage': the case of the 1933 building, Shanghai," *International Journal of Heritage Studies* 24,3 (2017), 2.

indirect, by facilitating the local economy via engagement with creative industry and academic institutions. Mobile apps are then the perfect match for this strategy, a novel and attracting way to engage with new audiences. Accordingly a wealth of mobile apps was developed, thanks to collaborations with creative media practitioners and supported by investment also through government institutions such as UKRI, the Arts Council and National Heritage Lottery Fund. At the heart of these projects is the academic research of new forms of mobile practices that leverage the technology to build a common core understanding between the heritage practitioners and creators of mobile experiences of how the technology can serve to support the heritage sector in remaining an important value for the society. It is within these premises that the first experience design frameworks have been developed.

Experience design frameworks have been extensively investigated and the results of this research has often resulted in several proposed approaches being developed and tested in research-lab contexts. Little scholarly attention has been paid to how frameworks born for commercial purposes have been performing “in the wild” of heritage sites. Commercial practices are the staple for the sector, since museums and heritage sites regularly produce and commercialise mobile apps which have been developed by the creative media industry using commercial frameworks. The further discussion, presented on the analysis of the case study of the Tower Bridge *Family Learning Trail*, aims at filling this gap. By investigating in chapter 3, the development of a mobile app for a heritage site, this thesis has been exploring the methodological approach used by a the creative agency Calvium to design mobile apps. The co-creation journey, a commercial working framework conceptualised by Calvium based on the Double Diamond model and grounded in design thinking, is a development model that the agency has been using to deliver all its projects. Knowing deeply the

case study, and the framework, since my embedded research has contributed to the development, the analysis of the design and development of the app has been structured using an ethnomethodological approach.

Investigating step-by-step the impact of the different stages of the production on the final product, has allowed this research to get a deep understanding at a granular level of the creative industry standards, in order to highlight the strength of this approach, while surfacing the constraints. The broader research questions that the critical review of the case study aimed at addressing is whether such an approach allows for organic growth of the mobile experience, one that accounts for both the audience's engagement and the site's value proposition, encouraging more resilient forms of mobile practice. In particular, the case study has been investigated in order to understand if and how the design felt constrained by the tech or by characteristics of the site, how this approach has been used to solve or mitigate these issues, and how the design of the experiences using the framework has been employing the design and narrative conventions identified in the classification proposed in chapter 2. On a methodological level, this research has shown the critical role of the iterative cycle design-test-refine as structured in the agile development. The process aims at developing a minable viable product of the app which can be tested to identify flaws and correct them before the final development. These prototypes provide the developers, but also the site with the opportunity to grasp, at an early stage of the development, an initial understanding of the performance of the design of app, in terms of usability of the device and user experience. During this test is possible to give a first evaluation of how the user journey unfolds, what type of behaviours are encouraged, and if any technical or organisational challenge went unnoticed during the design phase.

Whereas mid-development testing is often an overlooked aspect, in particular by projects born in research-lab contexts as we have seen with the VISTA AR model, the series of tests of the prototype, with the staff and with a sample of the audience, helps to identify some navigational and behavioural issues in the user experience of the *Family Learning Trail*. For instance, in the design phase of the games, it was initially planned for a series of activities at the bridge walks and a set of games to be played at the engine room. However, the first user testing highlighted how these activities were perceived by the visitors as somehow disconnected. Therefore, in the second round of development an additional game was developed to connect the experience across the two buildings. Similarly, when the test surfaced some constraints in the visitor flow caused by the users' behaviours when played with the app, the games have been simplified to reduce the dwelling time. Fixing these issues was crucial to align the realised experience of the users with the intended experience as planned by Tower Bridge, that is to encourage visits at both the bridge and the engine room, whilst keeping minimal the interference of the app to non-users visitors. As it has been discussed, the alignment of the two is key for a successful user experience, avoiding issues of obsolescence of the mobile experience. Ultimately, as the number of downloads proves, the *Family Learning Trail* strongly benefitted from the co-creation journey as methodological approach rooted in design thinking principles, which allowed to promptly identify constraints and quickly address them. This has facilitate the process of designing an intuitive and engaging app, while keeping the development agile.

Further looking into the media content of the app, the analysis also surfaced some theoretical implications, showing that the storytelling design of the *Family Learning Trail* uses several of the standard design and narrative conventions identified in the



qualitative classification that this research has elaborated, including some of the narrative strategies identified in the expanded taxonomy. This not only supports this research's ambition to provide a timely classification of the narrative strategies, but also it allows this thesis to contribute to current literature on best practices for heritage apps design. Furthermore, the narrative approach using situated and interactive games offers a novel way of using the tech affordances of the app technology to encourage learning. Whereas further research would be needed to evaluate the actual learning outcomes, this research expands the current literature on mobile-based game for the cultural heritage sector by offering a new case study. In terms of strategies towards more resilient forms of design, this research contends that the main value of the co-creation journey in this direction lies in the early onboarding of the site's staff in the development of the experience. Calvium has outlined since the very beginning of the project the respective responsibility of the agency and the site, and by doing so has encouraged ownership of the site. By involving the staff on site in the creation of the mobile apps, it is possible to start a process of familiarisation with the mobile practice, which in turn can help mitigate potential issues of professional credibility and identity that might raise with the introduction of new mobile-based interpretation. The case study has also highlighted how keeping an open line of communication between the two counterparts, the heritage site and the creative agency, has established the premises for more sustainable practices that account for logistical challenges.

This approach has limitations too. The app has been designed as stand-alone visitor offer, and it is not connected to the existing on-site interpretation. The app previously developed for the Glass Floor has only been embedded as a link to external providers. The impossibility of integrating the app is due to issues of interoperability between mobile assets, and this further reinforces the claim of this thesis about the need of

thinking at the (technical) development of these apps in a more sustainable way. In doing so, it would be possible to not fall into the dreaded technology trap of creating a mobile app for the sake of including in the visitor offer a novel and audience appealing experience. Furthermore, it cannot be neglected that the 'co-creation journey' as design framework has overall proven successful. The app offers an engaging user-friendly experience, and the number of downloads confirms it. However, the process of development has been greatly facilitated by the fact that the site had carried out an extensive audience profiling which allowed the site to articulate accordingly the value proposition. With regard to this, it is important to strike a note of caution. The co-creation journey is fundamentally a technology-driven approach, where the ultimate aim is delivery to the end-user a highly functional app, in line with the commercial nature of the agency. Whereas Calvium advocates for the importance of the 'Discovery' phase, and indeed this the first step of the framework, this cannot be understood as a moment in which the site will have time to outline in detail their value proposition. The purpose of this phase is for Calvium to evaluate which of "your stories" better leverage the medium. While this may sound banal, given the client-seller dynamics involved here, it is in this step often overlooked by heritage institution that is likely to find the reason why, as we have previously discussed, the average threshold for download of apps is set at fewer than 1,000 times.

We have seen in this thesis that it is generally agreed that a well outlined value proposition is generally considered one of the key factors in order to avoid the technology trap of having a mobile app for the sake of offering at your visitors a product that is perceived cool. The value proposition allows you to focus on choosing the best suited medium for the stories you want to tell, and for your organisation format. Ultimately, we can develop an app following best practices in experience design, but

it is only when it has been introduced within a site, and evaluate its resilience when the novelty has passed, that it is possible to measure its successful development. Outlining the value proposition is one of the key steps to overcome issues of upkeep that can be an unresolved tension in the months and years following the launch of the app. The case studies of the VISTA AR project discussed in chapter 4 investigate how the underpinning scholarly research leverages on this growing awareness towards the a more holistic introduction of mobile apps at heritage sites. Framed in terms of business model for digital innovation, the design framework of VISTA AR has been used to develop several immersive experiences for heritage sites in the UK and in France. The mission of the academic investigation is to provide each heritage site with a new business model that would allow them to increase the number of visitors and, in turn, their tourism revenue. The business model wheel resulting from this conceptualisation has been used to inform the design of several immersive experience, three of which I have been personally curating, and thus became part of my embedded research.

Being one of the aims of my embedded research to understand the extent by which technical and logistic challenges impact the onboarding and the upkeeping of mobile heritage apps, the business model, which has at its core the understanding of the audience to formulate a solid valid proposition, has represented a good opportunity to advance my research. The insights of the research gained there have strongly informed the structuring of chapter 3, in which I recounted from an auto-ethnographic perspective, the whole journey of design, development and delivery of the mobile apps.

The aim of the chapter was to understand if a design framework grounded in business methodologies of service design, could foster a more sustainable experience design, and hopefully more resilient apps. It has been seen that the emphasis on the ‘analysis’ phase, where the site is supposed to carry out a thorough investigation of its audience and formulate accordingly a value proposition, facilitates the process of selecting what type of storytelling and tech features the app should have presented. The possibility for the site to be fully in charge of the design of the app contents really empowered them, making them more proactive in the process of onboarding with the introduction of new immersive experiences. However, the fact that the BMI is still in its embryonic stage of translating from academic research into an operational approach clearly transpired in the operational aspect of developing the app. One of the biggest constraints my embedded research encountered while developing the experience, was the actual technology. Whereas at Calvium, the “behind the scene” of the app development kept the pace of the experience design, at VISTA AR project several technical issues arose. This was mostly caused by the fact that the software we had developed was not robust enough, and by virtue of the research-lab nature of the project, much of the developing work has been assigned to students as part of their final year projects. Furthermore, few issues of onboarding arose, mainly in terms of the sites not finding the right amount of time to dedicate to the project. This issue could have been easily solved by outlining since the very beginning of the project the inputs needed from the site, much alike what the co-creation journey does. Whereas the BMI does hold the potential of becoming an alternative experience-centric framework, there is still more research to do before we could say that we have found a sustainable way of developing a mobile heritage practice that mitigates the imperatives of logistic and operational constraints without sacrificing the creative aspect of these experiences.

The same concern about sustainability of heritage practices has surfaced in the last chapter with the case study of the *Hidden Florence* app and its analytics. The initial enquire line for this embedded research was to investigate if and how the analytics could inform a better understanding of the type of user engagement, and this embedded research has surfaced an interesting aspect of the app, its armchair modality of engagement, which actually is the primary way in which users engage with the app. Despite the fact that this might be considered to some extent a pitfall in the performance of a location-based app, this research has highlighted the multiplicity of the forms in which mobile app can engage users with heritage practices, in perfect accordance with the novel ways of bonding with the heritage that the smartphone has unleashed. Concern has been also voiced about highly digitised practices where human agency is reduced to database traffic, where we become less-able to decide on when and how to engage with the physical and social environment around us, where individual identity and social life become moulded into the standards and categories of embedded technical systems.<sup>7</sup> In this frame, there is a constraint on the expression of human complexity that may limit the possible futures we are capable of expressing, driving down ‘a route towards less dialogue, less innovation, less commercial opportunities, less adaptability and less sustainability’<sup>8</sup>. The case study of *Hidden Florence* shows instead how successful the dialogue between the public and the private sector can be when framed within a solid process of co-production, which resulted in a practice flexible and resilient, as well as further commercial opportunities with the Hidden Florence 3D.

---

<sup>7</sup> Mihai Nadin, “Antecipare ergo sum: what price knowledge?,” *AI & Society* 28, no. 1 (2013). <http://doi.org/10.1007/s00146-012-0400-8>.

<sup>8</sup> Senior, Moreton and Dovey, *Working Paper*, 16.

The analytics have also been investigated from a more operational perspective, trying to understand if the alternative tours could inform a new type of visitors' behaviour, encouraging the engagement with less popular and touristic areas of the city of Florence. Apps have indeed a potential as touristic strategy, and this research recognises for mobile heritage practices some future research perspectives in this direction. However the app does not provide a solution to the issue of overtourism. This is because *Hidden Florence* has never had such ambition, but rather the app has been designed with research objectives. Data about the successful user engagement with scholarly contents reinforce the importance of the value proposition to deliver experience that engage and aligns with the site's needs.

In drawing this conclusion to an end, I shall contribute here to a final thought about the embedded research that underpins this thesis, and some future views for future research. All the learning acquired as embedded researcher transpires throughout the thesis. The discussion of the case studies presented in this work would have not been possible without the design knowledge gained during the placement at Calvium, the understanding of evaluation approaches during the work at the IIB Centre investigating the *Hidden Florence* app analytics, and the my role as curator of user experience design at the VISTA AR project. While these opportunities have presented progressively over the past eight years, the journey of my embedded research has been instead full of twists and turns. There had been times when it felt that my personal learning was not necessarily coinciding with new academic knowledge, and moments in which I realised that no academic knowledge could tell me how to be a good practitioner. I had sometimes struggled to make peace with the fact that ultimately, the rhythms of the research and those of the design practice are diverse, and often they do not align. Nevertheless, it is precisely in accepting this that I started to appreciate

the opportunity of experiencing a broad range of heritage practices, that have been a catalyst for a new professional and scholarly understanding of the need for a stronger conceptualisation of the heritage practices.

Over the course of this thesis, we have learnt to appreciate that the evolution of mobile practice for heritage has not only been influenced and facilitated by the advancements in the technology, but it has also been strongly shaped by the cultural changes in the society which have led to (re)thinking at the value and mission of heritage in the digital world. One of the key issues faced by museums, heritage institutions and those academics concerned with critical heritage debates is that there is often a misunderstanding or lack of knowledge about alternative forms of heritage that may sit outside of or are excluded and obscured by the authorised heritage discourse. As discussed in chapter 2, this animates what is chosen as “heritage” in the West, deifies the great and the good, the beautiful and the old, the comfortable and the consensual. It also ignores or distains people, places, artefacts and traditions that are not associated with the economic and cultural elite, or recall uncomfortable or dissonant heritage. In other words, conducted within the confines of the authorised heritage discourse, official forms of heritage tend to reproduce established social hierarchies.

As a reaction to it, critical heritage studies have prompted a radical awareness by the marginalised of the symbolic power involved in the activity of representation; a growing sense of the centrality of culture and its relation to identity; the rise amongst the excluded of a ‘politics of recognition’ alongside the older politics of equality; a growing reflexivity about the constructed and thus contestable nature of the authority which some people acquire to ‘write the culture’ of others; a decline in the acceptance of the traditional authorities in authenticating the interpretative and analytic frameworks

which classify, place, compare and evaluate culture; and the concomitant rise in the demand to re- appropriate control over the 'writing of one's own story' as part of a wider process of cultural liberation.<sup>9</sup> In practice, as the case studies presented in this thesis demonstrate, this has often coincided with the rise of alternative expressions of heritage and identity di sub national interests.

Mobile heritage practices are therefore reflections of the society that produces them, and as such they are a creative process, which blend technological opportunities and established disciplinary traditions. Mobile heritage practices can represent a powerful resource for 'creating a future' and their development can lead us to the recognition of how a fundamental reconceptualization of the concept of heritage as uniquely placed not only to address claims about identity, ancestry and cultural transmission but to engage with key moral-ethical issues to our times.<sup>10</sup> The heterogeneity of these mobile practices is one of their strengths. What we, as scholars and creators of these apps should do is to concentrate efforts towards a new conceptualisation of heritage, recognising that its transformations are a result of the complex intertwining of role, competences and modes of operation and collaborations of cultural heritage institutions, academic institutions and of the whole ecosystem of stakeholders and infrastructures of cultural heritage. It is only by embracing this view that we can hope to find a more holistic way to truly support the heritage to remain relevant in our society and the ones of the future.

---

<sup>9</sup> Hall, *Whose Heritage*.

<sup>10</sup> Butler, *Heritage and the Present Past*, 463.



## Bibliography.

- Abba, Tom, Jon Dovey and Kate Pullinger. *Ambient Literature: Towards a New Poetic of Situated Writing and Reading Practices*. London: Springer International Publishing, 2020.
- Abbas, Jalil. "Quintessence of Traditional and Agile Requirement Engineering." *Journal of Software Engineering and Applications* 9 (2016): 63-70. <http://dx.doi.org/10.4236/jsea.2016.93005>.
- Abreu, Maria and Vadim Grinevich. "Academic Entrepreneurship in the Creative Arts." *Environment and Planning C: Government and Policy* 32, no. 3 (2014): 451-470. <https://doi.org/10.1068/c11144r>.
- Acumen Academy. "HCD Workshop (2013) - The Design Process." Accessed May 10, 2023. <http://blog.acumenacademy.org/design-process>.
- Agnew, Vanessa. "History's affective turn: Historical reenactment and its work in the present." *Rethinking History* 11, no. 3 (2007): 299–312. <https://doi.org/10.1080/13642520701353108>.
- Albino, Vito, Umberto Berardi and Rosa Maria Dangelico. "Smart Cities: Definitions, Dimensions, Performance and Initiatives." *Journal of Urban Technology* 22, no. 1 (2015): 3–21. <https://doi.org/10.1080/10630732.2014.942092>.
- Alelis, Genevieve, Ania Bobrowicz and Chee Siang Ang. "Exhibiting Emotion: Capturing Visitors' Emotional Responses to Museum Artefacts." In *DUXU/HCI 2013, Part III, LNCS 8014*, edited by Aroon Marcus, 429-438. Berlin-Heidelberg: Springer-Verlag, 2013.
- Amakawa, Jonathan and Jonathan Westin. "New Philadelphia: using augmented reality to interpret slavery and reconstruction era historical sites." *International Journal of Heritage Studies* 24, no. 3 (2017): 315-331. <http://doi.org.10.1080/13527258.2017.1378909>

- Andriotis, Konstantinos. "Genres of Heritage Authenticity: Denotations from a Pilgrimage Landscape." *Annals of Tourism Research* 38, no. 4 (2011): 1613-1633. <https://doi.org/10.1016/j.annals.2011.03.001>.
- Apple apps. "Hidden Florence." Accessed November 29, 2023. <https://apps.apple.com/gb/app/hidden-florence/id896723912>.
- Apple apps. "The Climate Change Trail." Accessed November 29, 2023. <https://apps.apple.com/au/app/the-climate-change-trail/id1582174503>.
- Ardissono, Liliana, Tsvi Kuflik and Daniela Petrelli. "Personalization in cultural heritage: the road travelled and the one ahead." *User Model User-Adap Inter* 22 (2012): 73-99. <https://doi.org/10.1007/s11257-011-9104>.
- Askew, Marc. *The magic list of global status: UNESCO, World Heritage and the agendas of states*. 1<sup>st</sup> ed. London: Routledge, 2010.
- Barber, John F. "Digital storytelling: New opportunities for humanities scholarship and pedagogy." *Cogent Arts & Humanities* 3, no. 1 (2016): Article: 1181037. <https://doi.org/10.1080/23311983.2016.1181037>.
- Barrett, William David Paul. "The Phenomenalisation of Heritage: Digital interactions through mobile devices with tangible and intangible heritage." PhD diss. University of Exeter, 2019. <https://ethos.bl.uk/OrderDetails.do?uin=uk.bl.ethos.775730>.
- Basaraba, Nicole. "The emergence of creative and digital place-making: A scoping review across disciplines." *New media & society* 25, no. 6 (2021): 1470-1497. <https://doi.org/10.1177/14614448211044942>.
- Basaraba, Nicole and Thomas Cauvin. "Public history and transmedia storytelling for conflicting narratives." *Rethinking History* 27, no. 2 (2023): 221-247. <https://doi.org/10.1080/13642529.2023.2184969>.
- Basaraba, Nicole, Owen Conlan, Jennifer Edmond and Peter Arnds. "Digital narrative conventions in heritage trail mobile apps." *New Review of Hypermedia and*

*Multimedia* 25, no. 1-2, (2019): 1-30.  
<http://dx.doi.org/10.1080/13614568.2019.1642963>.

Basaraba, Nicole, Owen Conlan, Jennifer Edmond and Peter Arnds. "A Data-Driven Approach to Public-Focused Digital Narratives for Cultural Heritage." In *The Palgrave Handbook of Digital and Public Humanities*, edited by Schwan Ann and Thomson Tara, 337-356. London: Palgrave MacMillan, 2022.  
[https://doi.org/10.1007/978-3-031-11886-9\\_18](https://doi.org/10.1007/978-3-031-11886-9_18).

Beavers, Sian and Sylvia Warnecke. "Audience perceptions of historical authenticity in visual media." in *The Middle Ages in Modern Culture: History and Authenticity in Contemporary Medievalism*, edited by Karl Alvestad and Robert Houghton, 74–89. London: Bloomsbury Academic, 2021.  
<http://dx.doi.org/doi:10.5040/9781350167452.0013>.

Bedford, Leslie. "Storytelling: the real work of museums." *Curator* 44 , no. 1 (2001): 27-34. <https://doi.org/10.1111/j.2151-6952.2001.tb00027.x>.

Benford, Steve and Gabriella Giannachi. *Performing mixed reality*. Cambridge, Massachusetts: MIT Press, 2011.

Benyon, David. "Presence in blended spaces." *Interacting with Computers* 24, no. 4 (2012): 219-226. <https://doi.org/10.1016/j.intcom.2012.04.005>.

Benyon, David. *Designing Interactive Systems: A comprehensive guide to HCI, UX and interaction design*. 3rd ed. London: Pearson, 2013.

Bergevin, Jennifer L. "Narratives of Transformation: Reframing and naming the impact of activist museum practice on visitors." PhD Diss. Leicester: School of Museum Studies, 2019. <https://hdl.handle.net/2381/43381>.

Bernschütz, Benjamin. "Microphone Arrays and Sound Field Decomposition for Dynamic Binaural Recording". PhD diss., Technical University of Berlin, 2016.

Berry, David, "The computational turn: thinking about the digital humanities." *Culture Machine* 12 (2011): 1-21. <https://hdl.handle.net/10779/uos.23407976.v1>.

- Bertacchini, Enrico, and Federico Morando. "The future of museums in the digital age: new models of access and use of digital collections." *International Journal of Arts Management* 15, no. 2 (2013) : 60-72. [https://iris.unito.it/retrieve/handle/2318/105581/58394/bertacchini\\_morando\\_ijam\\_paper-revised-final\\_reading.pdf](https://iris.unito.it/retrieve/handle/2318/105581/58394/bertacchini_morando_ijam_paper-revised-final_reading.pdf)
- Bertacchini, Enrico, Claudia Liuzza, Lynn Meskell and Donatella Saccone. "The politicization of UNESCO World Heritage decision making." *Public Choice* 167, no. 1 (2016): 1-29.
- Betsworth, Liam, Huw Bowen, Simon Robinson and Matt Jones. "Performative technologies for heritage site regeneration." *Pers Ubiquit Comput*, 18 (2014): 1631-1650. <https://doi.org/10.1007/s00779-014-0766-3>.
- Bini, Marco, Carolina Capitanio and Carlo Francini. *Buffer Zone – l'area di rispetto per il sito UNESCO Centro Storico di Firenze. The safeguarding area for the Historic Center of Florence, UNESCO site, Firenze*. Florence: DIDA - Dipartimento di Architettura - Università degli studi di Firenze, 2015. [https://issuu.com/dida-unifi/docs/buffer\\_zone\\_](https://issuu.com/dida-unifi/docs/buffer_zone_)
- Birindelli, Pierluca. "Cultural Experiences in Florence and Italy: The Grand Tour Narrative in the 21st Century." *Società Mutamento Politica* 10, no. 20 (2019): 191-205. <http://do.org/10.13128/smp-11057>.
- Bitgood, Stephen. *Attention and Value. Keys to Understanding Museum Visitors*. Walnut Creek, CA, Left Coast Press, 2013.
- Bitgood, Stephen and Harris H. Shettel. "An Overview of Visitor Studies." *The Journal of Museum Education* 21, no. 3 (1996): 6–10. <https://doi.org/10.1080/10598650.1996.11510329>.
- Blessner, Barry and Linda-Ruth Slater. *Space Speak, Are you Listening? Experiencing Aural Architecture*. Cambridge, Massachusetts: The MIT Press, 2007.
- Boiano, Stefania, Jonathan Bowen and Giuliano Gaia. "Usability, Design and Content Issues of Mobile Apps for Cultural Heritage Promotion: The Malta Culture Guide Experience." In *EVA London 2012 Conference Proceedings, Electronic*

- Workshops in Computing* (eWiC), edited by Stuart Dunn, Jonathan P. Bowen and Kia Ng, 66-73. London: British Computer Society, 2012. <https://doi.org/10.48550/arXiv.1207.3422>.
- Borowiecki, Karol Jan, Neil Forbes and Antonella Fresa. *Cultural Heritage in a Changing World*. Bern, Switzerland: Springer Open, 2016. DOI 10.1007/978-3-319-29544-2.
- Borsellino, Rosabella, Renee Zahnow and Jonathan Corcoran. "Not All Those Who Wander Are Lost: Exploring Human Mobility Using a Smartphone Application." *Australian Geographer* 49, no. 2 (2018): 317–333. <https://doi.org/10.1080/00049182.2018.1451215>.
- Bozzelli, Guido, Antonio Raia, Stefano Ricciardi, Maurizio De Nino, Nicola Barile, Marco Perrella, Marco Tramontano, Alfonsina Pagano, Augusto Palombini. "An integrated VR/AR framework for user-centric interactive experience of cultural heritage: The ArkaeVision project." *Digital Applications in Archaeology and Cultural Heritage* 15, article e00124 (2019). <https://doi.org/10.1016/j.daach.2019.e00124>.
- Bristol+Bath Creative R+D. "What is digital placemaking?." Accessed November 29, 2023, <https://bristolbathcreative.org/article/about-digital-placemaking>.
- Brown, Emily, and Paul Cairns. "A grounded investigation of game immersion." In *Proceeding CHI '04 Extended Abstracts on Human Factors in Computing Systems*, 1297-1300. New York: Association for Computing Machinery, 2004. <https://doi.org/10.1145/985921.986048>
- Brown, Tim. *Change by Design: how design thinking transforms organizations and inspires innovation*. New York: Harper Collins, 2009.
- Bruner, Jerome. "The Narrative Construction of Reality." *Critical Inquiry* 18, 1 (1991): 1–21. <http://www.jstor.org/stable/1343711>.
- Buckley, Julia. "Venice and Florence demand a curb on Airbnb." *CNN Travel*, March 25, 2021. <https://www.cnn.com/travel/article/venice-florence-airbnb-restrictions>.

- Buhalis, Dimitrios and Rosanna Leung. "Smart Hospitality - Interconnectivity and Interoperability towards an Ecosystem." *International Journal of Hospitality Management* 71 (2018): 41-50. <https://doi.org/10.1016/j.ijhm.2017.11.011>.
- Buhalis, Dimitrios, Barbara Neuhofer and Adele Ladkin. "A Typology of Technology-Enhanced Tourism Experiences." *International Journal of Tourism Research*, 16, no. 4 (2014): 340-350. <https://doi.org/10.1002/jtr.1958>.
- Buonsignori, Piera and Alessandra Marasco. "Enhancing Cultural Heritage Experiences with Smart Technologies: An integrated Experiential Framework." *European Journal of Tourism Research* 17 (2017): 83–101. <https://doi.org/10.54055/ejtr.v17i.295>.
- Bustard, John, Peter Bolan, Adrian Devine and Karise Hutchison. "The Emerging Smart Event Experience: An Interpretative Phenomenological Analysis." *Tourism Review* 74, no. 1 (2018): 116–128. <https://doi.org/10.1108/TR-10-2017-0156>.
- Butler, Beverley. "Heritage and the Present Past." In *The Handbook of Material Culture*, edited by Christopher C. Tilley, Keane Webb, Susanne Küchler, Michael Rowlands and Patricia Spyer. 463-479. London: Sage Publications, 2006.
- Calvium. "How AR, apps and digital placemaking are driving innovation for heritage sites." Accessed August 25, 2023. <https://calvium.com/sitemap/>.
- Calvium Ltd. "People Power: enable transformation with mobile innovation. WEAFF presentation." July 9, 2020. Video, 41:16. <https://vimeo.com/436770250>.
- Camarero, Carmen and Jose Ma Garrido. "Fostering innovation in cultural contexts: market orientation, service orientation, and innovations in museums." *Journal of Service Research* 15, no. 1 (2011): 2-12. <https://doi.org/10.1177/1094670511419648>.
- Cameron, Fiona. *The Future of Digital Data, Heritage and Curation in a More-than-Human World*, London: Routledge, 2011.

- Campbell, Sue. "Our Faithfulness to the Past: Reconstructing Memory Value." *Philosophical Psychology* 19, no. 3 (2006): pp. 361-380. <https://doi.org/10.1080/09515080600690573>.
- Carbone, Fabio, Luiz Oosterbeek, Carlos Costa and Ana Maria Ferreira. "Extending and adapting the concept of quality management for museums and cultural heritage attractions: A comparative study of southern European cultural heritage managers' perceptions." *Tourism Management Perspectives* 35 (July 2020): 1-9. <https://doi.org/10.1016/j.tmp.2020.100698>.
- Cardiff, Janet and George Bures Miller. "Janet Cardiff and George Bures Miller - Werke aus der Sammlung Goetz." Accessed: 29 November 2023. <https://www.hausderkunst.de/en/eintauchen/janet-cardiff-george-bures-miller-werke-aus-der-sammlung-goetz> ()
- Cavalheiro, Mariana, Luiz Joia and Gabriel do Canto Cavalheiro. "Towards a Smart Tourism Destination Development Model: Promoting Environmental, Economic, Socio-cultural and Political Values." *Tourism Planning & Development* 17, no. 3 (2020): 237–259. <https://doi.org/10.1080/21568316.2019.1597763>.
- Cavazza Marc, and Michael R. Young. "Introduction to Interactive Storytelling." In *Handbook of Digital Games and Entertainment Technologies*, edited by Ryohe Nakatsu, Matthias Rauterberg and Paolo Ciancarini, 1-16. Singapore: Springer, 2017. [http://doi.org/10.1007/978-981-4560-52-8\\_55-1](http://doi.org/10.1007/978-981-4560-52-8_55-1).
- Centre for Empathy and Visual Arts, CEVA White Paper. 2019. Accessed November 29, 2023. <https://images.artsmia.org/wp-content/uploads/2018/09/01101056/CEVA-White-Paper091318.pdf>.
- Chang, Yu-Lien, Huei-Tse Hou, Chao-Yang Pan, Yao-Ting Sung, Kuo-En Chang. "Apply an augmented reality in a mobile guidance to increase sense of place for heritage places." *Journal of Educational Technology & Society* 18, no. (2015):166–178. <https://www.learntechlib.org/p/158888/>.
- Chase, Christopher and Malcom Shaw. *The Imagined Past: History and Nostalgia*. Manchester - New York: Manchester University Press, 1989.

- Chen, Ning Chris, Michael Hall and Girish Prayag. *Sense of place and place attachment in tourism*. London-New York: Routledge, 2021.
- Chen Xiaowei and Ibrahim Zainuddin, "A Comprehensive Study of Emotional Responses in AI-Enhanced Interactive Installation Art." *Sustainability* 15, 22 (2023): Article15830. <https://doi.org/10.3390/su152215830>.
- Cheng, Kun-Hung. "An epistemic curiosity-evoking model for immersive virtual reality narrative reading: User experience and the interaction among epistemic curiosity, transportation, and attitudinal learning." *Computers & Education* 201 (2023): 104814. <https://doi.org/10.1016/j.compedu.2023.104814>.
- Chung, Namho, Hyunae Lee, Jin Young Kim and Chulmo Koo. "The role of augmented reality for experience-influenced environments: The case of cultural heritage tourism in Korea." *Journal of Travel Research* 57, no. 5 (2018): 627–643. <http://doi.org/10.1177/0047287517708255>.
- Cioffi, Luigina. "Embodiment and Place Experience in Heritage Technology Design." In *The International Handbook of Museum Studies: Museum Media*, edited by Michelle Henning, 419–446. Hoboken, NJ: Wiley, 2015. <https://doi.org/10.1002/9781118829059.wbihms319>.
- Cogburn, Courtney D., Jeremy Bailenson, Elise Ogle, Tobin Asher and Teff Nichols. "1000 cut journey." In *ACM SIGGRAPH 2018 Virtual, Augmented, and Mixed Reality (SIGGRAPH '18)*, Article 1, 1. New York, NY, USA: Association for Computing Machinery, 2018. <https://doi.org/10.1145/3226552.3226575>.
- Coombe, Rosemary J. and Melissa F. Baird. "The Limits of Heritage Corporate Interests and Cultural Rights on Resource Frontiers." In *A Companion to Heritage Studies*, edited by William Loga, Máiréad Nic Craith, and Ullrich Kockel. 337-354. London: Wiley-Blackwell, 2015.
- Crossick, Geoffrey. *Knowledge transfer without widgets: the challenge of the creative economy*. Goldsmiths: Royal Society of Arts in Leeds, 2006.
- Cundy, Alys and Yvonne Pörzge. "Emotional strategies in museum exhibitions." *Editorial, Special Issue: Museums & Society* 14, 3 (2016): 359-362.



DaCosta, Boaventura and Carolyn Kinsell. "Serious Games in Cultural Heritage: A Review of Practices and Considerations in the Design of Location-Based Games." *Educ. Sci.* 13, no. 1 (2023): 1-47. <https://doi.org/10.3390/educsci13010047>.

Dansey Neil, "Facilitating apophenia to augment the experience of pervasive games." Paper presented at *Breaking the magic circle seminar University of Tampere*, 2008. [https://researchportal.port.ac.uk/portal/files/94490/Neil\\_Dansey\\_Tampere\\_Paper.pdf](https://researchportal.port.ac.uk/portal/files/94490/Neil_Dansey_Tampere_Paper.pdf).

de Cesari, Chiara and Rozita Dimova. "Heritage, gentrification, participation: remaking urban landscapes in the name of culture and historic preservation." *International Journal of Heritage Studies* 25, no. 9 (2019): 863-869. <https://doi.org/10.1080/13527258.2018.1512515>

DeCorse, Christopher. *Small Worlds: Method, Meaning, and Narrative Craft in Microhistory*. Santa Fe, New Mexico: School for Advanced Research Press, 2008.

de Groot, Jerome. "Affect and empathy: re-enactment and performance as/in history." *Rethinking History* 15, no. 4 (2011): 587-599. <https://doi.org/10.1080/13642529.2011.603926>.

de Paula, Danielly F.O., Bianca H.X.M. Menezes and Cristiano C. Araújo. "Building a Quality Mobile Application: A User-Centered Study Focusing on Design Thinking, User Experience and Usability." In *DUXU Part II*, edited by Aaron Marcus, 313 – 322. New York: Springer, 2014.

de Souza e Silva, Adriana and Daniel M. Sutko. "Theorizing Locative Technologies Through Philosophies of the Virtual." *Communication Theory* 21, no. 1 (2011): 23 - 42. <https://doi.org/10.1111/j.1468-2885.2010.01374.x>

Department of Legislation. General Data Protection Regulation. 2016. Accessed October 23, 2023, [www.legislation.gov.uk/eur/2016/679/contents](http://www.legislation.gov.uk/eur/2016/679/contents).

- Dodds, Rachel and Richard Butler. "The Phenomena of Overtourism: A Review." *International Journal of Tourism Cities* 5, no. 4 (2019): 519–528. <http://doi.org/10.1108/IJTC-06-2019-0090>.
- Domingues, Diana, Cristiano Jacques Miosso, Suélia Siqueira Rodrigues Fleury Rosa and Carla Rocha. "Embodiments, visualizations, and immersion with enactive affective systems." In *Proceedings SPIE 9012, The Engineering Reality of Virtual Reality 2014, 90120J (28 February 2014)*, edited by Margaret Dolinsky and Ian E. McDowall, article 9012. San Francisco, California: SPIE Electronic Imaging, 2014. <http://dx.doi.org/10.1117/12.2042590>.
- Doolittle, Joseph, Aideen Moohan, John Simpson and Ian Soanes. "Building a Mobile Application Development Framework." *IT@Intel Best Practices Cloud Computing and Compute Continuum* (blog). August 13, 2012. <https://www.intel.co.jp/content/dam/www/public/us/en/documents/best-practices/mobile-app-development-framework.pdf>
- Dovey, Jon and Constance Fleuriot. "Dimensions of Mobile Media Design". In *The Mobile Audience*, edited by Martin Rieser, 97-108. London: Rodopi, 2012.
- Dovey, Jon and Constance Fleuriot. *The Pervasive Media Cookbook*. Bristol: University of the West of England (UWE) Bristol, 2012. <https://pervasivemediacookbook.com>
- Dovey, Jon, Simon Moreton and Ian Hargreaves. "REACT Report 2012–2016". Bristol: REACT, UWE Bristol, Pervasive Media Studio, 2016.
- Droitcour, Brian and William Smith. "The Digitized Museum." *Art in America*, accessed November 29, 2023. <https://www.artnews.com/art-in-america/features/the-digitized-museum-63201/>
- Economou, Maria. "Heritage in the Digital Age." In *A Companion to Heritage Studies*, edited by William Logan, Máiréad Nic Craith and Ullrich Kockel, 215-228. Oxford: John Wiley & Sons Inc., 2015. <http://doi.org/10.1002/9781118486634.ch15>

Economou, Maria and Elpiniki Meintani. "Promising beginning? Evaluating museum mobile phone apps." Paper presented at *Rethinking Technology in Museums 2011: Emerging experiences*, University of Limerick Ireland, May 26-27, 2011. <https://core.ac.uk/download/pdf/296171165.pdf>.

Economou, Maria and Lara Pujol-Tost. "Evaluating the use of virtual reality and multimedia applications for presenting the past." In *Handbook of Research on Technologies and Cultural Heritage*, edited by Georgios Styliaras, Dimitrios Koukopoulos and Fotis Lazarinis, 223–239. Hershey, Pennsylvania: IGI Global, 2007. <http://dx.doi.org/10.4018/978-1-60960-044-0.ch011>.

Economou, Maria, Hilary Young and Emilia Sosnowska. "Evaluating emotional engagement in digital stories for interpreting the past. The case of the Hunterian Museum's Antonine Wall EMOTIVE experiences." In *3rd Digital Heritage International Congress, San Francisco, CA, USA, October 26-30, 2018*, 1-8. San Francisco, CA, USA: IEEE. <http://doi.org/10.1109/DigitalHeritage.2018.8810043>.

ECORYS. *Economic Value of Ireland's Historic Environment. Final report to the Heritage Council*. Rotterdam: ECORYS, 2012. Accessed August 27, 2023. [https://www.heritagecouncil.ie/content/files/ecorys\\_economic\\_evaluation\\_historic\\_environment\\_final\\_report\\_1mb.pdf](https://www.heritagecouncil.ie/content/files/ecorys_economic_evaluation_historic_environment_final_report_1mb.pdf)

Ellis, Carolyn. *The ethnographic I: A methodological novel about autoethnography*. California, USA: AltaMira Press, 2004.

Emmanouilidis, Christos, Remous-Aris Koutsiamanis and Aimilia Tasidou. "Mobile guides: Taxonomy of architectures, context awareness, technologies and applications." *Journal of Network and Computer Applications* 36, no. 1 (2013): 103-125. <https://doi.org/10.1016/j.jnca.2012.04.007>.

"EMOTIVE Project". Accessed November 29, 2023. <https://emotiveproject.eu/homepage/.html>.

- English Heritage. "Slavery connections to English Heritage sites." Accessed November 29, 2023, <https://www.english-heritage.org.uk/learn/research/slavery/>.
- Erdal, Ivar John, Kjetil Vaage Øie, Brett Oppegaard and Oscar Westlund. "Invisible Locative Media: Key Considerations at the Nexus of Place and Digital Journalism." *Media and Communication* 7, no. 1 (2019): 166-78. <https://doi.org/10.17645/mac.v7i1.1766>
- European Creative Business Network. "Europe's Creative Hubs – Who they are, what they do." Accessed November 29, 2023, <https://www.ecbnetwork.eu/europes-creative-hubs-mapping/>.
- Evans, Jody and Kerrie Bridson. *Branding the public art museum sector: a new competitive model*. Victoria, Australia: Deakin University Press, 2013. <http://hdl.handle.net/10536/DRO/DU:30064936>.
- Exeter Cathedral. "Exeter Cathedral Virtual Tour." Accessed May 21, 2023. <https://www.exeter-cathedral.org.uk/our-building/virtual-tour/>.
- Falk, John Howard. *Identity and the museum visitor experience*. San Francisco: Left Coast Press, 2009.
- Falk, John Howard. "Understanding museum visitors' motivations and learning." In *AAVV, Museums Social Learning and Knowledge Producing Processes, Copenhagen, Danish Agency For Culture*, 106-127. Copenhagen: Kulturstyrelsen, 2013. [https://slks.dk/fileadmin/user\\_upload/dokumenter/KS/institutioner/museer/Indsatsomraader/Brugerundersogelse/Artikler/John\\_Falk\\_Understanding\\_museum\\_visitors\\_\\_motivations\\_and\\_learning.pdf](https://slks.dk/fileadmin/user_upload/dokumenter/KS/institutioner/museer/Indsatsomraader/Brugerundersogelse/Artikler/John_Falk_Understanding_museum_visitors__motivations_and_learning.pdf).
- Falk, John Howard and Lynn Dierking. "Enhancing visitor interaction and learning with mobile technologies." In *Digital Technologies and the Museum Experience*, edited by Kevin Walker and Tallon Loic, 19-34. Lanham, MD: AltaMira Press, 2008.

- Falk, John Howard and Lynn Dierking. *The museum experience revisited*. Walnut Creek, CA: Left Coast Press, 2013.
- Fanini, Bruno, Enzo d'Annibale, Emanuel Demetrescu, Daniele Ferdani and Alfonsina Pagano. "Engaging and shared gesture-based interaction for museums the case study of K2R international expo in Rome." *Digital Heritage* 1 (September 2015): 263-270. <https://doi.org/10.1109/DigitalHeritage.2015.7413880>.
- Farman, Jason. *Mobile Interface Theory. Embodied Space and Locative Media*. New York and London: Routledge, 2012.
- Farman, Jason. *The mobile story: Narrative practices with locative technologies*. New York and London: Routledge, 2014.
- Farman, Jason. "Storytelling with Mobile Media." In *The Routledge Companion to Mobile Media*, edited by Gerard Goggin, and Larissa Hjorth, 528-537. New York and Oxford: Routledge, 2015.
- Farrelly, Glen. "Claiming Places: An Exploration of People's Use of Locative Media and the Relationship to Sense of Place." PhD diss., University of Toronto, 2017. <http://hdl.handle.net/1807/78991>.
- Fenu, Cristina and Fabio Pittarello. "Svevo tour: The design and the experimentation of an augmented reality application for engaging visitors of a literary museum." *International Journal of Human-Computer Studies*, 114 (2018): 20-35. <http://doi.org/10.1016/j.ijhcs.2018.01.009>.
- Finke, Andrew. "Lake: A Digital Wizard of Oz Prototyping Tool." In *Proceedings of CHI Conference on Human Factors in Computing Systems Extended Abstracts*, 46-53. New York: Association for Computing Machinery, 2019. <https://doi.org/10.1145/3290607.3308455>.
- Firenze Patrimonio Mondiale. *Destinazione Firenze: accoglienza e gestione dei visitatori nel centro storico di Firenze*. 2013. Accessed August 27, 2023. [https://www.firenzepatrimoniomondiale.it/wp-content/uploads/2015/11/2.Report\\_FL\\_Card.pdf](https://www.firenzepatrimoniomondiale.it/wp-content/uploads/2015/11/2.Report_FL_Card.pdf).

Firenze Patrimonio Mondiale. *The management plan of the Historic Centre of Florence. UNESCO World Heritage*. 2016. Accessed August 27, 2023. <http://www.firenzepatrimoniomondiale.it/wpcontent/uploads/2015/12/Pianogestione-en-web.pdf>.

Firenze Patrimonio Mondiale. "HeRe\_Lab – Heritage Research." Accessed November 29, 2023. [https://www.firenzepatrimoniomondiale.it/here\\_lab-heritage-research/](https://www.firenzepatrimoniomondiale.it/here_lab-heritage-research/).

Frey, Bruno and Meier Stefano. "The Economics of Museums." in *Handbook of the Economics of Art and Culture*, edited by Victor A. Ginsburgh and David Throsby, 1017-1047. Amsterdam: Elsevier, 2006.

Frevert, Ute. *Emotions in History -Lost and Found*. Budapest: Central European University Press, 2011.

Furio, David, Maria Carmen Juan, Iris Seguí and Roberto Vivó. "Mobile Learning vs. Traditional Classroom Lessons: A Comparative Study." *Journal of Computer Assisted Learning* 31 (2015): 189- 201. <https://doi.org/10.1111/jcal.12071>.

Gaëtan, Parseihian, Ystad, Sølvi, Aramaki, Mitsuko, and Kronland Martinet, Richard. "The process of sonification design for guidance tasks." *Wi: Journal of Mobile Media* 9, no. 2 (2015): 1-24. <http://wi.mobilities.ca/gaetan-parseihian-the-process-of-sonification-design-for-guidance-tasks>.

Galani, Areti and Jenny Kidd. "Evaluating Digital Cultural Heritage 'In the Wild': The Case For Reflexivity." *Journal of Computing and Cultural Heritage* 12, no. 1, Article 5 (February 2019): 1-15. <https://doi.org/10.1145/3287272>.

Galani, Areti, Aron Mazel, Deborah Maxwell and Kate Sharpe. "Situating Cultural Technologies Outdoors: Empathy in the Design of Mobile Interpretation of Rock Art in Rural Britain." In *Visual Heritage in the Digital Age*, edited by Eugene Ch'ng, Vincent Gaffney, and Henry Chapman, 183–204. London: Springer, 2013.

Gatelier, Elsa, David Ross, Laura Phillips and Jean-Baptiste Suquet. "A business model innovation methodology for implementing digital interpretation

experiences in European cultural heritage attractions.” *Journal of Heritage Tourism* 17, no. 4 (2022): 391-408. <https://doi.org/10.1080/1743873X.2022.2065920>.

Gentry, Kynan and Laurajane Smith. “Critical heritage studies and the legacies of the late-twentieth century heritage canon.” *International Journal of Heritage Studies* 25, no. 11 (2019): 1148-1168.

Germark, Claudio, Maria Luce Lupetti, Luca Guiliano, Ng Kaouk, and E. Miguel. “Robots and Cultural Heritage: New Museum Experiences.” *CITAR Journal* 7, no. 2 (2015): 47–57. <http://doi.org/10.7559/citarj.v7i2.158>.

Gharavi, Tina. “*Narrative Cannibals: Whose Story Is It Anyway? The Politics of Representation and the Veracity of the image in the age of digital Storytelling. The Cinema and Community Animations of Tina Gharavi.*” Phd Diss., Newcastle: Newcastle University, 2013.

Giannachi, Gabriella. “Lost Origin and Beyond. Towards a design framework for mixed reality theatrical experiences.” *Body, Space & Technology* 22, no. 1 (2023): 40–64. <https://doi.org/10.16995/bst.9674>.

Ginsberg & O'Connor. “Staying safe while playing Pokémon Go.” Accessed November 29, 2023, <https://www.ginsberglaw.com/articles/staying-safe-while-playing-pokemon-go/>.

Goggin, Gerard. “Adapting the mobile phone: The iPhone and its consumption.” *Continuum: Journal of Media & Cultural Studies* 23, no. 2 (April 2009): 231-244. <https://doi.org/10.1080/10304310802710546>.

Goggin, Gerard. “Going Mobile.” In *The Handbook of Media Audiences*, edited by Virginia Nightingale, 128-146. Oxford: Blackwell Publishing Ltd., 2011. <https://doi.org/10.1002/9781444340525.ch6>.

Gokcigdem, Elif M.. *Fostering Empathy Through Museums*. London: Rowman & Littlefield, 2016.

- Gong, John and Paul Tarasewich. "Guidelines for handheld mobile device interface design." In *Proceedings of the DSI 2004 Annual Meeting*, 3751-3756. Atlanta, Georgia: DSI Georgia State University, 2004.
- Gordon, Eric and Adriana de Souza e Silva. *Net Locality: Why Location Matters in a Networked World*. Oxford: John Wiley & Sons, 2011. <https://doi.org/10.1080/10304310802710546>.
- Gottlieb, Halina. "Interactive Adventures." in *Digital Technologies and the Museum Experience: Handheld Guides and Other Media*, edited by Loic Tallon and Kevin Walker, 167–178. Lanham: AltaMira Press, 2008.
- Graf, Holger, Jens Keil, Alfonsina Pagano and Sofia Pescarin. "A contextualized educational museum experience connecting objects, places and themes through mobile virtual museums." *Digital Heritage* 1 (September 2015): 337-340. <https://doi.org/10.1109/DigitalHeritage.2015.7413896>.
- Graziano, Teresa and Donatella Privitera. "Cultural heritage, tourist attractiveness and augmented reality: insights from Italy." *Journal of Heritage Tourism* 15, no. 6 (2020): 666-679. <http://doi: 10.1080/1743873X.2020.1719116>.
- Green, Joseph. "How Will iOS 14 Affect the Location Data Industry?." *xmode* (blog). <https://xmode.io/how-will-ios-14-affect-the-location-data-industry-2/>.
- Green, Lindsey, Alison Webb and Martha Henson. "Mobile culture: innovating the audience experience, not the technology." *Guardian*, June 7, 2013. <https://www.theguardian.com/culture-professionals-network/culture-professionals-blog/2013/jun/07/mobile-museums-audience-experience-technology>
- Green, Lindsey. "What we know about mobile experiences in Museums after 6 years of research." Accessed August 27, 2023. <https://medium.com/frankly-green-webb/what-we-know-about-mobile-experiences-in-museums-after-6-years-of-research-42117def2c49>
- Greffe, Xavier. "Concept study on the role of Cultural Heritage as the fourth pillar of Sustainable Development." *Venice Sustcult Project* (2012): 1–73.



<http://docplayer.net/24195641-Concept-study-on-the-role-of-cultural-heritage-as-the-fourth-pillar-of-sustainable-development.html>.

Greimas, AJ and Catherine Porter. "Elements of a Narrative Grammar." *Diacritics* 7, no. 1 (1977): 23-40. <https://doi.org/10.2307/464872>.

Gretzel, Ulrike. "Intelligent systems in tourism: A Social Science Perspective." *Annals of Tourism Research* 38, no. 3 (2011): 757-779, <https://doi.org/10.1016/j.annals.2011.04.014>.

Gretzel, Ulrike, Lina Zhong and Chulmo Koo. "Application of Smart Tourism to Cities." *International Journal of Tourism Cities* 2, no. 2 (2016): 1-5. <https://doi.org/10.1108/IJTC-04-2016-0007>.

Indans, Reinis, Eva Hauthal and Dirk Burghardt. "Towards an Audio-Locative Mobile Application for Immersive Storytelling." *Journal of Cartography and Geographic Information* 69 (2019): 41–50. <https://doi.org/10.1007/s42489-019-00007-1>.

Haahr, Mads. "Creating Location-Based Augmented-Reality Games for Cultural Heritage." In *Serious Games. JCSG 2017. Lecture Notes in Computer Science, vol 10622*, edited by Mariano Alcañiz, Stefan Göbel,, Minhua Ma, Manuel Fradinho Oliveira, Jannicke Baalsrud Hauge and Tim Marsh, 313-318. New York: Springer, Cham. [http://doi.org/10.1007/978-3-319-70111-0\\_29](http://doi.org/10.1007/978-3-319-70111-0_29).

Hall, Stuart. "Whose Heritage? Un-settling 'The Heritage', Re-imagining the Post-nation." in *Whose Heritage? Challenging Race and Identity in Stuart Hall's Post-nation Britain*, edited by Susan L.T. Ashley and Degna Stone, 13- 25. New York: Routledge, 2023.

Ham, Sam. *Interpretation - Making a Difference on Purpose*. Golden Colorado: Fulcrum, 2016.

Han, Dai-In, Timothy Jung and Alex Gibson. "Dublin AR: implementing augmented reality in tourism." In *Information and Communication Technologies in Tourism 2014*, edited by Zheng Xiang and Iis Tussyadiah, 511-523. New York: Springer Cham, 2014. [https://doi.org/10.1007/978-3-319-03973-2\\_37](https://doi.org/10.1007/978-3-319-03973-2_37).

- Harley, Jason. "Measuring Emotions: A Survey of Cutting-Edge Methodologies Used in Computer-Based Learning Environment Research." In *Emotions, Technology, Design, and Learning*, edited by Simon Tettegah and Michael Gartmeier, 89-114. Cambridge, MA: Elsevier Academic Press, 2015.
- Harrison, Rodney. *Understanding the Politics of Heritage*. Manchester: Manchester University Press, 2010.
- Hart, Claudia and Rose Marie May. "Really Fake or Faking Reality? The Riot Grrrls Project." In *Augmented Reality Art. From an Emerging Technology to a Novel Creative Medium*, edited by Vladimir Geroimenko, 387-399. Springer Nature Switzerland 2022. [http://dx.doi.org/10.1007/978-3-319-69932-5\\_21](http://dx.doi.org/10.1007/978-3-319-69932-5_21).
- Henley, James. "Overtourism in Europe's historic cities sparks backlash." *Guardian*, January 25, 2020. <https://www.theguardian.com/world/2020/jan/25/overtourism-in-europe-historic-cities-sparks-backlash>.
- Heritage Lottery Fund. *Interpretation guidance*. Accessed November 29, 2023. <https://www.heritagefund.org.uk/funding/good-practice-guidance/interpretation-guidance>.
- Heritage Lottery Fund. *Investing in heritage of diverse ethnic communities*. Accessed November 29, 2023. <https://www.heritagefund.org.uk/our-work/investing-heritage-diverse-ethnic-communities>.
- Hewison, Robert. *The Heritage Industry. Britain in a Climate of Decline*. London: Routledge, 1987.
- Hincapié, Mauricio, Christian Díaz, Maria-Isabel Zapata-Cárdenas, Henry de Jesus Toro Rios, Dalia Valencia and David Güemes-Castorena. "Augmented reality mobile apps for cultural heritage reactivation." *Computers & Electrical Engineering* 93 (2021): Article 107281. <https://doi.org/10.1016/j.compeleceng.2021.107281>.
- Hincapie, Mauricio, Christian Diaz, Maria Zapata and Camilo Mesias. "Methodological Framework for the Design and Development of Applications for Reactivation of

Cultural Heritage: Case Study Cisneros Marketplace at Medellin.” *Colombia. J. Comput. Cult. Herit.* 9, no. 2 (May 2016): 1-24. <https://doi.org/10.1145/2827856>.

Historic England. *Funding projects untold stories of working class heritage*. Accessed November 29, 2023. <https://historicengland.org.uk/whats-new/news/funding-projects-untold-stories-working-class-heritage/>.

Historic Royal Palace. “The Lost Palace.” August 8, 2016. Video. 01:09. [https://youtu.be/QzfC\\_se0wPU?si=Zv3FMCJHgw4URk7M](https://youtu.be/QzfC_se0wPU?si=Zv3FMCJHgw4URk7M).

Hjorth, Larissa, Jean Burgess and Ingrid Richardson. *Studying Mobile Media Cultural Technologies, Mobile Communication, and the iPhone*. London and New York: Routledge, 2012.

Horniman, *Rethinking Relationships and Building Trust Around African Collections*, 2020. [www.horniman.ac.uk/project/rethinking-relationships/](http://www.horniman.ac.uk/project/rethinking-relationships/).

Hussain, Azham and Elaine Ferneley. “Usability metric for mobile application: a goal question metric (GQM) approach.” In *Proceedings of the 10th International Conference on Information Integration and Web-based Applications & Services (iiWAS '08)*. 567–570. New York: Association for Computing Machinery, 2008. <https://doi.org/10.1145/1497308.1497412>.

Information Commissioner’s Office. Privacy in Mobile Apps. December 2013. Accessed October 23, 2023, <https://ico.org.uk/media/for-organisations/documents/1596/privacy-in-mobile-apps-dp-guidance.pdf>.

Ingersoll, Alex Monroe. “The Shadow Space of Allegorical Machines Situating Locative Media.” PhD diss., University of North Carolina at Chapel Hill, 2013.

International Organization for Standardization. *ISO 9241-210: 2019. Ergonomics of human-system interaction, Part 210: Human-centred design for interactive systems*. Washington, DC: American National Standards Institute ANSI, 2019. Accessed November 29, 2023. <https://www.iso.org/standard/52075.html>.

- Jackson, Anthony and Jenny Kidd. *Performing heritage. Research, practice and innovation in museum theatre and live interpretation*, edited by Anthony Jackson and Jenny Kidd. Manchester: Manchester University Press, 2012.
- Johnson, Larry. *NMC The Horizon Report: 2010 Museum Edition*. Austin, Texas: The New Media Consortium, 2010.
- Johnston, Robert and Xiangyu Kong. "The customer experience : a road-map for improvement." *Managing Service Quality* 21, no. 1 (2011): 5-24. <http://doi:10.1108/09604521111100225>.
- Jung, Timothy and Claudia tom Dieck. "Augmented Reality, Virtual Reality and 3D Printing for the Co-Creation of Value for the Visitor Experience at Cultural Heritage Places." *Journal of Place Management and Development* 10 (2017): 140-151. <http://doi:10.1108/JPMD-07-2016-0045>.
- Kabanoff A. "The 'Netflix Effect' or how the streaming giant is impact international tourism". Accessed November 29, 2023. [http://interfacetourism.fr/en/2019/06/11/green\\_team-2/](http://interfacetourism.fr/en/2019/06/11/green_team-2/) .
- Kärklinš, Jānis. "Preface." in *Proceedings of Memory of the World in the Digital Age: Digitization and Preservation, An international conference on permanent access to digital documentary heritage 26-28/9/2012*, edited by Luciana Duranti and Elizabeth Shaffer, 4-5. Toronto, Canada: University of Toronto Press, 2012. <https://unesdoc.unesco.org/ark:/48223/pf0000373728.locale=fr>.
- Keil, Jens, Florian Schmitt, Timo Engelke, Holger Grafand and Manuel Olbrich. "Augmented Reality Views: Discussing the Utility of Visual Elements by Mediation Means in Industrial AR from a Design Perspective." In *Virtual, Augmented and Mixed Reality: Applications in Health, Cultural Heritage, and Industry. VAMR 2018. Lecture Notes in Computer Science Volume 10910*, edited by Jessie Chen and Gino Fragomeni, 298-312. New York: Springer, 2018. [https://doi.org/10.1007/978-3-319-91584-5\\_24](https://doi.org/10.1007/978-3-319-91584-5_24).

- Kelley, John F. "An iterative design methodology for user-friendly natural-language office information applications." *ACM Transactions on Office Information Systems* 2, no. 1 (1984): 26-41. <https://doi.org/10.3758/BF03204642>.
- Kenderdine, Sarah. "Embodiment, Entanglement, and Immersion in Digital Cultural Heritage." In *A New Companion to Digital Humanities*, edited by Susan Schreibman, John Unsworth and Ray Siemens, 22 - 41. London: John Wiley & Sons Ltd., 2016. <https://doi.org/10.1002/9781118680605.ch2>.
- Kent Beck, Mike Beedle, Arie van Bennekum, Alistair Cockburn, Ward Cunningham, Martin Fowler, James Grenning, Jim Highsmith, Andrew Hunt, Ron Jeffries et al. "Manifesto for Agile Software Development." Accessed November 29, 2023. <http://agilemanifesto.org/>
- Facer, Keri and Bryony Enright. "Creating Living Knowledge: The Connected Communities Programme, community-university relationships and the participatory turn in the production of knowledge". Bristol: University of Bristol Press/AHRC Connected Communities, 2016. [https://research-information.bris.ac.uk/ws/portalfiles/portal/75082783/FINAL\\_FINAL\\_CC\\_Creating\\_Living\\_Knowledge\\_Report.pdf](https://research-information.bris.ac.uk/ws/portalfiles/portal/75082783/FINAL_FINAL_CC_Creating_Living_Knowledge_Report.pdf).
- Kidd, Jenny. *Museums in the New Mediascape: Transmedia, Participation, Ethics*. Farnham: Routledge, 2014.
- Kidd, Jenny. *Representation*. 1st ed. London - New York: Routledge, 2015. <https://doi.org/10.4324/9781315666785>.
- Kidd, Jenny. "Gaming for Affect: Museum Online Games and the Embrace of Empathy." *Journal of Curatorial Studies* 4, no. 3 (2015): 414-432. [http://dx.doi.org/10.1386/jcs.4.3.414\\_1](http://dx.doi.org/10.1386/jcs.4.3.414_1).
- Kidd, Jenny. "Public heritage and the promise of the digital." In *The Oxford Handbook of Public Heritage Theory and Practice*, edited by Angela M. Labrador and Asher Silberman, Neil, 197–208. Oxford: Oxford University Press, 2018. <https://doi.org/10.1093/oxfordhb/9780190676315.001.0001>.

- Kidd, Jenny and Rosie Cardiff. "A Space of Negotiation': Visitor Generated Content and Ethics at Tate." *Museum and Society* 15, no. 1 (2017): 43–55. <http://dx.doi.org/10.29311/mas.v15i1.661>.
- Kidd, Jennifer and McAvoy Eva Nieto. "Immersive experiences in museums, galleries and heritage sites: a review of research findings and issues." Discussion Paper Creative Industries Policy and Evidence Centre (PEC), 2019. <https://www.pec.ac.uk/discussion-papers/immersive-experiences-in-museums-galleries-and-heritage-sites-a-review-of-research-findings-and-issues>.
- Kidd, Jennifer. "Immersive heritage encounters." *The Museum Review* 3, no. 1 (2018). 1-17. <https://orca.cardiff.ac.uk/id/eprint/110788>.
- Kim, Jong-Hyeong and Ritchie J. R. Brent. "Cross-Cultural Validation of a Memorable Tourism Experience Scale (MTES)." *Journal of Travel Research* 53, no. 3 (2014): 323-335. <https://doi.org/10.1177/0047287513496468>.
- Kitchin, Rob. *The Data Revolution: Big Data, Open Data, Infrastructures and Their Consequences*. London: SAGE, 2014.
- Kitchin, Rob, Claudio Coletta, Leighton Evans, Liam Heaphy and Darach MacDonncha. "Smart cities, urban technocrats, epistemic communities and advocacy coalitions." *SocArXiv* Article rxk4r (2017). <http://doi.org/10.31219/osf.io/rxk4r>.
- Kontiza, Kalliopi, Antoniou Angeliki, Abdullah Daif, Susana Reboreda-Morillo, Maddalena Bassani, Silvia González-Soutelo, Ioanna Lykourantzou, Catherine Emma Jones, Joseph Padfiel and Martín López-Nores. "On How Technology-Powered Storytelling Can Contribute to Cultural Heritage Sustainability across Multiple Venues - Evidence from the CrossCult H2020 Project." *Sustainability* 12, no. 1666 (2020): 1-26. <http://doi.org/10.3390/su12041666>.
- Koolen, Marijn, Jasmijn Van Gorp and Jacco van Ossenbruggen. "Toward a Model for Digital Tool Criticism: Reflection as Integrative Practice." *Digital Scholarship in the Humanities* 34, no. 2 (2019) : 368–385. <https://doi.org/10.1093/llc/fqy048>.

- Kourouthanassis, Panos, Costas Boletsis and George Lekakos. "Demystifying the design of mobile augmented reality applications." *Multimedia Tools and Applications* 74, no. 3 (2014): 1045-1066. <http://doi.10.1007/s11042-013-1710-7>.
- Lanir, Joe, Dim Tsvi, Eyal Kuflik, Alan J. Wecker and Oliviero Stock. "The Influence of a Location-Aware Mobile Guide on Museum Visitors' Behavior." *Interacting with Computers* 25, no. 6 (November 2013): 443-460. <https://doi.org/10.1093/iwc/iwt002>.
- Lazzaretti, Luciana and Andrea Sartori. "Digitization of Cultural Heritage and Business Model Innovation: The Case of the Uffizi Gallery in Florence." *Il Capitale culturale. Studies on the Value of Cultural Heritage* 14 (2016): 945-970. <http://doi.org/10.13138/2039-2362/1436>.
- Lewis, Andrew. "What do visitors says about using mobile devices in museums?," *The V&A* (blog), March 13, 2013, <https://www.vam.ac.uk/blog/digital/museum-visitors-using-mobile>.
- Liang, Lena and Statia Eliot. "A systematic review of augmented reality tourism research: What is now and what is next?" *Tourism and Hospitality Research*, 21, no. 1 (2021): 15–30. [https://doi.org/10.1177/2F1467358420941913\\_](https://doi.org/10.1177/2F1467358420941913_)
- Liao, Tom and Lee Humphreys. "Layered places: Using mobile augmented reality to tactically reengage, reproduce, and reappropriate public space." *New Media and Society* 17, no. 9 (2015): 1418-1435. <https://doi.org/10.1177/1461444814527734>.
- Liarokapis, Fotis, Panagiotis Petridis, Daniel Andrews and Sara de Freitas. "Multimodal Serious Games Technologies for Cultural Heritage." *Mixed Reality and Gamification for Cultural Heritage* (2017): 371-392. <http://doi.org/10.1007/978-3-319-49607-8>.
- Light, Ben, Jean Burgess and Stephanie Duguay. "The walkthrough method: An approach to the study of apps." *New Media & Society* 20, no. 3 (2018): 881–900. <https://doi.org/10.1177/1461444816675438>.

- Liu, Alan, Scott Kleinman, Jeremy Douglass, Lindsay Thomas, Ashley Champagne, and Jamal Russell. "Open, Shareable, Reproducible Workflows for the Digital Humanities: The Case of the 4Humanities.org 'WhatEvery1Says' Project." Paper presented at the International Conference on Digital Health DH2017. <https://dh2017.adho.org/abstracts/034/034.pdf>.
- Loevlie, Anders, "Textopia: Designing a locative literary reader." *Journal of Location Based Services* 3, no. 4 (2009): 249-276. <http://doi.org/10.1080/17489720903463658>.
- Loevlie, Anders, "Locative literature: Experiences with the textopia system." *International Journal of Arts and Technology* 4, no. 3 (2011): 234-248. <http://doi.org/10.1504/IJART.2011.041479>.
- Lombardo, Vincenzo and Rossana Damiano. "Storytelling on mobile devices for cultural heritage." *New Review of Hypermedia and Multimedia* 18 (2012): 11-35. <http://doi.org/10.1080/13614568.2012.617846>.
- Lumley, Robert. *The Museum Time-Machine*. London: Routledge, 1988.
- Lupo, Eleonora. "Design visions for the Cultural Heritage sector in the post-pandemic crisis: designing for 'CH and museums of proximity.'" In *14th International Conference of the European Academy of Design, Safe Harbours for Design Research, Blucher Design Proceedings*, edited by Leon Cruickshank, Louise Valentine, David Perez Ojeda, Marzia Mortati, Spyros Bofylato, and Ja Young Hwang, 544- 555. São Paulo: Blucher Publishing House, 2021. <http://doi.org/10.5151/ead2021-121>.
- Luterbacher, Celia. "We need to stop being socially naïve about what heritage is." Accessed October 29, 2023. <http://actu.epfl.ch/news/we-need-to-stop-being-socially-naive-about-what-he/>.
- McCarthy, John and Luigina Ciolfi. "Place as dialogue: Understanding and supporting the museum experience." *International Journal of Heritage Studies* 14, no.3 (2008): 247-267. <https://hdl.handle.net/2381/43381>.



- McCarthy, John and Peter Wright. "Time, Place and Technology in Museums: A Dialogical Approach to the Experience." In *Interaction Design Centre 2005: Proceedings of the International Workshop "Re-thinking technology in museums: towards a new understanding of people's experience in museums"*. University of Limerick (Ireland), 29th-30th June, 2005, edited by Luigina Ciolfi, Katherine Scott and Sara Barbieri, 93-98. Limerick: University of Limerick Press, 2005. [http://shura.shu.ac.uk/6583/1/Tech2011\\_final%282%29.pdf](http://shura.shu.ac.uk/6583/1/Tech2011_final%282%29.pdf).
- MacQuaid, Jonathan, "Audience engagement in arts and heritage: the traps we fall into." *Guardian*, October 6, 2014. <https://www.theguardian.com/culture-professionals-network/culture-professionals-blog/2014/oct/06/audience-engagement-arts-heritage-traps>.
- Malpas, Jeff, "New Media, Cultural Heritage and the Sense of Place: Mapping the Conceptual Ground." *International Journal of Heritage Studies* 14, no. 3 (2008): 197–209. <https://doi.org/10.1080/13527250801953652>.
- Mann, Laura and Grace Tung. "A new look to an old friend. Reevaluating the Met's audio-guide service." Accessed August 27, 2023. <https://mw2015.museumsandtheweb.com/paper/a-new-look-at-an-old-friend-re-evaluating-the-mets-audio-guide-service>.
- Manovich, Lev. "Introduction to Info-Aesthetics", in *Antinomies of Art and Culture: Modernity, postmodernity, contemporaneity*, edited by Terry Smith, Okwui Enwezor and Nancy Condee, 333-344. Durham and London: Duke University Press, 2008.
- Manovich, Lev. "The Science of Culture? Social Computing, Digital Humanities and Cultural Analytics." *Journal of Cultural Analytics* 1, no. 1 (2016): 1-15. <https://doi.org/10.22148/16.004>.
- Matney, Lucas. "Oculus announces VR for good initiative to help students and non-profits capture community life." Accessed November 29, 2023, <https://techcrunch.com/2016/05/16/oculus-announces-vr-for-good-initiative-to-help-students-and-non-profits-capture-community-life/>.

- Martingano, Alison Jane, Fernanda Herrera and Sara Konrath. "Virtual Reality Improves Emotional but Not Cognitive Empathy: A Meta-Analysis." *Technology, Mind, and Behavior* 2, no. 1 (2021): 1-15. <https://doi.org/10.1037/tmb0000034>.
- McGinity, Ruth and Majja Salokangas. "Introduction: 'Embedded Research' as an Approach into Academia for Emerging Researchers." *Management in Education* 28, no. 1 (January 2014): 3-5. <https://doi.org/10.1177/0892020613508863>.
- Mellal, Mohamed Arezki, "Obsolescence - A review of the literature." *Technology in Society* 63, Article 101347 (2020). <https://doi.org/10.1016/j.techsoc.2020.101347>.
- Meyer, Sylke. "Right, Left, High, Low Narrative Strategies for Non-linear Storytelling." *Lecture Notes in Computer Science* (2016): 325-335. [http://doi.org/10.1007/978-3-319-48279-8\\_29](http://doi.org/10.1007/978-3-319-48279-8_29)
- Milk, Chris. "How virtual reality can create the ultimate empathy machine." March 2015. Video, 10:16. [https://www.ted.com/talks/chris\\_milk\\_how\\_virtual\\_reality\\_can\\_create\\_the\\_ultimate\\_empathy\\_machine](https://www.ted.com/talks/chris_milk_how_virtual_reality_can_create_the_ultimate_empathy_machine).
- Millard, David, Heather Packer, Yvonne Howard and Charlie Hargood. "The balance of attention: the challenges of creating locative cultural storytelling experiences." *Journal on Computing and Cultural Heritage (JOCCH)* 13, no. 4 (2020): 1-24. <https://doi.org/10.1145/3404195>.
- Minghetti, Valeria, Andrea Moretti and Stefano Micelli. "Reengineering the museum's role in the tourism value chain: towards an IT business model." *Journal of Information Technology and Tourism* 4, no. 1 (2001):131-143. <https://doi.org/10.3727/109830501108750949>.
- Monrad Nielsen Christian, Michael Overgaard, Michael Pedersen, Jan Stage and Sigge Stenild. "It's worth the hassle!: the added value of evaluating the usability of mobile systems in the field". In *Proceedings of the 4th Nordic conference on Human-computer interaction: changing roles* (2006): 272–280.

<https://vbn.aau.dk/da/publications/its-worth-the-hassle-the-added-value-of-evaluating-the-usability>.

Montola, Markus, "A ludological view on the pervasive mixed-reality game research paradigm," *Pers Ubiquit Comput* 15 (2011): 3-12. <https://doi.org/10.1007/s00779-010-0307-7>.

Moorhouse, Natasha, Claudia tom Dieck and Timothy Jung. "Augmented reality to enhance the learning experience in cultural heritage tourism: An experiential learning cycle perspective." *eReview of Tourism Research* 8 (2017): 110-117. <http://doi.org/10.1016/J.JDMM.2017.03.002>.

Morrison, Jo. "Digital Placemaking and user experience". In *Hidden Cities. Urban Space, Geolocated Apps and Public History in Early Modern Europe*, edited by Fabrizio Nevola, David Rosenthal, and Nicholas Terpstra, 39-60. London: Routledge, 2022. <https://doi.org/10.4324/9781003172000>.

Mortara, Michele, Chiara Catalano, Bellotti, Francesco and Giusy Fiucci. "Learning cultural heritage by serious games," *Journal of Cultural Heritage* 15, no. 3 (2014): 318-325. <http://doi.org/10.1016/j.culher.2013.04.004>.

Mosconi, Cristina. *Hidden Florence Analytics Report, 2017–18*. 2018. <https://ore.exeter.ac.uk/repository/bitstream/handle/10871/125232/Hidden%20Florence%20Analytics%20Report%202017-18.pdf?sequence=1&isAllowed=y>.

Mosconi, Cristina. *Hidden Florence Analytics Reports. Overview of the Analytics of the app platforms, WordPress website, and social media accounts (Facebook, Twitter, and Instagram)*, 2020. Unpublished.

Mourby, Miranda, Heather Gowans, Stergios Aidinlis, Hannah Smith and Jane Kaye. "Governance of academic research data under the GDPR – lessons from the UK". *International Data Privacy Law* 9, no. 3 (2019): 192–206. <https://doi.org/10.1093/idpl/ipz010>.

Nadin, Mihai. "Antecipare ergo sum: what price knowledge?." *AI & Society* 28, no. 1 (2013): 39-50. <http://doi.org/10.1007/s00146-012-0400-8>.

- Namberger, Philipp, Sascha Jackisch, Jürgen Schmude and Marion Karl. "Overcrowding, Overtourism and Local Level Disturbance: How Much Can Munich Handle?", *Tourism Planning & Development* 16, no. 4 (2019): 452-472. <http://doir.org/10.1080/21568316.2019.1595706>.
- National Trust. "For everyone, for ever: our strategy to 2025." Accessed November 23, 2023. <https://www.nationaltrust.org.uk/who-we-are/our-strategy>.
- NESTA. "The State of Creativity. Policy, Research, Industry. 2023." Accessed November 29, 2023. <https://pec.ac.uk/research-reports/the-state-of-creativity>.
- Nees, Michael A. and Bruce N. Walker. "Auditory interfaces and sonification." In *The Universal Access Handbook*, edited by Christos Stephanidis, 507- 522. New York: CRC Press, 2008.
- Nevola, Fabrizio and David Rosenthal. "Locating experience in the Renaissance city using mobile app technologies: the 'Hidden Florence' project." In *Mapping Space, Sense, and Movement in Florence: Historical GIS and the Early Modern City*, edited by Nicholas Terpstra and Colin Rose, 187- 209. London: Routledge, 2016. <https://doi.org/10.4324/9781315639314>.
- Nevola, Fabrizio, Tim Coles and Cristina Mosconi. "Hidden Florence revealed? Critical insights from the operation of an augmented reality app in a World Heritage City." *Journal of Heritage Tourism* 17, no. 6 (February 2022): 1-20. <https://doi.org/10.1080/1743873X.2022.2036165>.
- Ng, Wai-Kit, Fu-Tien Hsu and Chung-Lian Chen. "The Impacts of Digital Technology on Service Design and Experience Innovation: Case Study of Taiwan's Cultural Heritage under the COVID-19 Pandemic." *Systems* 10, no. 5 (2022): 184-202. <https://doi.org/10.3390/systems10050184>.
- Nitins, Tanya and Christy Collis. "'Grounding the internet': Categorising the geographies of locative media." *Media International Australia* 146, no.1 (2013): 69-78. <https://doi.org/10.1177/1329878X1314600110>.
- Norman, Don. *The Design of Everyday Things*. New York: Basic Books, 1988.

- Norman, Don and Jakob Nielsen "The Definition of User Experience (UX)'." Accessed November 29, 2023. <https://www.nngroup.com/articles/definition-user-experience/>.
- Oppegaard, Brett. "From orality to newspaper wire services: Conceptualizing a medium". In *Communication and Technology*, edited by Lorenzo Cantoni, and James A. Danowski, 21-33. Berlin-Boston: Walter de Gruyter Press, 2015.
- Oppegaard, Brett. "Mobility matters: Classifying locative mobile apps through an affordances approach." In *Emerging perspectives on the mobile content evolution*, edited by Juan Miguel Aguado, Claudio Feijóo and Inmaculada J. Martínez, 200-219. Hershey, Pennsylvania: IGI Global, 2016.
- Oppegaard, Brett and Daniel Grigar. "The Interrelationships of Mobile Storytelling." In *The Mobile Story: Narrative Practices with Locative Technologies*, ed. Jason Farman, 18-33. New York: Routledge, 2014.
- Oppegard, Brett and Michael K. Rabby. "Proximity: Revealing new mobile meanings of a traditional news concept." *Digital Journalism* 4, no. 5 (2016): 621-638. <https://doi.org/10.1080/21670811.2015.1063075>.
- Oppegaard, Brett and Michael K. Rabby. "The App-Maker Model: An Embodied Expansion of Mobile Cyberinfrastructure." *Digital Humanities Quarterly* 10, no. 3 (2016): 116-134. <http://www.digitalhumanities.org/dhq/vol/10/3/000267/000267.html>.
- Padilla-Meléndez, Antonio and Ana Rosa del Águila-Obra. "Web and Social Media Usage by Museums: Online Value Creation." *International Journal of Information Management* 33, no. 5 (October 2013): 892–898. <http://doi.org/10.1016/j.ijinfomgt.2013.07.004>.
- Pagano, Alfonsina and Ivana Cerato. "Evaluation of the educational potentials - Interactive technologies applied to Cultural Heritage". *Conference Seminar* (September 2015): 329-332. <http://doi.org/10.1109/DigitalHeritage.2015.7419516>.
- Park, Yu. *Heritage Tourism*. New York: Routledge, 2013.

- Parry, Ross. "The End of the Beginning: Normativity in the Postdigital Museum." *Museum Worlds* 1, no. 1 (2013): 24–39. <https://doi.org/10.3167/armw.2013.010103>.
- Pendlebury, John, Yi-Wen Wang and Andrew Law. "Re-using 'uncomfortable heritage': the case of the 1933 building, Shanghai." *International Journal of Heritage Studies* 24, no. 3 (2017): 211-229. <https://doi.org/10.1080/13527258.2017.1362580>.
- Pekrun, Reinhard and Raymond Perry. "Control-value theory of achievement emotions." In *International handbook of emotions in education*, edited by Reinhard Pekrun and Lisa Linnenbrink-Garcia, 120–141. New York: Taylor & Francis Group, 2014.
- Perry, Sara, Roussou Maria, Economou Maria, Hilary Young and Lara Pujol. "Moving Beyond the Virtual Museum: Engaging Visitors Emotionally." in *23rd International Conference on Virtual Systems & Multimedia (VSMM), Dublin, 2017*, 1-8. New York: IEEE, 2017. <https://doi.org/10.1109/VSM.2017.8346276>.
- Petrie, Matthew. "Dear museums: the time is right to embrace mobile." *Guardian*, May 31, 2013. <https://www.theguardian.com/culture-professionals-network/culture-professionals-blog/2013/may/31/museums-mobile-visitors>.
- Petrelli, Daniela, Elena Not, Areti Damala, Dick van Dijk and Monika Lechner, "meSch – Material Encounters with Digital Cultural Heritage." In *Digital Heritage. Progress in Cultural Heritage: Documentation, Preservation, and Protection. EuroMed 2014. Lecture Notes in Computer Science. vol 8740*, edited by Marinos Ioannides, Nadia Magnenat-Thalmann, Eleanor Fink, Roko Žarnić, Alex-Yianing Yen and Ewald Quak. London: Springer, Cham. [https://doi.org/10.1007/978-3-319-13695-0\\_53](https://doi.org/10.1007/978-3-319-13695-0_53).
- Petrelli, Daniela. " Making virtual reconstructions part of the visit: An exploratory study," *Digital Applications in Archaeology and Cultural Heritage* 15 (2019): 1-15. <https://doi.org/10.1016/j.daach.2019.e00123>.

- Pett, Daniel. "Use of social media within the British Museum and the museum sector." In *Archaeology and digital communication: Towards strategies of public engagement*, edited by Chiara Bonacchi, 83-102. London: Archetype, 2012.
- Pine, Joseph B. II and James H. Gilmore. *The Experience Economy*. Boston, MA: Harvard Business School Press, 1999.
- Play Google. "Hidden Florence." Accessed November 29, 2023, <https://play.google.com/store/apps/details?id=uk.ac.exeter.hiddenflorence&hl=it&gl=US>.
- Play Google. "The Climate Change Trial." Accessed November 29, 2023. <https://play.google.com/store/apps/details?id=com.SouthWestCoastPath.TheClimateChangeTrail&hl=en&gl=GB>.
- Play Google. "West Front AR." Accessed November 29, 2023. <https://play.google.com/store/apps/details?id=com.DPN.Westfront&gl=GB>.
- Polaine, Andy, Lavrans Løvlie and Ben Reason. *Service Design: From Insight to Implementation*. New York: Rosenfeld Media, 2013.
- Ponsignon, Frederique, Francois Durrieu and Tatiana Bouzdine-Chameeva. "Customer experience design: a case study in the cultural sector." *Journal of Service Management* 28, no. 4 (2017): 763-787. <https://doi.org/10.1108/JOSM-01-2017-0016>.
- Poole, Steve. "Ghosts in the Garden: locative gameplay and historical interpretation from below." *International Journal of Heritage Studies* 24, no. 3 (2018): 300-314. <https://doi.org/10.1080/13527258.2017.1347887>.
- Popp, Monika. "Positive and negative urban tourist crowding: Florence. Italy." *Tourism Geographies*, 14, no. 1 (2021): 50-72. <https://doi.org/10.1080/14616688.2011.597421>.
- Poudel, Surya and Gyan P. Nyaupane. "The Role of Interpretative Tour Guiding in sustainable Destination Management: A Comparison between Guided and

- Nonguided Tourists.” *Journal of Travel Research* 52, no. 5 (2013): 659-672. <https://doi.org/10.1177/0047287513478496>.
- Price, Aaron, Jana Nicole Greenslit, Lauren Applebaum, Natalie Harris, Gloria Segovia, Kimberly A. Quinn, Sheila Krogh-Jespersen. ‘Awe & Memories of Learning in Science and Art Museums.” *Visitor Studies* 24, no. (2021): 137–65. <https://doi.org/10.1080/10645578.2021.1907152>.
- Proctor, Nancy and Chris Tellis. “The State Of The Art In Museum Handhelds In 2003.” Paper presented at the Museums and the Web, Toronto. March 19-22, 2003. <https://eric.ed.gov/?id=ED482157>.
- Price, Dominic, Alan Chamberlain, Martin Flintham, Kevin Glover, Christ Greenhalgh, Steve Benford, Andy Gower and Amanda Gower. “Participate: Pervasive Computing for Environmental Campaigns.” In *HCI International 2013 - Posters’ Extended Abstracts. HCI 2013. Communications in Computer and Information Science 374*, edited by Stephanidis, Constantine, 633-637. Berlin, Heidelberg: Springer, 2013. [https://doi.org/10.1007/978-3-642-39476-8\\_127](https://doi.org/10.1007/978-3-642-39476-8_127).
- Pullman, Madeleine and Michael A. Gross. “Ability of Experience Design Elements to Elicit Emotions and Loyalty Behaviors.” *Decision Science* 35, no. 3 (2014): 551-578. <https://doi.org/10.1111/j.00117315.2004.02611>.
- Owen, John Mackenzie. “Authenticity and Objectivity in Scientific Communication: Implications of Digital Media.” In *Sign Here!: Handwriting in the Age of New Media*, edited by Sonja Neef, José van Dijck, and Eric Ketelaar, 60–75. Amsterdam University Press, 2006. <http://www.jstor.org/stable/j.ctt46mzz3.6>.
- REACT. “Curpanion.” Accessed November 29, 2023. <http://old.react-hub.org.uk/objects-sandbox/projects/2014/curpanion/>.
- REACT. “Reflecting the Past. Pioneering the use of augmented reality ‘mirrors’, to create interactive heritage experiences.” Accessed November 29, 2023. <http://www.react-hub.org.uk/projects/heritage/reflecting-past/>.



- REACT. "With New Eyes I see. A site specific documentary using torches, projection and RFID to unlock Cardiff's WW1 past." Accessed November 29, 2023. <http://www.react-hub.org.uk/projects/feasibility/new-eyes-i-see/>.
- Reid, Jo. *How AR, apps and digital placemaking are driving innovation for heritage sites*. Bristol: Calvium E-book, 2021. <https://calvium.com/free-e-book-how-ar-apps-and-digital-placemaking-are-driving-innovation-for-heritage-sites/>.
- Reid, Josephine, Erik Geelhoed, Richard Hull, Kirsten Cater and Ben Clayton. "Parallel worlds: Immersion in location-based experiences." In *Extended Abstracts Proceedings of the 2005 Conference on Human Factors in Computing Systems, CHI 2005, Portland, Oregon, USA, April 2-7, 1733-1736*. New York: ACM, 2005. <http://doi.org/10.1145/1056808.1057009>.
- Reid, Josephine, Richard Hull, Kirsten F Cater and Constance Fleuriot. "Magic moments in situated mediascapes." In *Proceedings of the 2005 ACM SIGCHI International Conference on Advances in Computer Entertainment Technology (ACE 2005)*, 290-293. New York: ACM, 2005. <https://doi.org/10.1145/1178477.1178529>.
- Reid, Josephine, Kirsten Cater, Constance Fleuriot and Richard Hull. "Experience Design Guidelines for Creating Situated Mediascapes." University of Bristol, Department of Computer Science, Working Paper (2005). [http://www.cs.bris.ac.uk/Publications/pub\\_master.jsp?id=2000510](http://www.cs.bris.ac.uk/Publications/pub_master.jsp?id=2000510).
- Richards, Greg and Lian Duif,. *Small cities with big dreams: Creative placemaking and branding strategies*. New York: Routledge, 2018.
- Richards-Rissetto, Heather and Kristin Landau. "Movement as a means of social (re)production: using GIS to measure social integration across urban landscapes." *Journal of Archaeological Science*, 41 (2014): 365-375. <https://doi.org/10.1016/j.jas.2013.08.006>.
- Rieser, Martin. "Locative Media and Spatial Narrative." Paper presented at REFRESH conference. First International Conference on the Media Arts, Sciences and Technologies, Banff Center, September 29 to October 4, 2005.

[http://95.216.75.113/bitstream/handle/123456789/304/Martin\\_Rieser\\_refresh.pdf?sequence=1&isAllowed=y](http://95.216.75.113/bitstream/handle/123456789/304/Martin_Rieser_refresh.pdf?sequence=1&isAllowed=y).

Royce, Walter W. "Managing the Development of Large Software Systems." In *Proceedings of IEEE WESCON*, vol. 26, 328-388. New York: Institute of Electrical and Electronics Engineers, 1970.

Rossitto, Chiara, Louise Barkhuus and Arvid Engström. "Interweaving place and story in a location-based audio drama." *Personal and Ubiquitous Computing* 20, no. 2 (2016): 245-160. <http://doi.org/10.1007/s00779-016-0908-x>.

Ruoss, Engelbert and Loredana Alfara. "Challenging hit and run tourism in cultural heritage sites." Accessed November 29, 2023. <https://destinationcenter.org/2013/10/challenging-hit-and-run-tourism-in-cultural-heritage-sites/>.

Ryan, Marie Laure, Kenneth Foote and Maoz Azaryahu. *Narrating space/spatializing narrative: Where narrative theory and geography meet*. Ohio: The Ohio State University Press, 2016.

Sacco, Pier Luigi. "Culture 3.0: Building competitiveness and innovative capacity through culture." Paper presented at the A vision for European (digital) cultural heritage 2025. Varna, May 28 and 29, 2018. <https://www.slideshare.net/Europeana/culture-30-building-competitiveness-and-innovative-capacity-through-culture-by-pier-luigi-sacco-a-vision-for-european-digital-cultural-heritage-2025-varna-28-29-may-2018>.

Sacco, Pier Luigi and Ekatarina Travkina. "Culture Shock. COVID-19 and the cultural and creative sector." (Paris: Organisation for Economic Co-operation and Development (OECD), 2020) [https://www.researchgate.net/publication/344191530\\_Culture\\_shock\\_COVID19\\_and\\_the\\_cultural\\_and\\_creative\\_sectors](https://www.researchgate.net/publication/344191530_Culture_shock_COVID19_and_the_cultural_and_creative_sectors).

Saker, Michael and Jordan Frith. "From hybrid space to dislocated space: Mobile virtual reality and a third stage of mobile media theory." *New Media and Society* (2018): 1-27. <http://doi.org/10.1177/1461444818792407>.

Samuel, Raphael. *Theatres of Memory*. London: Verso, 1997.

- Schaper, Marie-Monique, Maria Santos, Laura Malinverni, Berro Zerbini and Juan Narciso Pares. "Learning about the past through situatedness, embodied exploration and digital augmentation of cultural heritage sites." *International Journal of Human-Computer Studies* 114, (2018): 36-50. <https://doi.org/10.1016/j.ijhcs.2018.01.003>
- Scholz, Joachim and Andrew Smith. "Augmented reality: Designing immersive experiences that maximize consumer engagement." *Business Horizons* 59, no. 2 (2016): 149-161. <http://dx.doi.org/10.1016/j.bushor.2015.10.003>.
- Schorch, Philipp. "Museum encounters and narrative engagements." In *The international handbooks of museum studies. Volume 1*, edited by Kylie Message and Andrea Witcomb, 437-457. London: John Wiley & Sons, 2013. <https://doi.org/10.1002/9781118829059.wbihms121>.
- Schraffenberger, Hanna and Edwin van der Heide. "Everything augmented: on the real in augmented reality." *CITAR Journal* 6, no. 1 – Special Issue (2014): xCoAx.
- Senior Timothy J., Simon Moreton and Jonathan Dovey. "Working Paper: The Arts and Humanities in the Internet of Things." Working paper, REACT Hub Bristol, 2015. <http://www.react-hub.org.uk/sites/default/files/publications/AH%20in%20IoT.pdf>.
- Shakespeare, Sandra, Malik Qanitah and Edem-Jordjie Edinam. "Whose Heritage? Deconstructing and reconstructing counter-narratives in heritage." In *Whose Heritage? Challenging Race and Identity in Stuart Hall's Post-nation Britain*, edited by Susan L.T. Ashley and Degna Stone, 95-110. New York: Routledge, 2023.
- Sheik, Knvul. "Journalists as Characters: Using First-Person Narration to Drive Stories." Accessed November 29, 2023. <https://www.theopennotebook.com/2019/04/30/journalists-as-characters-using-first-person-narration-to-drive-stories/>

- Shu-Pei, Tsai. "Augmented Reality Enhancing Place Satisfaction for Heritage Tourism Marketing." *Current Issues in Tourism* 23, no. 9 (2020): 1078–1083. <https://doi.org/10.1080/13683500.2019.1598950>.
- Smart, Philip Andi, Laura Phillips, David Ross, Pikakshi Manchanda and Cristina Mosconi. "A panoptic framework of visitor intelligence." In *The CAUTHE 2020. Vision: New Perspectives on the Diversity of Hospitality, Tourism and Events, Auckland, New Zealand, (February 2020)*, 301–304. Auckland: Auckland University of Technology, 2020. <https://search.informit.org/doi/10.3316/informit.9780473509231>.
- Smith, Koven. "The Future of Mobile Interpretation." In *Museums and the Web 2009. Proceedings*, edited by Jennifer Trant and David Bearman. Toronto: Archives & Museum Informatics, 2019. <http://www.archimuse.com/mw2009/papers/smith/smith.html>
- Smith, Laurajane. *Uses of Heritage*. 1<sup>st</sup> ed. London: Routledge, 2006.
- Smith, Laurajane. "Changing Views? Emotional Intelligence, Registers of Engagement and the Museum Visit." In *Museums as Sites of Historical Consciousness: Perspectives on museum theory and practice in Canada*, edited by Viviane Gosselin and Phaedra Livingstone, 101-121. Vancouver: UBC Press, 2016. <http://hdl.handle.net/1885/265122>.
- Smith, Laurajane. *Emotional Heritage: Visitor Engagement at Museums and Heritage Site*. London-New York: Routledge, 2021.
- Smith, Laurajane and Gary Campbell. "The elephant in the room: heritage, affect and emotion." In *A Companion to Heritage Studies*, edited by William Loga, Máiréad Nic Craith, and Ullrich Kockel, 443-460. London: Wiley-Blackwell, 2015. <https://doi.org/10.1002/9781118486634.ch30>.
- Smith, Laurajane, Paul Shackel and Gary Campbell. *Heritage, Labour and the Working Classes*. 1<sup>st</sup> ed. London: Routledge, 2011. <https://doi.org/10.4324/9780203813232>

- Smith, Laurajane and Emma Waterton. "The recognition and misrecognition of community heritage." *International Journal of Heritage Studies* 16, 1-2 (2010): 4-15. <https://doi.org/10.1080/13527250903441671>.
- Smith, Laurajane and Waterton Emma. "Constrained by commonsense: the authorized heritage discourse in contemporary debates." In *The Oxford Handbook of Public Archaeology*, edited by Robin Skeates, Carol McDavid and John Carman, 153-171. Oxford: Oxford University Press, 2012. <http://hdl.handle.net/1885/26708>.
- Smith, Laurajane, Michael Wetherell and Campbell Gary. *Emotion, Affective Practices, and the Past in the Present*. London: Routledge, 2018.
- "Snap4City." Accessed November 29, 2023. <https://www.snap4city.org/dashboardSmartCity/management/iframeApp.php?linkUrl=https://www.snap4city.org/drupal&linkId=snap4cityPortalLink&pageTitle=www.snap4city.org&fromSubmenu=false>.
- Sofaer Joanna, Ben Davenport, Marie Louise Srensen, Erini Gallou and David Uzzell. "Heritage sites, value and wellbeing: Learning from the COVID-19 pandemic in England." *International Journal of Heritage Studies* 27, no. 11 (2021): 1117–1132. <https://doi.org/10.1080/13527258.2021.1955729>.
- Spence, Jocelyn, Adrian Hazzard, Sean McGrath, Chris Greenhalgh and Steve Benford. "The Rough Mile: Testing a Framework of Immersive Practice." In *AM '17: Proceedings of the 2017 Conference on Augmented and Participatory Sound and Music Experiences*, Article 41, 1-8. New York: ACM, 2017. <https://doi.org/10.1145/3064663.3064756>.
- Staiff, Russel. *Re-imagining Heritage Interpretation. Enchanting the Past-Future*. London-New York: Routledge, 2016.
- Stephan, Paul. "Binaural recording technology: A historical review and possible future developments." *Acta Acustica united with Acustica* 95, no. 5 (2009): 767-788. <http://dx.doi.org/10.3813/AAA.918208>.

- Stroumpoulis, Asterios, Evangelia Kopanaki and Sotirios Varelas. "Role of Artificial Intelligence and Big Data Analytics in smart Tourism: a resource based view approach." *WIT Transactions on Ecology and the Environment* 256 (2022): 99-108. <http://doi.org/10.2495/ST220091>.
- Styliani, Sylaiou, Fotis Liarokapis, Kostas Kotsakis and Patias Petroset. "Virtual museums, a survey and some issues for consideration." *Journal of cultural Heritage* 10, no. 4 (2009): 520-528. <http://doi.org/10.1016/j.culher.2009.03.003>.
- The New Media Consortium. *NMC The Horizon Report: 2010 Museum Edition*. Austin, Texas: The New Media Consortium, 2010. Accessed November 29, 2023. <https://www.learntechlib.org/p/182019/>.
- Throsby, David and Hasan Bakhshi. *Culture of Innovation, An economic analysis of innovation in arts and cultural organizations*. London: NESTA Research Report, 2010. [https://media.nesta.org.uk/documents/culture\\_of\\_innovation.pdf](https://media.nesta.org.uk/documents/culture_of_innovation.pdf).
- Tilden, Freeman. *Interpreting our heritage: principles and practices for visitor services in parks, museums, and historic places*. Chapel Hill, NC: University of North Carolina Press, 1957.
- Tower Bridge. "Family Trail App." Accessed November 29, 2023, <https://www.towerbridge.org.uk/familytrailapp/>.
- Trunfio, Mariapina, Salvatore Campana and Adele Magnelli. "Measuring the impact of functional and experiential mixed reality elements on a museum visit." *Current Issues in Tourism*, 23, no. 16 (2020): 1990–2008. <https://doi.org/10.1080/13683500.2019.1703914>.
- Trunfio, Mariapina, Maria Della Lucia, Salvatore Campana and Adele Magnelli. "Innovating the cultural heritage museum service model through virtual reality and augmented reality: The effects on the overall visitor experience and satisfaction." *Journal of Heritage Tourism* 17, no. 7 (2021): 1-19. <https://doi.org/10.1080/1743873X.2020.1850742>.
- Tuck, Deborah and Iryna Kuksa. "Virtual Heritage Tours: Developing Interactive Narrative-Based Environments for Historical Sites." In *Interactive Storytelling*.

*ICIDS 2009. Lecture Notes in Computer Science*, edited by Ido Iurgel, Nelson Zagalo and Paolo Petta, vol. 5915, 336-339. Berlin, Heidelberg: Springer, 2009. [https://doi.org/10.1007/978-3-642-10643-9\\_43](https://doi.org/10.1007/978-3-642-10643-9_43).

Tussyadiah, Iis P. "Toward a theoretical foundation for experience design in tourism." *Journal of Travel Research* 53, no. 5 (2014): 543-564. <https://doi.org/10.1177/0047287513513172>.

Tyng, Chai, Hafeez Amin, Mohamad Saad and Amiir Malik. 'The Influences of Emotion on Learning and Memory.' *Frontiers in Psychology* 8 (2017): 1454. <https://doi.org/10.3389/fpsyg.2017.01454>.

UNESCO. *Voices of the City. Lab 2030*. UNESCO, 2019. Accessed November 29, 2023. [https://en.unesco.org/creativecities/sites/default/files/16\\_pages\\_villes\\_creatives\\_uk\\_bd.pdf](https://en.unesco.org/creativecities/sites/default/files/16_pages_villes_creatives_uk_bd.pdf).

UNESCO. *Charter on the preservation of the digital heritage, 32nd session: The general conference of the United Nations Educational, Scientific and Cultural Organization, UNESCO, Paris*. 2009. Accessed November 29, 2023. <https://unesdoc.unesco.org/ark:/48223/pf0000179529>.

UNESCO. *Charter on the preservation of the digital heritage*. 2003. Accessed November 29, 2023, <https://en.unesco.org/about-us/legal-affairs/charter-preservation-digital-heritage>.

UWE. "Ghosts in the Garden: REACT Heritage Sandbox." Accessed November 29, 2023, <https://www.uwe.ac.uk/research/centres-and-groups/regional-history/projects/ghosts-in-the-garden>.

Uzzell, David. "The Hot Interpretation of War and Conflict." in *Heritage Interpretation: Volume I: The Natural and Built Environment*, ed. David Uzzell, 34-48. London: Belhaven Press, 1989.

Uzzell, David and Roy Ballantyne. "Heritage that Hurts: Interpretation In A Post-Modern World." In *Contemporary Issues in Heritage and Environmental Interpretation: Problems and Prospects*, ed. David Uzzell and Roy Ballantyne, 152-171. London: The Stationery Office, 1998.

- van Es, Karin, Mirko Tobias Schäfer and Maranke Wieringa. "Tool Criticism and the Computational Turn. A 'Methodological Moment'." *Media and Communication Studies* 69 , no. 1 (2021): 46-64. <http://dx.doi.org/10.5771/1615-634X-2021-1-46>.
- Varutti, Marzia. 'Affective Encounters in Museums.' in *Heritage Ecologies*, edited by Phóra Pétursdóttir and Torgei Rinke Bangstad, 129-144. London: Routledge, 2021.
- Varutti, Marzia. "The 'emotional turn' in museum practice." *ICOM Voices* (blog). September 14, 2022. <https://icom.museum/en/news/the-emotional-turn-in-museum-practice/>.
- Ventura, Sara and Alison Jane Martingano. "Roundtable: Raising Empathy through Virtual Reality." In *Empathy. Advanced Research and Applications*, edited by Sara Ventura, 1-13. London: Intechopen, 2023. <http://doi.org/10.5772/intechopen.109835>.
- Vergo, Peter. *The New Museology*. Chicago: The University of Chicago Press, 1989.
- Verrest, Hebe and Karin Pfeffer. "Elaborating the Urbanism in Smart Urbanism: Distilling Relevant Dimensions for a Comprehensive Analysis of Smart City Approaches." *Information, Communication & Society* 22, no. 9 (2019): 1328–1342. <https://doi.org/10.1080/1369118X.2018.1424921>.
- Vindrola-Padros Cecilia, Laura Eyre, Helen Baxter *et al.* "Addressing the challenges of knowledge co-production in quality improvement: learning from the implementation of the researcher-in-residence model BMJ." *Quality & Safety* 28, no. 1 (2019): 67-73. <http://doi.org/10.1017/S1463423614000310>.
- VISTA Project. "VISTA AR Interactive Workbook." Accessed November 29, 2023. <https://www.VISTA-ar.com/en/>.
- Vithani, Tejas and Kumar Anand. "Modeling the Mobile Application Development Lifecycle." In *Proceedings of the International MultiConference of Engineers and Computer Scientists, March 12-14 2014, Hong Kong*, edited by Sang I. Ao, Oscar Castillo, Craig Douglas, David Dagan Feng and Jeong-A Lee, 596-600. Hong Kong: Newswood Limited, 2014. [https://www.iaeng.org/publication/IMECS2014/IMECS2014\\_pp596-600.pdf](https://www.iaeng.org/publication/IMECS2014/IMECS2014_pp596-600.pdf).



- Vogt, Thurid, Elisabeth Andre, Johannes Wagner, Marc Cavazza and Stephen William Gilroy. "Real-time vocal emotion recognition in art installations and interactive storytelling: Experiences and lessons learned from CALLAS and IRIS." In *Proceedings of the 2009 3rd International Conference on Affective Computing and Intelligent Interaction and Workshops, Amsterdam, The Netherlands, 10–12 September 2009*. Washington, DC: IEEE Computer Society, 2009. <http://dx.doi.org/10.1109/ACII.2009.5349501>.
- Von Schwerin, Jennifer, Heather Richards-Rissetto, Fabio Remondino, Giorgio Agugiaro and Gabrio Girardi. "The MayaArch3D project: A 3D WebGIS for analyzing ancient architecture and landscapes." *Literary and Linguistic Computing* 28, no. 4 (December 2013): 736 - 753. <https://doi.org/10.1093/lilc/fqt059>.
- Waite, Gordon. "Consuming Heritage: Perceived Historical Authenticity." *Annals of Tourism Research* 27, no. 4 (2000): 835-862. [https://doi.org/10.1016/S0160-7383\(99\)00115-2](https://doi.org/10.1016/S0160-7383(99)00115-2).
- Wang Xinyuan, Rosa Lasaponara, Lei Luo, Fulong Chen, Hong Wan, Ruixia Yang and Jing Zhen. "Digital Heritage." In *Manual of Digital Earth*, edited by Huadong Guo, Michael F. Goodchild and Alessandro Annoni, 565–591. Singapore: Springer, 2020. [https://doi.org/10.1007/978-981-32-9915-3\\_17](https://doi.org/10.1007/978-981-32-9915-3_17).
- Waterton, Emma and Steve Watson. "Methods in motion: Affecting heritage research." In *Affective methodologies: Developing cultural research strategies for the study of affect*, ed. Britta Tim Knudsen and Carsten Stage, 97-118. Basingstoke: Palgrave Macmillan UK, 2015. [https://doi.org/10.1057/9781137483195\\_5](https://doi.org/10.1057/9781137483195_5).
- Wetherell, Margaret. *Affect and Emotion: A New Social Science Understanding*. London: Sage, 2012.
- Wieser, Leonie. "Historical methods implicated in the making of 'The Heritage'." In *Whose Heritage? Challenging Race and Identity in Stuart Hall's Post-nation Britain*, edited by Susan L.T. Ashley and Degna Stone, 82-94. New York: Routledge, 2023.

- Wilken, Rowan. "Locative media: From specialized preoccupation to mainstream fascination." *Convergence: The International Journal of Research into New Media Technologies* 18, no. 3 (2012): 243-247. doi: 10.1177/1354856512444375
- Wincott, Abigail, Ravenscroft, Neil, and Gilchrist, Paul. "Roses and castles: competing visions of canal heritage and the making of place." *International Journal of Heritage Studies* 26, no. 8 (2020): 737-752. <http://doi.org/10.1080/13527258.2019.1693412>.
- Witcomb, Andrea. "Toward a Pedagogy of Feeling." In *International Handbook of Museum Studies*, ed. Helen Rees, Kylie Message, Andrea Witcomb, Sharon Macdonald, 321-344. Chichester, West Sussex: John Wiley & Sons Ltd, 2015.
- Yang, Li, Jason Hong and James Landay,. "Design Challenges and Principles for Wizard of Oz Testing of Location-Enhanced Applications." *IEEE Pervasive Computing* 6, no. 2 (April-June 2007): 70-75. <http://doi.org/10.1109/MPRV.2007.28>.
- Xifei, Lu. "Clouds of Sidra. Empathy and Immersion in VR Storytelling." Accessed November 29, 2023. <https://medium.com/@irenenu728/clouds-over-sidra-empathy-and-immersion-in-vr-storytelling-fc2c107147fe>.
- Zhang, Weidi, Donghao Ren and George Legrady. "Cangjie's Poetry: An Interactive Art Experience of a Semantic Human-Machine Reality." *Proc. ACM Comput. Graph. Interact. Tech.* 4, no. 2 (July 2021): Article 19. <https://doi.org/10.1145/3465619>.
- Zhu, Hengshu, Huanhuan Cao, Enhong Chen, Hui Xiong and Jilei Tian. "Mobile App Classification with Enriched Contextual Information." *IEEE Transactions on Mobile Computing* 13, 7 (2014): 1550-1563. <http://dx.doi.org/10.1109/TMC.2013.113>.

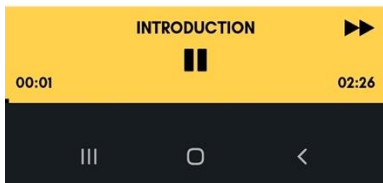
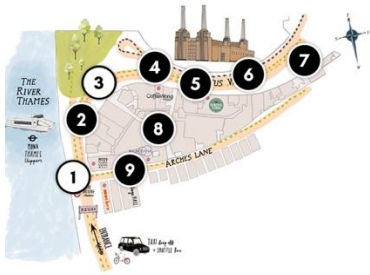


Figure 2.1 Battersea Power Station Trail and the SWCP Climate Trail custom made maps (Source: author's own image).

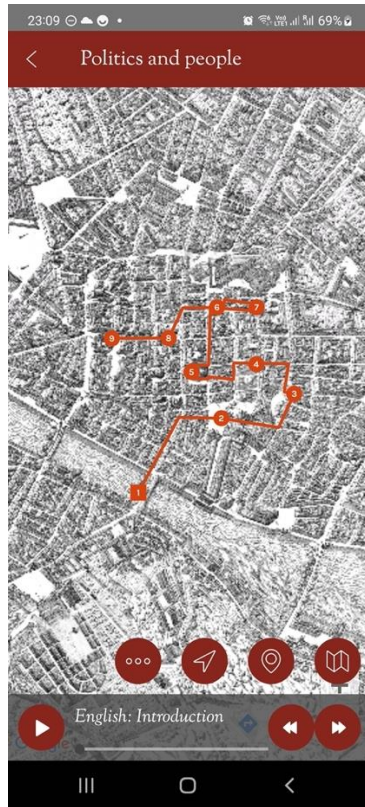


Figure 2.2 *Hidden Florence* map POI icon's change (Source: author's own image).

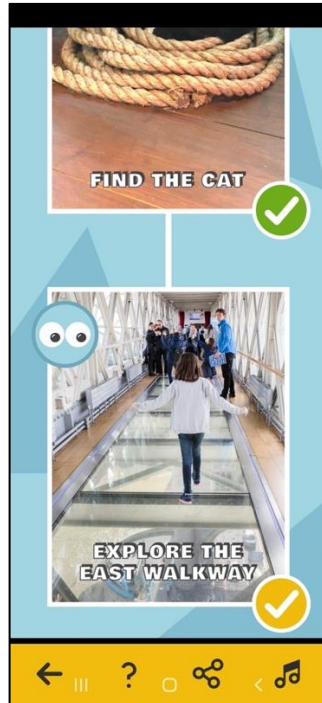


Figure 2.3 *Family Learning Trail* tick icon colour's change (Source: author's own image).



Figure 2.4 *Climate Trail app* closing the superimposed written layer (Source: author's own image).

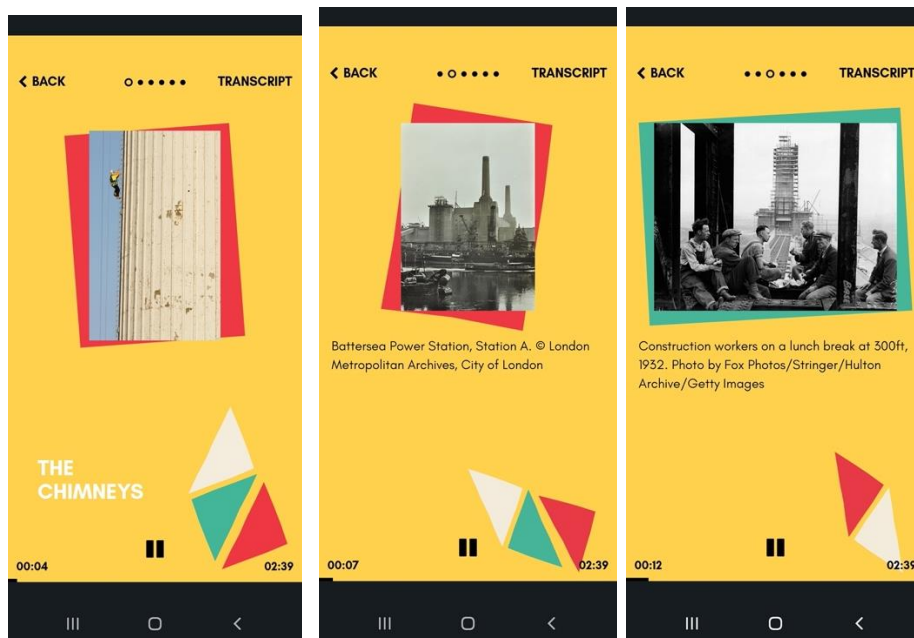


Figure 2.5 *Battersea Power Station* gallery of pictures (Source: author's own image).

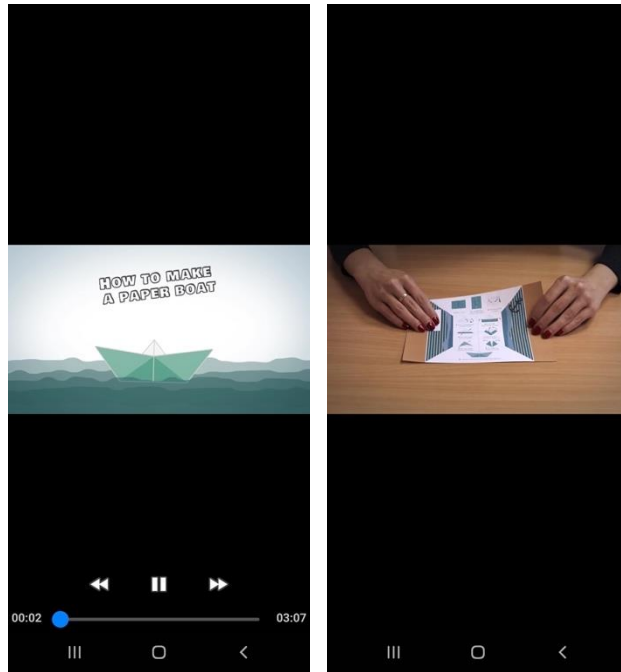


Figure 2.6 *Family Learning Trail* instructions for the paper game 'Origami Boat'; (Source: author's own image).



Figure 2.7 *Battersea Power Station* app and the *Climate Trail* features AR (Source: author's own image).



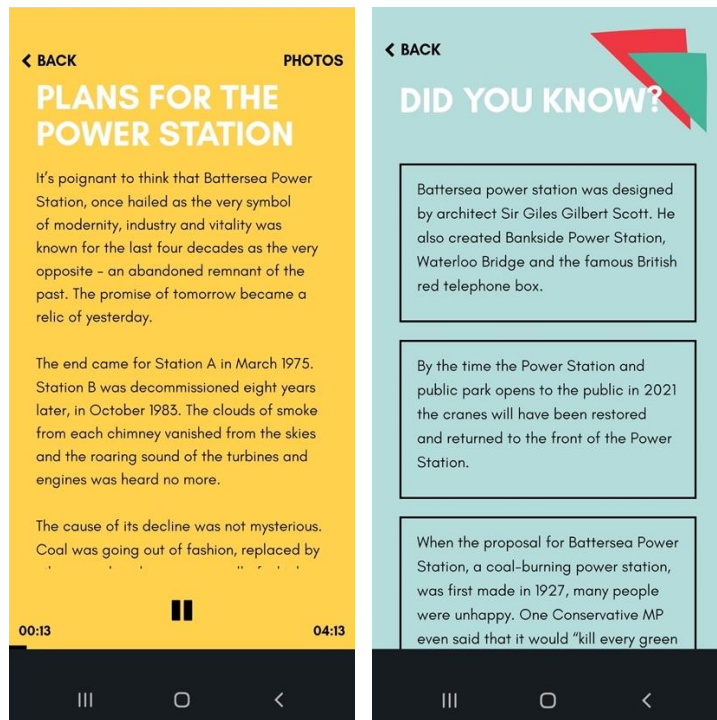


Figure 2.8 *Battersea Power Station* descriptive/educational style (Source: author's own image).

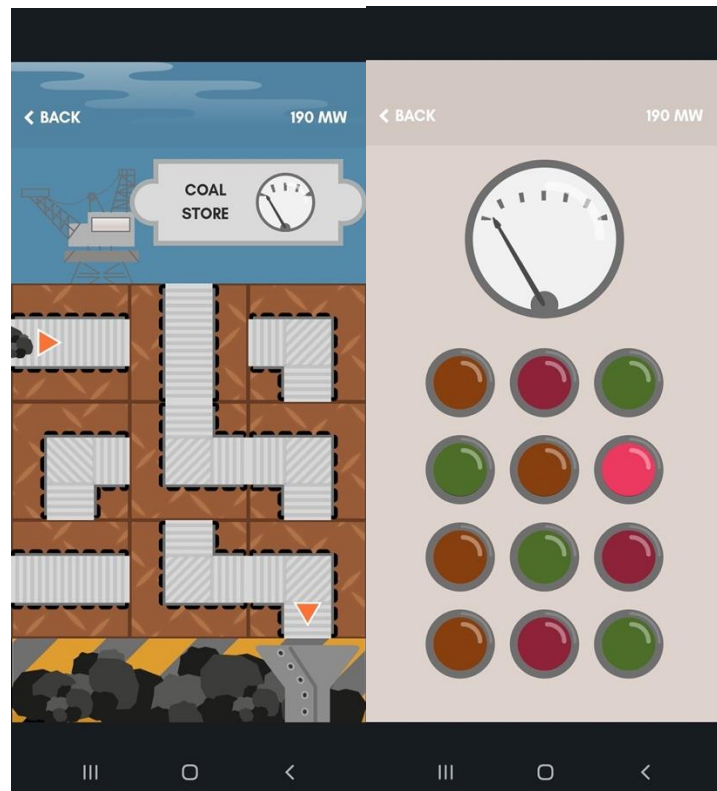


Figure 2.9 *Battersea Power Station* games (Source: author's own image).

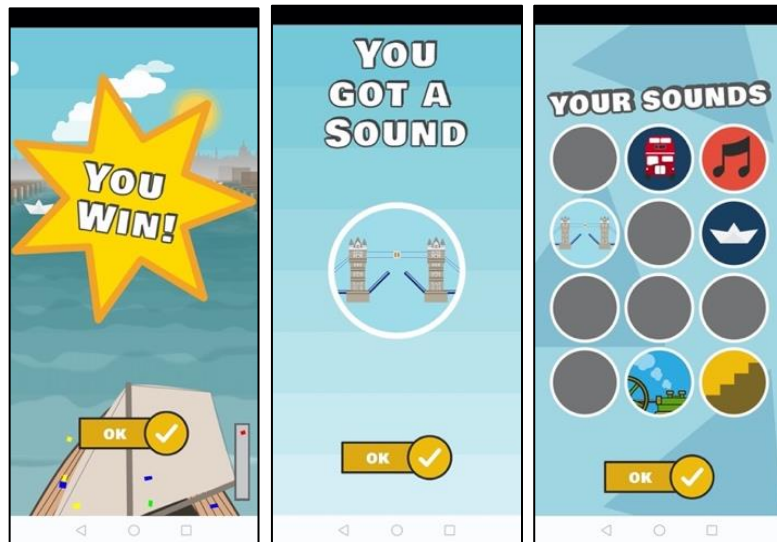


Figure 2.10 *Family Learning Trail* sound collection (Source: author's own image).

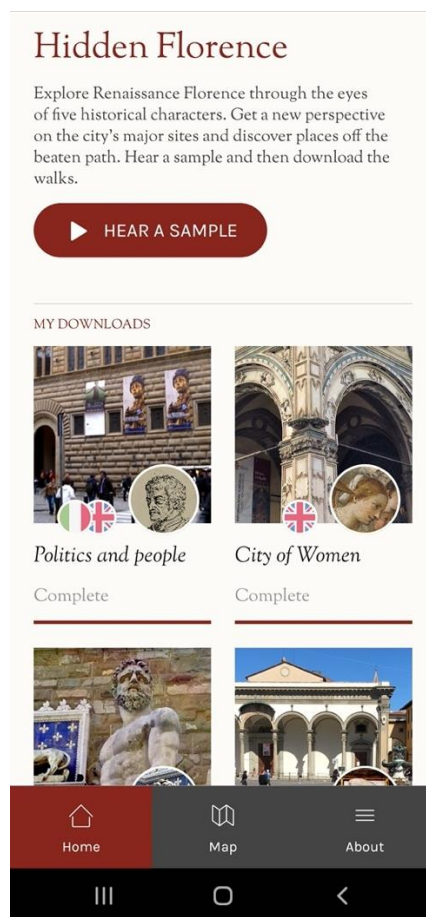


Figure 2.11 *Hidden Florence* example of trails (Source: author's own image).



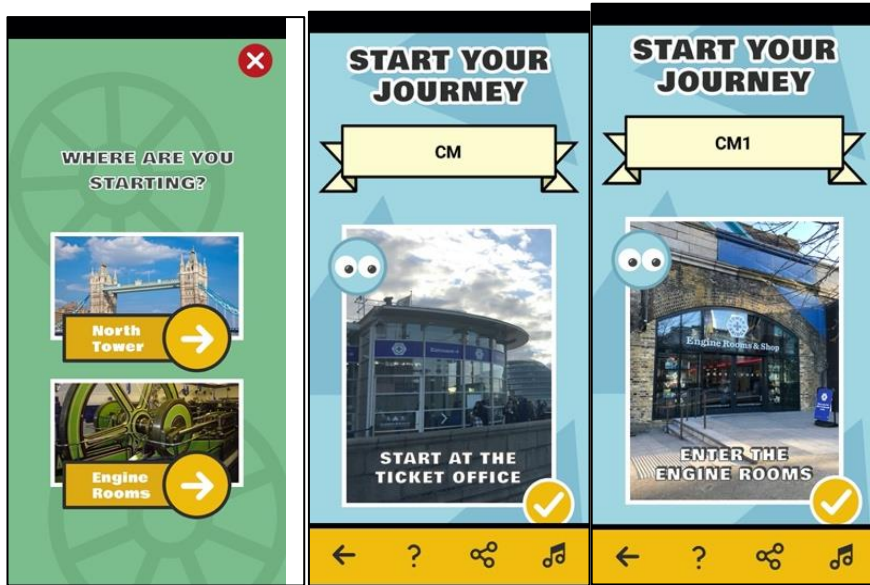


Figure 2.12 *Family Learning Trail* customised start of the tour (Source: author's own image).

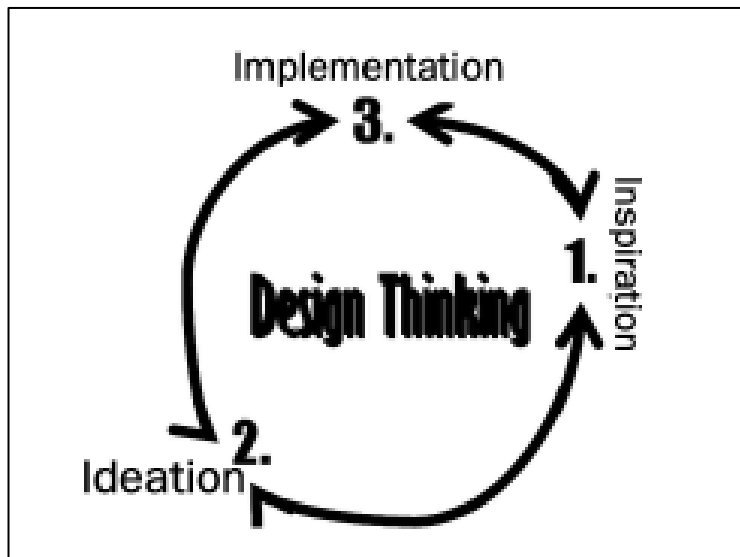


Figure 3.1. Schematic Design Thinking Model (Source: Design Thinking website).

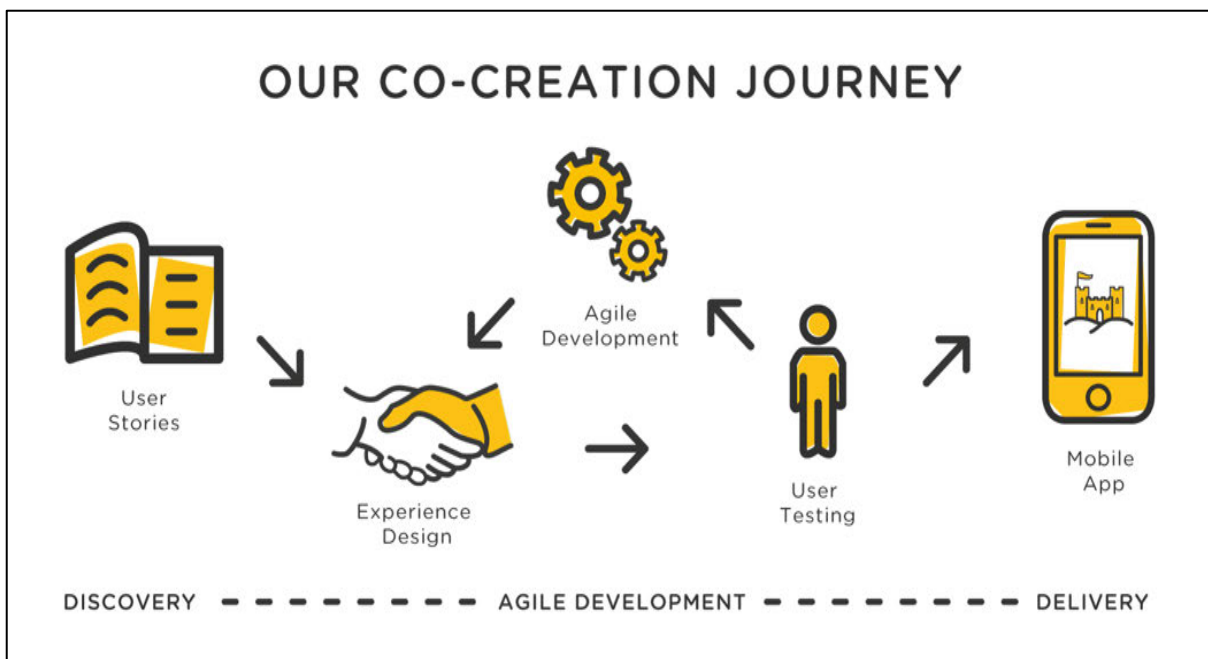


Figure 3.2. Calvium's 'Co-creation Journey' illustration. (Source: Calvium website)

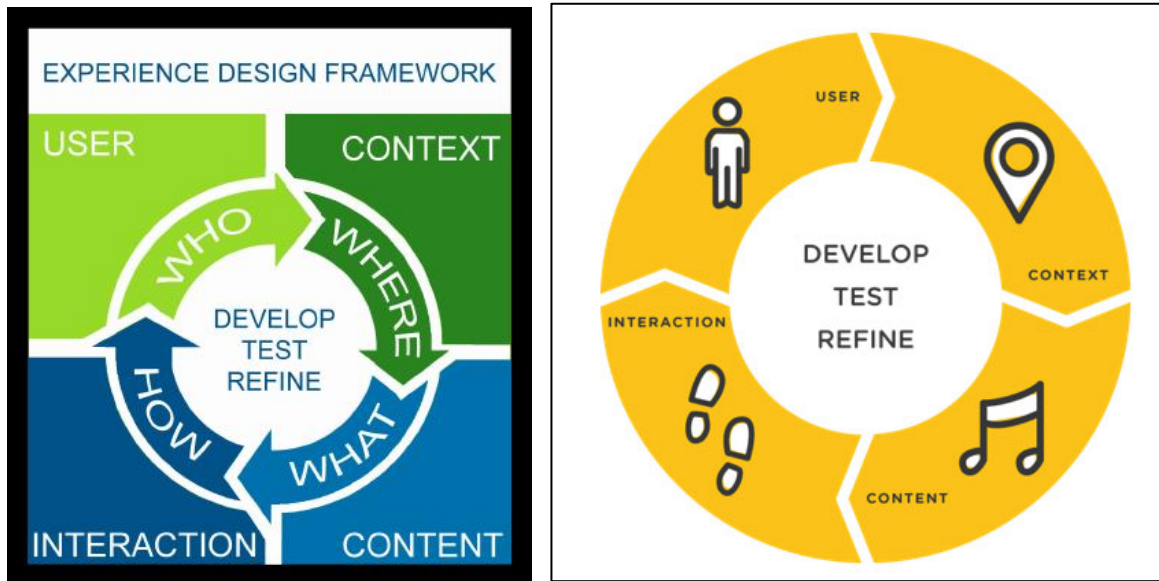


Figure 3.3. Calvium ‘Experience Design Framework’ (on the left, the original version, on the right the 2015 version)(Source: Calvium website).

<input type="checkbox"/>	<b>ACTIVITY</b>	WHAT YOUR BODY DOES, E.G. ‘YOU WALK AROUND THERE’
<input type="checkbox"/>	<b>PLACE</b>	WHERE DOES IT HAPPEN, E.G. ‘IN QUEEN SQUARE’
<input type="checkbox"/>	<b>EQUIPMENT</b>	THE VISIBLE EQUIPMENT, E.G. HEADPHONES, BACKPACK AND ‘THE SMALL SCREEN THAT YOU HOLD’
<input type="checkbox"/>	<b>CONTENT</b>	WHAT IS IT ABOUT? E.G. ‘PERSONAL STORIES’
<input type="checkbox"/>	<b>MEDIA MODE</b>	FOR EXAMPLE SOUND, STILL IMAGES, VIDEO, ETC.
<input type="checkbox"/>	<b>GENRE</b>	FOR EXAMPLE: HISTORY, DRAMA, DOCUMENTARY, ‘THE REAL SOUNDS THAT HAPPENED IN THAT PLACE’
<input type="checkbox"/>	<b>AFFECT</b>	HOW DOES IT MAKE YOU FEEL? ‘SPECIAL MAGIC MOMENTS’, ‘A BIT SPOOKY/SCARY’, ‘LIKE EAVESDROPPING’
<input type="checkbox"/>	<b>SOCIALITY</b>	IS IT SOMETHING YOU DO ON YOUR OWN OR WITH OTHER PEOPLE?
<input type="checkbox"/>	<b>SKILLS</b>	DO YOU NEED ANY SPECIAL ABILITIES TO DO IT? ‘IT’S SIMPLE TO USE, EASY TO LEARN HOW TO MAKE IT WORK’
<input type="checkbox"/>	<b>TIME</b>	FIXED DURATION OR OPEN-ENDED?

Figure 3.4 The Pervasive Media Cookbook checklist (Source: Jon, Dovey and Constance, Fleuriot. “The Pervasive Media Cookbook”, Bristol: DCRC Press, UWE Bristol, 2014, 80).

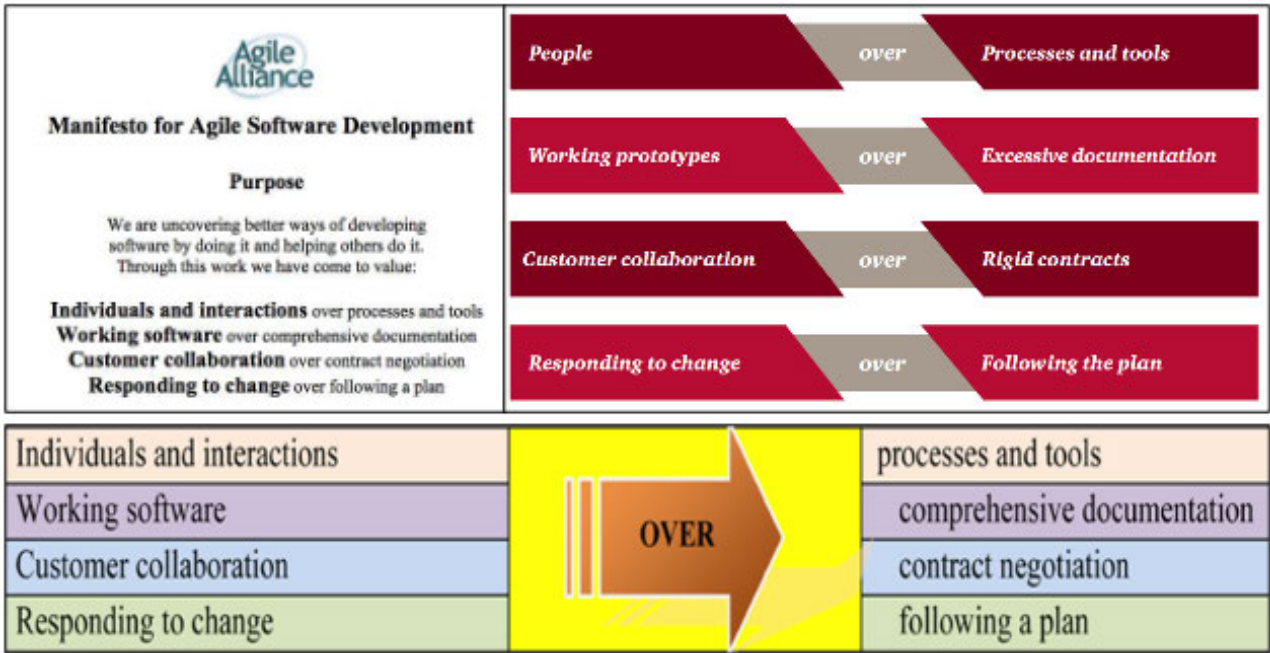


Figure 3.5 The *Agile Manifesto* ‘four values’ and its derived visual representations (Source: author’s own elaboration).

	Name	Description	Inputs from you	Outputs
<b>WP1</b>	Discovery	Work with you to finalize your requirements	Your time, your ideas,	Requirements document
<b>WP2</b>	Prototyping Proposal	Which of the tasks we will prototype and how	Agree proposal	Wireframe designs and behaviour specification document
<b>WP3</b>	Prototype development	Create the prototypes (paper, digital and human)	Media assets, critique and direction	User testable prototypes
<b>WP4</b>	User testing plan	Define the process and measures for the user testing	Direction, requirements	Plan and capture materials
<b>WP5</b>	Paper trail	Design and produce the paper equivalents for the digital experiences	Direction, sign off	Paper trail
<b>WP6</b>	User trial	Test the prototypes with target families over a two week period	Staff briefing, access to families and operational support (test devices)	Feedback data
<b>WP7</b>	User trial	Analyse the feedback	Disseminate to key	Trial report

	feedback report	data and report back	stakeholders.	
<b>WP8</b>	Planning workshop	Jointly decide how to incorporate feedback in final experience	Your time	Outline specification of the final experience
<b>WP9</b>	Specification	Functional specification for final experience	Details on other parts of the solution (e.g. integrating other apps, signage)	Specification document
<b>WP10</b>	Graphic design	Graphic design for app and paper trail	Brand guidelines and assets	Design mock ups
<b>WP11</b>	App development	Build the mobile app	Licenses or access to any required services (eg image recognition)	Mobile app for testing
<b>WP12</b>	Text copy	Write text for tasks and overall experience narrative	Curatorial knowledge, direction	Experience text document
<b>WP13</b>	Graphics production	Media element production (image, sound, layouts)	Sign off	Colour palette and fonts defined, graphical elements
<b>WP14</b>	Paper trail production	Create printable proofs for a paper trail	Sign off	Print ready design
<b>WP15</b>	Tests with target users	Usability testing	Staff briefing, access to families and operational support	Documented issues or positives
<b>WP16</b>	Solicit feedback and tests with staff	Usability / operational testing	Staff briefing /test devices	Documented issues or positives
<b>WP17</b>	App final amends and QA testing	Ensure the app works as intended		Confidence that the app works as planned
<b>WP18</b>	iOS Submission	Prepare app store details	Access to Apple account or correct certificates	App submitted for approval
<b>WP19</b>	Android submission	Prepare app store details	Access to Google Play account or correct certificates	App published

Figure 3.6 List of the work packages (Source: 'Consultancy, Design and Production of a Digital Family Learning Trail for Tower Bridge').

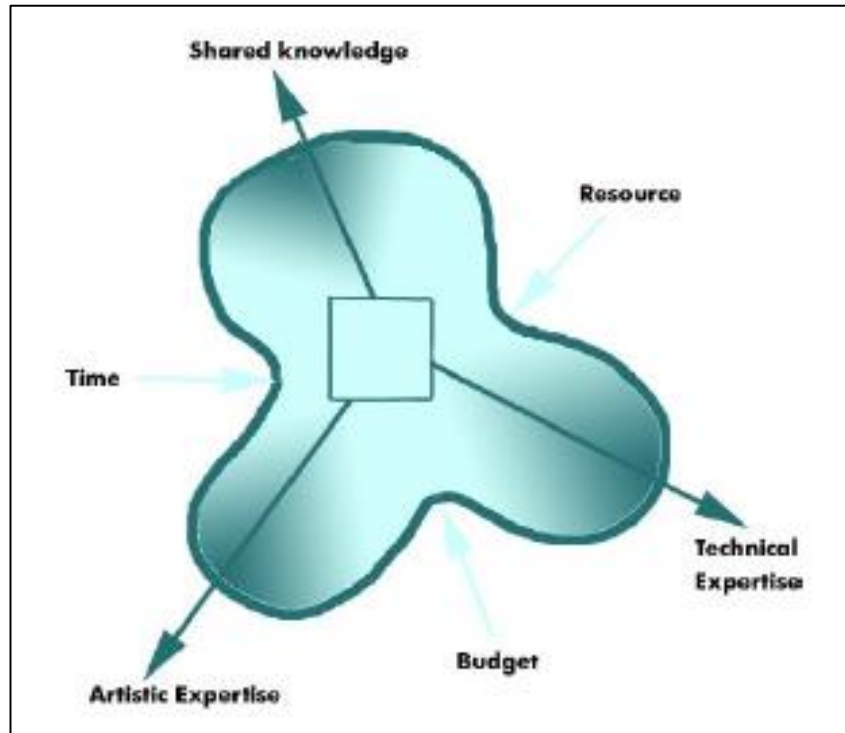


Figure 3.7 The Forces of Creative Tension as proposed by Calvium (Source: Calvium Experience Design Framework).



Figure 3.8 Screenshots of the two starting points (Source: author's own image).





Figure 3.9. Screenshots of the visual navigation system (Source: author's own image).

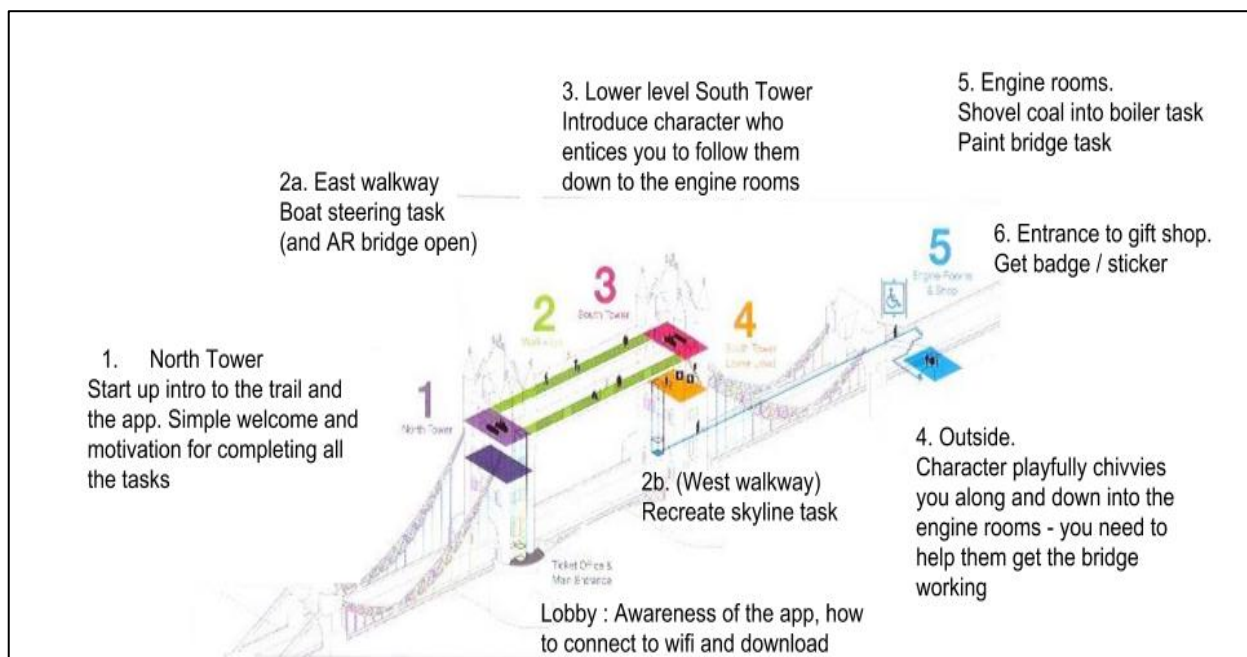


Figure 3.10. Calvium mock-up of the proposed user journey for the FLT (Source: : 'Consultancy, Design and Production of a Digital Family Learning Trail for Tower Bridge').



Figure 3.11 Screenshots of the digital games (Source: author's own image).

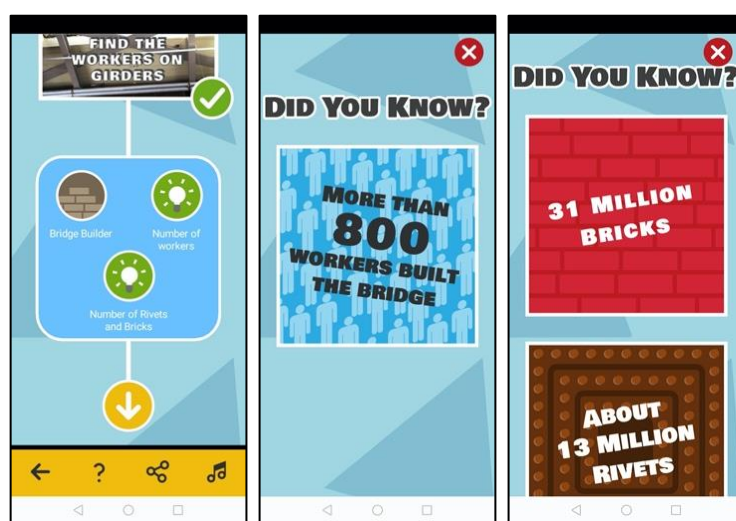


Figure 3.12 Screenshots of the curiosity facts (Source: author's own image).



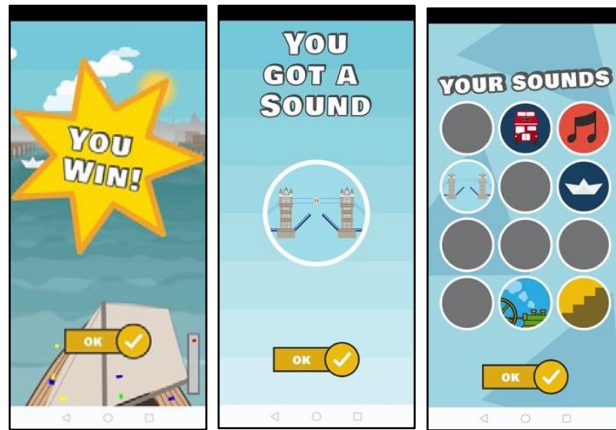


Figure 3.13 Screenshots of the reward page and sound collection (Source: author's own image).

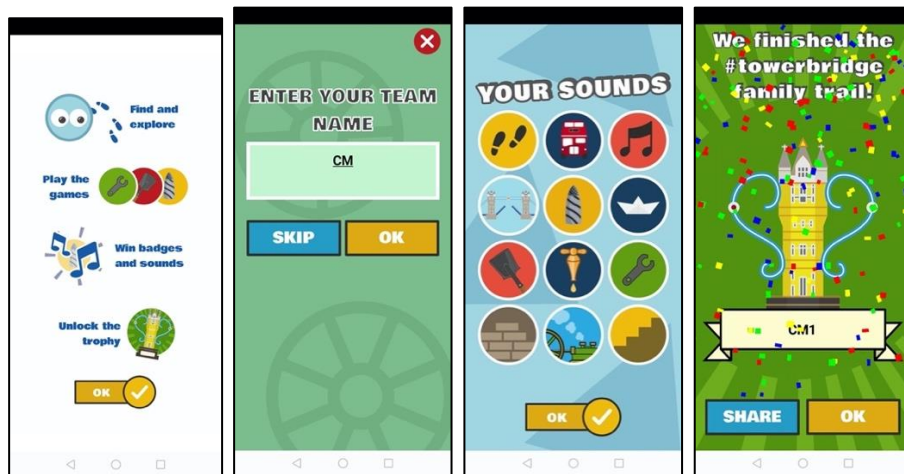


Figure 3.14 Screenshots of the play sequence of the treasure-hunt game (Source: author's own image).

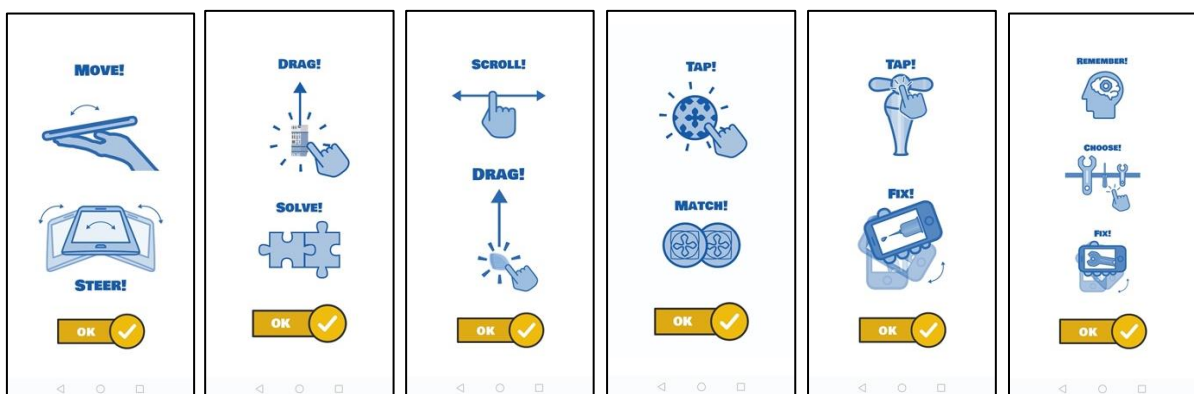


Figure 3.15 Screenshots of the different types of haptic functionalities (Source: author's own image).

<b>Dimension</b>	<b>From</b>	<b>To</b>	<b>Explanation</b>
<b>Immersion</b>	Information	Evocation	Does the experience inform or evoke emotions?
<b>User control</b>	None	Full	Does the user control navigation through the experience?
	Clear rules	Unclear rules	Does the user control navigation through the experience?
<b>Space/place mapping</b>	Arbitrary	Meaningful	Is content related to the user's physical surroundings or disconnected from it?
<b>Space</b>	Linearity	Non linearity	Can the user explore the experience or only move along a predefined path?
<b>Time</b>	Fixed running	Open running	Does the experience have an internal timeline?
	Specific	Unspecific	Is the experience bound to a certain time (time of day, season, time of year)?
	Permanent	One-off	How long will the experience (installation) be available to visitors?
<b>Depth of data</b>	One level	Several levels	Are there several layers of data, i.e. like "worlds" in games or is everything accessible at once?
<b>Social</b>	Private	Public	Is the experience personal or is it open to be seen by a wider audience?
	Solitary	Collaborative	Do users see the same or separate media, can they interact in relation to the same media?
<b>Producer expertise</b>	Professional	Amateur	Does content appear "produced" or does it look authentic as if created by "real people"?
<b>Relation to environment</b>	Augmentation	New experience	Is the experience bound to the location or new and separate?

Table 3.1 Table of the series of dimensions identified in the Experience Design Framework for Digital Economy (Source: Calvium website).

<b>Production Timeline (October 2015 – June 2016)</b>						
OCTOBER 2015		NOVEMBER 2015- MAY 2016				JUNE 2016
'Discovery'		'Agile Development'				'Delivery'
WP 1		WP 2-5				WP 8-19
(Tender)	<b>Kick-Off Meeting</b>	<b>Experience Design, Agile Development &amp; User Testing</b>				<b>Distribution &amp; Maintenance</b>
(Aug-Sep 2015)	Oct-Nov 2015	<b>Experience Design &amp; Agile Development*</b>	<b>User Testing</b>			Jun 2016-present
			<b>Staff Testing*</b>	<b>User Testing*</b>	<b>Usability &amp; Functionality Testing</b>	
(On site)	On site	Nov 2015-May 2016	Nov 2015	Dec 2015 & Mar 2016	Jan-May 2016	Off site
		<i>Off site</i>	<i>On site</i>	<i>On site</i>	<i>Off &amp; On site</i>	

\* This production phases include both the mobile application and the companion booklet

Table 3.3: Production timeline of the FLT (Source: author's own elaboration).

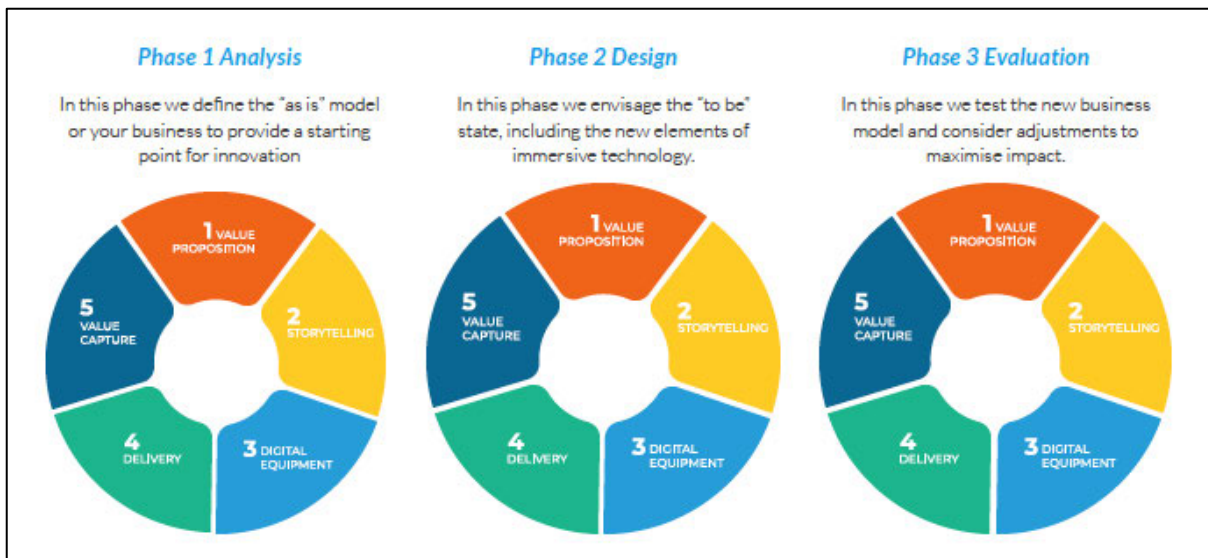


Figure 4.1 The Business Model pipeline for digital innovation (Source: 'Vista AR Interactive Workbook', 3).

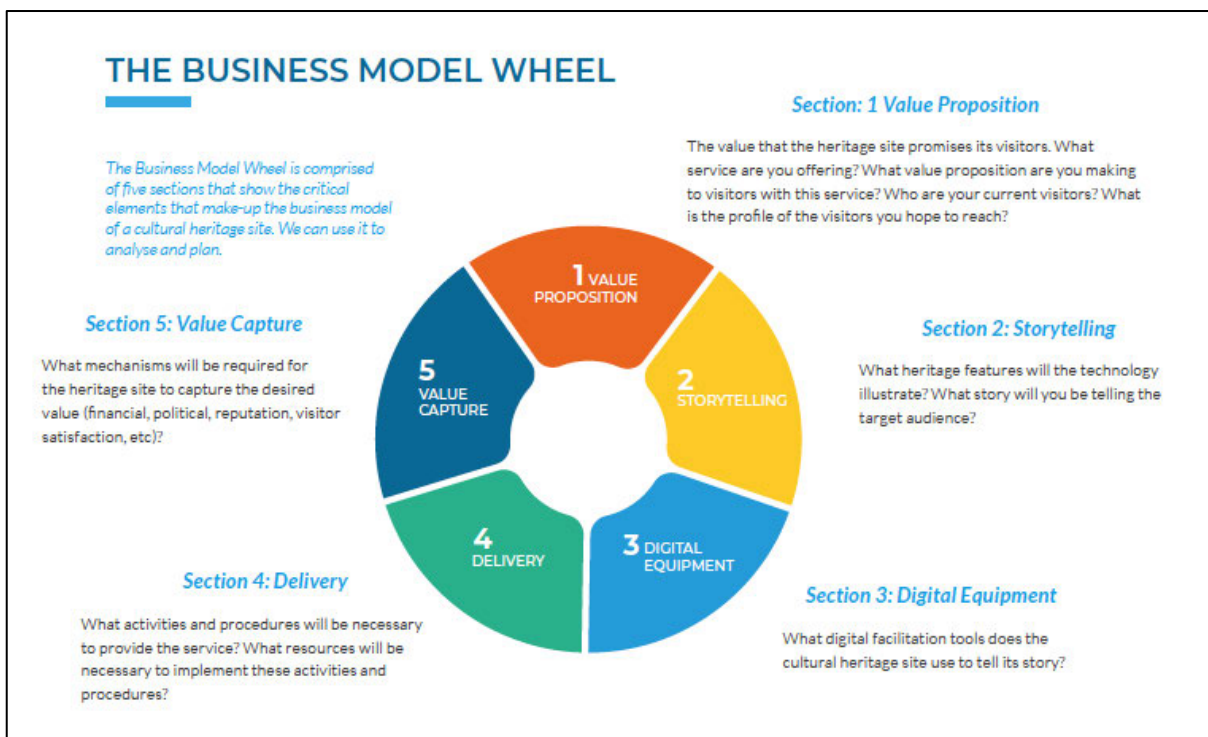


Figure 4.2 The Business Model Wheel (Source: 'Vista AR Interactive Workbook', 8).

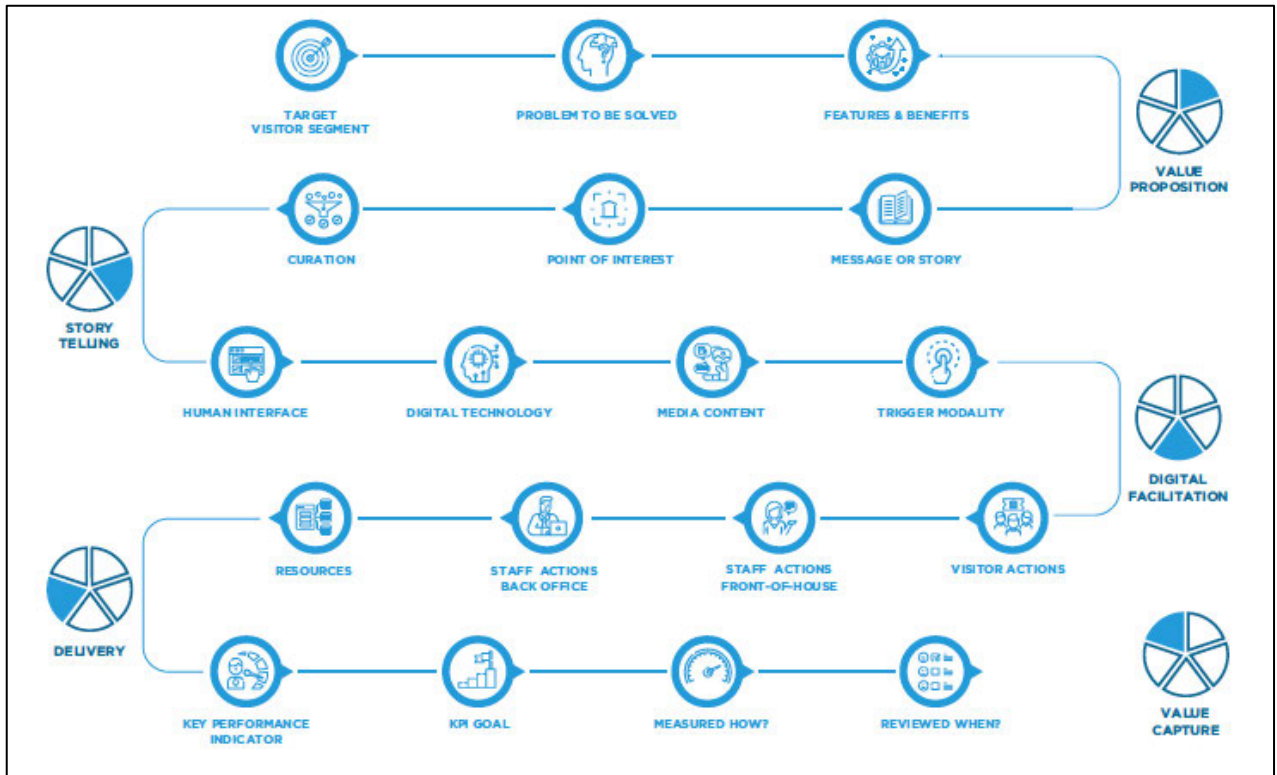


Figure 4.3. Pipeline of the deployment of the BMI wheel (Source: 'Vista AR Interactive Workbook', 13)

BM dimension	Key questions
Value Proposition	<ul style="list-style-type: none"> <li>• What service does the CH site offer?</li> <li>• What is the value proposition of new digital experiences?</li> <li>• Who are the current visitors?</li> <li>• What is the profile of the target audience of the digital experience?</li> </ul>
Storytelling	<ul style="list-style-type: none"> <li>• What is the significance and message of the site's content?</li> <li>• What heritage features will the technology illustrate?</li> <li>• What story will be told, and how, to the target audience?</li> </ul>
Mediation tools	<ul style="list-style-type: none"> <li>• What mediation tools does the heritage site use to tell its story?</li> <li>• What technologies are best suited to tell the story and deliver the value proposition?</li> <li>• Do the digital tools integrate the current visitor journey or is an entirely new journey required?</li> </ul>
Delivery	<ul style="list-style-type: none"> <li>• How does the heritage site operate to provide the services offered to visitors?</li> <li>• What activities and procedures will be necessary to provide the new digital service?</li> <li>• What resources will be necessary to implement these activities?</li> </ul>
Value Capture	<ul style="list-style-type: none"> <li>• What mechanisms will be required for the heritage site to capture the desired value from the new digital experiences (financial, political, reputation, visitor satisfaction, etc.)?</li> <li>• What are the options to monetise AR/VR experiences?</li> </ul>

Figure 4.4 . List of the key questions in the BMI (Source: Gatelier, et.al., "A business model innovation methodology", Table 3).



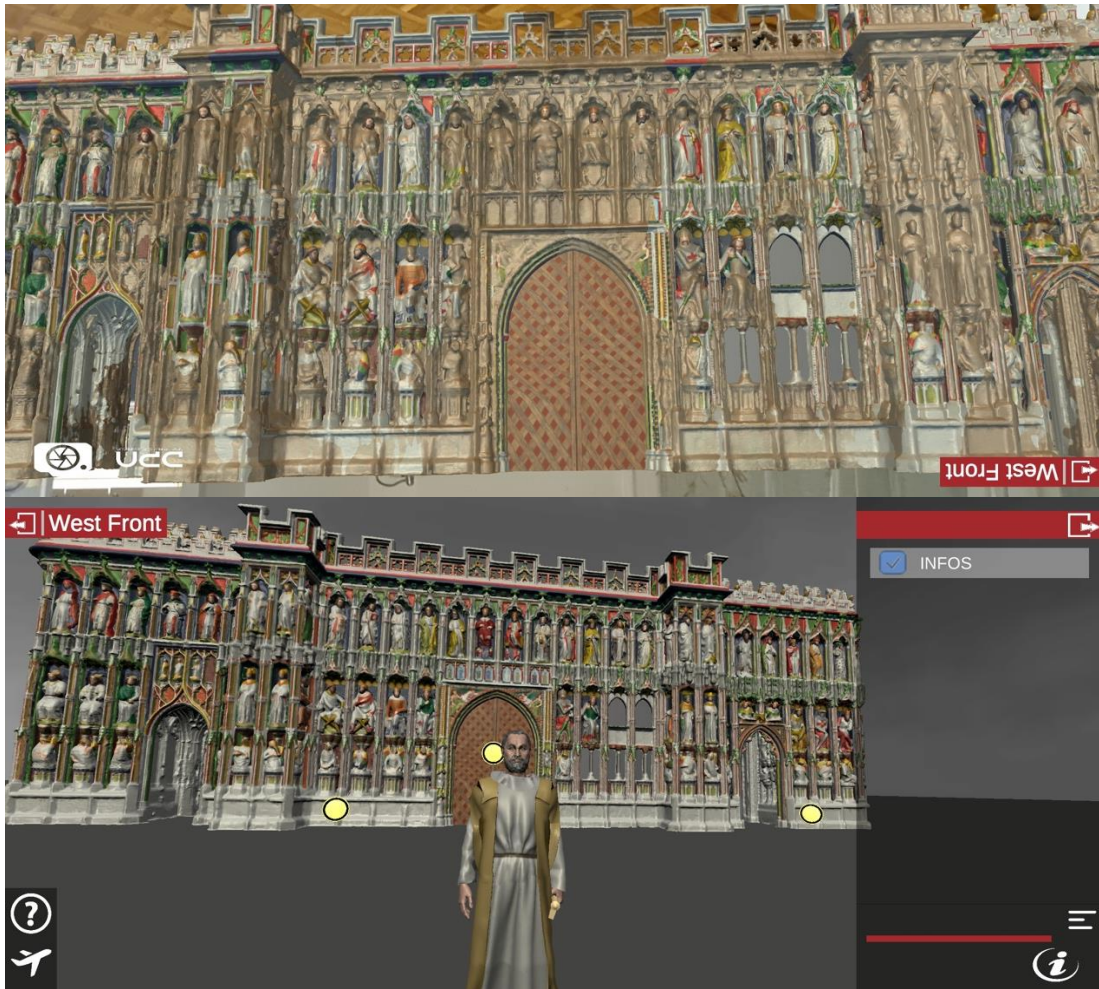


Figure 4.5 Screenshots of the West Front AR app (Source: author's own image).



Figure 4.6 Screenshots of the Minstrels' Gallery AR app Source: author's own image).

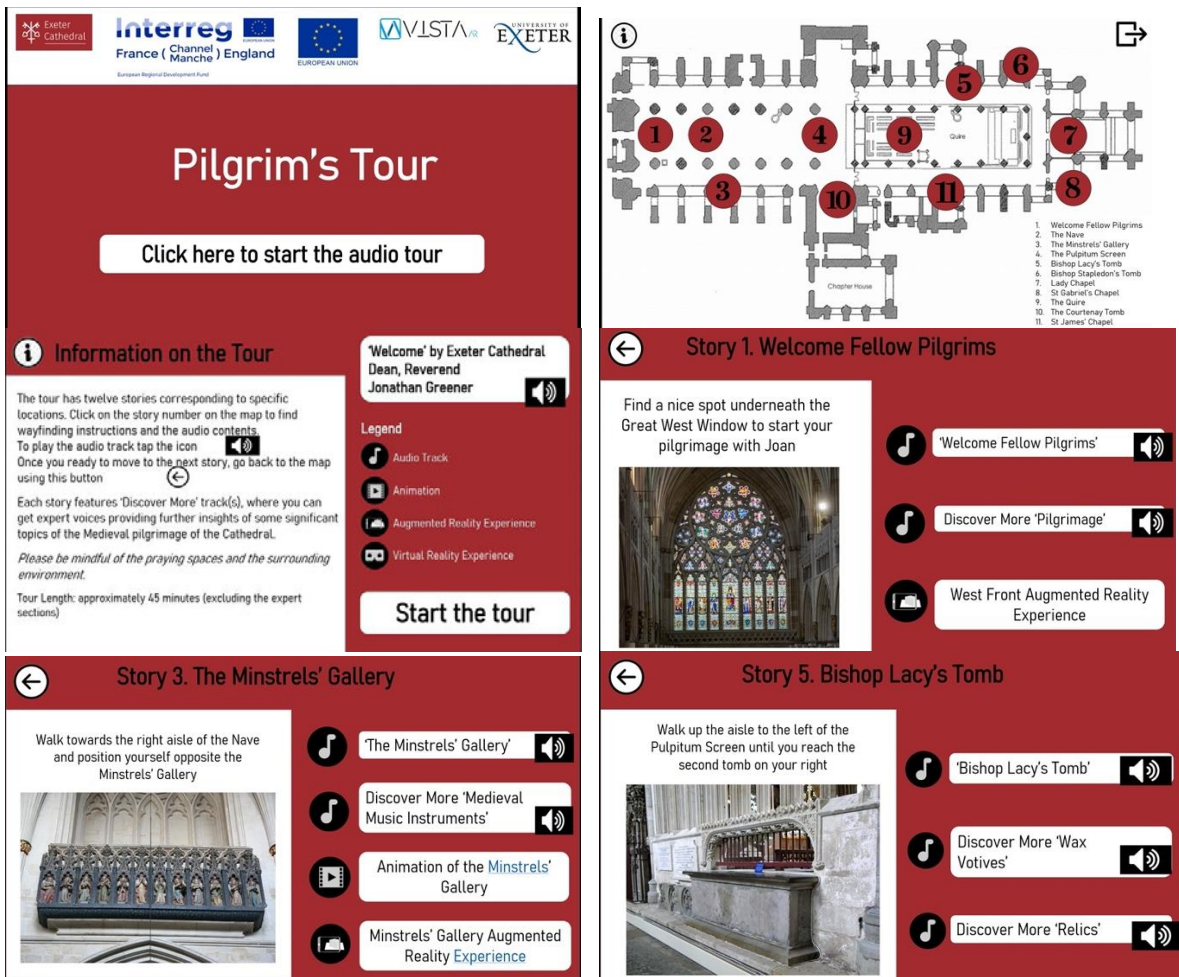


Figure 4.7. Screenshots of the 'Pilgrim's Tour' (source: author's own image).



Figure 4.8 Screenshots of the 'Mining at the Edge of the World' AR app (source: author's own image).



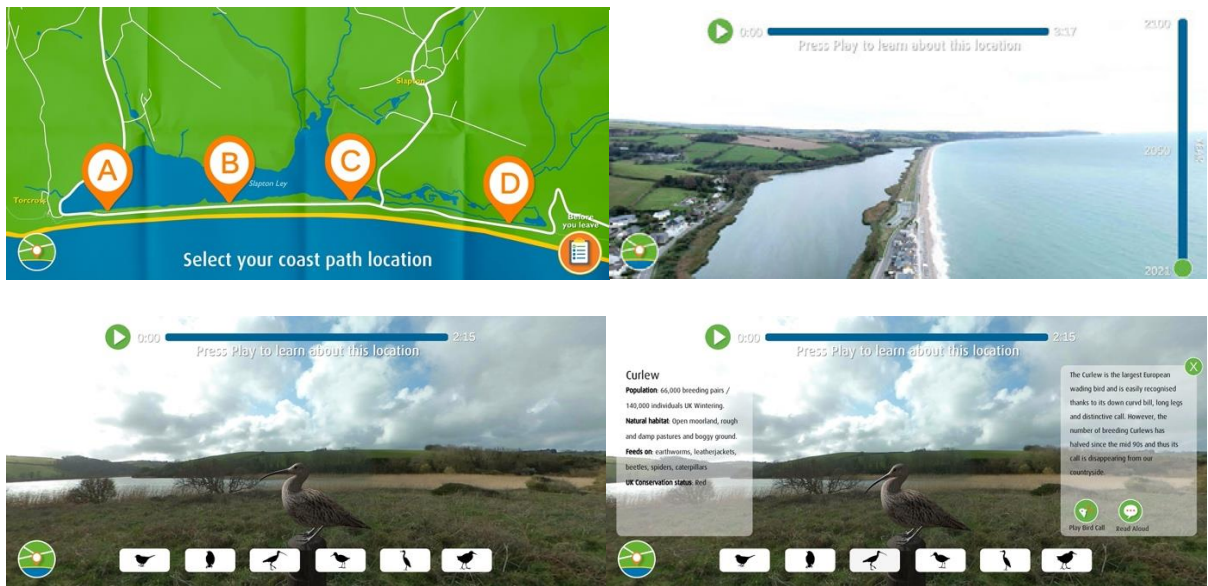


Figure 4.9 Screenshots of the 'Climate Trail' AR app (source: author's own image).



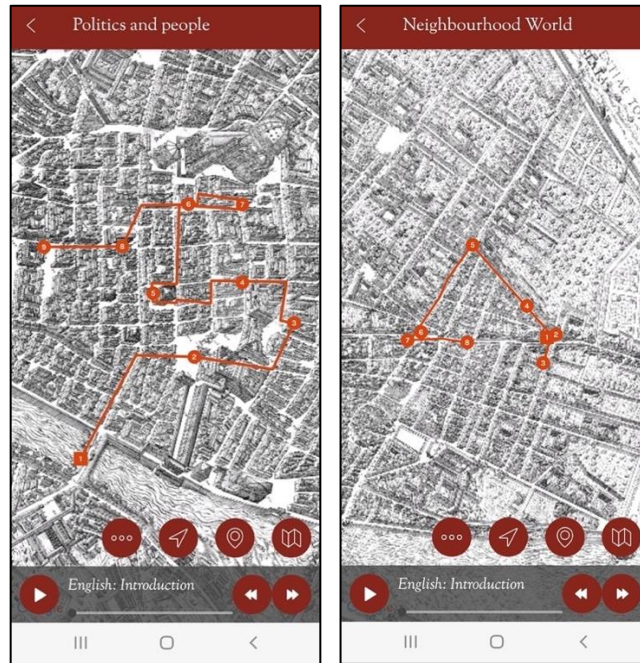


Figure 5.1 Screen pages for central walk ('Politics and people') and S.Ambrogio walk ('Neighbourhood walk') (Source: author's own image).



Figure 5.2 Screenshots of the walks from the 2019 update (Source: author's own image).

Main walks tracks			Discover More tracks		
Master of Florence	Neighbourhood World	Saints and Sinners	Master of Florence	Neighbourhood World	Saints and Sinners
<ol style="list-style-type: none"> <li>1. Baptistery</li> <li>2. Palazzo Medici</li> <li>3. San Lorenzo</li> <li>4. Canto alle Macine</li> <li>5. Santa Apollonia</li> <li>6. San Marco</li> <li>7. Santissima Annunziata</li> <li>8. Rotonda S. Maria degli Angeli</li> <li>9. Duomo north door</li> </ol>	<ol style="list-style-type: none"> <li>1. Outside Sant' Ambrogio Church</li> <li>2. Inside Sant' Ambrogio Church</li> <li>3. Via dei Macci</li> <li>4. Via dei Pilastri</li> <li>5. Canto al Monteloro</li> <li>6. Volta di San Pier Maggiore</li> <li>7. Piazza di San Pier Maggiore</li> <li>8. Canto alle Rondini</li> </ol>	<ol style="list-style-type: none"> <li>1. San Salvatore al Vescovo</li> <li>2. Columns of San enobi</li> <li>3. Torre dei Pierozzi</li> <li>4. Palazzo Pazzi</li> <li>5. Giraldi Tabernacle</li> <li>6. Palazzo Alessandri</li> <li>7. Piazza San Pier Maggiore</li> <li>8. San Pier Maggiore</li> </ol>	<ol style="list-style-type: none"> <li>1. Introduction: Balancing the Books, Merchants to Magi, Building Magnificence, Microcosm of Community, Friends on the Corner, Sisters in Spirit,</li> <li>3. Patron's Penitence,</li> <li>4. Shrine for the City,</li> <li>5. Visions of Rome,</li> <li>6. Flowers and Fiorins.</li> </ol>	<ol style="list-style-type: none"> <li>1. Introduction: A day in the life;</li> <li>2. Kings for a day;</li> <li>3. Relics on Parade;</li> <li>4. The worker's home;</li> <li>5. Street ecology;</li> <li>6. Neighbourhood Madonnas;</li> <li>7. Tavern Tales;</li> <li>8. A slice of piazza;</li> <li>9. The apothecary's shop.</li> </ol>	<ol style="list-style-type: none"> <li>1. Introduction: Politics, Pies and the Pazzi;</li> <li>2. A civic religion,</li> <li>3. The heart of the City,</li> <li>4. Telling Truth to Power,</li> <li>5. Politics as a Blood Sport,</li> <li>6. Saints on the Street,</li> <li>7. Family Matters,</li> <li>8. Sacred Union,</li> <li>9. The invisible city.</li> </ol>
Politics and People	City of Women	Crime and Punishment	Politics and People	City of Women	Crime and Punishment
<ol style="list-style-type: none"> <li>1. Ponte Vecchio</li> <li>2. Piazza della Signoria</li> <li>3. Canto del Bargello</li> <li>4. San Martino</li> <li>5. Orsanmichele</li> <li>6. Vicolo del Giglio</li> <li>7. The Opera Workshop</li> <li>8. Piazza della Repubblica</li> <li>9. Palazzo Strozzi</li> </ol>	<ol style="list-style-type: none"> <li>1. Ospedale degli Innocenti</li> <li>2. Orbatello</li> <li>3. Via della Pergola</li> <li>4. Santa Maria Nuova</li> <li>5. Stone Laws</li> <li>6. Bigallo</li> <li>7. Onestà</li> </ol>	<ol style="list-style-type: none"> <li>1. Piazza della Signoria</li> <li>2. The Bargello</li> <li>3. Le Stinche</li> <li>4. Piazza Santa Croce</li> <li>5. Via dei Malcontenti</li> <li>6. Le Murate</li> </ol>	<ol style="list-style-type: none"> <li>1. Introduction: A day in the life;</li> <li>2. Bridging the Arno;</li> <li>Politics and the Piazza; Crime and Punishment; Performance and Patronage;</li> <li>3. Merchants and workers;</li> <li>4. Sex and the city;</li> <li>5. Craft work;</li> <li>6. Women in the streets; Palaces and Pavements.</li> </ol>	<ol style="list-style-type: none"> <li>1. Introduction: The art of survival;</li> <li>2. City of Orphans;</li> <li>3. Widows and Welfare;</li> <li>4. Waving a Life;</li> <li>5. Sickness, health, and chicken soup;</li> <li>6. Sounds of the street;</li> <li>7. It takes a village;</li> <li>8. Prostitutes and poverty.</li> </ol>	<ol style="list-style-type: none"> <li>1. Introduction: politics and police;</li> <li>2. The speaking statue;</li> <li>3. Torture and truth-telling;</li> <li>4. Life in prison;</li> <li>5. Street life and soccer;</li> <li>6. Walking the last mile;</li> <li>7. A history behind the walls.</li> </ol>

Figure 5.3 Lists of main tracks and 'Discover More' tracks of the six walks (Source: author's own image).

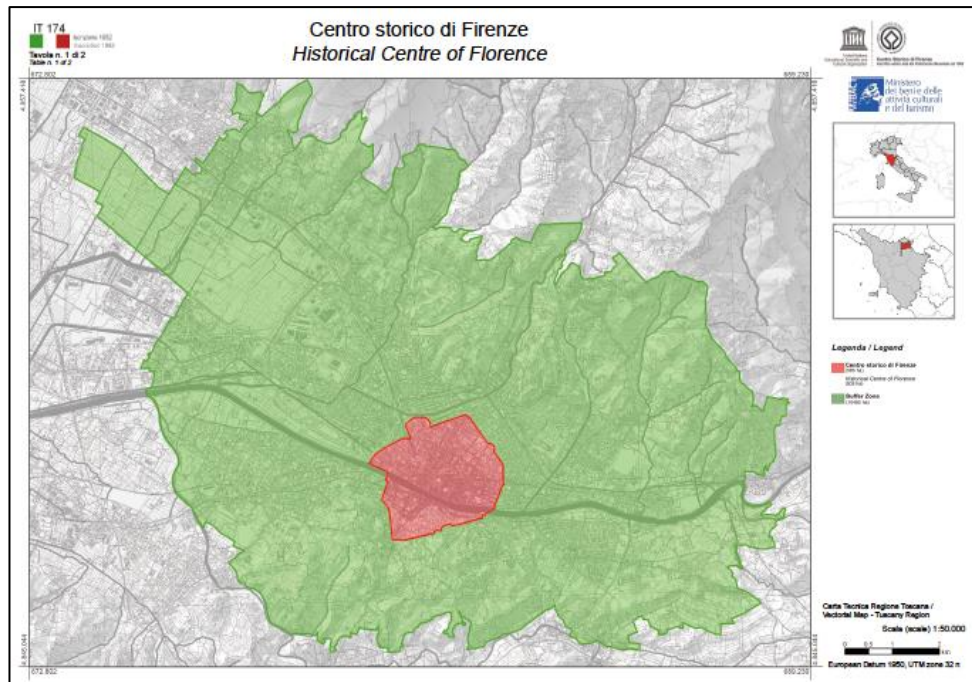


Figure 5.4 Map of the 'core zone' (red) and 'buffer zone' of historical centre of the city of Florence (Source: author's own image).



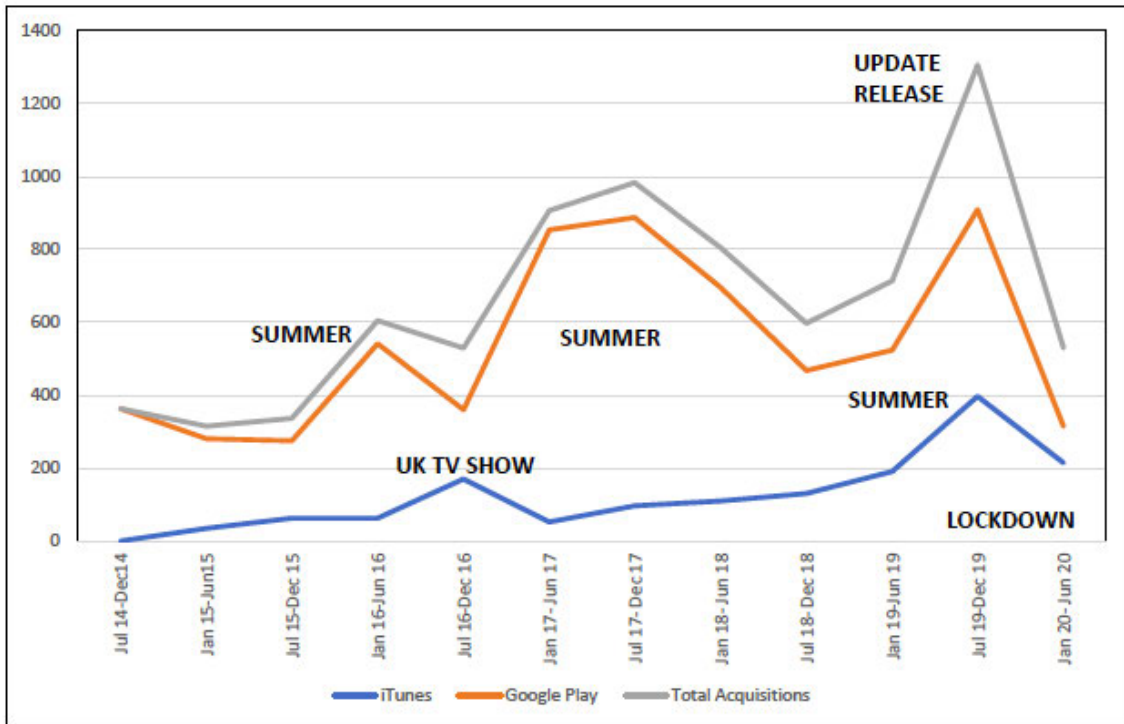


Figure 5.5 Temporal distribution of the downloads (Source: author's own image).

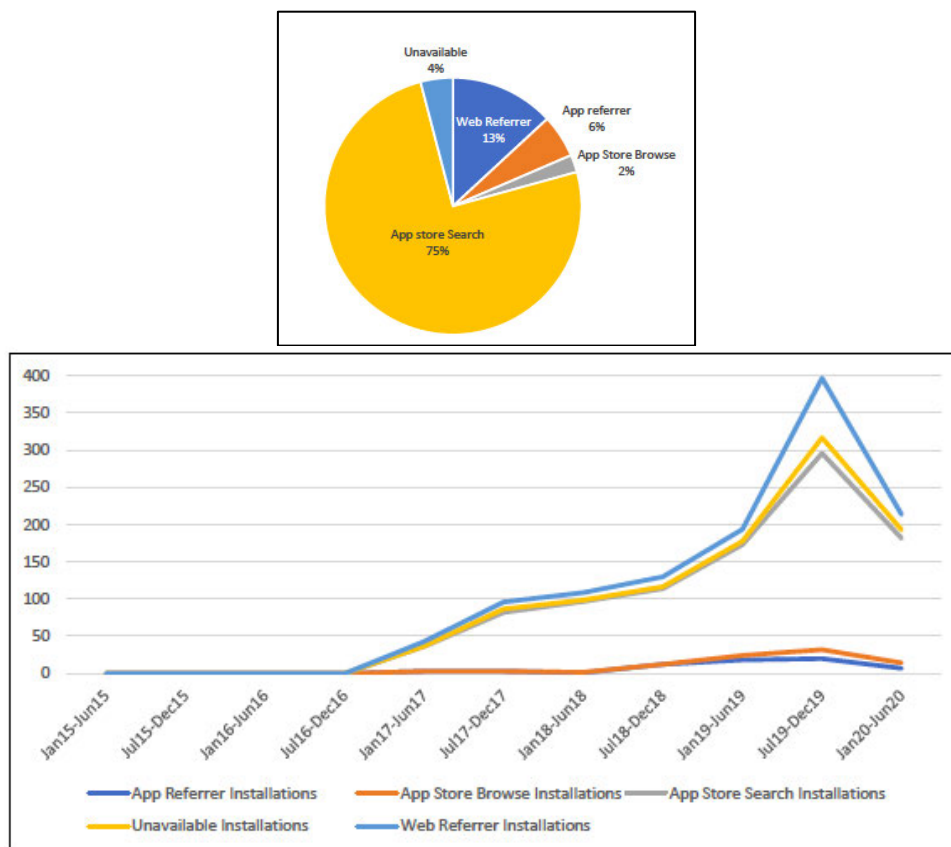


Figure 5.6 Distribution of the installations by source and time (Source: author's own image).

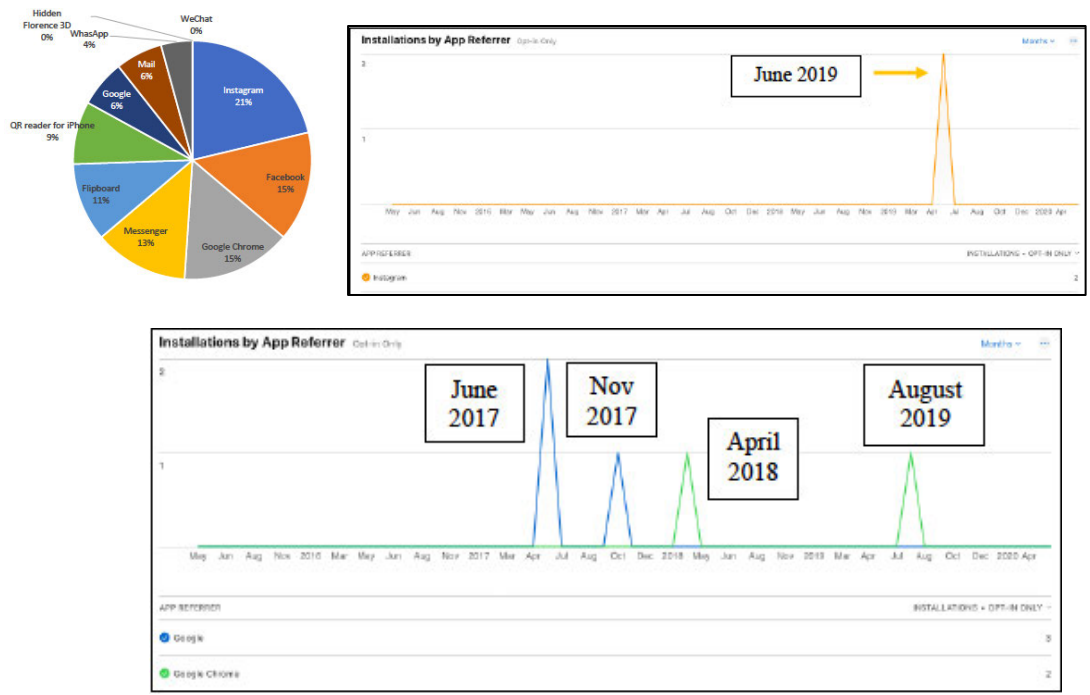


Figure 5.7 Distribution app referrer by type and temporal distribution by location (Italy above, UK below)

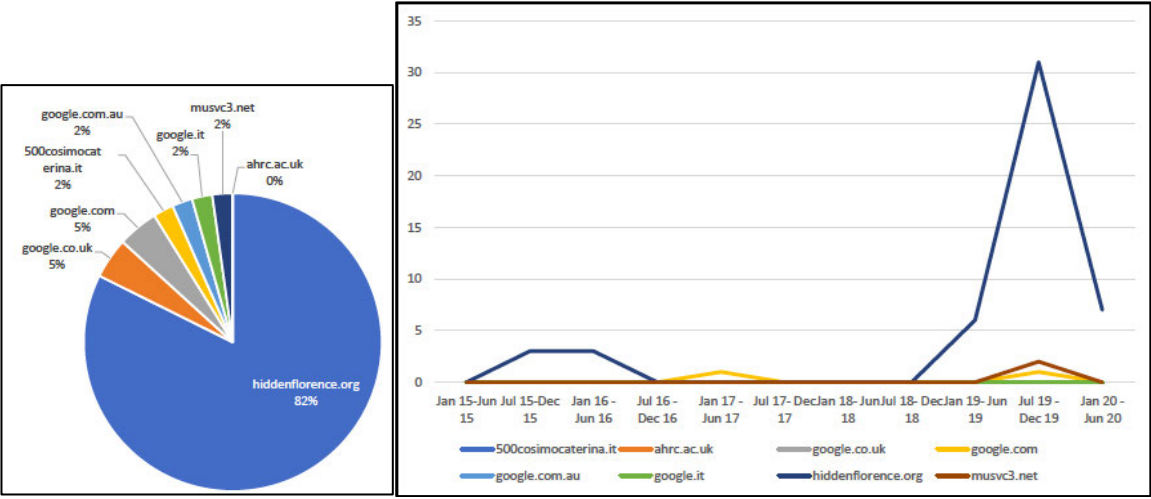


Figure 5.8 Distribution app referrer by type and temporal distribution by location (USA)

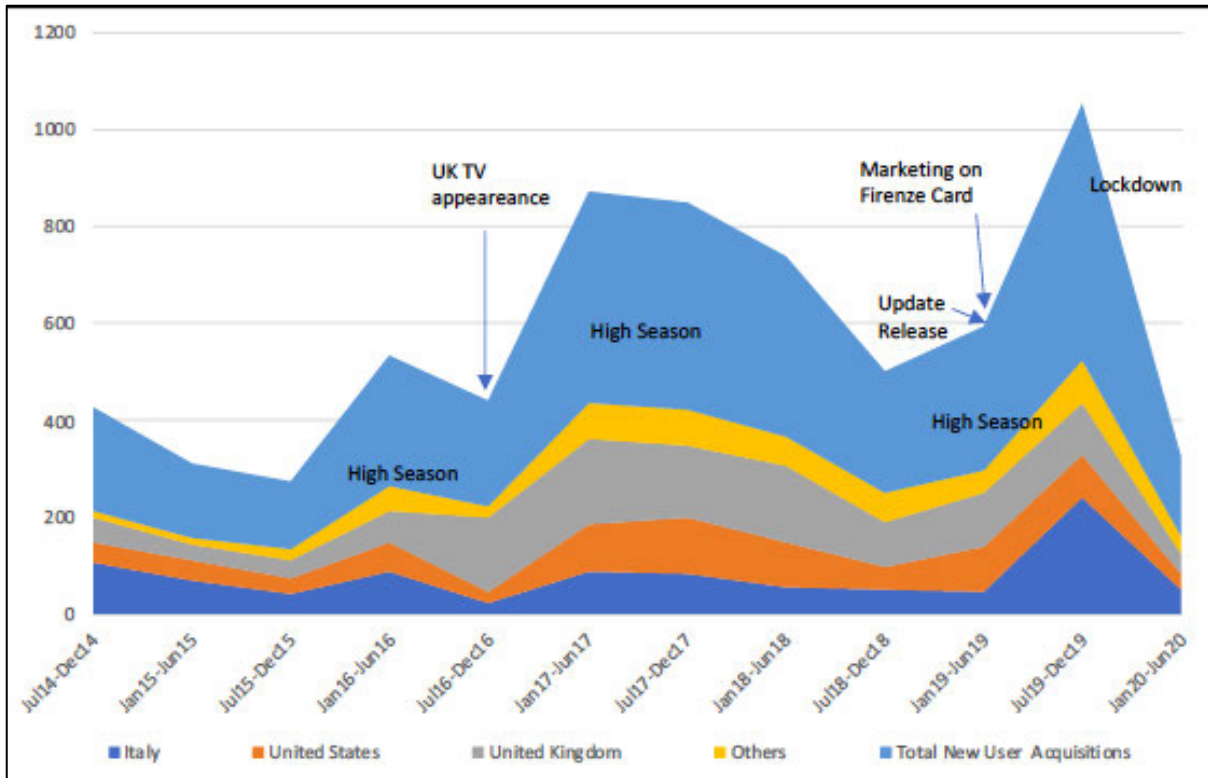


Figure 5.9 Temporal distribution of users by country (Source: author's own image).

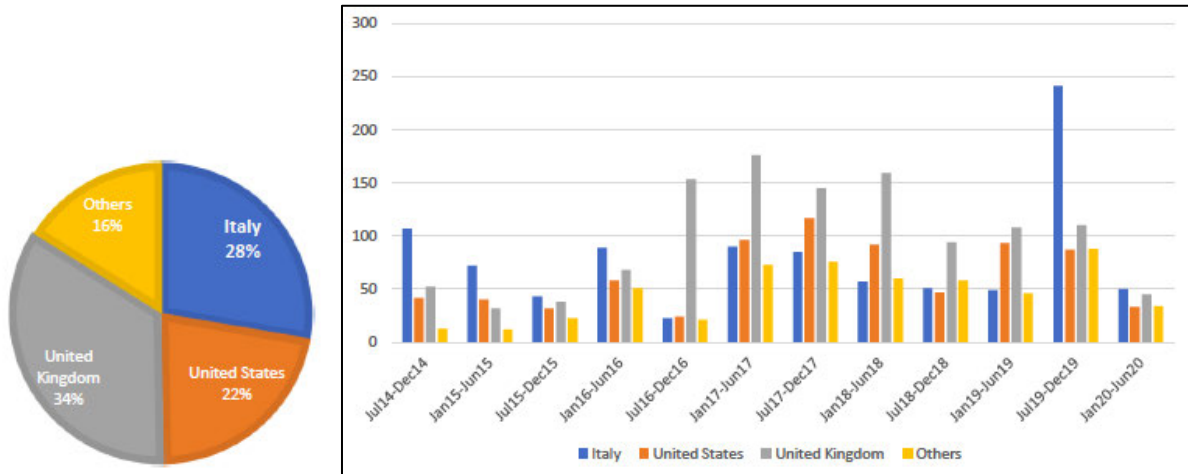


Figure 5.10 Geographical distribution of new users and temporal distribution by countries (2014-2018) (Source: author's own image).

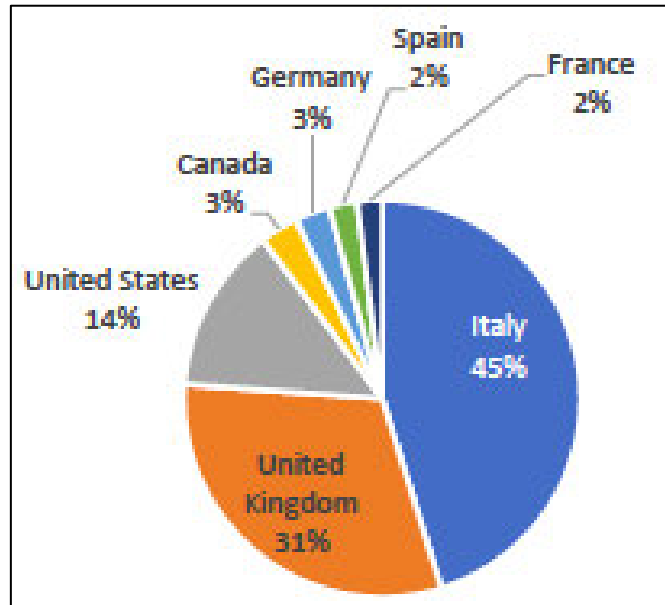


Figure 5.11 Geographical distribution of users (2018-2020) (Source: author's own image).

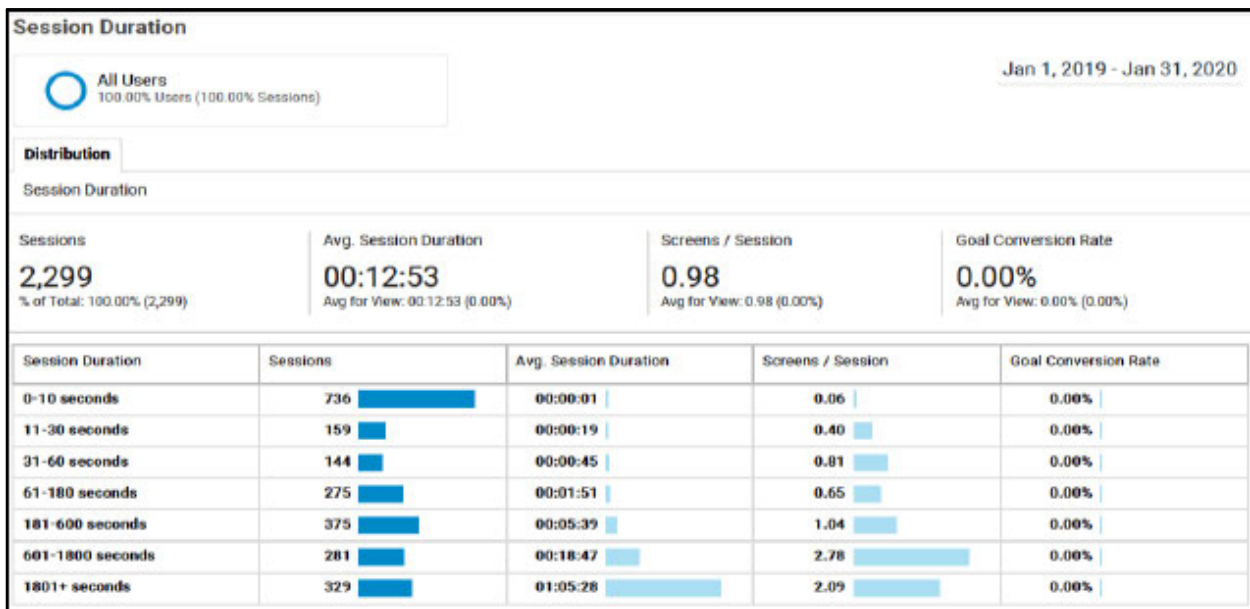


Figure 5.12 Breakdown of the length of the sessions (January 2019- January 2020) (Source: author's own image).

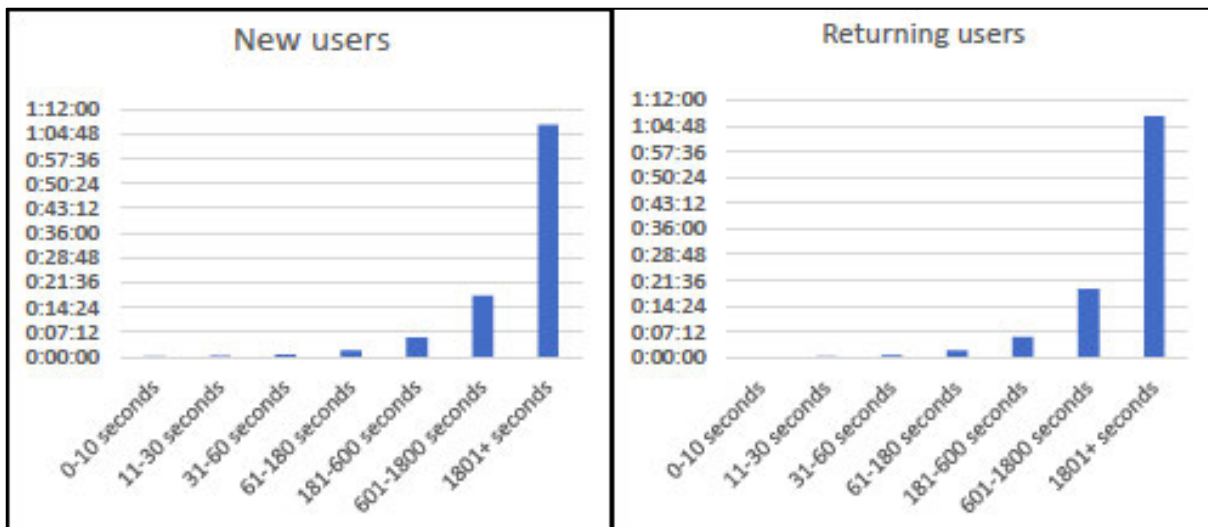


Figure 5.13 Overview of the average session duration by new and returning users (period 2019-2020) (Source: author's own image).

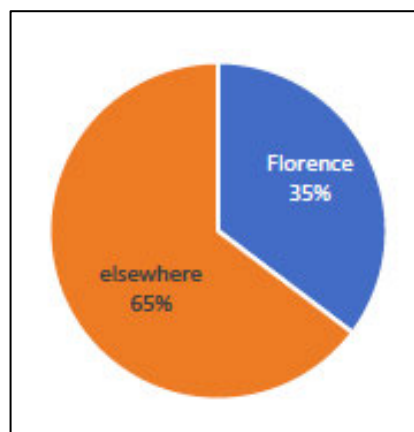


Figure 5.14 Overview of all users for 2018-2020 (Source: author's own image).

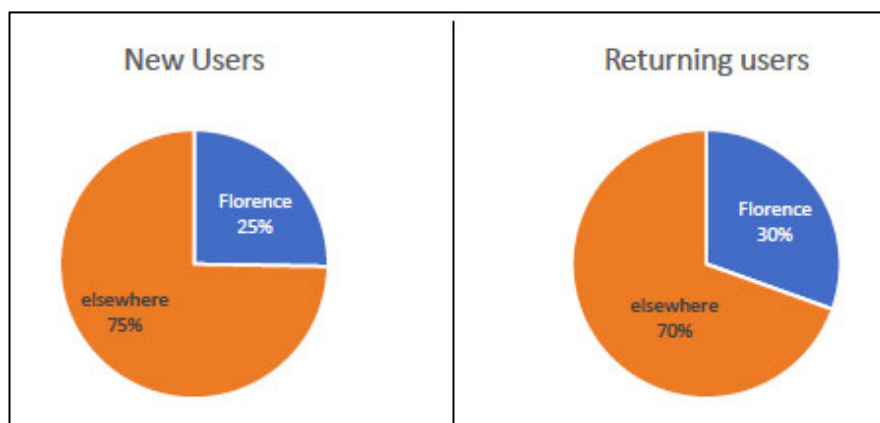


Figure 5.15 Distribution of new vs returning users in Florence and elsewhere (Source: author's own image).

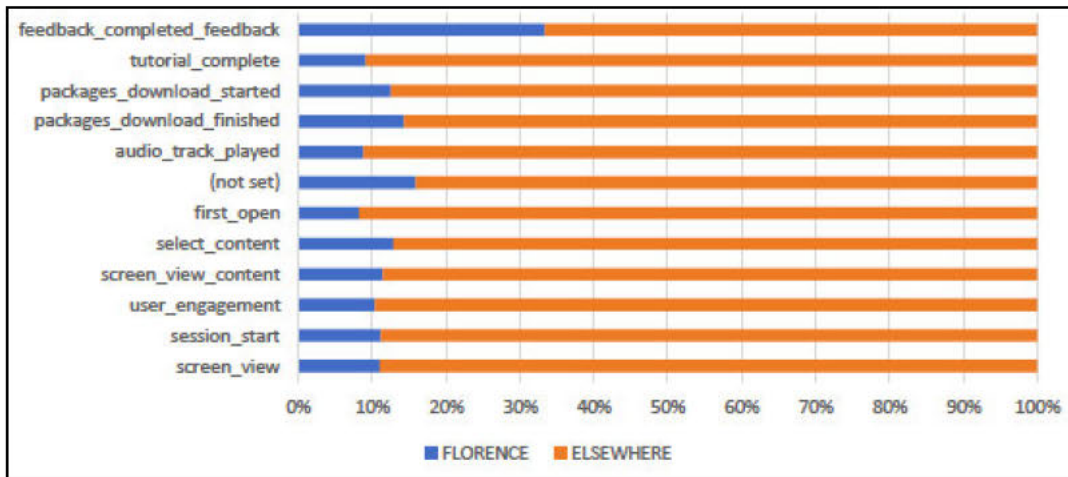


Figure 5.16 Overview of access to categories in Florence and elsewhere (Source: author's own image).

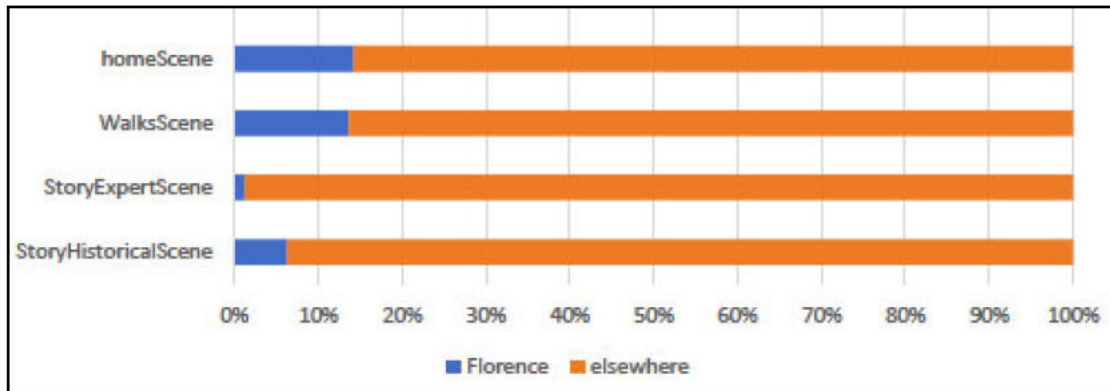


Figure 5.17 Comparative view of scene access by unique users in Florence and elsewhere (Source: author's own image).

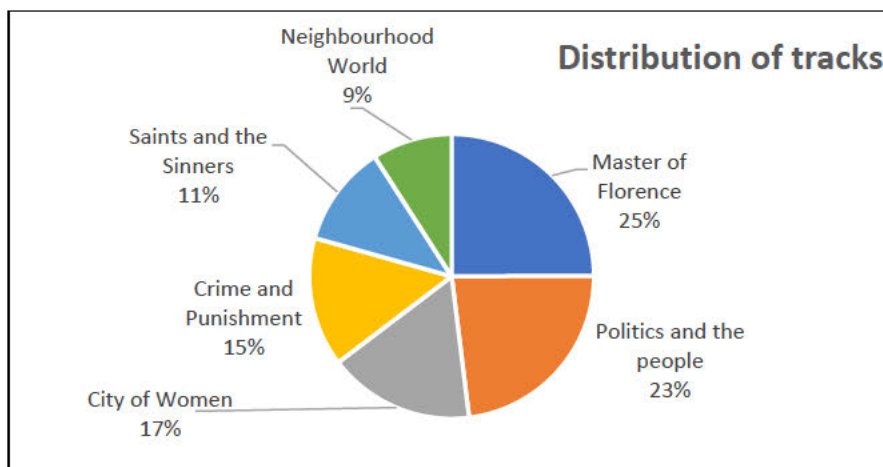


Figure 5.18 Distribution of the tracks by walks (Source: author's own image).



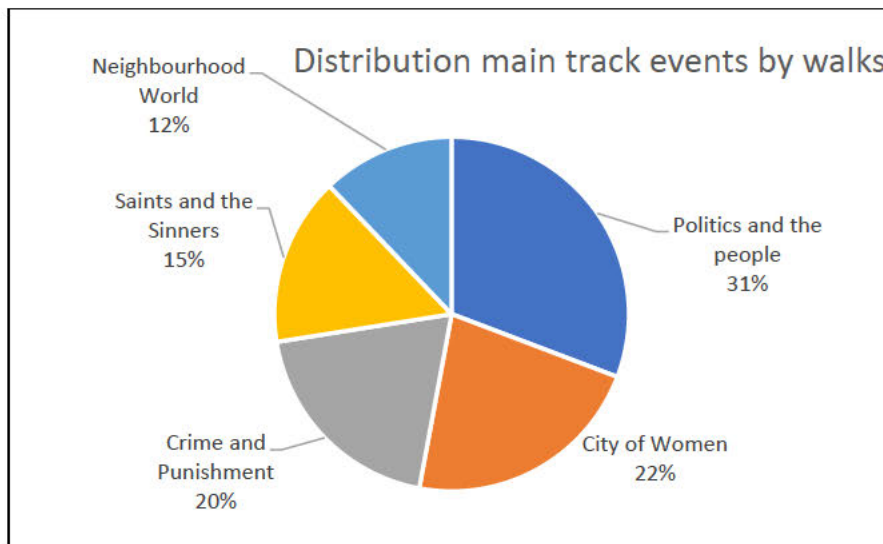


Figure 5.19 Distribution main track events by walks (Source: author's own image).

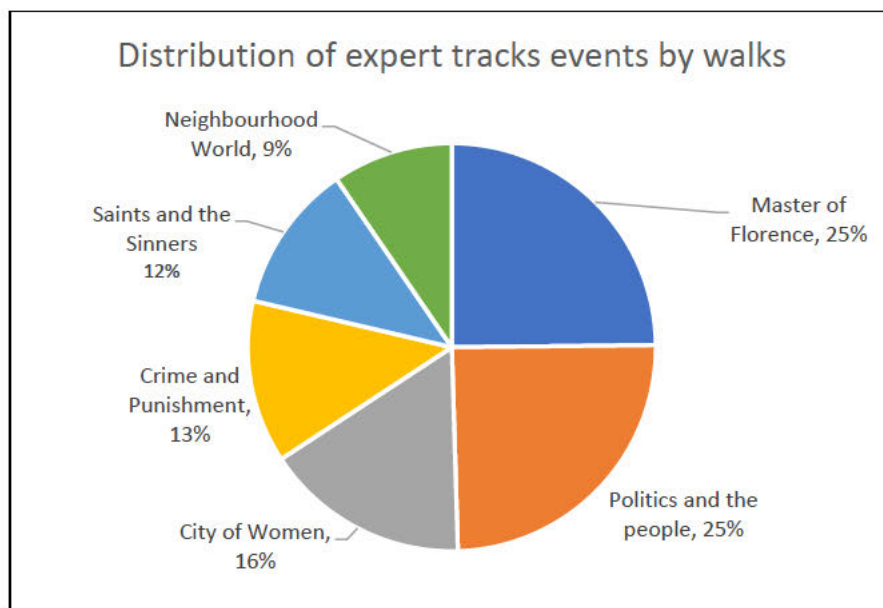


Figure 5.20 Distribution of expert track events by walks (Source: author's own image).

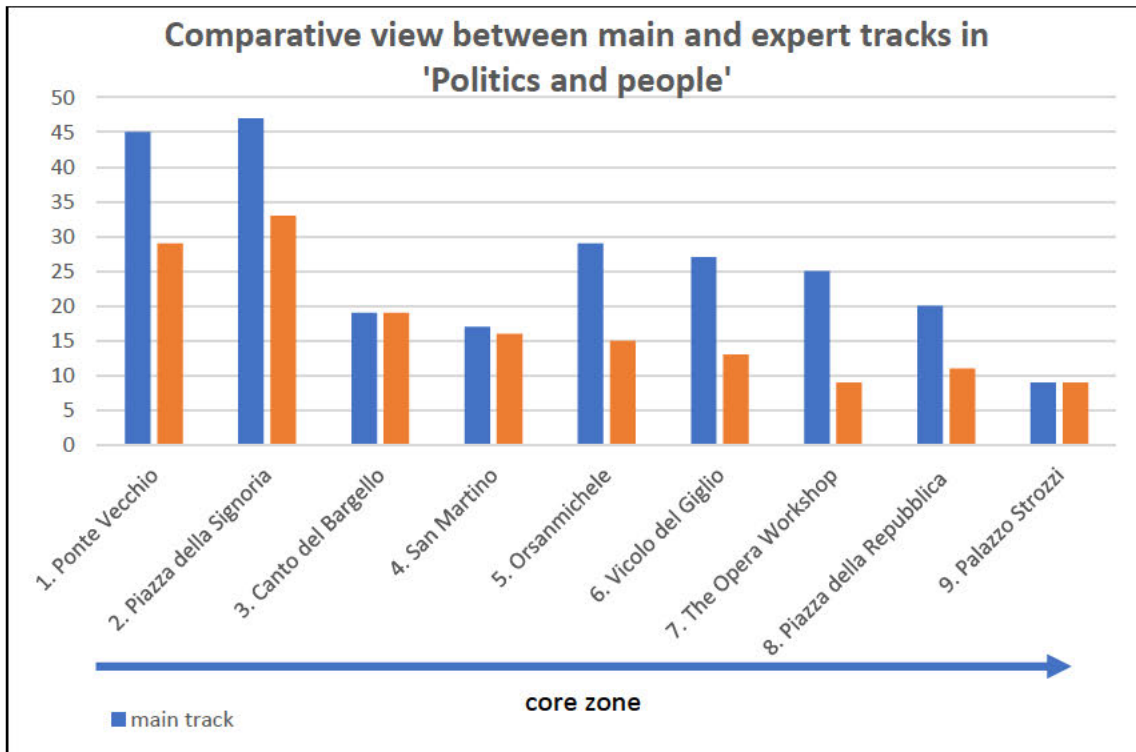


Figure 5.21 Comparative view main and expert tracks for 'Politics and people' (Source: author's own image).

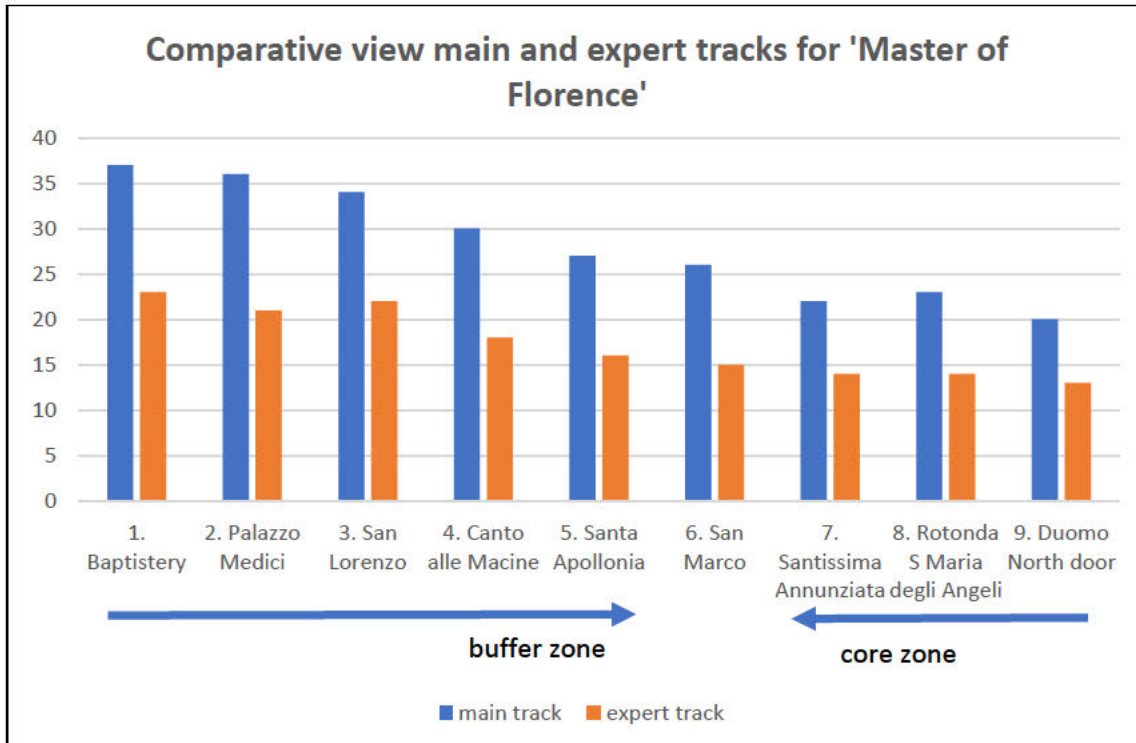


Figure 5.22 Comparative view main and expert tracks for 'Master of Florence' (Source: author's own image).

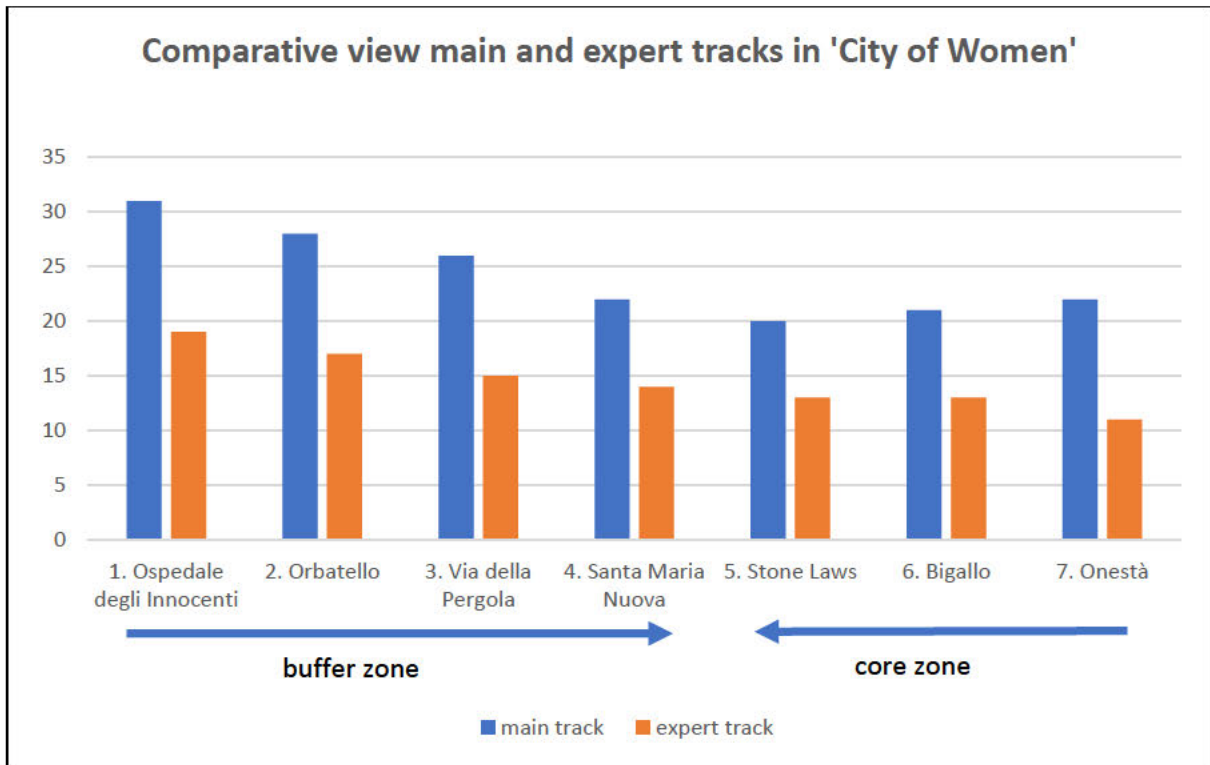


Figure 5.23 Comparative view main and expert tracks for 'City of Women' (Source: author's own image).

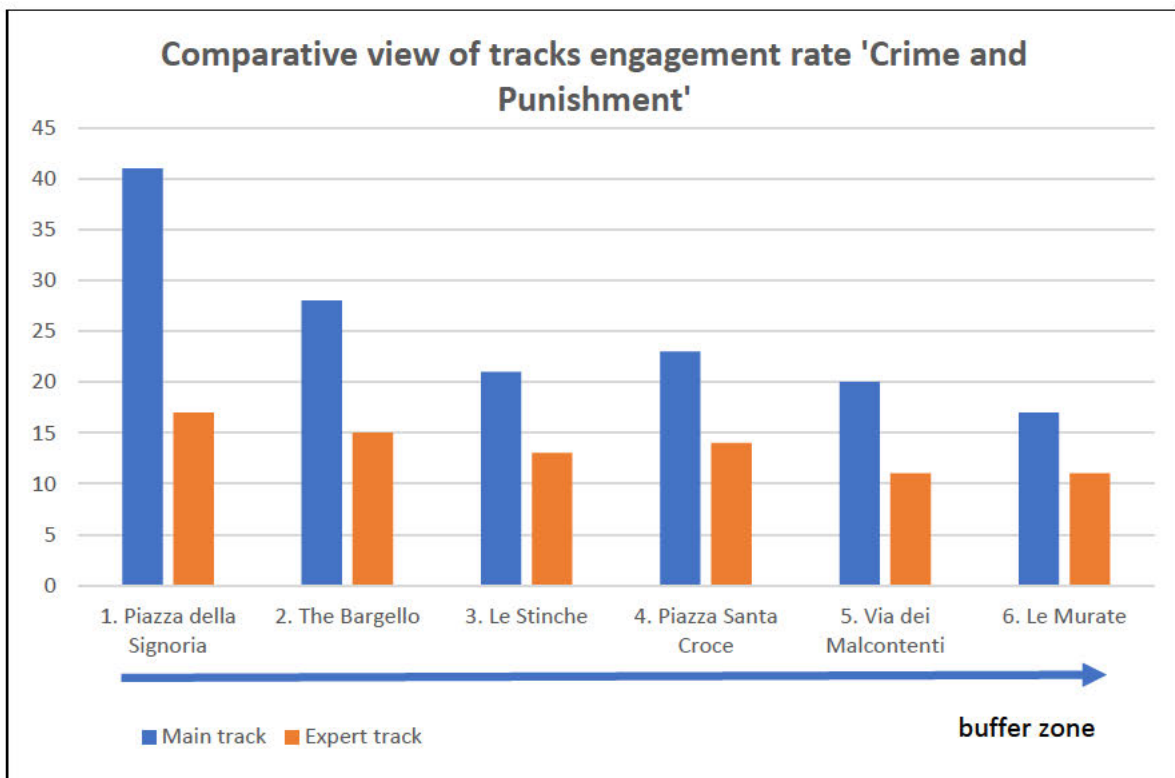


Figure 5.24 Comparative view main and expert tracks for 'Crime and Punishment' (Source: author's own image).

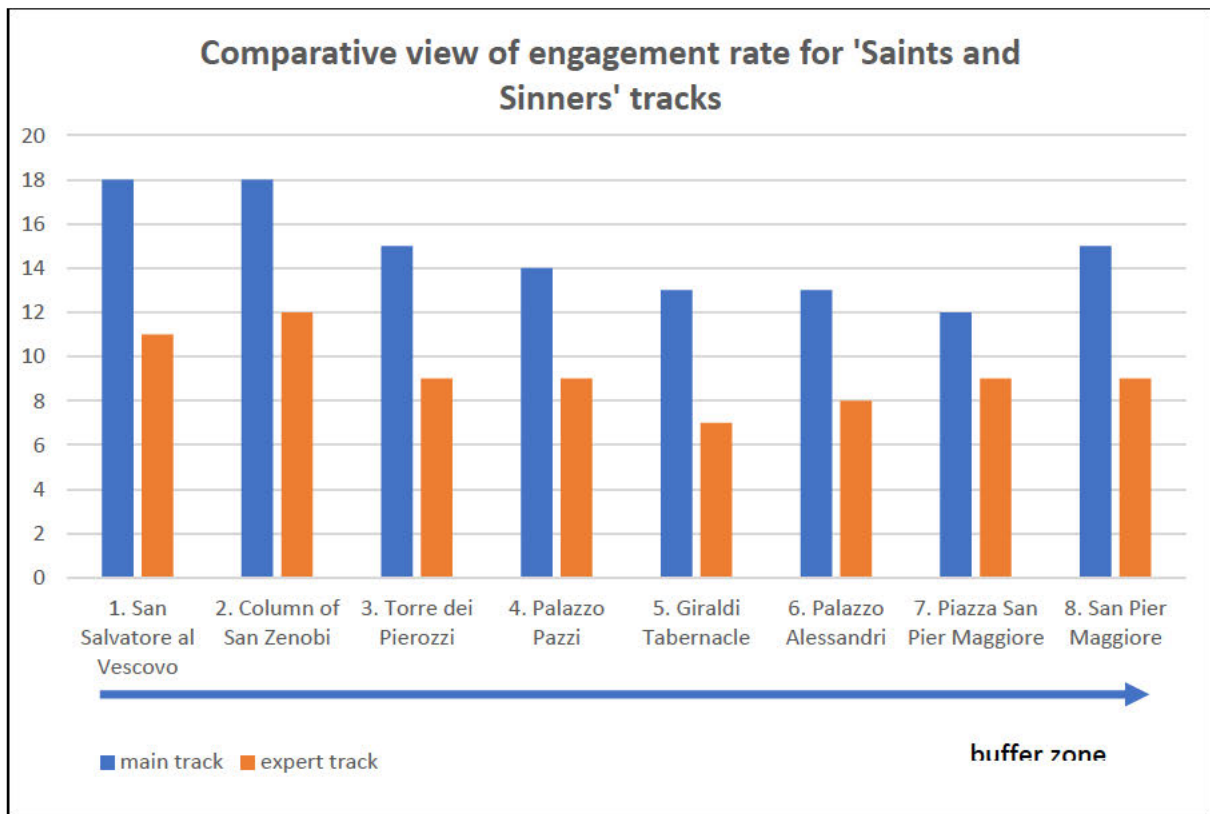


Figure 5.25 Comparative view main and expert tracks for 'Saints and Sinners' (Source: author's own image).

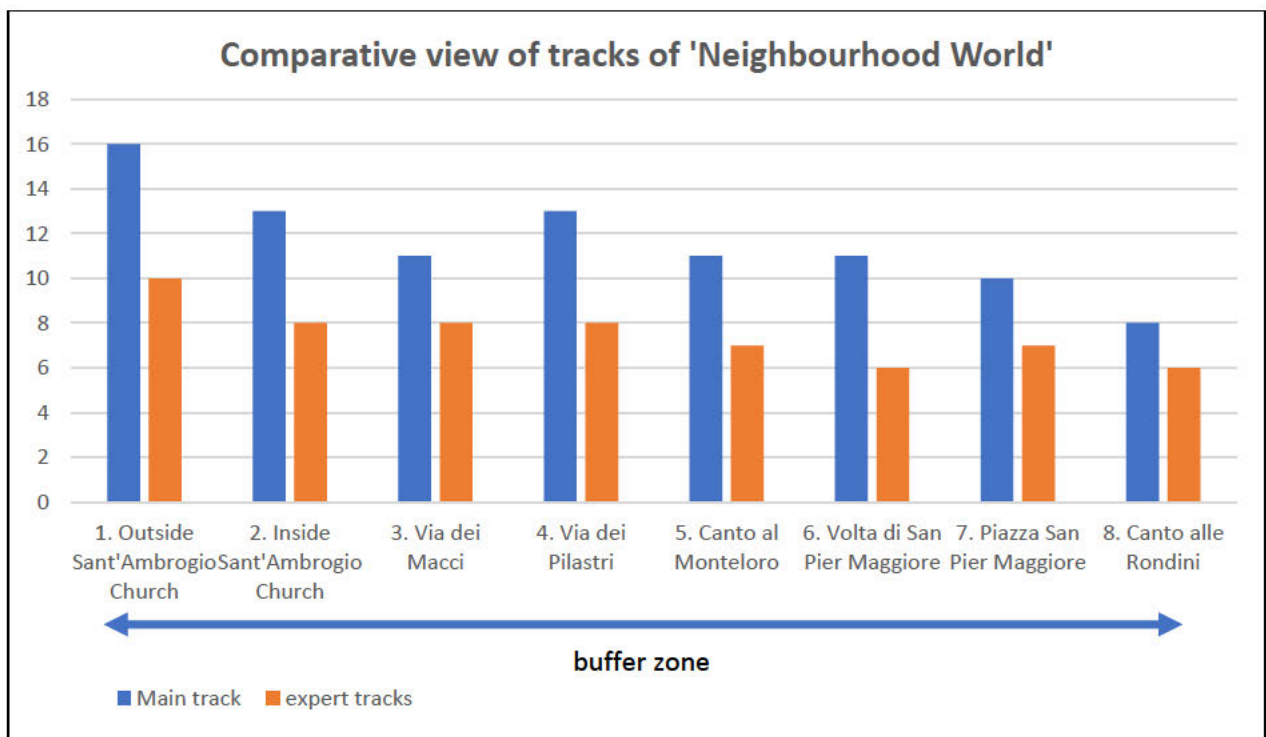


Figure 5.26 Comparative view main and expert tracks for 'Neighbourhood World' (Source: author's own image).

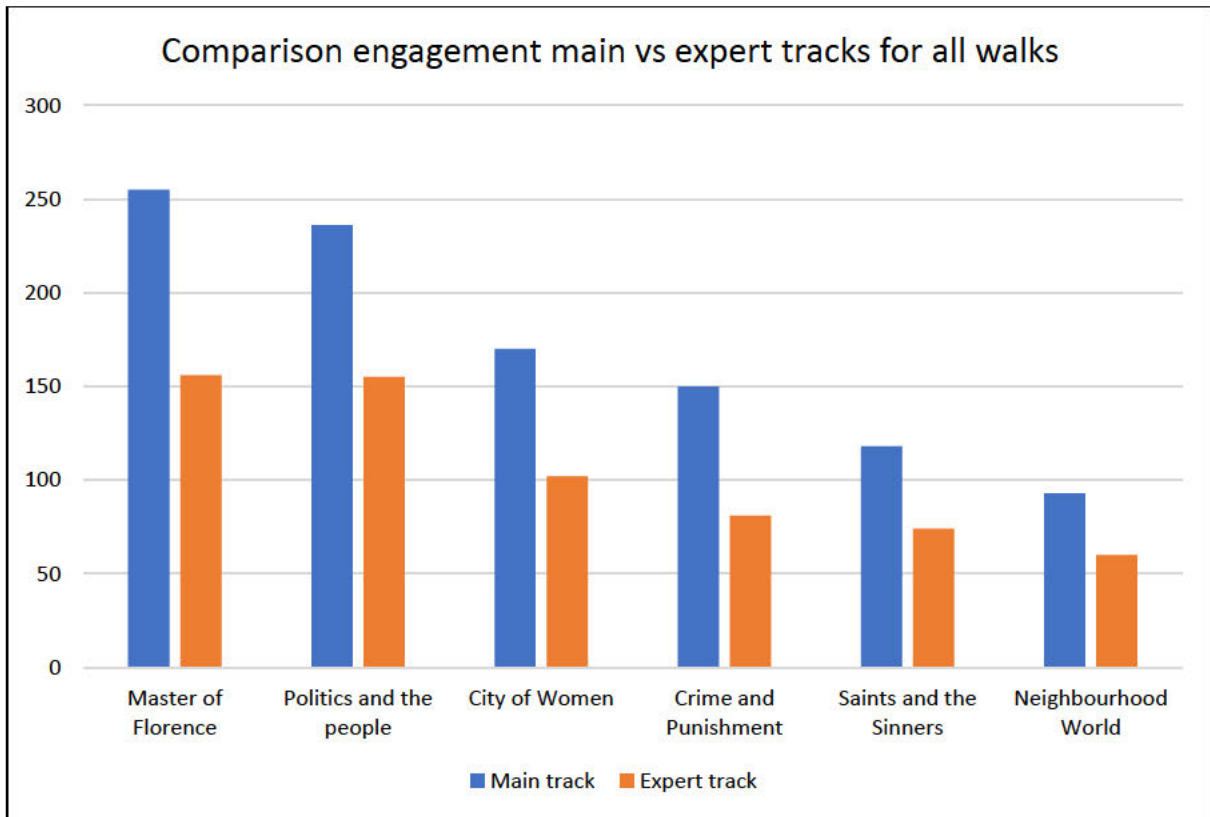


Figure 5.27 Comparative overview of all walk by main and expert tracks (Source: author's own image).

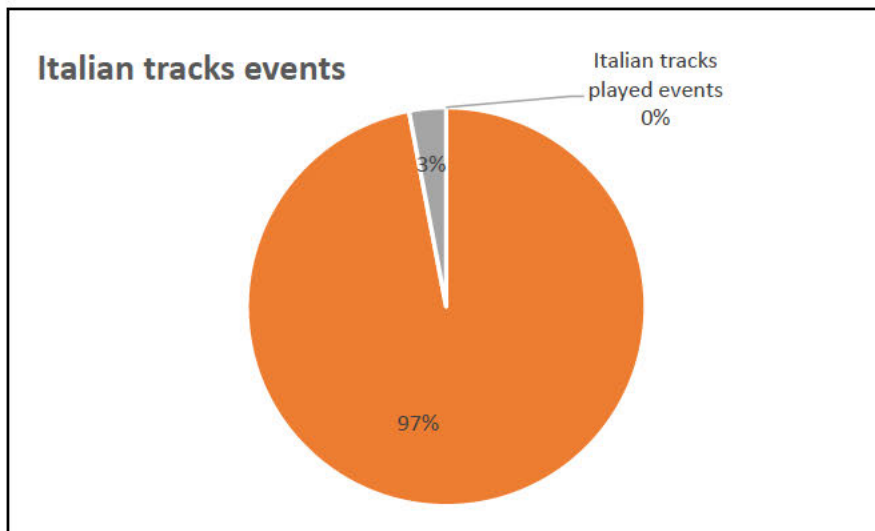


Figure 5.28. Total Italian tracks played events (Source: author's own image).

Downloads	Google Play Console (Android devices)	iTunes (Apple devices)	Total
		6102	1519

Table 5.1 Breakdown of total downloads by platforms (Source: author's own elaboration).

\*Data on new acquisitions from iTunes start from April 4, 2015. \*\*Interim COVID 19 period (March to June 2020).

Semester		Platforms			
		iTunes – iOS devices		Google Play – Android devices	
		Installations	Variation	Acquisitions	Variation
Jul 14-Dec14	0	-	-	(354)	-
Jan 15-Jun15	1	34*	-	268	(-22.6%)
Jul 15-Dec 15	2	62	+82.3%	261	-2.1%
Jan 16-Jun 16	3	63	+1.6%	519	+97.1%
Jul 16-Dec 16	4	170	+169.8%	333	-33.6%
Jan 17- Jun 17	5	53	-68.8%	811	+137.2%
Jul 17- Dec 17	6	96	+81.1%	846	+3.9%
Jan 18- Jun 18	7	109	+13.5%	648	-21.5%
Jul 18- Dec 18	8	130	+19.2%	447	-32.9%
Jan 19-Jun 19	9	191	+46.9%	500	+11.9%
Jul 19-Dec 19	10	397	+107.8%	847	+73.8%
Jan 20- Jun 20**	11	214	-46.1%	268	-65.3%
<b>Total acquisitions</b>		<b>1519</b>		<b>6102</b>	

Table 5.2 Comparative overview of downloads from first app release to June 20202 (included) (Source: author's own elaboration).

	<b>2019-20</b> (Jan 1, 2019 – Jan 31, 2020)	<b>2017-18</b> (Jan 8, 2017 – Jan 31, 2018)	<b>Variation (%)</b>
<b>Total Unique users</b>	1283	2279	<b>-77%</b>
<b>New Users</b>	711	2277	<b>-220%</b>
<b>Total Sessions</b>	2299	4514	<b>-96%</b>
<b>Average session duration per sessions</b>	12 min 53 s	7 min 05 s	<b>+45%</b>

Table 5.3 Comparative overview between the periods 2019-20 and 2017-18 (from Google Analytics platform) (Source: author’s own elaboration).

<b>Session length</b>	<b>Number of sessions</b>	<b>% of all sessions</b>
<b>0-10 secs.</b>	<b>1091</b>	<b>24.1</b>
<b>11-30 secs.</b>	<b>411</b>	<b>9.1</b>
<b>31-60 secs.</b>	<b>600</b>	<b>13.3</b>
<b>1-3 mins.</b>	<b>987</b>	<b>21.6</b>
<b>3-10 mins.</b>	<b>739</b>	<b>16.4</b>
<b>10-30 mins.</b>	<b>434</b>	<b>9.6</b>
<b>30+ mins.</b>	<b>252</b>	<b>5.6</b>

Table 5.4 Breakdown of the length sessions (period 2017-2018) (Source: author’s own elaboration).



# Response Proposal for the Consultancy, Design and Production of a Walk Trail for Penguin Publishers

Document version number: FLT01  
14 August 2015

Prepared for: Dirk Bennett, Exhibition Development Manager  
Tower Bridge and Monument (“Customer”)

Prepared by Jo Reid  
Calvium Ltd.  
Mariner House  
62 Prince Street  
Bristol  
BS1 4QD  
jo@calvium.com  
Tel: 0117 226 2000  
www.calvium.com

**CALVIUM**  
MOBILE APP DEVELOPMENT

Company Registration No: 07055812, VAT registration No: 112476634  
Registered office: The Old School House, 75a Jacobs Wells Road, Bristol, BS8 1DJ



## 1. Creative Response

Tower Bridge are developing a new interpretive strategy and aim to provide an enthusiastic, engaging, informative and welcoming visitor experience. They are looking for a supplier who can deliver a pilot study and a quick and quirky new Family Trail to explore the bridge, as a vital addition to the interpretation on site.

### Audience

Families with children are the primary audience for this trail. Ideally the trail would engage younger children whilst also appealing to a wide non-specialist, non-technical audience with an emphasis on a light-touch approach and learning by stealth. To ensure that the trail can easily extend to international tourists the experience will be largely hands-on with a strong visual design so that it is accessible and understandable without needing to read the text.

The trail will be designed for use on personal devices, loan devices and paper. This flexible approach will ensure that the trail is accessible to all family groups and make it easier for all members to participate and to share the experience.

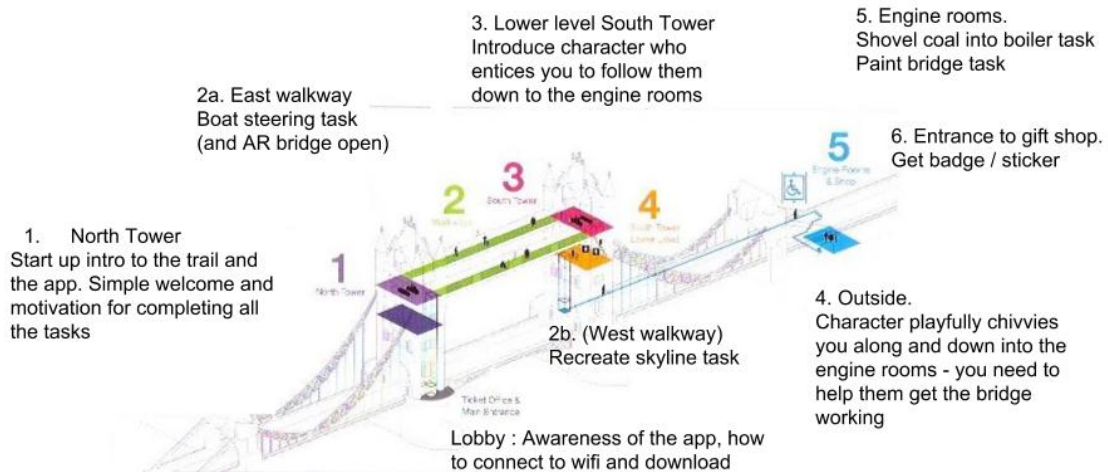
The trail will not duplicate information found in the revised presentation of on site interpretation. In family groups where the adults are less comfortable with technology then the children can be the primary users of the app while the adults can spend time reading the interpretation while the children are happily entertained by activities in the trail.

In family groups where everyone enjoys playing games then the trail will offer different levels of difficulty and lend itself to being shared by more than one user.

In family groups with several young children then the paper versions of the trail will enable everyone to have their own.

## User journey

Whilst we intend to work with the Bridge team to decide on the exact number, nature and mechanics of the individual tasks we present the following user journey as an illustration of the kind of trail we would pilot and make.



## Arrival (Lobby)

On arrival in the lobby families will be made aware of the free Family Learning trail via posters and the lobby staff. Whilst lining up for admission to the lift they can connect to the free wifi and easily download the app (QR code on leaflet or poster and quick links from the main web site).

## North Tower

On exit from the lift in the North Tower paper versions of the trail could be made available.

On start up of the app there is a simple welcome page which introduces the trail and encourages you to complete the tasks as you encounter them on your walk, the suggested locations for doing the tasks will be indicated. They can be done at any time and in any order so that it is still possible to play the games at home, or at any point on the trail, but it will be more fun to do them at the locations suggested.

You will be encouraged to ask members of staff for key information to unlock bonus features or treats as part of the trail.

We will pilot a design where alerts and prompts will auto-trigger at key locations along the route to suggest tasks and encourage you to continue. The triggers may be in the form of signage on the walk or using iBeacons. A simple navigational map will also indicate which games are best played at which locations.

## 2a. East walkway

The view that opens up and the novelty of being in the glass corridor of the East walkway is an exciting and exhilarating experience. As this will also be the first encounter with the glass floor then it seems sensible to have a task which relates to the excitement of looking down and seeing the boats, people and buses pass underneath.

Our suggested game for this location would be to steer boats through the bascules. In the pilot we could experiment with a couple of levels of difficulty and a choice of boats to see what might be important for different age groups. The game would not use Augmented reality so that players would not have to stay at the glass floor section and block the space for other visitors if they want to play longer than a few minutes.

An equivalent game for the paper trail would be to count the number of buses and boats that pass through in a 5 minute period.

## 2b. West walkway

As our family move round to the West walkway even more iconic buildings come into view. Our suggested game for this location is to recreate the view that you see in a version of the skyline with the modern buildings removed.

An idea of how the simple level of the game might look is illustrated in the following image.



To play users drag the correct building into the correct place. Harder levels might not show the outline, ask you to place them in ascending order of when they were built and in the fastest time you can. Names and dates of the buildings would be added so that players could learn the right order to place them.

We would investigate how to introduce themes related to the fixed interpretation into the task, for example by asking staff or finding the answer to a question to unlock one of the levels in the game or helpful information such as the dates the buildings were built to be able to add them in the correct order.

On the West walkway the pilot can also test the current AR app to see how it might be included in the trail.

## 3. Lower level South Tower

After the excitement of the walkways the trail needs to encourage families to continue down to the engine rooms. We suggest that on the way down they get introduced to a male and/or female character who needs help to get the bridge working and to get it ready for a big event.

We would experiment with different kinds of character to see whether cartoon, realistic or fantasy types work best to engage the users and motivate them to help.

The paper trail version could use a scene and ask you to find the characters and then encourage you to go and help them in the Engine rooms (similar to Where's Wally)

#### 4. Outside walk to Engine rooms

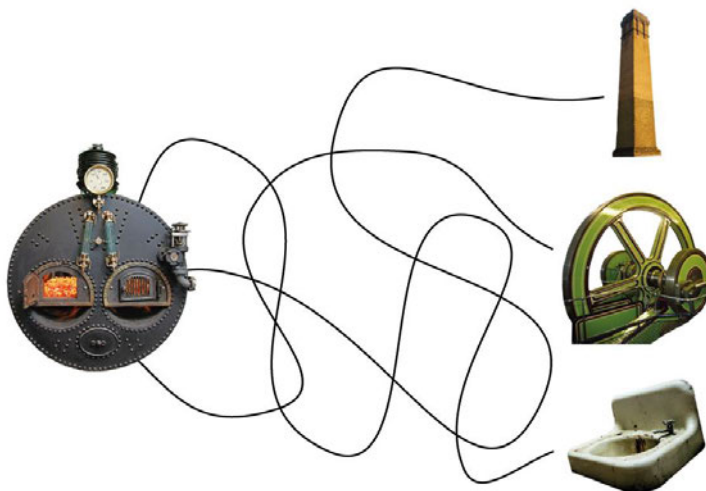
The characters will pop up outside to chivvy the Family along the bridge and encourage them to carry on to the Engine rooms they will also remind them that they will get a reward if they are able to succeed.

In the pilot we will experiment with GPS, Beacons, image recognition and timing to find out the most effective mechanisms to make the experience a robust and entertaining way to encourage the family to complete the tour.

#### 5. Engine rooms

One of the first things the family encounter is the Lancashire boilers. Our suggested game for this location is to shovel coal in order to get the boilers up to the right heat and pressure to drive the pumping engine. This will help the character introduced earlier on the bridge to get the bridge working.

We would experiment with gestural interactions to simulate shovelling to see which ones were most fun and reliable. We imagine using the accelerometers in the phone to detect a "shovelling" gesture, similar to the way you use a Wii controller to play tennis. As you shovel a gauge will rise indicating how much more coal you need. When you reach the right level a simulation of the steam going through the pipes to drive the steam pump will be shown. You will be congratulated and encouraged to walk through to the next room to see the success of your venture.



For the paper equivalent of the game we suggest something similar to the classic find the right path game illustrated in the following picture. Each path may have different pressure settings and you have to find the right one for driving the engine. Too high and the steam goes through the chimney, too low and it's down the drain!

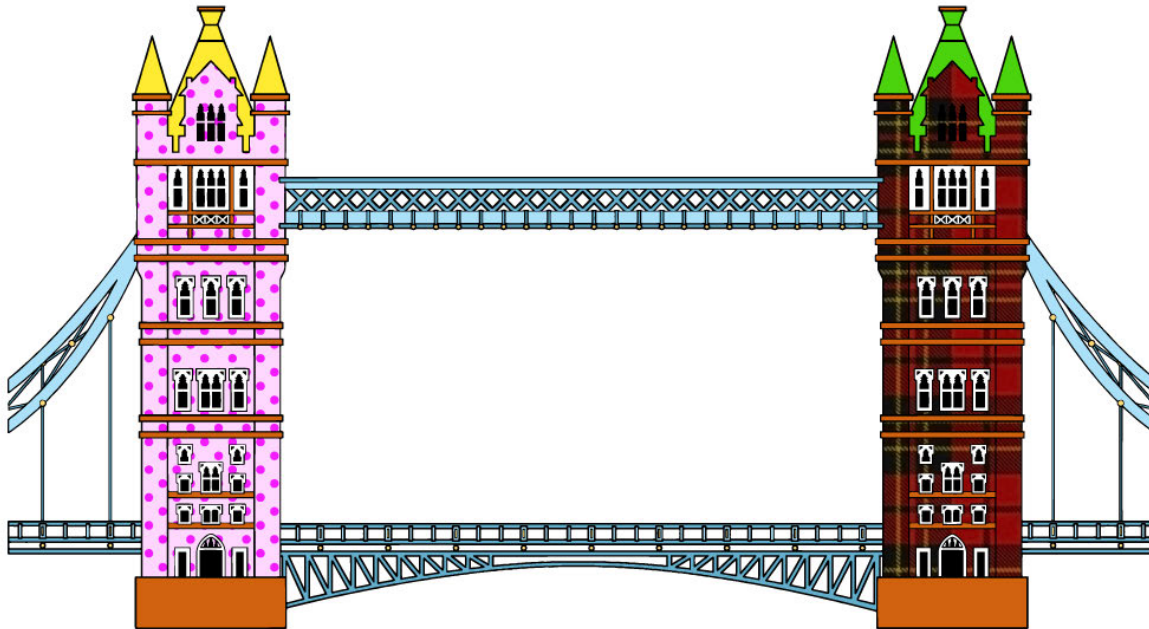
When the family move through to the next room they will see the pump wheel turning, which they should feel they made happen from completing the coal

shovelling game.

To the right there is a desk and this is where they are directed to help one of the characters design the decoration of the bridge for the big event.

The game that we suggest for this location is to paint the bridge. The app will show a grey structure of the bridge with a paint palette on the right. Simply pick a colour and point at a region to fill it with that colour. Some more exotic features such as tartan paint and flags may be locked unless you have completed the other tasks or found answers to questions by asking staff or reading the interpretation.

We will encourage and make it easy for you to share your bridge designs on social media.



## 6. Entrance to gift shop

When you have finished your design and completed all of the tasks you will have helped the characters to make the bridge work and paint it ready for the event.

You will be rewarded with a final animation of the bridge, in your design opening the bascules and letting the processional boats through with cheering crowds and music. You will be thanked for making it all happen.

The paper version of the trail will simply have an outline of the bridge for you to colour in and make your own design.

You are encouraged to show the staff member at the desk before the exit your design for them to approve. In the paper trail they could perhaps put a physical stamp on the paper. In both digital and paper forms participants could be given a sticker (or badge) as a reward.

## Outcomes

With our rapid prototyping, user trial pilot and iterative process we are confident that we can design a trail that will deliver the following outcomes.

## User statistics

We will instrument the app with analytics so that throughout the pilot and after launch in addition to the number of downloads we will be able to track which games are played, for how long and how often. We would also be able to monitor how often the app is used off site in addition to its use on the

Bridge. It would be harder to automatically gather user demographics of the users unless we added an explicit way for them to offer it, we can discuss ideas for encouraging them to register data for example by having a league table, prize or bonus level they can get if they register.

## Knowledge

The trail and the games will expose families to knowledge about

- flow, use and operation of the bridge (boat game)
- the growth of the city and the buildings in the environment (skyline game)
- stories from the bridge and the people who made it (through the characters)
- how the bridge works (coal shovelling game)
- history of the bridge and its fame (bridge painting game)

## Emotion

The emotional journey doing the trail will augment and extend that of the physical context. The games on the walkways play into the natural excitement from the vistas and the thrill of the glass floor. The characters will introduce new excitement and jeopardy once you leave the walkways which should provide incentive to continue on and complete the mission. The games in the engine room will be fun and will culminate in an exciting reward at the finish of the trail.

## Attitude

The characters will provide an engaging way to learn about the inventiveness of the people who designed the bridge. The boat and skyline game will provide opportunity to expose and appreciate the tradition, long life and work of London Bridge Trust and the Corporation of London. The bridge painting game will provide the opportunity to appreciate the importance of the bridge as a symbol of London.

## Skills

The games will allow players to learn how the bridge works through play. They will need to simulate skills of control, design, attention to detail in mastering the games and appreciate how they were applied to the Bridge.

## Behaviour

Our proposed design takes into account the current flow and time that people will want to spend on the bridge. It will allow players to move away from areas where visitors might be looking at the fixed interpretation to concentrate more on what you can see outside on the walkways and items that would not naturally be a long dwell point in the engine rooms.

## Social media

We would encourage sharing of bridge designs, photographs and scores on social media to co-ordinate with the Bridge teams social media strategy and presence.

## Agile methodology and process

We will adopt the best principles of agile development to prototype, get user feedback and iterate around designs. Our design and approach will make it possible to test elements and games within the trail as they are developed. The overall concepts and end-to-end experience will be tested in the planned user trials.



## On-going audience engagement and road map

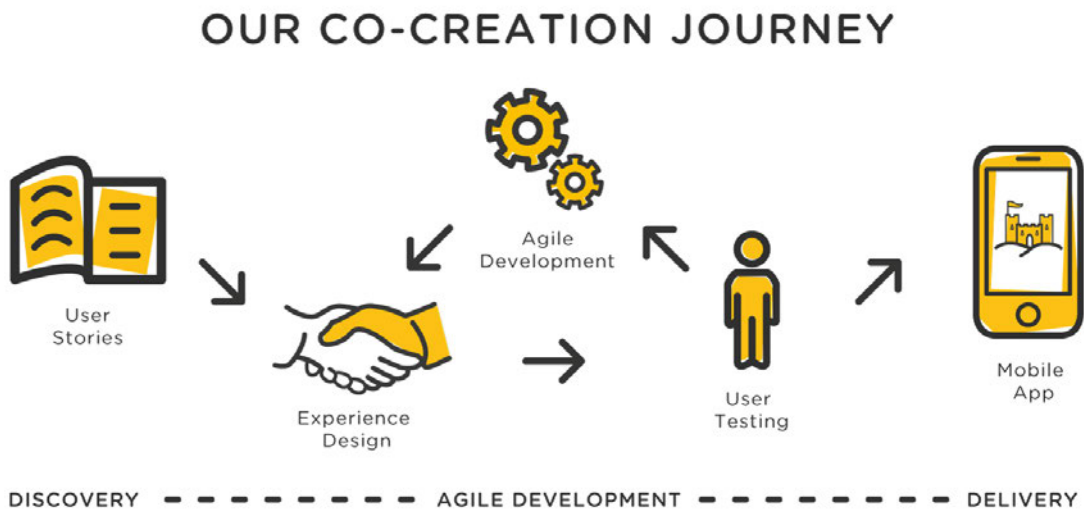
We would establish an approach and methods that will allow continuous evolution of the trail and on-going audience feedback. In the first instance the trail will be launched with English language with a predominantly visual design that can easily lend itself for translation. We imagine that there are far more game ideas than we can incorporate within the initial launch, they can be developed as a follow on and added to the trail as updates.

## 2. Method Statement

Calvium Ltd is a mobile development company based in Bristol. We have a proven, systematic and reliable development processes that helps you to realise ideas quickly and rapidly prototype concepts that can be tested with users. Feedback from the user tests is then used to refine the experience design and iterate around the solution.

All projects are a journey from discovery to delivery, and beyond. We believe that the best work is a result of collaboration and co-creation and this is how we approach our projects.

To illustrate this, we follow a three step process:



1. Discovery - Understand the brand, business, content and technology to define objectives. Identify personas and user stories
2. Agile Development - Design the User Experience, develop initial concepts, rapidly prototype them and test with users. Refine and test again until satisfied
3. Delivery - Fully develop the app for public or private distribution. Manage and maintain it.

This approach to our work has guided the prompt and successful delivery of over 20 geolocated, navigational and tourism apps for clients in the heritage and arts sector from all over the world.

The following is a specific and in depth explanation of how we will apply this approach for the Consultancy, Design and Production of a Digital Family Learning Trail for Tower Bridge.

## Work Packages

We break projects down into smaller “work packages” that focus on particular aspects of the deliverables and provide appropriate touch points for interaction with customers. For this project the work packages would be :

	Name	Description	Inputs from you	Outputs
<b>WP1</b>	Discovery	Work with you to finalize your requirements	Your time, your ideas,	Requirements document
<b>WP2</b>	Prototyping Proposal	Which of the tasks we will prototype and how	Agree proposal	Wireframe designs and behaviour specification document
<b>WP3</b>	Prototype development	Create the prototypes (paper, digital and human)	Media assets, critique and direction	User testable prototypes
<b>WP4</b>	User testing plan	Define the process and measures for the user testing	Direction, requirements	Plan and capture materials
<b>WP5</b>	Paper trail	Design and produce the paper equivalents for the digital experiences	Direction, sign off	Paper trail
<b>WP6</b>	User trial	Test the prototypes with target families over a two week period	Staff briefing, access to families and operational support (test devices)	Feedback data
<b>WP7</b>	User trial feedback report	Analyse the feedback data and report back	Disseminate to key stakeholders.	Trial report
<b>WP8</b>	Planning workshop	Jointly decide how to incorporate feedback in final experience	Your time	Outline specification of the final experience
<b>WP9</b>	Specification	Functional specification for final experience	Details on other parts of the solution (e.g. integrating other apps, signage)	Specification document
<b>WP10</b>	Graphic design	Graphic design for app and paper trail	Brand guidelines and assets	Design mock ups
<b>WP11</b>	App development	Build the mobile app	Licenses or access to any required services (eg image recognition)	Mobile app for testing
<b>WP12</b>	Text copy	Write text for tasks and	Curatorial	Experience text



		overall experience narrative	knowledge, direction	document
<b>WP13</b>	Graphics production	Media element production (image, sound, layouts)	Sign off	Colour palette and fonts defined, graphical elements
<b>WP14</b>	Paper trail production	Create printable proofs for a paper trail	Sign off	Print ready design
<b>WP15</b>	Tests with target users	Usability testing	Staff briefing, access to families and operational support	Documented issues or positives
<b>WP16</b>	Solicit feedback and tests with staff	Usability / operational testing	Staff briefing /test devices	Documented issues or positives
<b>WP17</b>	App final amends and QA testing	Ensure the app works as intended		Confidence that the app works as planned
<b>WP18</b>	iOS Submission	Prepare app store details	Access to Apple account or correct certificates	App submitted for approval
<b>WP19</b>	Android submission	Prepare app store details	Access to Google Play account or correct certificates	App published

### WP1 (Discovery)

As the tender brief is very comprehensive and the vision for the project clearly outlined we will not require a lengthy Discovery process.

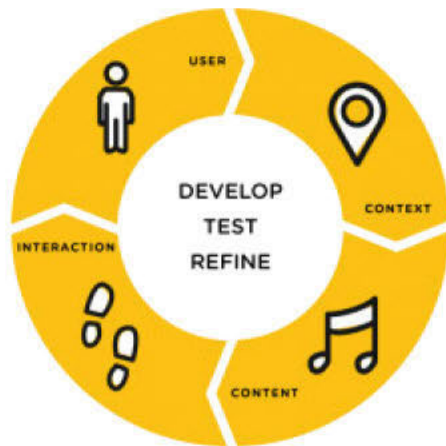
Upon acceptance of our tender and agreed contracts our first step will be to meet with the Tower Bridge team for a half day workshop. The goals for the workshop will be to :

- Agree user personas for our experience design
- Create an ordered list of our task ideas

### WP2 - WP7 (Agile Development)

Calvium will estimate how many tasks and to what extent those tasks can be developed in order to create a good enough prototype for user testing. We will think about the core features of the task and the minimum that would be required to give a realistic sense of what it would be like if it was fully developed. This “wizard of oz” approach will allow us to test a few different mechanisms and ideas quickly whilst keeping within the budget and time constraints of our project plan. For example we may not fully develop the interface, may have the user tester describe rather than implement a background story, or implement one aspect in a multi-faceted task.

EXPERIENCE DESIGN FRAMEWORK



We will apply our Experience Design Framework to quickly produce a first prototype. Key to this will be time spent on site to understand the context, test out the technology and get an idea of how this experience will fit into the current experience and the logistics of the current visitor management.

We will agree the format for the user tests. How we will engage families, what we will offer them to participate, how we will monitor them and collect feedback (analytics, observation, video, questionnaire or self recording). How to test both digital and non digital versions of the experience. Whether to ask them to use their own phones or supply test devices. Whether we dictate who in the family should use the device or leave that to them to decide.

Jo Reid will oversee the design and planning for the user tests, drawing on her experience running trials whilst at Hewlett-Packard research laboratories. Our research assistant will be the main person conducting the tests and gathering data. We imagine running tests over a two week period with an aim to have in the order of twenty or more families participate.

We will analyse and report the findings from the user tests and discuss them at a follow on planning workshop. They will be used to inform the design of the final experience.

Delivery (WP8 - WP19)

If the user tests give us enough confidence we would plan to turn the prototypes into final designs and develop the complete experience. The schedule and work packages we describe map that course. If however the user tests flag serious concerns about the task based approach or any specific tasks then we would need to consider a second round of iteration and user testing. We would need to re-factor budgets and plans to accommodate this extra round.

Even in the situation where we are proceeding through to a final delivery we will plan in usability testing with test users and staff throughout the development so that we can make sure that the interface design is working as intended. It should be possible to test tasks independently before incorporation into the final app.

3. Cost Breakdown

The following table summarises the resource, estimate of days and cost for each of the work packages.

Consultancy, Design and Production of a Digital Family Learning Trail for Tower Bridge				
Work Package	Name	Days	Resource	Cost (£) Excl VAT
WP1	Kick off meeting - agree first set of tasks to prototype	1	Senior consultant	
WP2	Wireframe designs for tasks	3	Senior consultant	
WP3	Prototype development	24	App developer	
WP4	User testing plan	1	Senior consultant	
WP5	Non digital prototype (paper equivalent)	5	Media producer	

WP6	User trials	3	Project management	
	User trials	10	Research assistant	
WP7	User trial feedback report	2	Senior consultant	
		5	Research assistant	
WP7	User trial feedback report	5	App developer	
WP8	Next phase planning workshop	1	Senior consultant	
		1	Research assistant	
WP9	Functional specification of agreed experience	5	Research assistant	
WP10	Graphic design proposals	3	Graphic Design	
WP11	App development (iOS & Android)	26	App developer	
WP12	Text copy (English only)	3	Copywriter	
WP13	Graphics production	2	Graphic Design	
WP14	Paper trail production	5	Media producer	
WP15	Tests with target users	10	Research assistant	
WP16	Solicit feedback and tests with staff	4	Research assistant	
WP17	App QA testing	5	Tester	
WP18	Submission of iOS app to app store	0.5	App developer	
WP19	Android submission	0.5	App developer	

The costs are based on the following rate card.

RATE CARD	
Senior consultant	
Senior developer	
Project management	
App developer	
Graphic Design	
Unity developer	
Tester	
Media producer	
UX specialist	
Research assistant	
Copywriter	

In summary the cost for Calvium time on the project is :

- [redacted] to deliver the user trial with prototypes
- [redacted] for production of the apps and paper based trail

In addition to these costs we estimate the following for expenses :

- [redacted]
- [redacted]

We would also expect the project to purchase any test devices should they be required and cover costs for producing any supporting materials such as printouts, signage or rewards for participating in user testing eg. free tickets, souvenir etc.





- we have described how we will run workshops and invite testing and feedback from the internal Tower Bridge team
- Give an opportunity to use the FLT as a service tool
  - We will gather analytics information and work with the staff on innovative ways to gather more demographic data. The auto-triggers will be used to experiment with ways of moving users through the experience
- Provide data for the evaluation of the involved processes for future applications
  - We will establish a user testing and feedback process that could be used in further applications

To deliver this proposal will require :

- Access to the Bridge for developing and testing the creative ideas
- Access and time of the Tower Bridge staff to be involved in workshops, game testing and supporting the user trial
- Possible purchase of test devices for the user trials
- Access and clearance to test iBeacons
- Regular project management meetings

## 6. Samples of Previous Work

City of London Visitor Trail | March 2014



**Client:** City of London Corporation

**Reference:** "Following a rigorous tender process, we partnered with Calvium because we knew we could rely on their professionalism and their expertise – not to mention their design skills and creativity. Jo and the team delivered exactly what we were looking for, even if it was something we hadn't thought of before: their advice was at all times excellent and they solved any problem we encountered easily." - Stuart Millar, Visitor Marketing Executive, City of London Corporation.

**Project undertaken:** The City of London was looking to change people's perceptions of the city as a home only to the countries economic policy enforcers and instead highlight it as a tourist destination, illustrating the wonderful architecture and rich history of the square. It therefore aimed to improve public access to, and historical interpretation of, the City. In addition to this The City wanted to use the app to bring in new and younger audiences by making their existing content available through a 'younger' medium.

The app enables users to explore London's famous Square Mile on foot through a series of fascinating routes, itineraries, personal insights and stories. From iconic landmarks to hidden gems, the City is a glorious maze of attractions, all within walking distance of each other. The City of London previously produced a physical map and tour guide that could be collected at their visitor centre. Calvium built the app with this pre-existing map in mind and rather than replicating all the information that was available in print, the app gave users additional and complementary content. Working in tandem with material that was already available proved successful as the individual preferences and needs of large groups of visitors we're met.

UCAN Go | January 2015



Client: UCAN Productions

**Reference:** "Working with Calvium to create the UCAN go app has been a pleasure. Their ability to work with partners and collaborators has resulted in a wonderful working relationship in which both parties have learnt huge amounts. Their solid technical background and confidence in creative problem solving kept the project moving and all deadlines were kept." - Jane Latham, UCAN Productions

Co-designed by UCAN Productions and Calvium, this app is the result of a yearlong research and development project funded by the Digital R&D Fund for the Arts in Wales, in partnership with the Wales Millennium Centre and The Torch Theatre.

UCAN Productions is a membership arts organisation working with young, visually impaired people to develop skills and confidence through drama and performance. Despite being passionately engaged in the arts, UCAN members were frustrated by the difficulties and constant barriers they face when visiting arts venues. Their wish was to have an app that could allow them to visit theatres independently by guiding them to their seat, the nearest toilet or bar.

Calvium tackled the problem by working closely with the UCAN members, understanding how they used their mobile devices, how, despite being registered blind, they were still able to see shapes and landmarks and how they are taught by helpers to navigate in the world.

We suggested that they simulate "being the app", to record one leading the other through a space to be able to analyse the language, style and guidance they naturally used.

We knew that the key to solving the problem was to work with the UCAN team to co-create a great solution. We also wanted to make sure that the solution could be deployed without the venues needing to install special technologies thus making it easier to adopt and more robust against breakdown (iBeacons running out of battery, getting moved by cleaners etc).

We came up with a solution based on using landmarks that the user should easily be able to identify so that the route leads you from landmark to landmark. We wanted to test that such a visual approach would work and so we developed a series of prototypes and conducted user trials with UCAN members and refined the solution over the period of the project. We tested the approach with 50 Visually Impaired users and 10 non Visually Impaired stakeholders.

You can read a full report at: <http://www.nesta.org.uk/ucan-go#sthash.qSEJLA AH.dpuf>

Once we knew the approach worked we mapped the entire Wales Millenium Centre and the Torch theater in Milford Haven. We also developed a smart routing algorithm which works out the best route taking into account your gender (so that you are taken to the right toilet) and whether you can use stairs (so that you can be routed via the ramps).

The result is UCAN GO, an iOS app which is fully accessible with a design that appeals to all users. Within the design there are several features particularly important for visually impaired users. You can easily choose from three colour scheme settings which cater for the common differences in type of visually impairment. You can zoom or use triple tap to hear the interface. The buttons are arranged consistently so that it is easy to remember how to move forward or back whilst listening to instructions and walking in the venue.

Outcomes Achieved: We are thrilled to say that this ongoing relationship has been most prosperous, with both members of Calvium and UCAN being invited to give a talk at Digital Innovation Week Wales on 'Exploring The Value of Co-Creation'. Furthermore, both parties have gained considerable knowledge with the UCAN team acquiring a good understanding of what is involved in app development and content production, while we have learnt much about the specific needs of the VI community. Calvium has now partnered with UCAN Productions to offer UCAN GO as a service to offer our new and existing clients.

## Escape From The Tower of London (2009)



Reference: "It has been a pleasure working with the team at Calvium to develop Escape from the Tower. We are delighted with the final product and the initial download figures."



Project Undertaken: We worked with Historic Royal Palaces (HRP) to create the 'Prisoner Escape from the Tower of London' app. Early tests of the app included a trial where the fore-runner to iBeacons, a manufactured RFID pinger, were placed within the palace and carried by Yeoman Warders to trigger an event in the app.

The curators at HRP were keen to understand how apps might be used to engage younger visitors and enhance the visitor experience. Specifically, they knew which stories they wanted to tell, wanted to engage family groups and teenagers, and wanted to know the most popular locations and movement patterns of their visitors.

Working together with the curators, Calvium filled in the knowledge gaps and the idea for a location-based game was suggested, one that would take players around less visited areas of the Tower of London and engage them with its colourful history in quizzes. Calvium helped to provide the knowledge and technical know-how, leading to: Idea generation, Testing game mechanics and technologies, Interaction design and Development process.

Using AppFurnace, an initial prototype of the game was developed and written by HRP themselves, including sample content provided by HRP. Then, utilising the , Calvium helped create a working prototype and jointly tested it with several family groups, on location at the Tower of London. Acting on feedback from the user trial, we refined the game and HRP commissioned professional script writers and media producers to hone the experience and produce quality audio.

We were also keen to make sure players had a great experience when they were using the app: HRP installed a wifi hotspot next to the poster advert for the game, so downloading the app was quick and painless. A "no-location" interface was added, so the game can be played by visitors that didn't finish the experience whilst they were on site, as well as on the iPod Touch. A High-Score interface was added to the HRP website, allowing users to enter monthly prize draws and give feedback about their experience with the app.

## 7. References

### **Jane Latham**

Development Director, UCAN Productions  
<http://ucanproductions.org/about-us/who-we-are/>

Email : [jane@ucanproductions.org](mailto:jane@ucanproductions.org)

### **Francesca Panetta**

Multimedia special projects editor  
The Guardian  
<http://www.theguardian.com/profile/francescapanetta>

Email : [franpanetta@gmail.com](mailto:franpanetta@gmail.com)

### **Aileen Peirce**

Interpretation Manager  
Historic Royal palaces  
(Collaborated on Tower of London Prisoner app)

Email : [Aileen.Peirce@hrp.org.uk](mailto:Aileen.Peirce@hrp.org.uk)

### **Stuart Millar**



Stuart commissioned the City of London app but has now left the organisation  
He may be contactable via [Gabrielle.Brown@cityoflondon.gov.uk](mailto:Gabrielle.Brown@cityoflondon.gov.uk). or [buscemian@hotmail.com](mailto:buscemian@hotmail.com)

# Tower Bridge Family User Testing

- The overall feedback from parents was that they were grateful their children had activities to do/ games to play, keeping them occupied and making their experience of Tower Bridge more fun than they expected it to be for their children. Many parents said that without the games, their children would have been bored.
- Dirk's wife spoke about how attractions such as Tower Bridge rarely have activities like this for families and that Tower Bridge should focus on how best to market this idea of a family activity (above and beyond stickers etc). Dirk later mentioned his Wife's suggestion and that it might be good to think on this...
- Throughout the game playing one quickly identifiable pitfall was where and how the children might play the games - particularly the paper games. Many children sat or lay on the floor, which though fine when the bridge was quiet, became quite difficult when it was busy and crowded.
- Everyone loved the 'you win' screens at the end of the games. Perhaps something to keep in some way? For children, you could see it gave them validation and also, a sense of accomplishment.
- The games between the second walkway and the engine rooms do feel as if something is missing between them - it feels like quite a gap after doing so many games in the walkways.

## Raise the Bridge

Cool was often the word used to describe watching the bridge lift, but beyond watching, there was little further interaction/conversation, though this was a favourite game for several families!

## Spot the Difference

Great for younger children, and surprisingly, for some older children too. Though some children were confused as to which side they should circle the differences on and by doing it on both sides, became confused as to how many differences they had spotted.

## Steer Boat

Most children, if not all, didn't know to blow into the microphone, and only did so with a prompt from us. The steering mechanism, of tilting the phone to steer, similarly needed prompting. Though once children understood the mechanism, they really enjoyed the game - it was a favourite for many.

The older children that recognised the boat would still sail (albeit slowly) without blowing, began to doubt the blowing affected the boat at all, and so let it sail through on its own. Can we perhaps begin the game with the boat at a standstill? Waiting for the bridge to open before it sails through? This might feel more like the user is affecting the change, particularly for older children.

## Match the Pairs

Great for younger children, but far too easy for many who were slightly older. Suggestions from one family included objects that didn't match up to throw you off. Also, children didn't like that their lines went through 'Match the Pairs' so I'd suggest we move the title to the top of the page.

## Match Skyline

Great for all ages and the pop ups, giving information about each building, prompted many children to say the building's name and/or point to it in the skyline.

In terms of usability many picked up the first building straight away, only afterwards realising that you could scroll through the skyline horizontally, some dragging the building across the skyline. Also, HMS Belfast and St Paul's Cathedral we're a bit too tricky to place, only working at a very particular point.

## Architect Papers

For some children this was too open an invitation, many not feeling they could draw well enough to try. It also was problematic for children too small to see the buildings. Visually, this game also felt very different to the others - needs work?

## Origami Boat

The most challenging and time consuming of all the games, but the most effective game at encouraging collaboration and conversation between parents and children, and the game that resulted in the most pride on completion.

The instructions on the boat were not used, everyone following the video, though the video did need to be paused after every instruction and sometimes replayed. Is there a different way to approach this? Chris did show us a series of short videos/gifs on a webpage that you could scroll down through. Could this work better?

## Pressure Gauge Maze

The older children relished the challenge in this, though some did work backwards! Most children took the time to work out the best route, however on two occasions parents intervened thinking the route couldn't cross the lines of other paths. Also, we need to think about how the copy can relate to game to the furnace in the room, as they can work out the right pressure by looking around them.

## Fix Engine

This game worked really well and at times didn't for several reasons. On starting the game, many children kept pressing the screen, perhaps prompted by the arrow. Some then tried to slide the screen up. The pressing of the screen meant that by the time the tools came up, they missed the

shape. This was particularly the case when we tested with overseas families. At this point, as you don't see the shape again, children sometimes went through a series of wrong tools. On getting the right tool, the majority of children didn't understand the motion of cranking a spanner - some turned the phone all the way around, and for others it didn't work as they didn't hold the phone upright enough. Once, shown, they got the motion quickly and enjoyed it from there, but getting the mechanics proved difficult to most.

## Tool Search and Find

Lots of children enjoyed this game, however quite a few didn't know what to do on finding the spanner, or missed it and just counted up the nuts and bolts. Without the answers, this game perhaps didn't have quite as good a sense of achievement - not knowing if they'd done it right or wrong.

## Play Bridge

This was difficult to test as no musical stamps appeared on completing the games, making it seem very separate at the end of the trail. However, one young girl in a Spanish family listened to Play Bridge throughout her experience and it was her favourite game!



## Tower Bridge - Word Association

What are the first 5 words that come to mind when you think of Tower Bridge? Try and write one word in each of the boxes below.

1. How fun were the games to play? Rate from 1 (very UN-ENJOYABLE) to 5 (very ENJOYABLE)

1      2      3      4      5

2. How easy did you find the games to play? Rate from 1 (very DIFFICULT) to 5 (very EASY)

1      2      3      4      5

3. What kind of games did you prefer?

digital games

paper games

all the games

4. How likely are you to recommend the experience? Rate from 1 (very UNLIKELY) to 5 (very LIKELY)

1      2      3      4      5

5. What did you like?

.....

.....


6. What did you not like?

.....


.....

## Group Discussion

- Do you think these games will work for your visitors?

- 
- Is the style and content right for your visitors?
  - Do you think these games will enhance visitor experience and encourage active engagement?
  - Can you suggest names for each of the games?
  - Did you need more instructions for any of the games?
  - Explore the visitor journey - how will visitors experience the trail across the bridge and into the engine rooms - how can we encourage visitors to complete the trail?





# Tower Bridge Family Learning Trail

## User Trials Feedback Statistics



# Public Trials

## Walkthrough Testing

9 family groups were shadowed as they experienced Tower Bridge, and were asked to take part in the Family Trail activities at specific points in their visit.

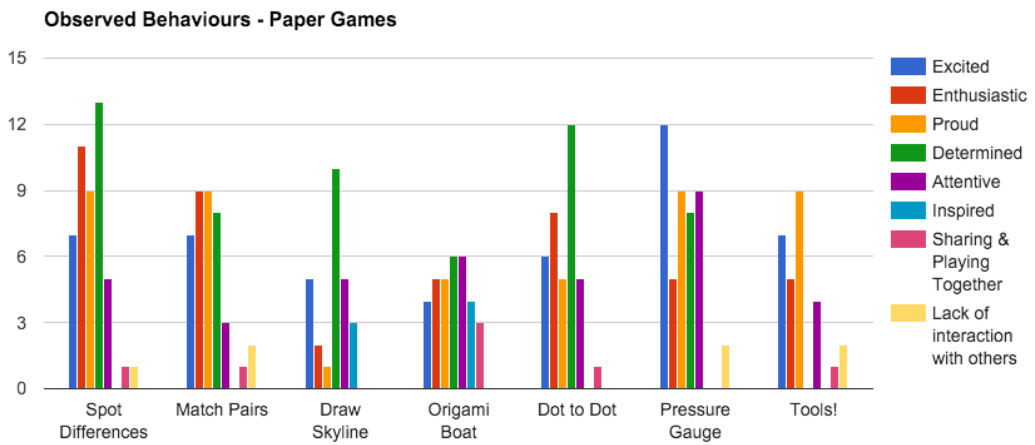
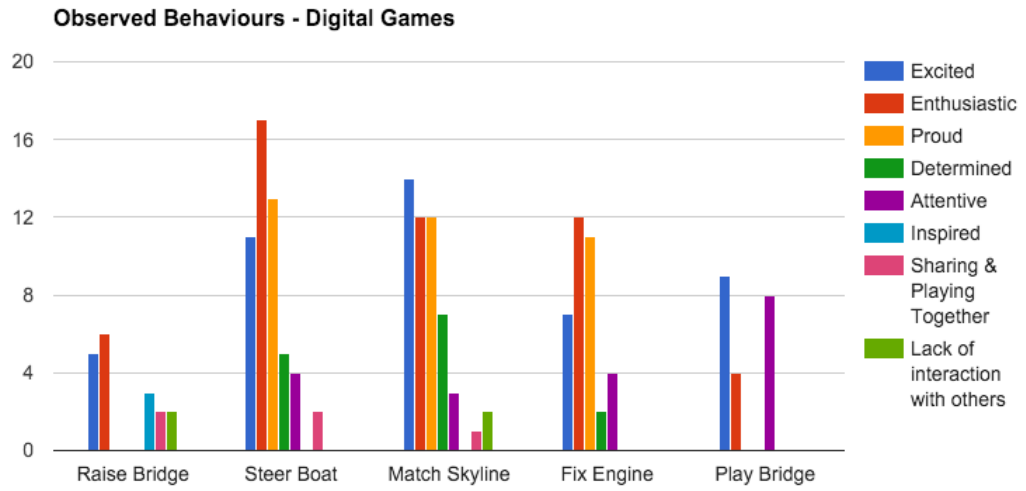
At the end of their visit, they were given questionnaires and had a short discussion with the team.

## Observed Behaviours Methods

Behaviours were observed, as demonstrations of the kinds of interactions and emotions participants expressed, including:

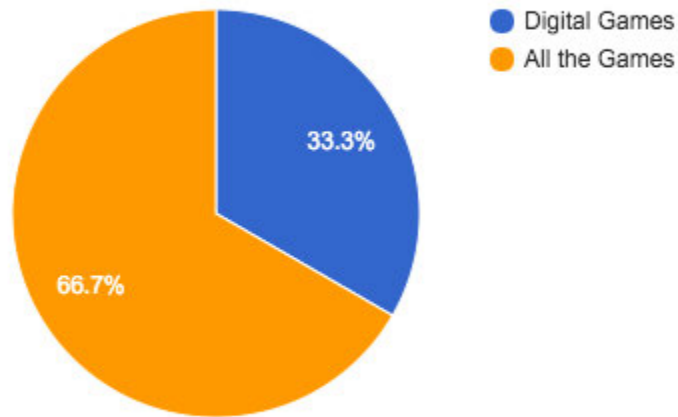
- Excited: children happy to play games when offered
- Enthusiastic: children wanted to play game more than once
- Proud: children were very glad they were able to successfully accomplish the task
- Determined: children wanted to accomplish the task despite the challenge of the game
- Attentive: children were focused into carefully accomplish the task
- Inspired: children were stimulated by the game to think creatively about the games itself or the topic that involved
- Sharing & Playing Together: children were co-operating with peers or adults
- Lack of interaction with others: children were focused solely on the activity

## Observed Behaviours Charts

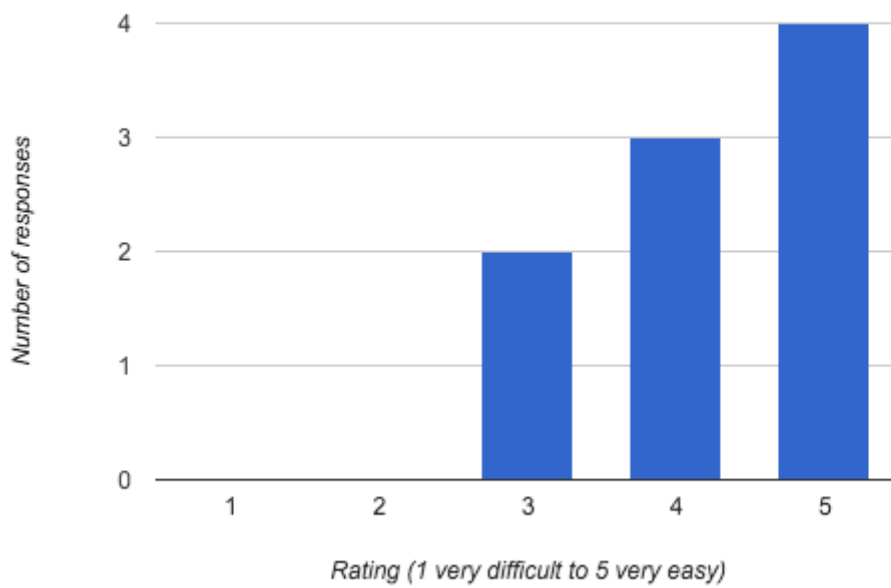


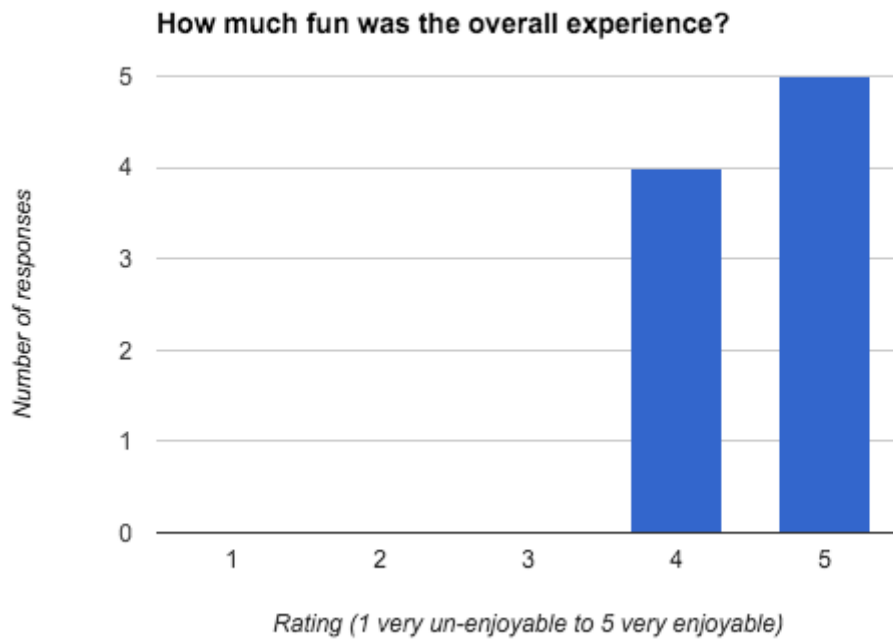
## Feedback Forms

**What kind of games did you prefer?**



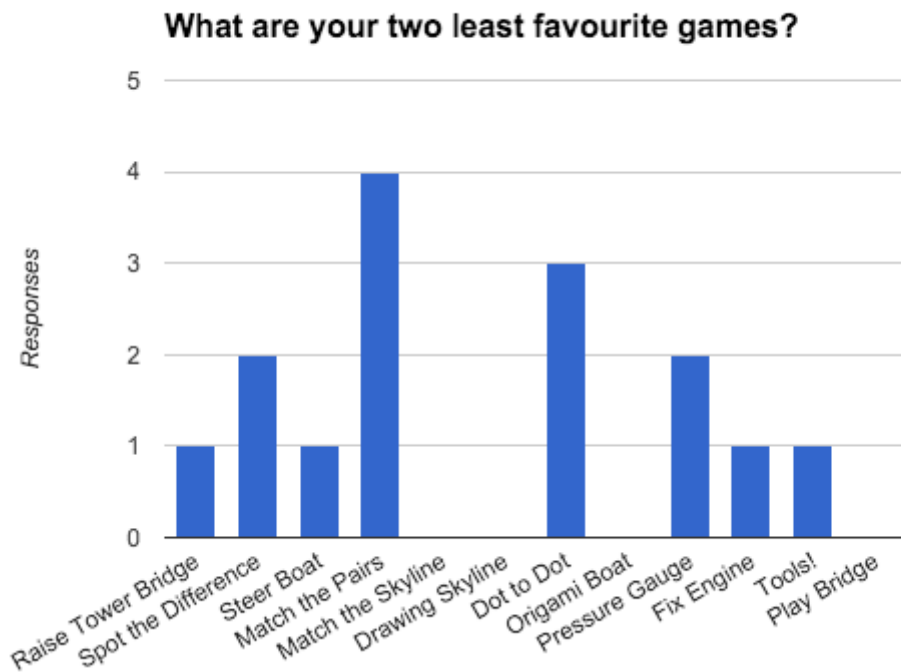
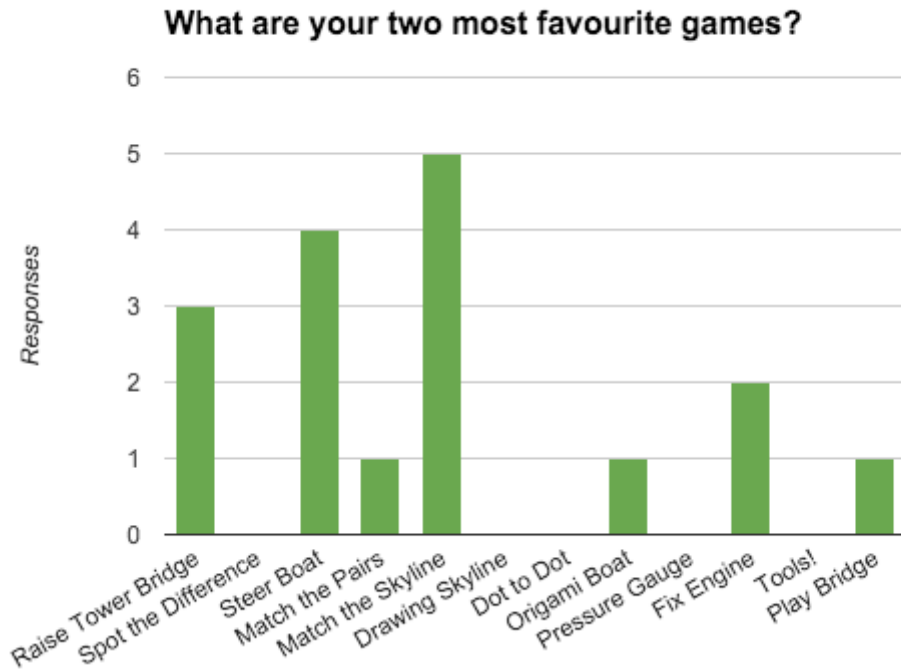
**How easy did you find the games to play?**





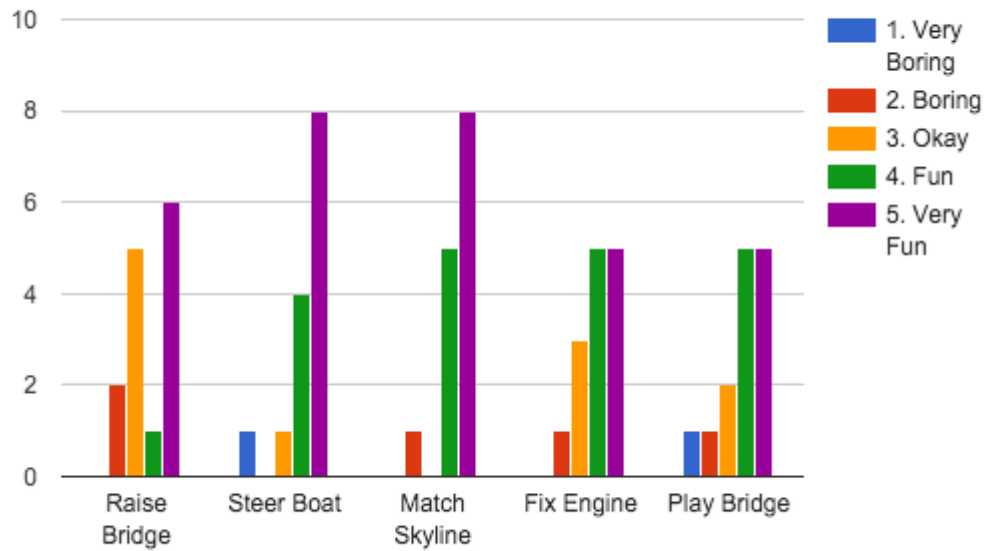
## Feedback Forms

### Favourite & least favourite games

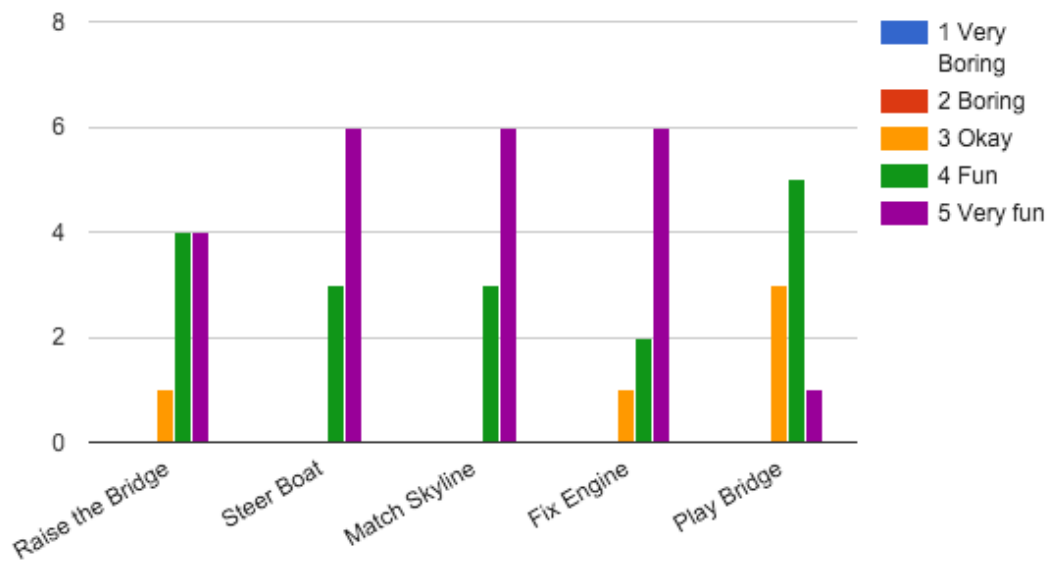


## Parents & Children's Responses Digital Games

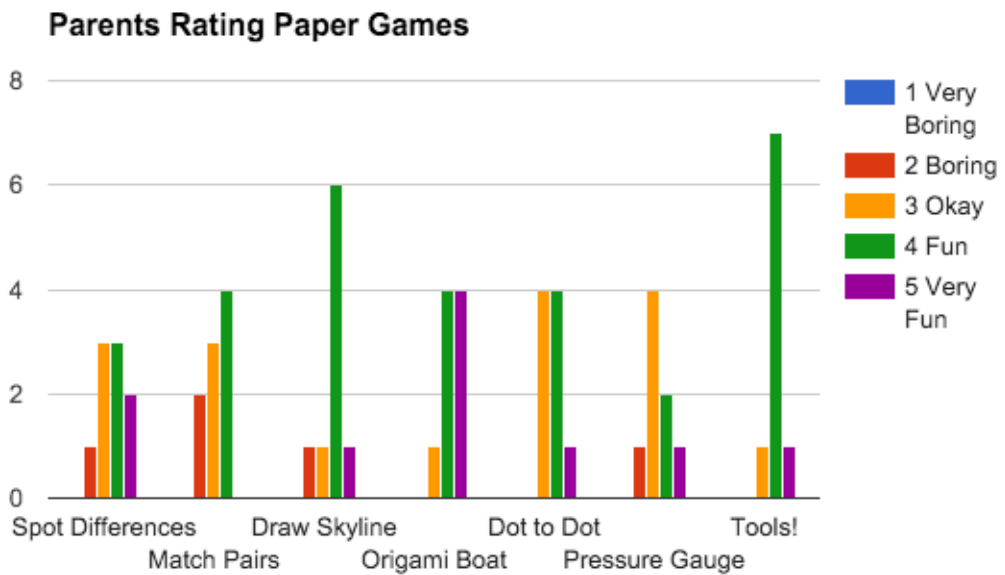
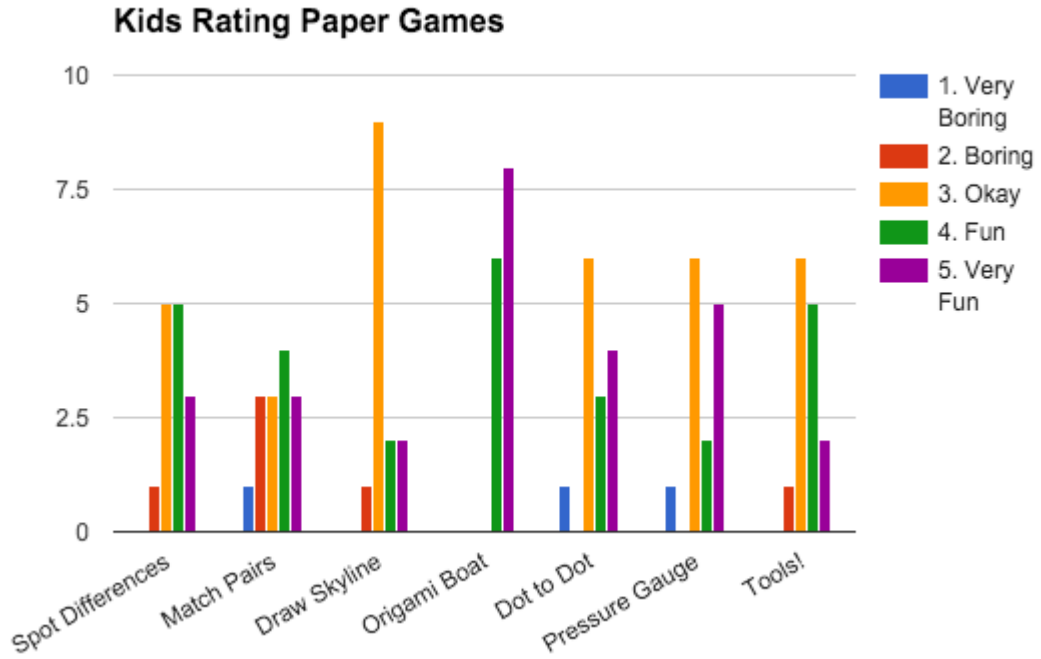
**Kids Rating Digital Games**



**Parents Rating Digital Games**



## Parents & Children's Responses Paper Games





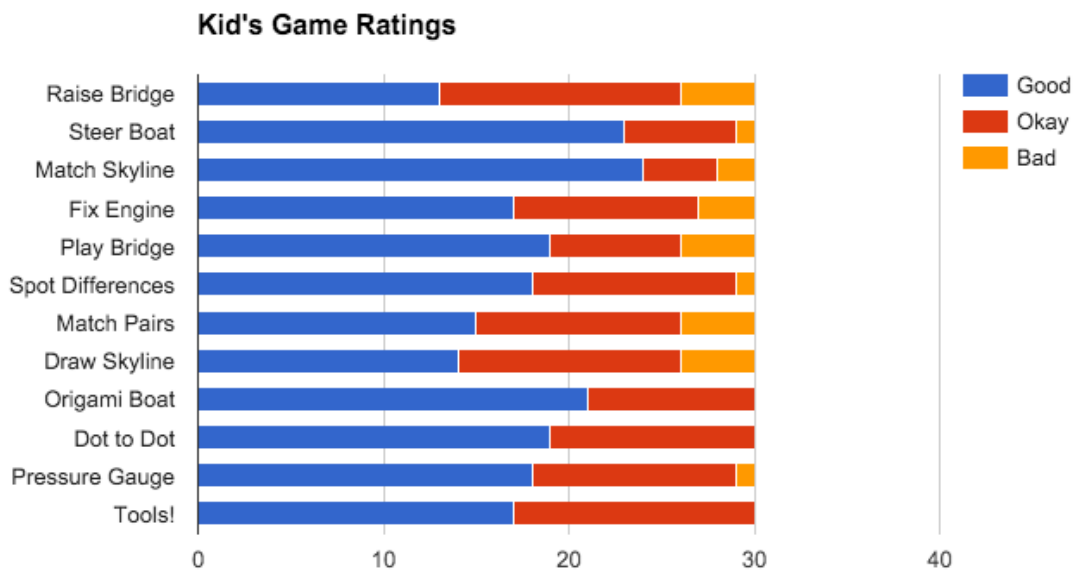
## On-the-Spot Testing

Walkthroughs were taking longer than expected, and many families invited to walkthroughs had already pre-booked tickets, and did not speak fluent English, so were less enticed to engage.

So, our team carried out “on-the-spot” testing, where suitable families were asked if they would like to try some activities being designed in situ, and were involved in about three activities each, on average.

42 children participated, and after their experience, they were asked to rate the games as “Good”, “OK”, or “Bad”, as many visitors didn’t speak enough English to participate in more in-depth discussion.

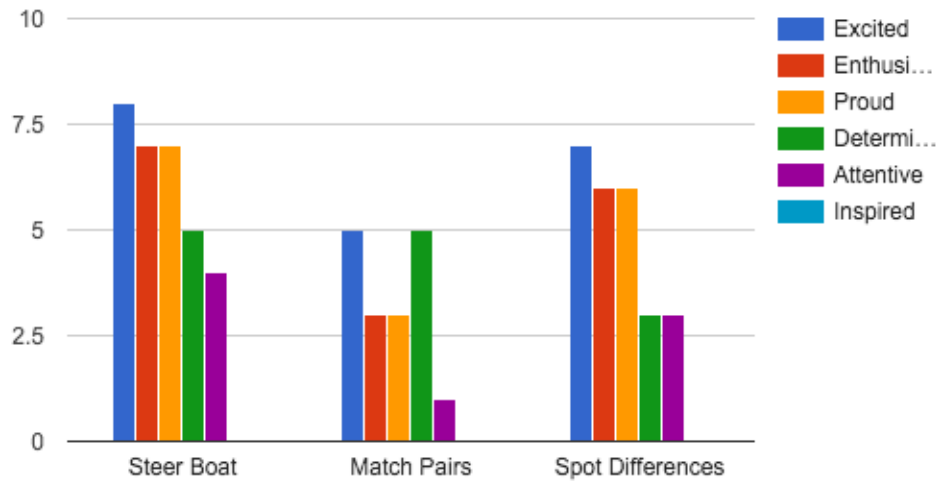
## On-the-Spot Testing Feedback



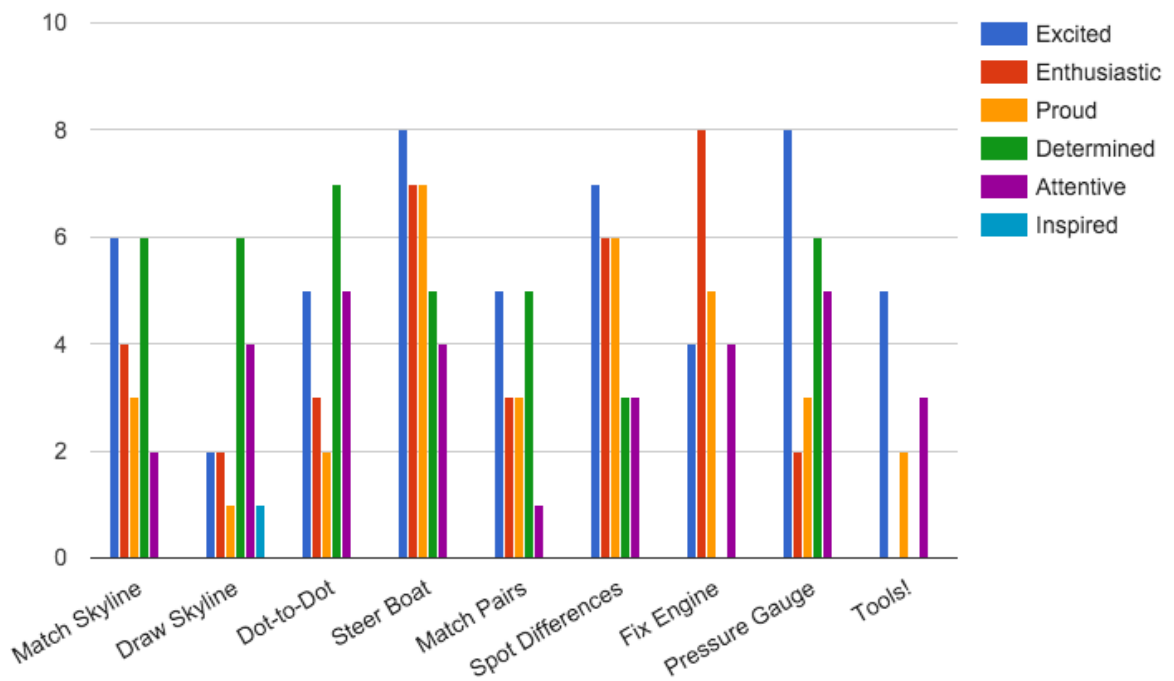
## On-the-Spot Testing Observed Behaviours

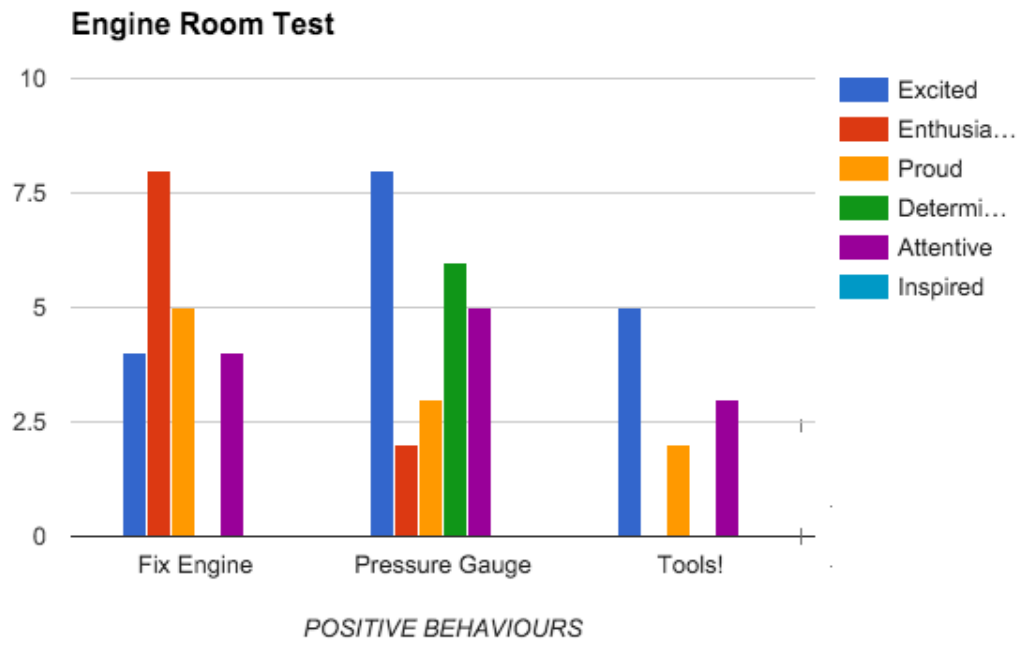
Tests were conducted in different areas of the bridge, presenting different games in each, depending on context and availability of participants and space at the time of testing.

**East Walkway Test**



**West Walkway Test**



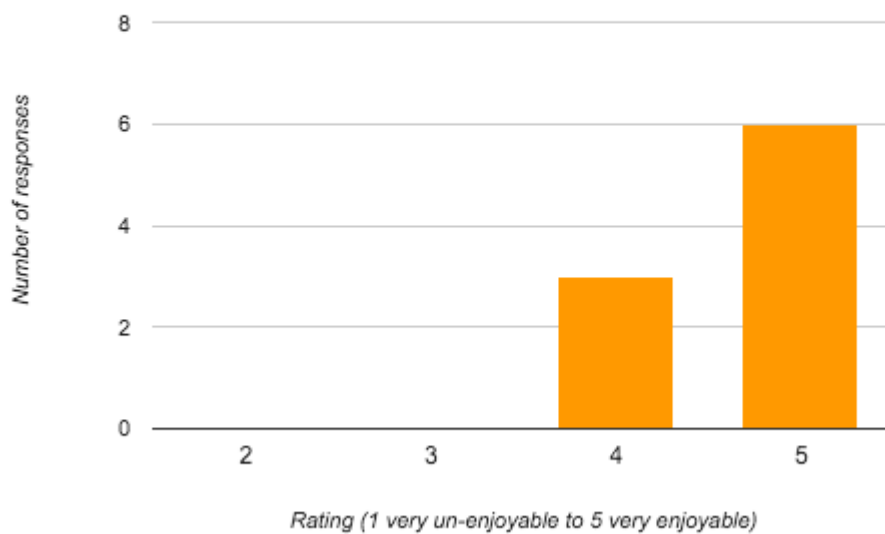


# Staff Trials

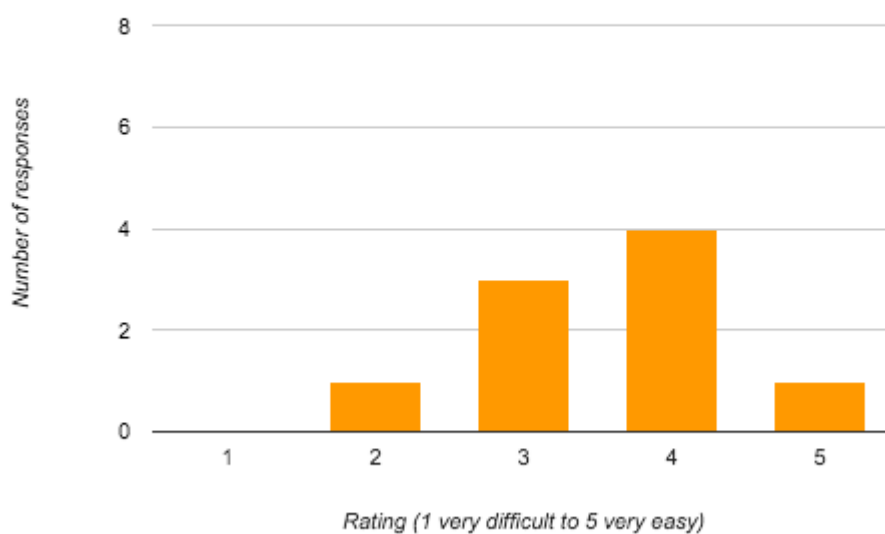
During staff trials, questionnaires and discussion feedback were used to make improvements to the experiences of the public user trials carried out, so this data is included as an appendix.

## Questionnaire Feedback

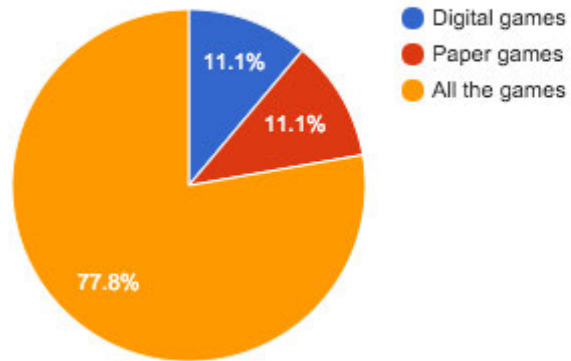
### How fun were the games to play?



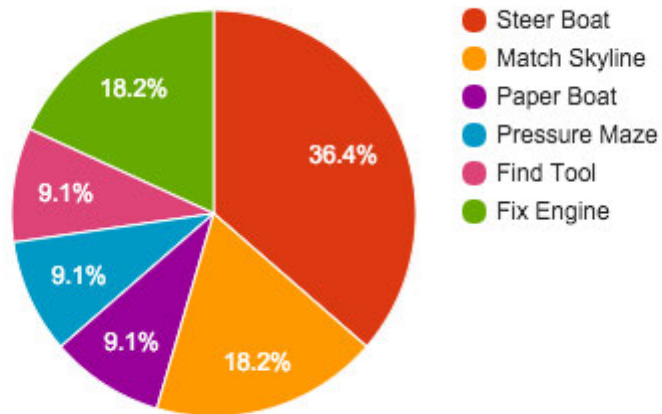
### How easy did you find the games to play?



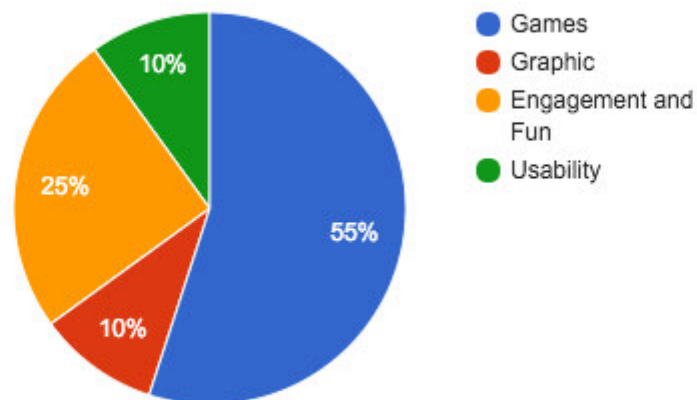
### What kind of games did you prefer?



### Favourite Games



### What parts of the experience did you like?





## Evaluation of Visitor Experience and propensity to visit: Exeter

### Cathedral (T5.1.2)



## Introduction

At its inception, the aim of the project was to collate visitor data to investigate the impact of VISTA AR technologies and solutions on visitor profiles and numbers. Visitor volume data, provided by Exeter Cathedral, was gathered for 2019 as a baseline year. Further, visitor profile data was collected through two visitor surveys at Exeter Cathedral in low and high season in 2019. Unfortunately, given the pandemic, these baseline figures are based on pre-pandemic numbers and do not provide a meaningful benchmark for measurement. Instead, this evaluation will focus on the effect of VISTA AR technologies on the visitor experience at Exeter Cathedral and on propensity to visit the site. Two studies are conducted to explore these effects.

## Study 1: Evaluation of visitor experience at Exeter Cathedral

### Background

VR and AR are purported to increase relevancy, engagement, and visitor numbers at visitor attractions. Given the pandemic and ongoing restrictions, it was not possible to evaluate a meaningful change in visitor numbers in 2021 as a result of VISTA AR technologies. Instead, this study aims to evaluate the impact of these technologies on the visitor experience at Exeter Cathedral.

### Methods

Data was collected at Exeter Cathedral in summer 2021. Two groups of participants were studied, those who had a 'standard' visit, without digital experiences, and those who were exposed to five VISTA AR experiences as part of their visit: a themed tablet tour (Pilgrim's Tour); two AR experiences (West Front AR, Minstrels' Gallery AR); and two VR experiences (Choir VR, North Tower VR). These two samples were collected on separate days to ensure the 'standard' visit wasn't affected by the technologies being on site.

Those exposed to the digital experiences were given a themed tablet tour (Pilgrim's Tour), along the visitor journey there was the option to experience two AR experiences (West Front AR, Minstrels' Gallery AR) and two VR experiences (Choir VR, North Tower VR). Table 1 shows how many respondents chose to use each of the experiences. All participants took a pre-visit and post-visit survey, which captured their visitor profile and their evaluation of the overall experience. Affective valence was also measured across the visitor journey: at the start, after interaction with each of the digital experiences and at the end of the journey. Affective valence is simply a measure of how pleasant vs. unpleasant a person feels. By tracking this across their visit we can evaluate what impact the technologies had on these feelings. How pleasant vs. unpleasant they would feel if they were to repeat the behaviour was also measured.

VISTA AR technology	Number of Participants
---------------------	------------------------



West Front AR	39
Minstrels' Gallery AR	40
Choir VR	54
North Tower VR	67

Table 1: number of participants choosing to experience the VISTA AR technologies

In total, 177 visitors participated in the study; 114 who experienced a visit including the five VISTA AR experiences and 63 tourists who did not visit when these technologies were being showcased. The perceived length of visit without digital experiences was 'less than an hour', whereas with digital experiences this increased to '1-2 hours'. The profile of those who participated in the study is summarised in figures 2-6. The age and gender profile of visitors was fairly evenly distributed. The majority of participants had an explorer (36%) or experience seeker (30%) motivation to visit the site (see figure 1 for description of these profiles), were from the United Kingdom (95%), visiting for the first time (77.5%) with one other adult (45%) or in a group with children (30%).

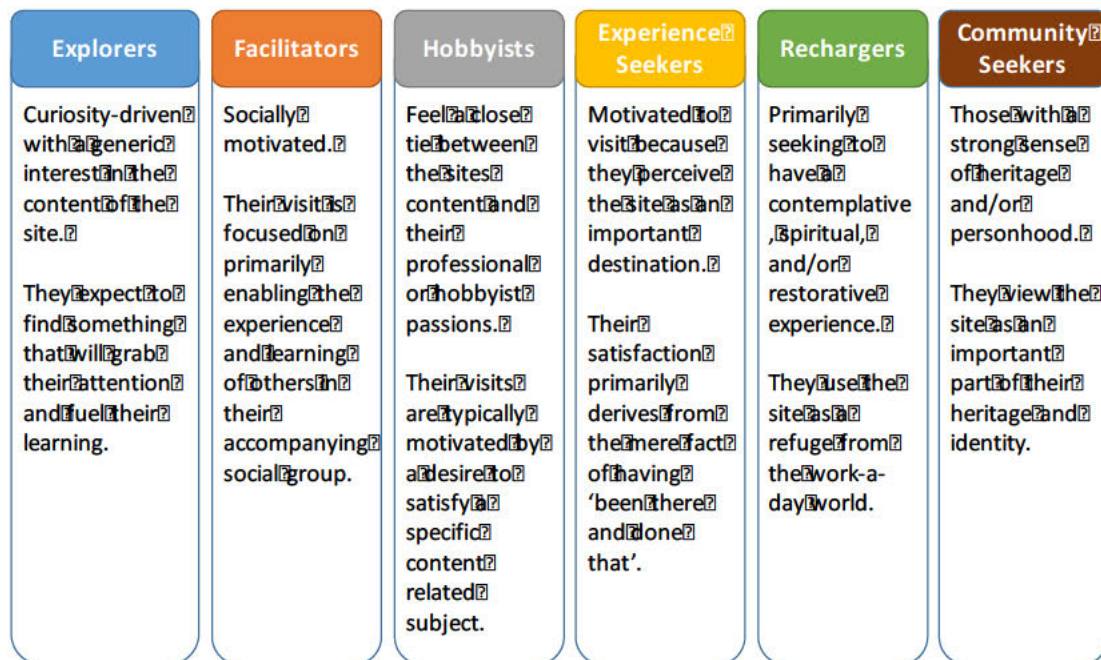


Figure 1: Description of visitor motivations



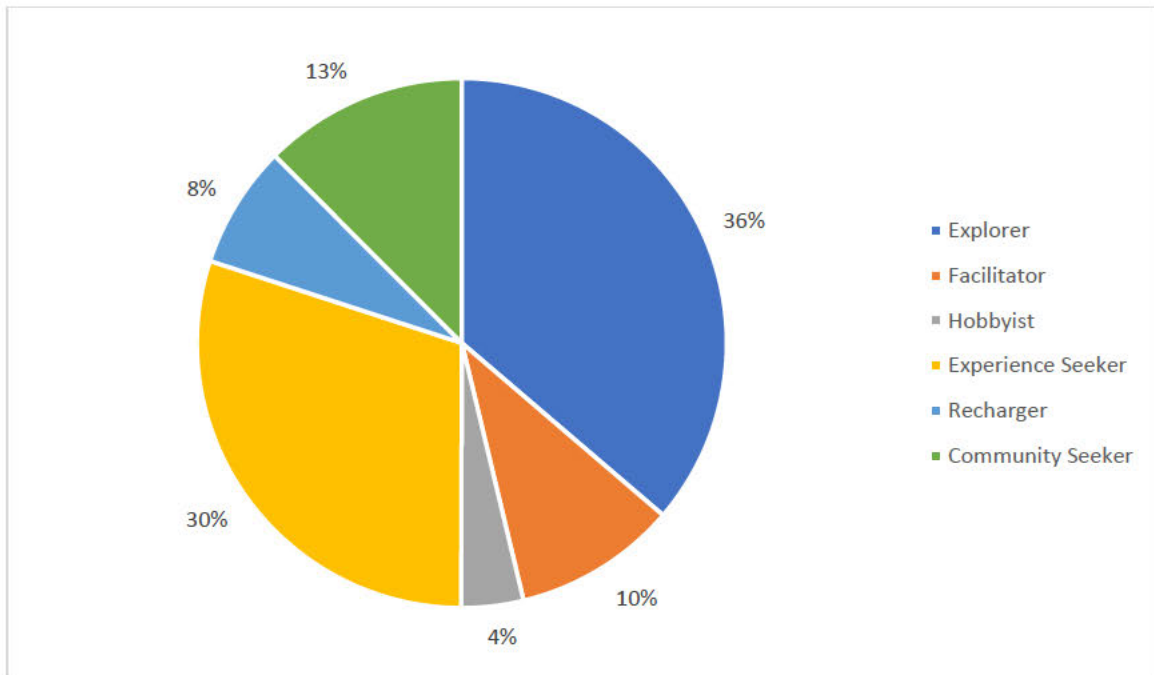


Figure 2: Motivation to visit

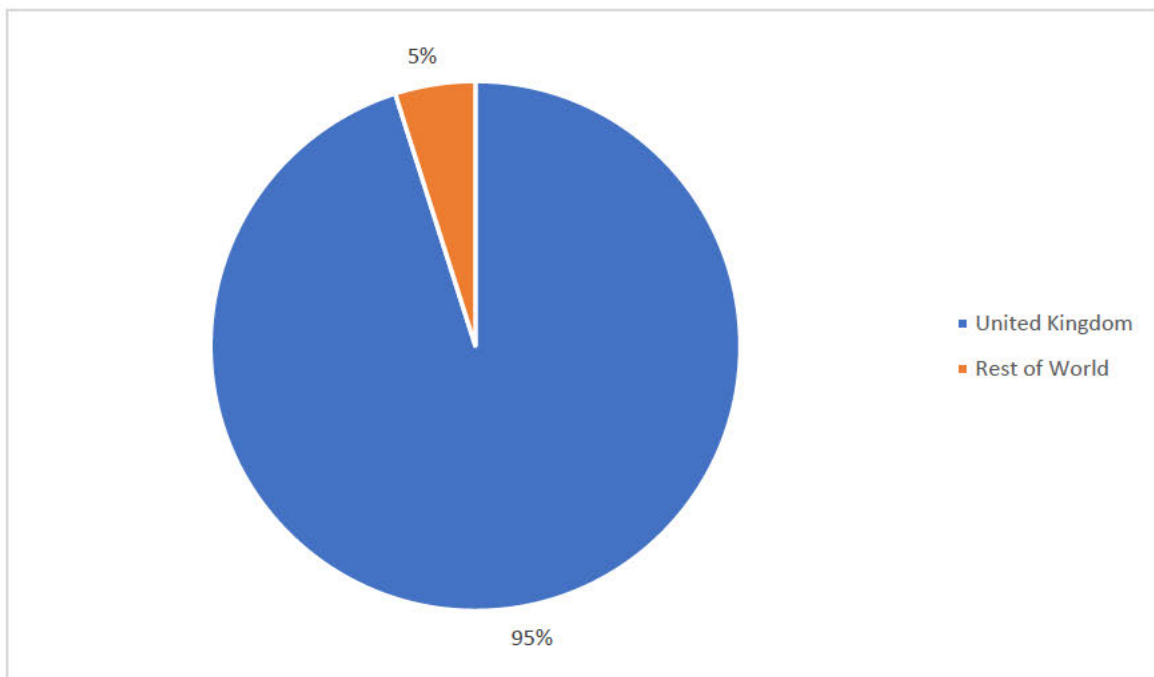


Figure 3: Country of residency

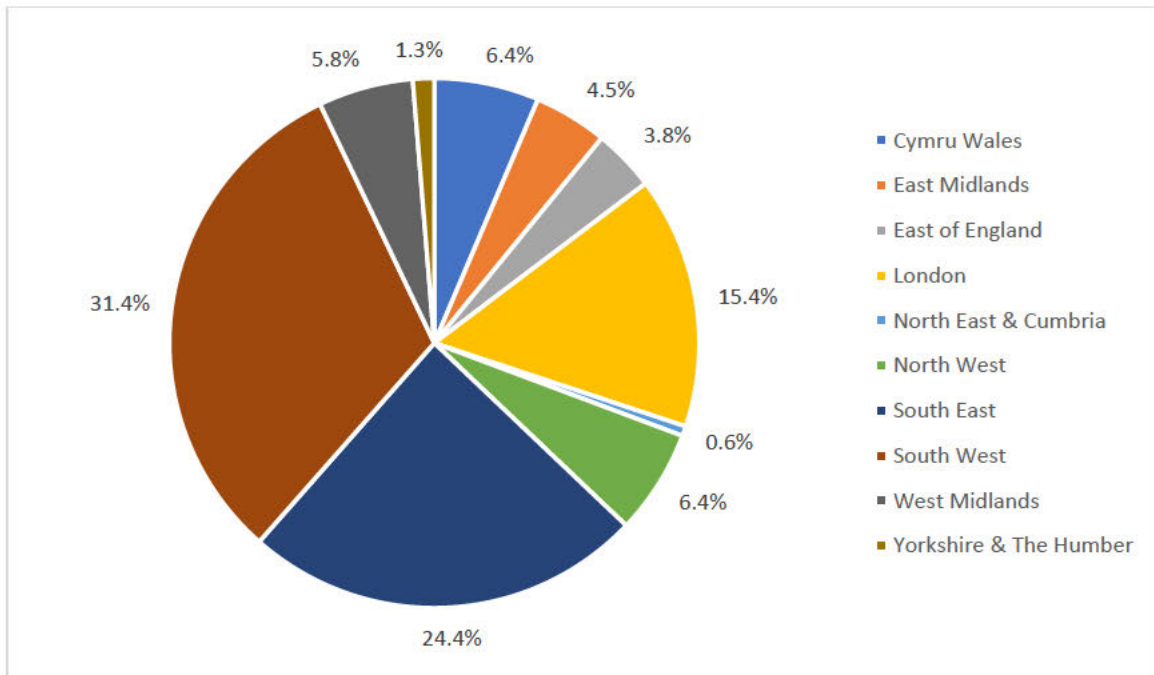


Figure 4: Regional profile of UK residents

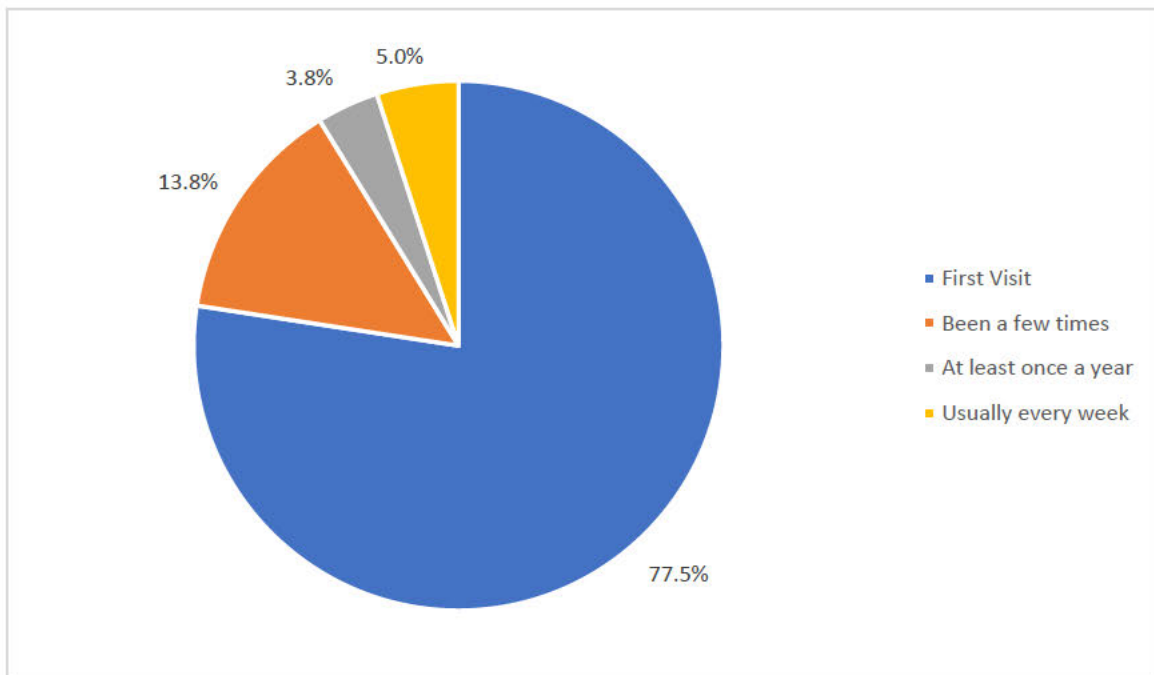


Figure 5: Visit frequency

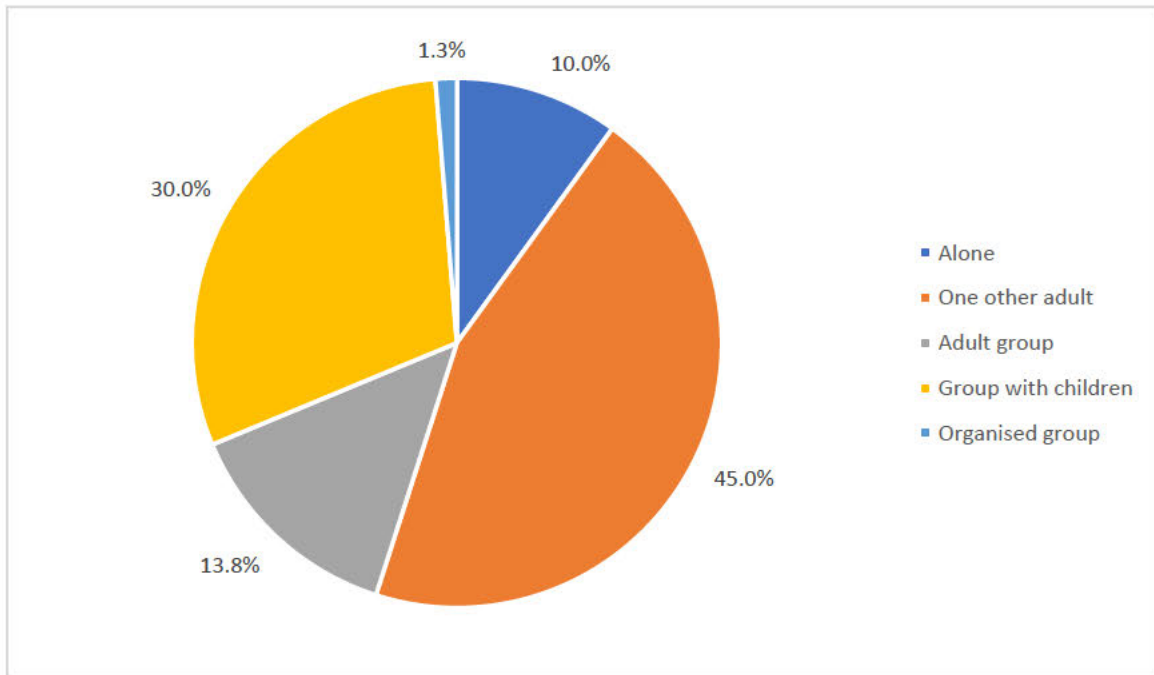


Figure 6: Party type

## Results

### Impact of VISTA AR technologies on experience ratings

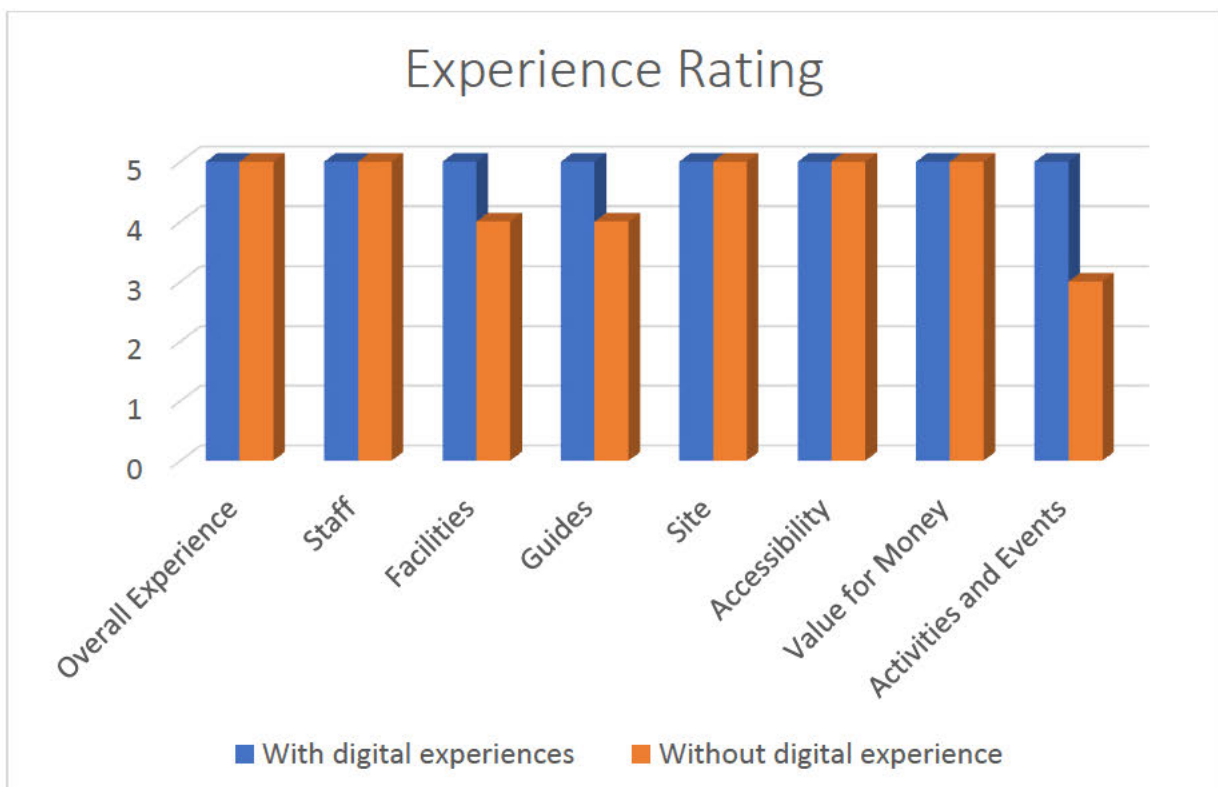
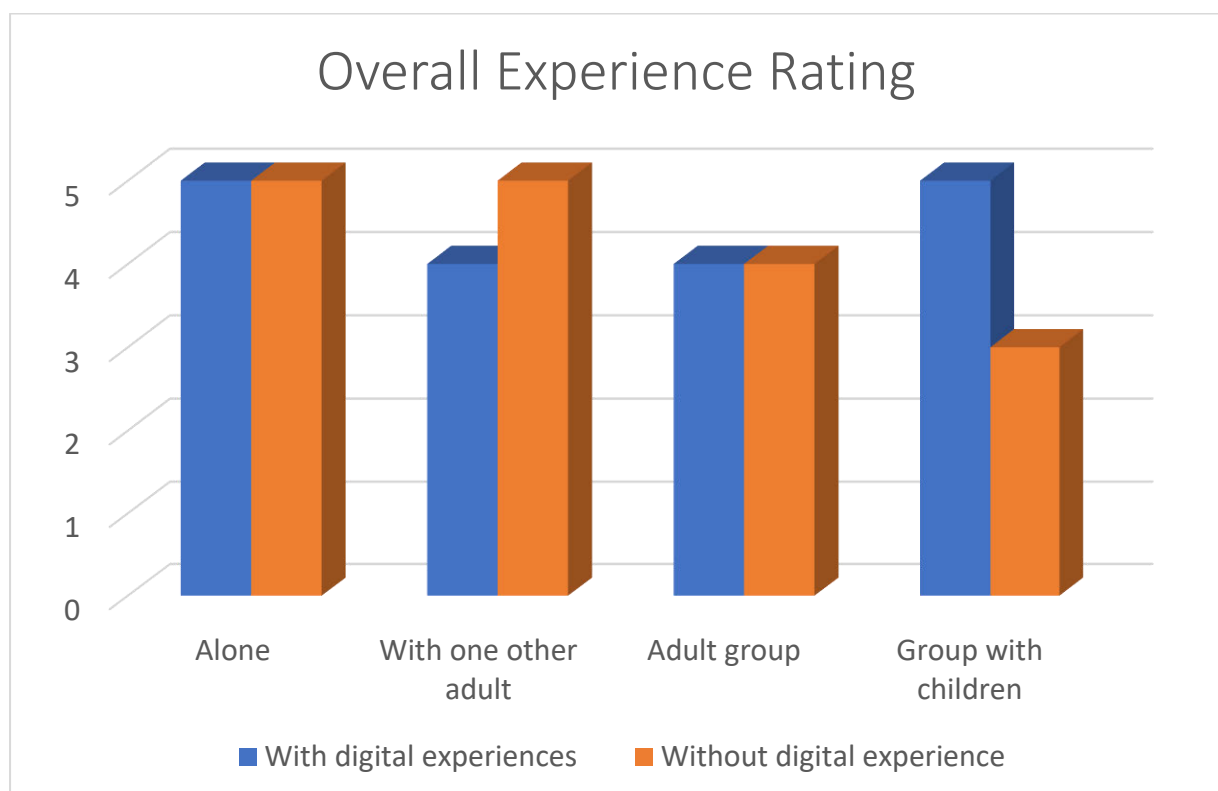


Figure 7: Comparison of rating with and without digital experiences

Figure 7 shows a comparison of the average visitor ratings, across several dimensions, when visiting the cathedral both with and without digital experiences. There were statistically significant differences between the rating of the two visit types in three areas: facilities<sup>1</sup>, guides<sup>2</sup> and activities and events<sup>3</sup>. While the overall rating was high for visits both with and without digital experiences, the digital experiences did improve the rating in these three areas, which can reasonably be associated with interpretation of the sites assets and ways to engage with them.

Further interrogation of the ratings showed that the overall experience rating was impacted by party type (i.e., who you visit the cathedral with). The difference in overall rating between party types was statistically significant when the visit included digital experiences, but not when visiting without<sup>4</sup>. This suggests that the overall experience when visiting with digital experiences is perceived differently depending on who you are in a party with.



<sup>1</sup> Mann-Whitney analyses were employed to examine the effect of digital experiences on rating of facilities, the effect was found to be significant ( $U= 2051, ps = .029$ )

<sup>2</sup> Mann-Whitney analyses were employed to examine the effect of digital experiences on rating of guides, the effect was found to be significant ( $U= 1852.5, ps = .002$ )

<sup>3</sup> Mann-Whitney analyses were employed to examine the effect of digital experiences on rating of activities and events, the effect was found to be significant ( $U= 1399.5, ps < .001$ )

<sup>4</sup> Kruskal Wallis analyses were employed to examine the effect of party type on overall rating. The effect was found to be significant with digital experience ( $H(6)=9.191, p=0.42$ ) but not without digital experiences ( $H(6)=6.483, p>0.05$ )

Figure 8: Comparison of overall experience rating by party type

Notably, as visualised in figure 8, people visiting in a group with children rated the overall experience higher than those who visited in a group with children when the technologies were not being showcased<sup>5</sup>. Further, visitors in a party with one other adult who visited with digital experiences on average rated the overall experience lower than those who visited when the technologies were not being showcased<sup>6</sup>.

#### Impact of VISTA AR technologies on affective responses (feeling of pleasure)

The findings revealed that each of the VISTA AR digital experiences prompted high affective valence scores, supporting the notion that visitors enjoyed using the devices on-site. The VR devices were associated with higher scores when compared to the AR devices (see Figure 9). Moreover, the North Tower VR experience facilitated greater affective valence ( $M = 8.34$  out of 9) when compared to the Choir VR experience ( $M = 7.43$  out of 9). In contrast to the Choir VR experience, which only tracked users' head movements (i.e., orientation tracking), the North Tower VR experience was fully immersive and had the capacity for positional tracking (i.e., the display updated in accordance with visitors' movements). Therefore, site managers are encouraged to consider the use of immersive VR technology to facilitate positive affective responses from visitors.

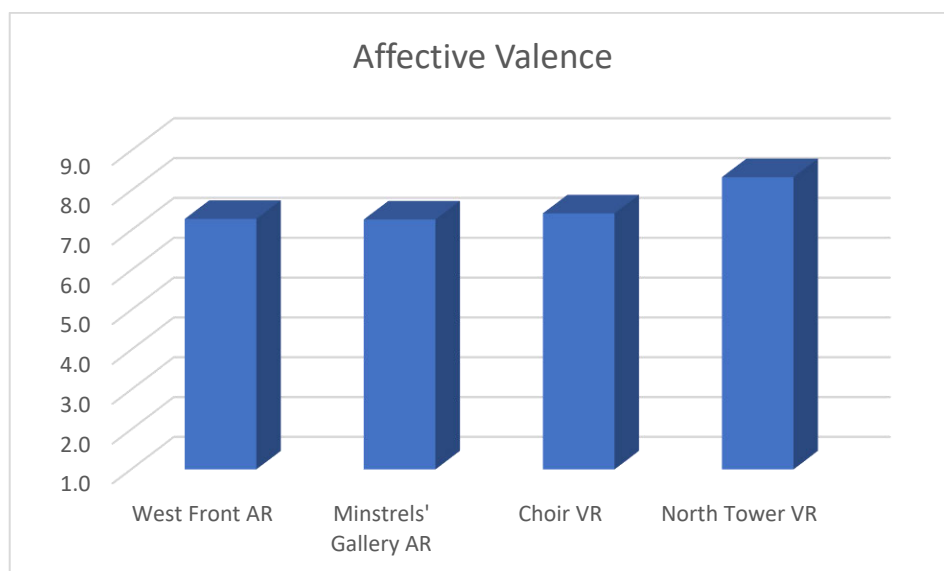


Figure 9. Affective valence data across each of the VISTA AR devices.

<sup>5</sup> Mann-Whitney analyses were employed to examine the effect of digital experiences on overall experience rating when visiting Exeter Cathedral in a group with children ( $U = 28$ ,  $ps = .052$ ). There was just over a 5% chance this relationship was observed by chance, more data is required to verify this.

<sup>6</sup> Mann-Whitney analyses were employed to examine the effect of digital experiences on overall experience rating when visiting Exeter Cathedral in with one other adult, the effect was found to be significant ( $U = 440$ ,  $ps = .018$ )

We also asked visitors how they would feel if they were to visit Exeter Cathedral again in the future (i.e., forecasted pleasure). The findings indicated that visitors forecasted greater enjoyment after engaging with VISTA AR technology when compared to visiting with no digital experiences (see Figure 10). Forecasted pleasure is associated with behavioural intentions (e.g., propensity to revisit a site) and therefore the findings provide support that VISTA AR technology can help retain visitors at Exeter Cathedral.

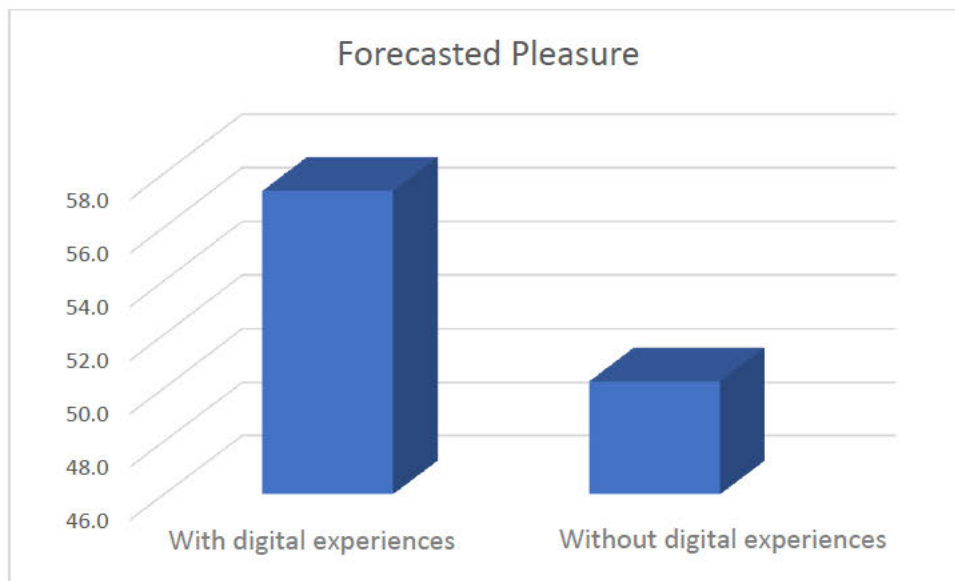


Figure 10. Forecasted pleasure data.

## Discussion

Overall, this study suggests that the technologies improve the visit in terms of its facilities, guides, and activities (i.e., interpretation and ways to engage). They also create a high feeling of pleasure both during a visit and as forecasted for future visits.

Comparing the profile of visitors to high season in 2019, indicates similarity in the profile of visitors between the two periods. Like summer 2019, most visitors had an explorer or experience seeker motivation to visit, were visiting with one other adult, for the first time. The volume of visitors from the United Kingdom was larger in 2021 (95%) than in 2019 (52%), which is likely a reflection of inbound travel restrictions in 2021. Overall, there was no discernible change in the profile of visitors at the cathedral in high season between 2019 and 2021. This is not unexpected as, at the time of the study, VISTA AR technologies were not part of a 'standard' visit. However, while the technologies improved the overall experience for those visiting in party with children, this was not the case for those visiting with one other adult. This suggests that the technologies may not appeal to all visitor markets equally and this type of activity and interpretation should be optional. In the future, the technologies may change the profile and volume of visitors, appealing to more groups with children.

## Study 2: Evaluation of propensity to visit (online teaser)

### Background

AR and VR content can easily be distributed online, this study aims to explore whether online teasers of 'Turning the Pages', an interactive virtual book collection, and '360 choir experience', a 360 video of the choir VR experience, can (a) provoke people to watch and interact with this type of content, spreading positive word of mouth, and (b) encourage visits to the site.

### Methods

Two online experiences were shared with the public as teasers of onsite experiences developed by VISTA AR for Exeter Cathedral. The online experiences were promoted in both the Exeter Cathedral and VISTA AR websites, social media, YouTube channels and newsletters and via a press release. Links to a short survey accompanied the experiences, designed to capture how satisfied people were with the experience and its influence on their intention to visit the site in the future. Web analytics were also used to capture engagement with the online experiences.

Across the two experiences 55 responses to the survey were captured: 33 for Turning the Pages and 22 for the 360 choir experience. A summary of the profile of respondents is provided in figures 11-15.

Respondents were aged 25 to 80, the majority were female (57.5%) and resided in the United Kingdom (68%), of those 57% were from the South West. 'To attend an event' (21%) and 'community seeker' (21%) were the most common motivations cited for visiting in the future.

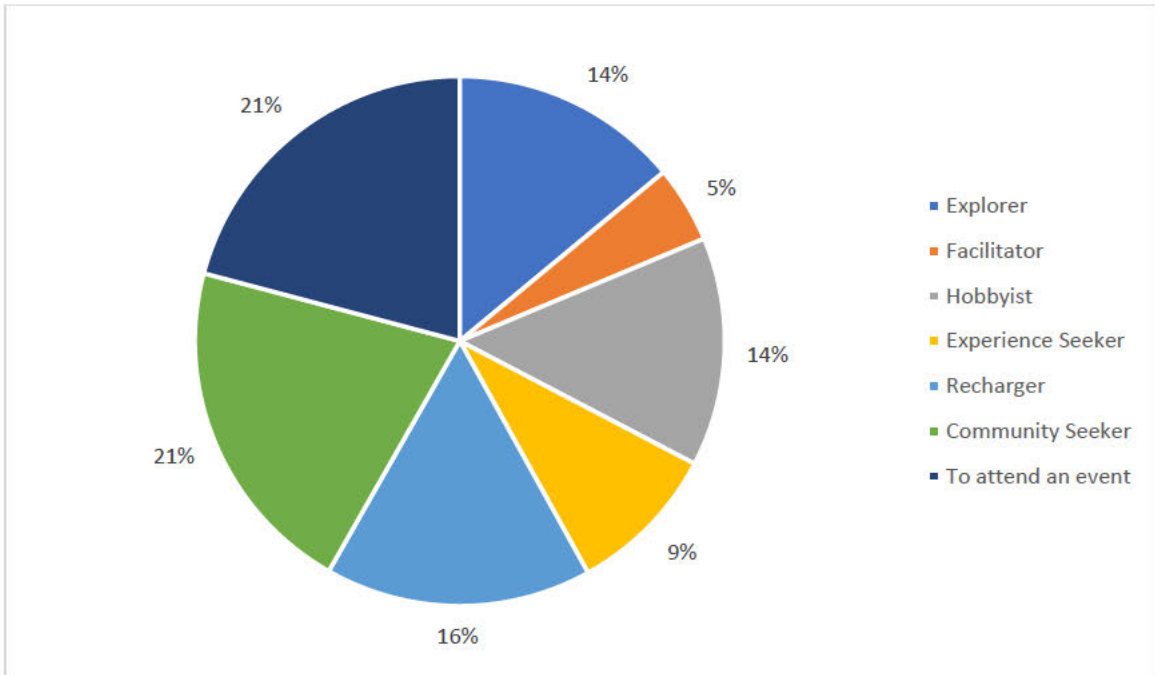


Figure 11: Motivation to visit

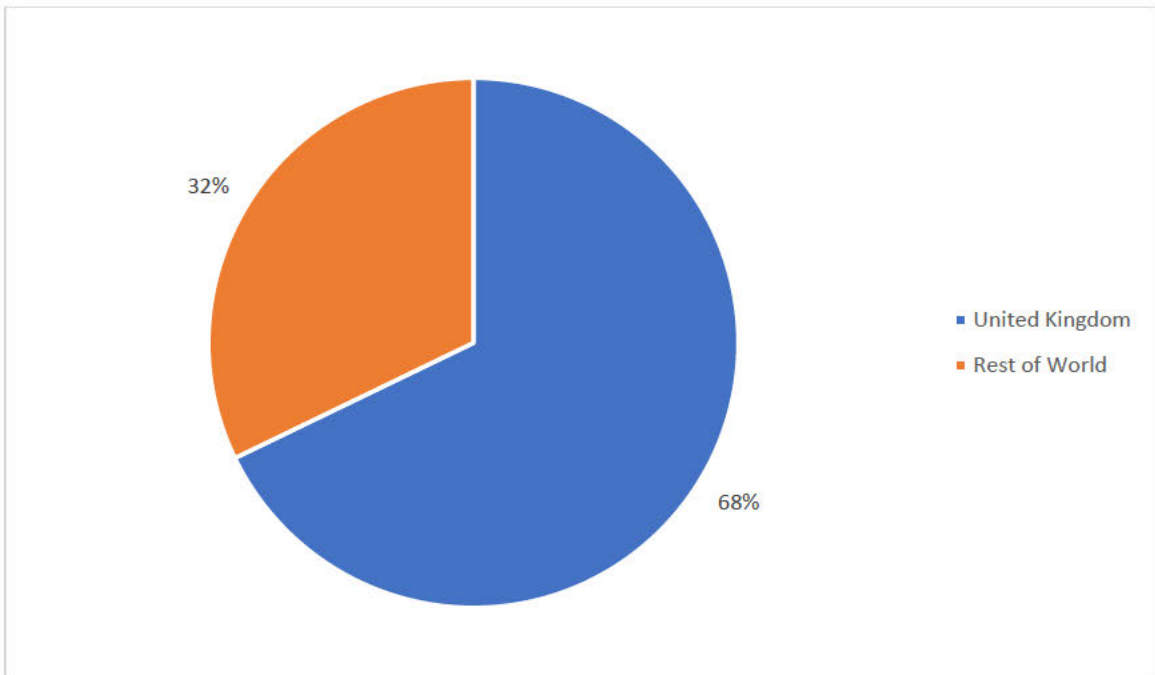


Figure 12: Country of residency



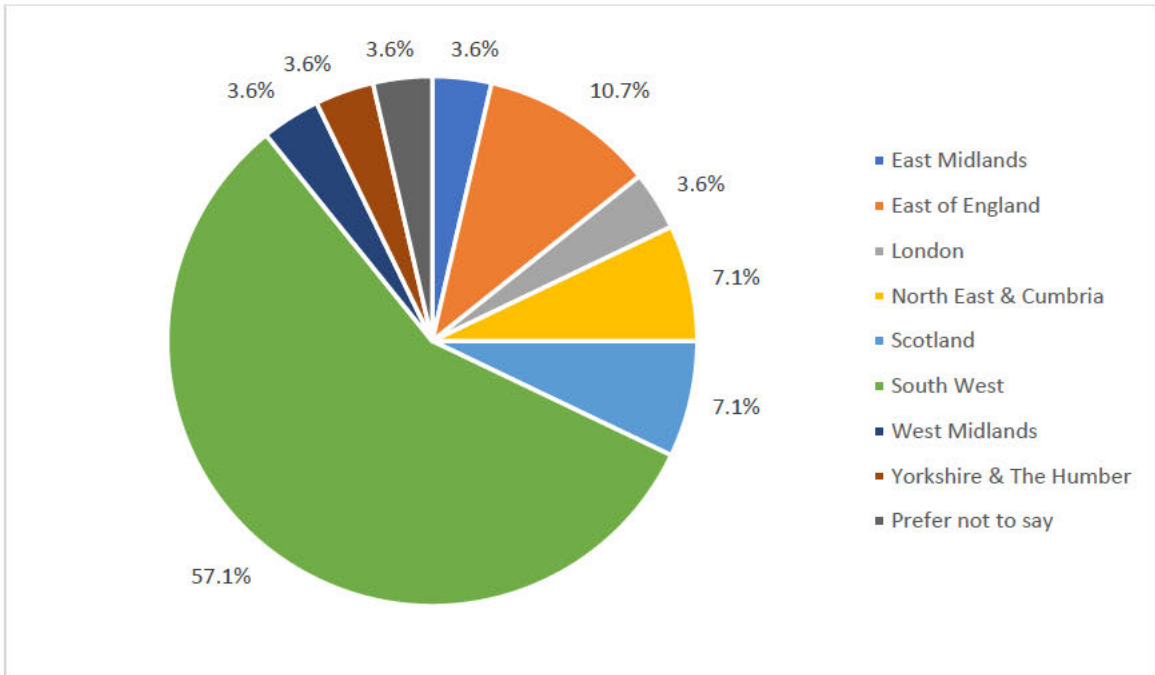


Figure 13: Regional residency of UK respondents

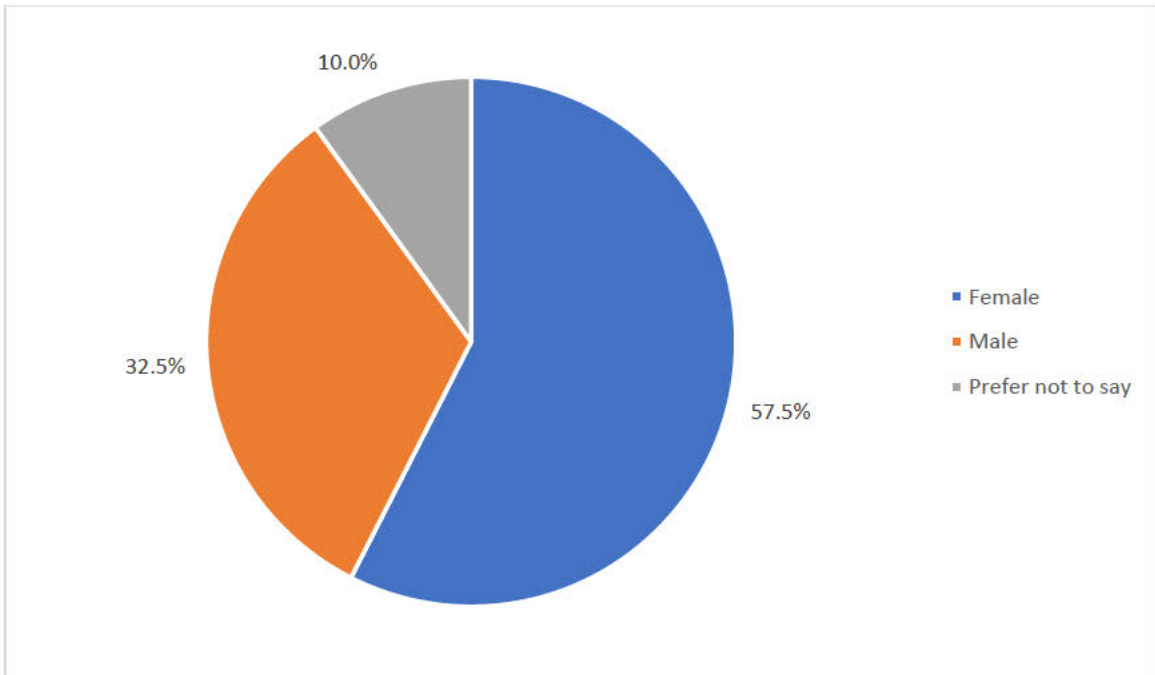


Figure 14: Gender profile of respondents

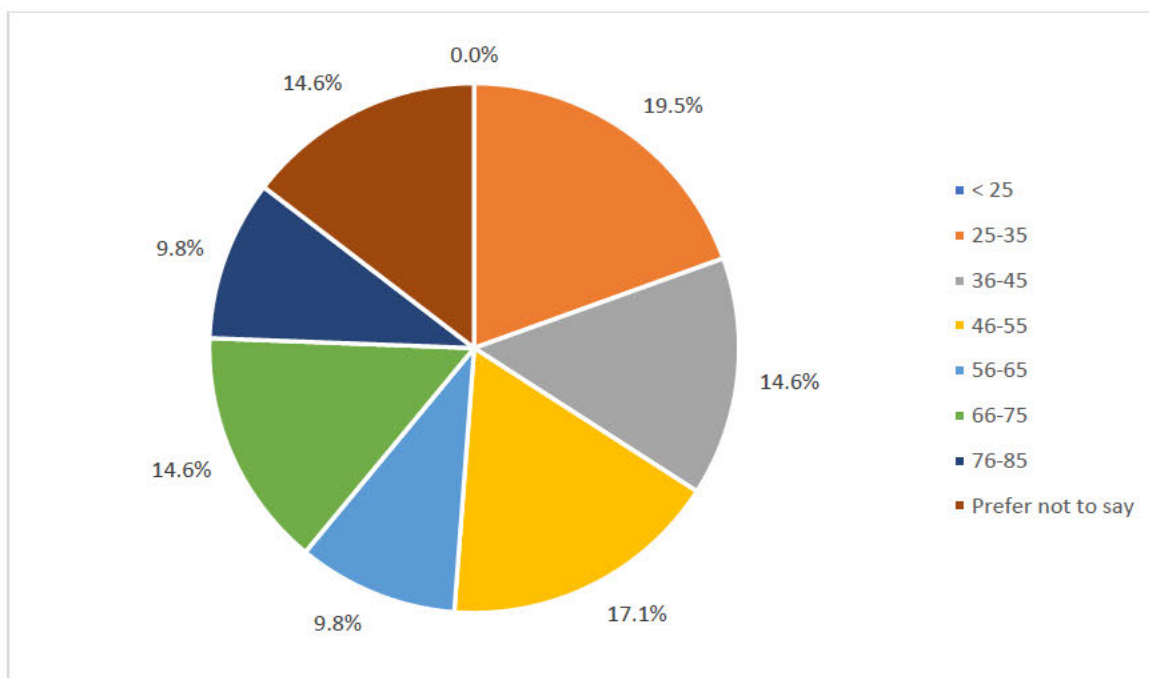


Figure 15: Age profile of respondents

## Results

### Engagement with the experiences

Table 2 details engagement with the two online experiences; the number of times they have been viewed, shared and feedback was captured (like and comments, survey responses etc).

Site	Experience Title	YouTube Views <sup>7</sup>	Social Media engagement <sup>8</sup>	Survey responses
<a href="#">Exeter Cathedral</a>	360 choir experience	642 views, across the site and VISTA AR YouTube channels	89 views, 7 shares, 1 like, 8 clicks	22
<a href="#">Exeter Cathedral</a>	Turning the Pages	Data not available	542 views, 4 shares, 6 likes, 9 clicks	33

Table 2: Online engagement

### Overall satisfaction and intention to visit as a result of the experiences

61% of respondents were satisfied with the experience, giving at least a score of 5 out of 7 (figure 17). Similarly, 54.5% of respondents agreed that they are more likely to visit the site as a result of the experience, giving a score of at least 5 out of 7 (figure 18). Statistically, there is a strong and significant

<sup>7</sup> Figures correct as of 22<sup>nd</sup> November 2021

<sup>8</sup> This data is totalled from data on social media platforms Facebook and LinkedIn, figures correct as of 29<sup>th</sup> November 2021

relationship<sup>9</sup> between the level of satisfaction and whether they are more likely to visit the site in the future.

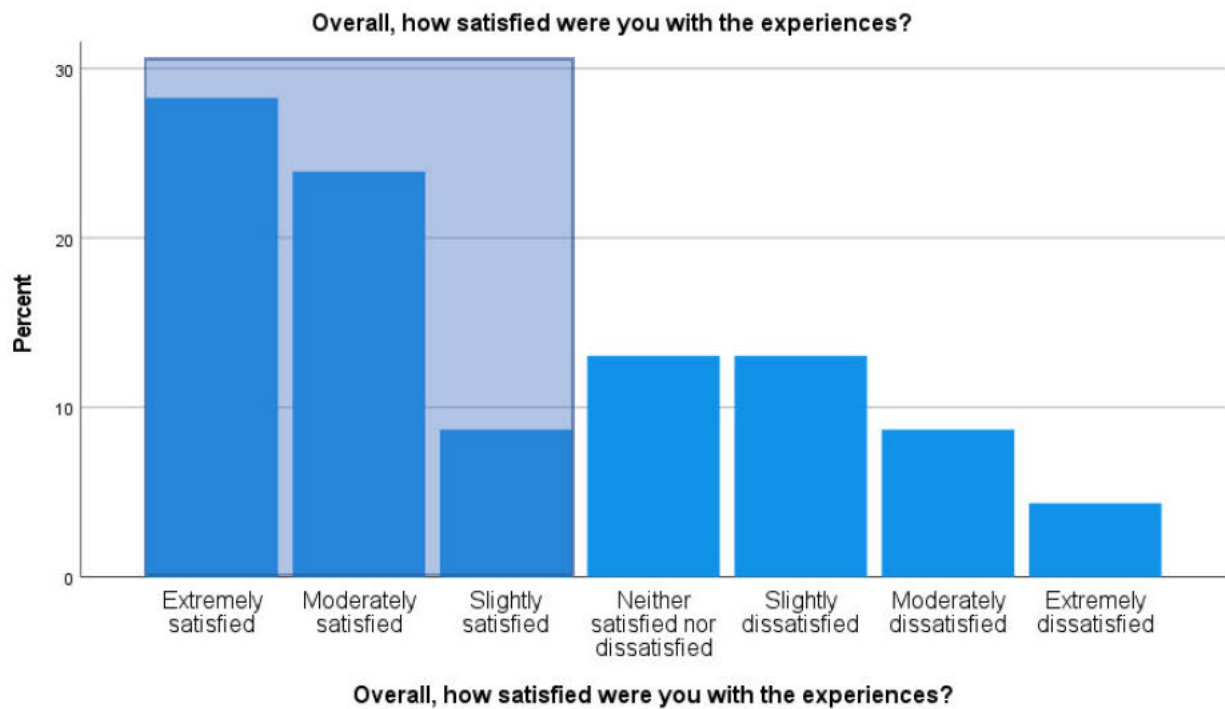


Figure 17: Satisfaction with experiences

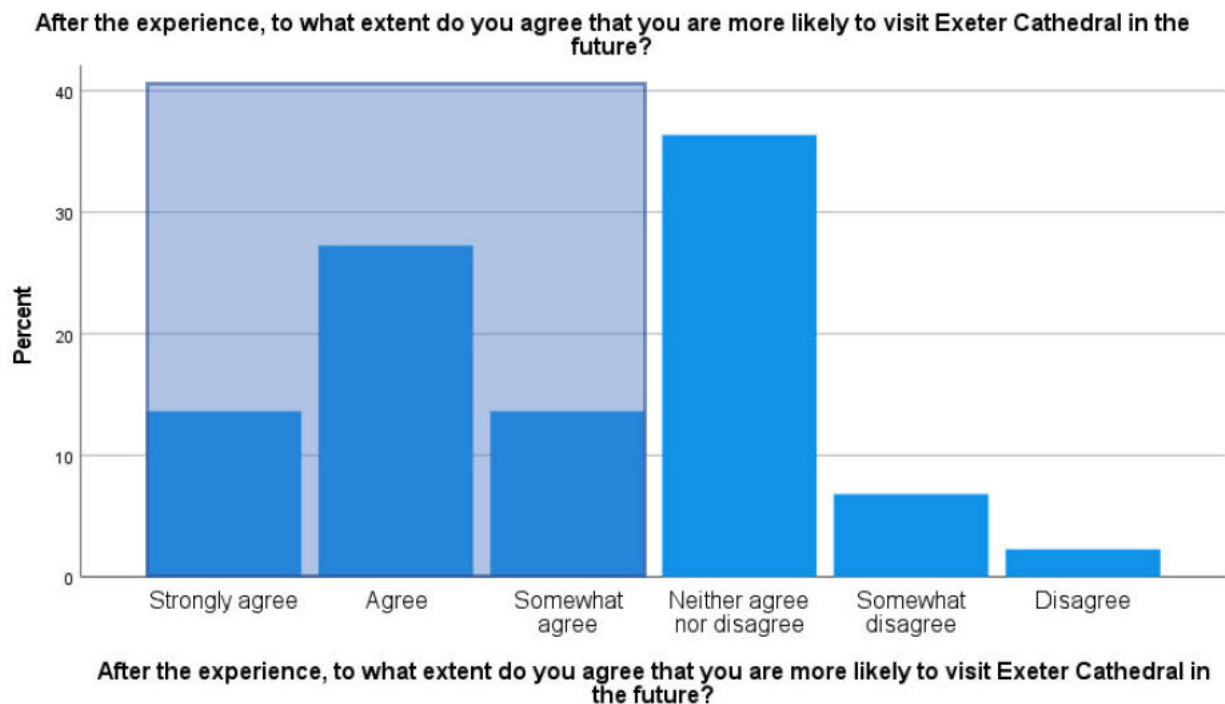


Figure 18: Impact of experiences on intention to visit

<sup>9</sup> A two-tailed Kendall's tau-b correlation revealed a strong positive relationship between satisfaction and visit intention, which was statistically significant ( $\tau_b = .568, p < .001$ ).

Tests were carried out to see if there was a difference in impact between the two experiences, but no statistically significant difference was found. Observationally, satisfaction (figure 19) and intention to visit as a result of the online teaser (figure 20) was higher for Turning the Pages. However, we cannot say that this difference was not observed by chance.

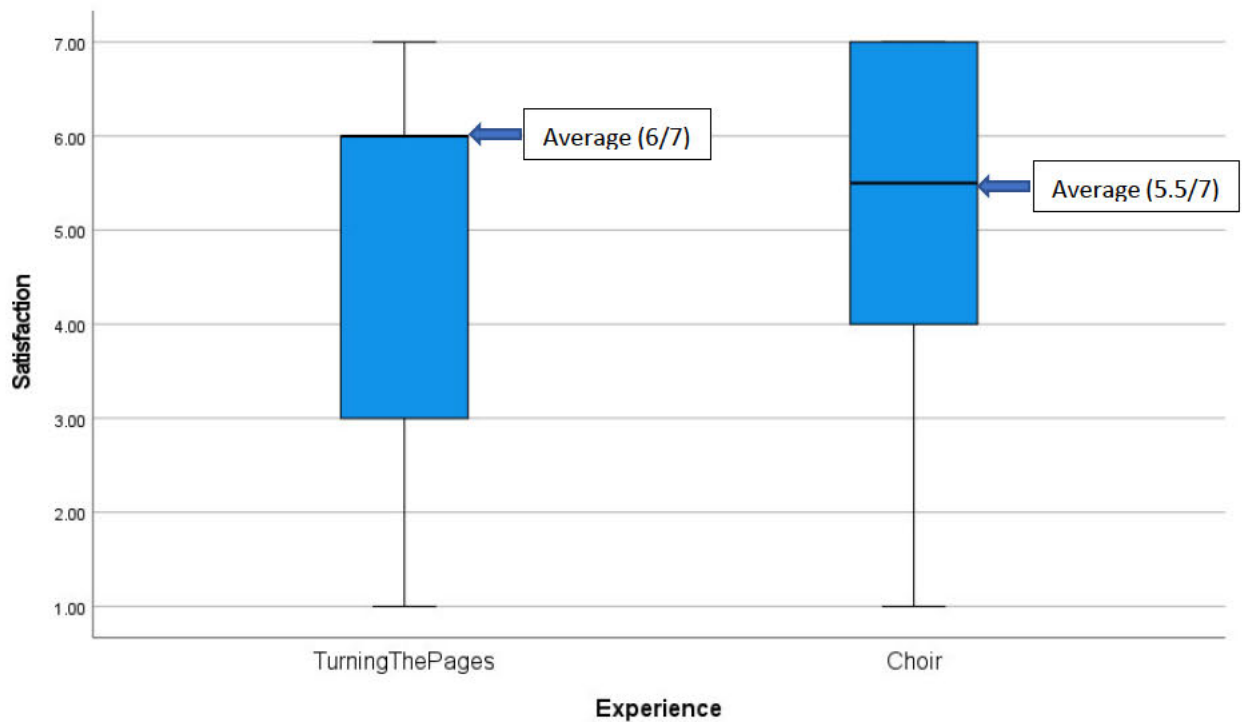


Figure 19: Median average levels of satisfaction per online experience

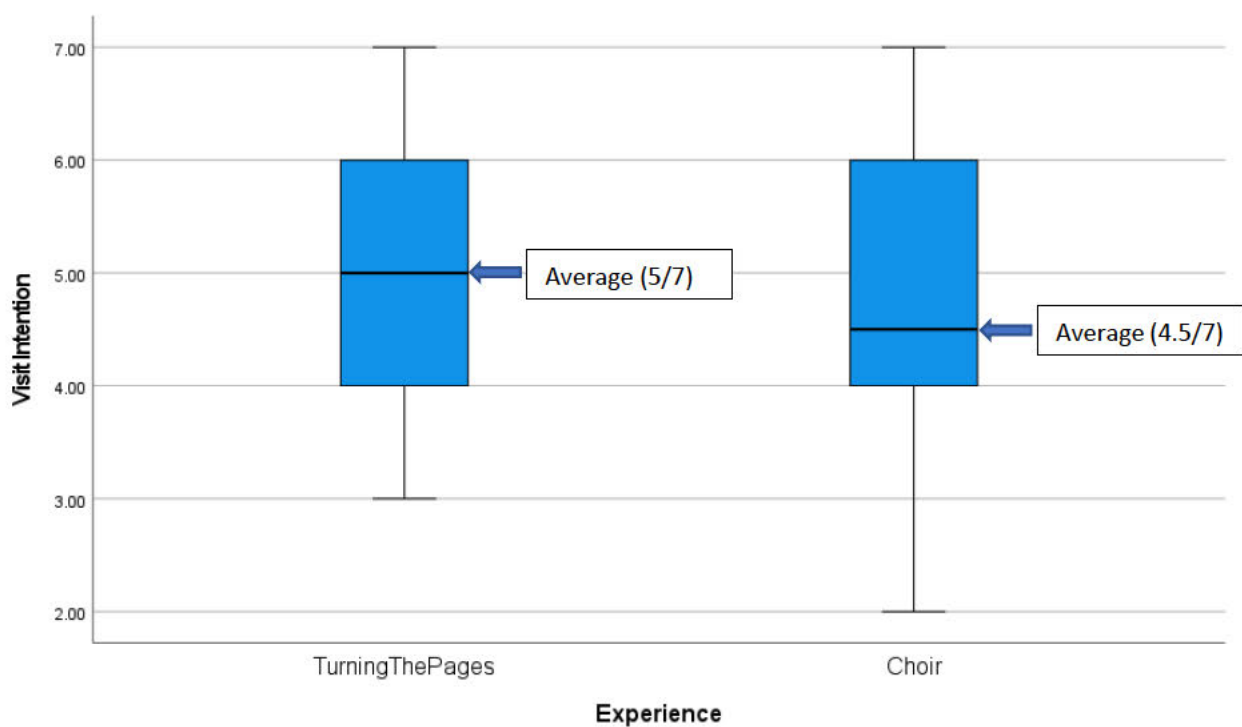


Figure 20: Median average response to effect of experience on intention to visit in the future

## Discussion

The results suggest that the online teasers of Turning the Pages and the 360 choir experience do increase the intention of people to visit Exeter Cathedral in future. It should be noted that the results represent intentions to visit a site, not actual visit behaviour. Further, the profile of those engaging with the online teasers differed from the profile of general visitors to the site in high season, namely in terms of their motivation to visit the site. This may reflect where the teasers were promoted and communicated. Engagement with the experiences through cathedral websites and newsletters may be reaching those who have an established relationship with the cathedral, either through worship, events, or local community.

## Discussion

To summarise the findings of this report:

- Teasers of the VISTA AR experiences online increased intention to visit the site in future
- Onsite, VISTA AR technologies improved visitor ratings of guides, facilities, and activities (i.e., interpretation and engagement)
- VISTA AR technologies were more appealing and had a greater impact on the overall visit of groups with children
- VISTA AR technologies created feelings of enjoyment that affected the visit on the day, as well as the forecasted enjoyment of future visits
- higher feelings of pleasure were created by VR technologies, particularly the more immersive and interactive VR experience (e.g., North Tower VR)

More research would be needed to test these initial findings outside of the context of the study. However, the findings do show that digital experiences have the potential to attract new and repeat visitors and improve the visitor experience.

# Exeter Cathedral Visitor survey 2018

# Profiling visitors

## Types of data

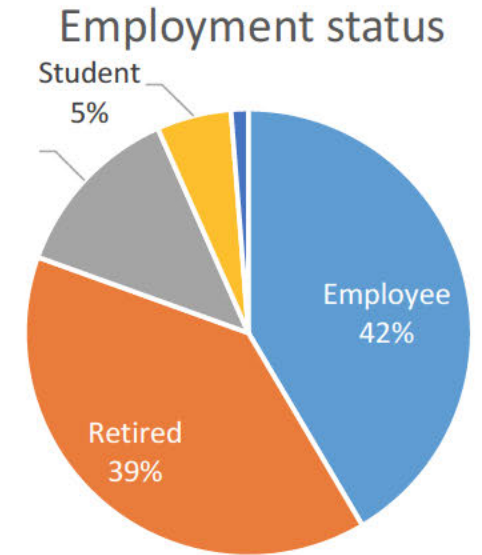
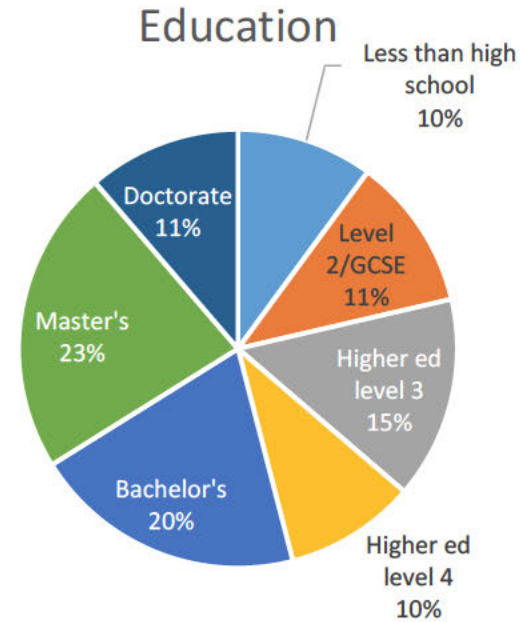
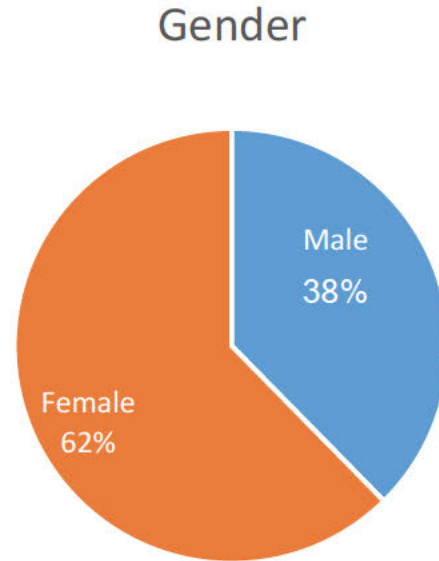
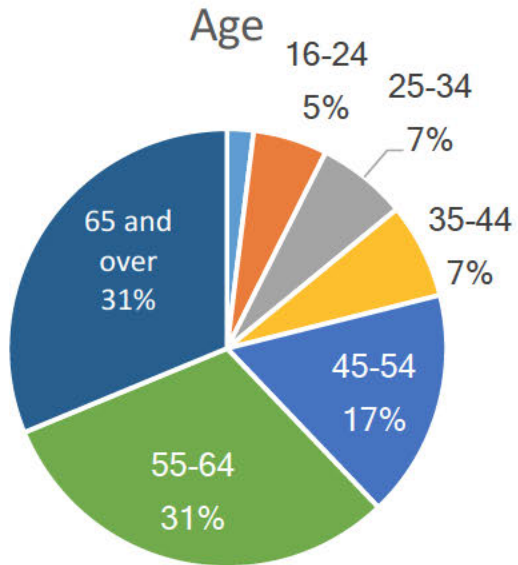
- Demographic: who are the visitors?
- Geographic: where are the visitors coming from?
- Psychographic: why are they visiting? (motivations)

## Exeter Cathedral visitor questionnaire

- 3 weeks: June-August 2018
- 265 respondents



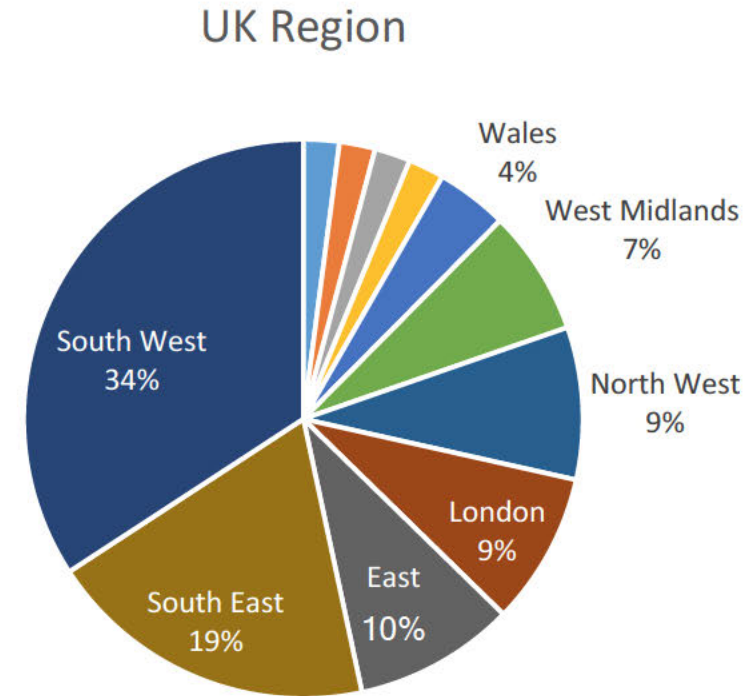
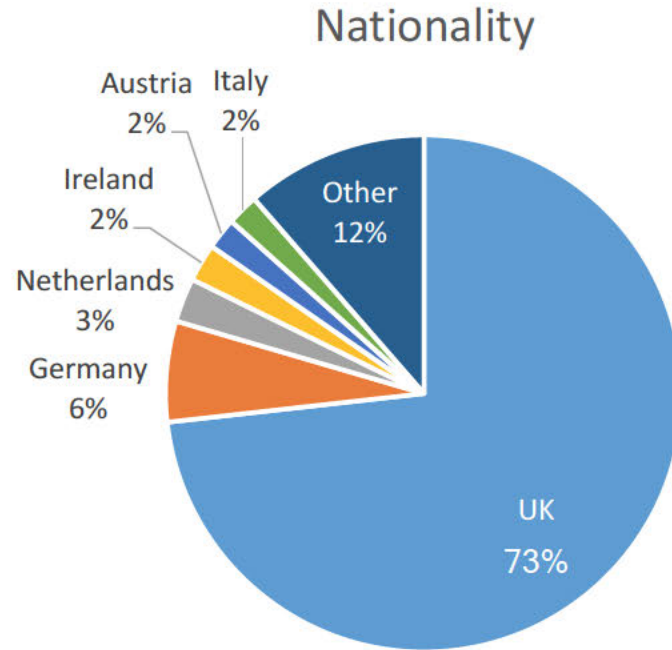
# Demographic



- 79% are over 55 years old
- Highly educated (university degree)



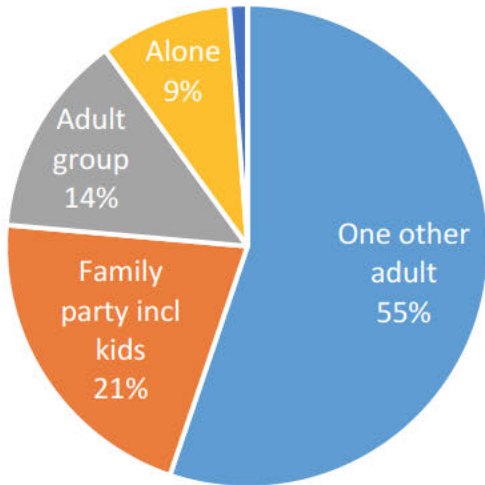
# Geographic



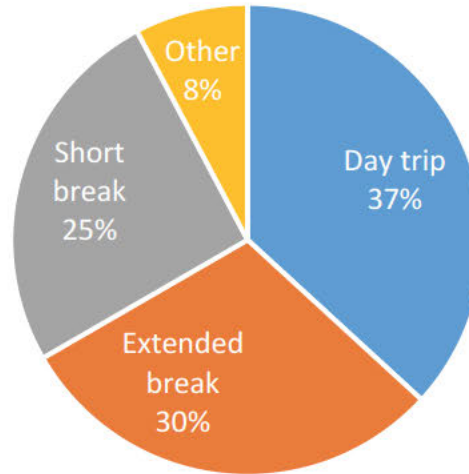
- Majority are UK nationals
- Live in proximity (within 100 miles)

# Visit context

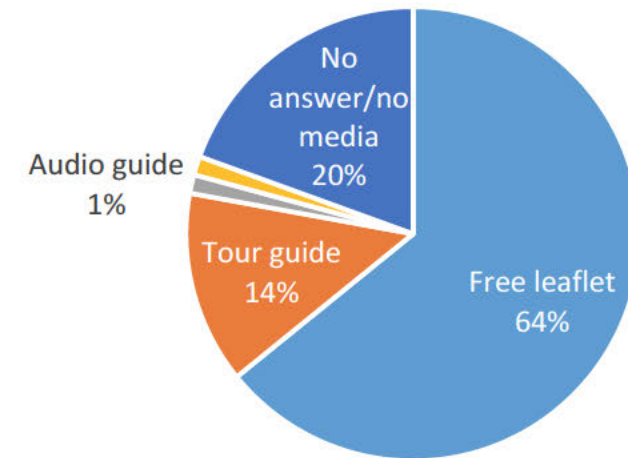
Party size



Visit type

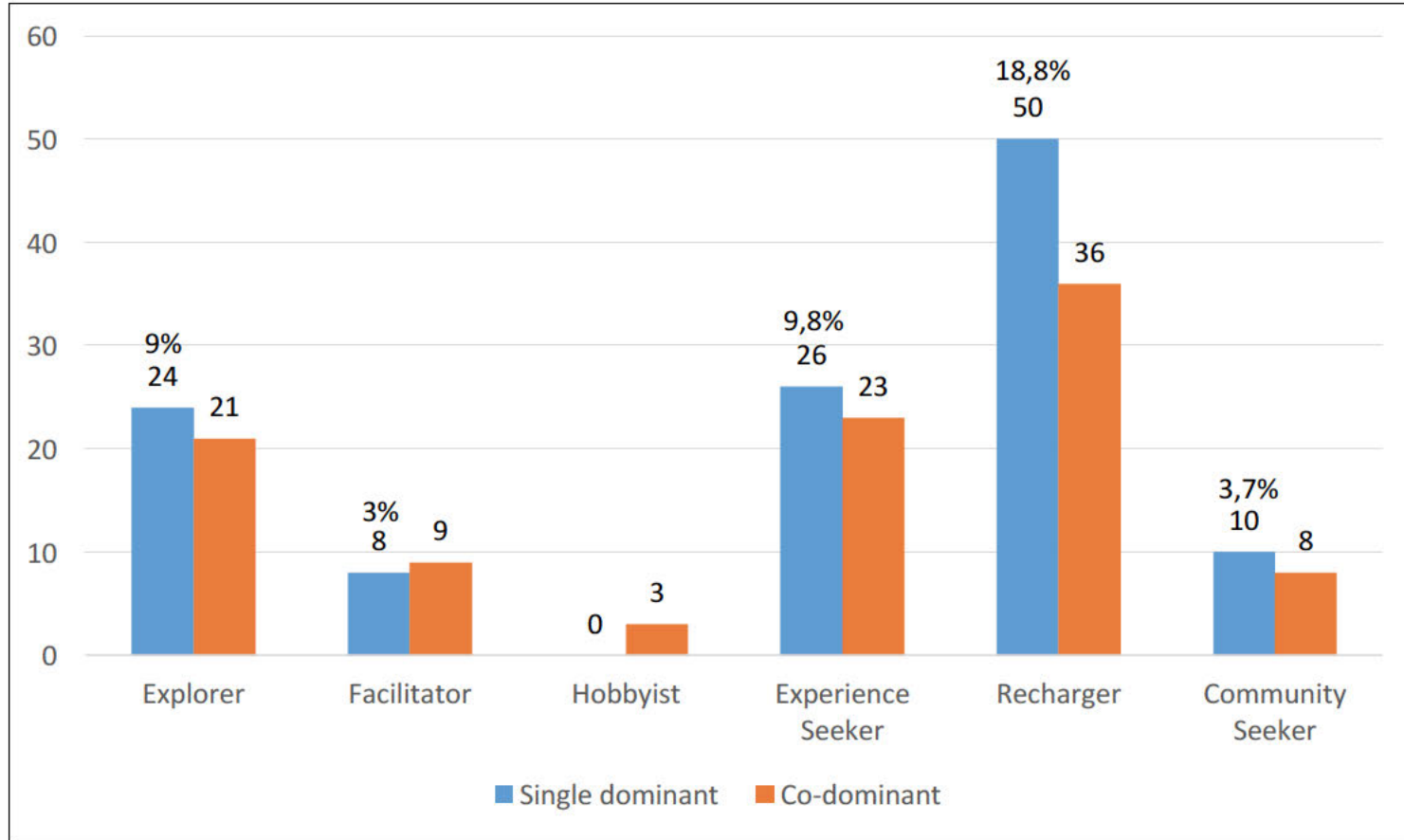


Supporting media



- Few groups with children
- Tours and audio guide are not very sought
- Average duration of visit was 61 minutes

# Psychographic segments



## Predominant segments

- Rechargers (spiritual motivation)
- Experience Seeker (visiting top attractions)
- Explorer (general curiosity)

# Current visitor motivations

- Most visitors are motivated to visit in order to escape from the busy daily lifestyle and have a chance to **experience peace** (Recharger segment). This suggests that a large number of visitors perceive the cathedral as a place of spiritual restoration, to be visited because of its religious and spiritual significance.
- The second most common segments are Explorer and Experience Seeker
  - The Explorer segment are motivated to visit to **learn something about the monument**, and includes casual visitors who are generally curious and interested in having an educational experience
  - The Experience Seekers segment includes visitors interested in collecting popular experience. These numbers highlight the place that Exeter Cathedral occupies as a **top attraction in the city**.
- Only 12 visitors (4.5% of respondents) were profiled as Community Seeker, which refers to a sense of heritage and personhood, suggesting that few visitors choose to visit Exeter cathedral to celebrate or perceive it as part of their heritage.
- Few visitors linked their motivation to visit the cathedral to a social experience, e.g. spend quality time with their partner or family (Facilitator segment). This is likely due to the low number of families visiting the cathedral.

# Using psychographics

## Identifying current audiences

- Visitors are motivated to escape from the busy daily lifestyle and have a peaceful experience
  - cathedral perceived as a place of spiritual restoration and significance – hence that need/want might already be fulfilled regardless of new interpretation

## Attracting new audiences

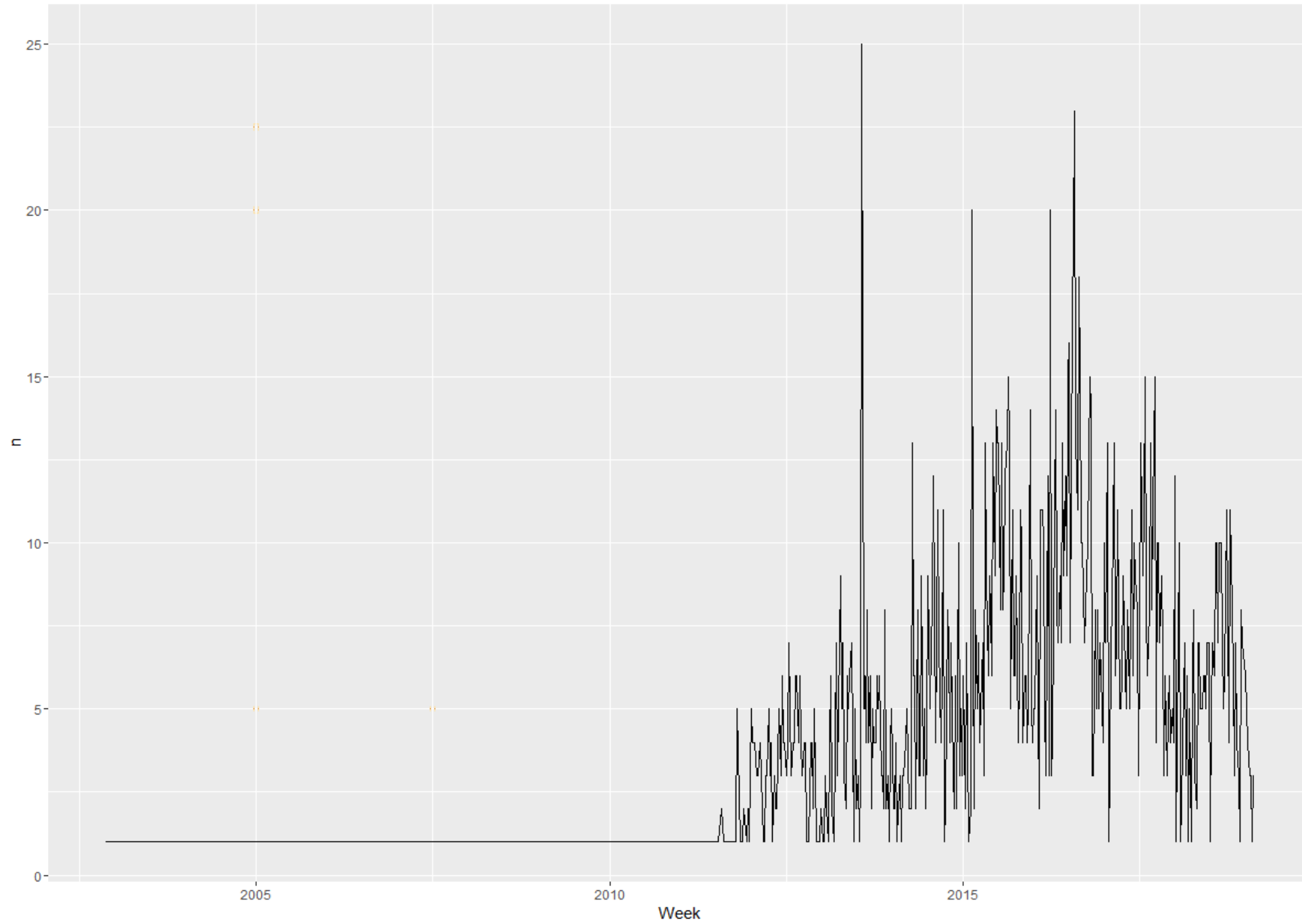
- Focus on interpretation for children to increase number of families visiting (*facilitators*)
- Invest in marketing that promotes the cathedral as a must see attraction in Devon (*Experience Seekers*), or its role in shaping Exeter's identity (*Community Seeker*)
- Consider impact on main/current segment (*rechargers*)

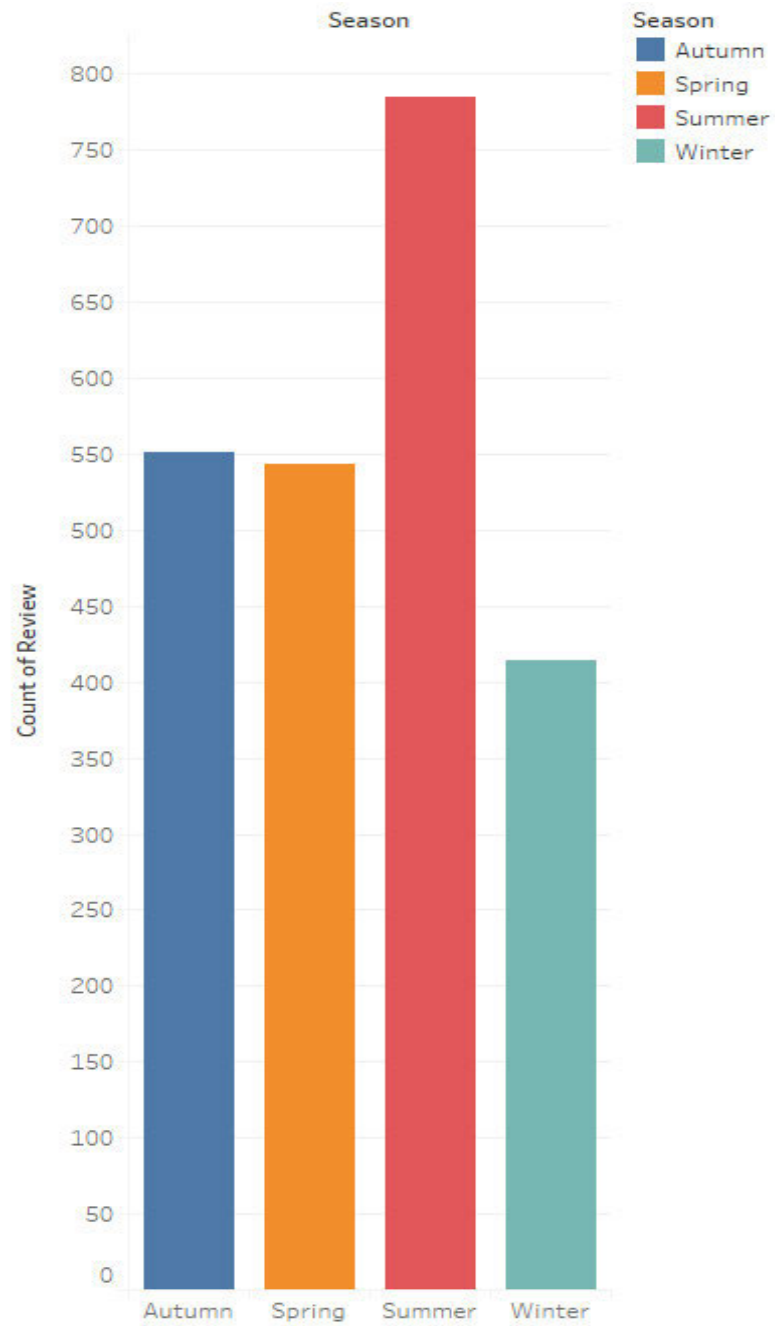
# TripAdvisor Data Analysis

## Visitor Reviews Summary:

- 2293 reviews
- Collection Period: 18 Nov 2002 to 13 Feb 2019

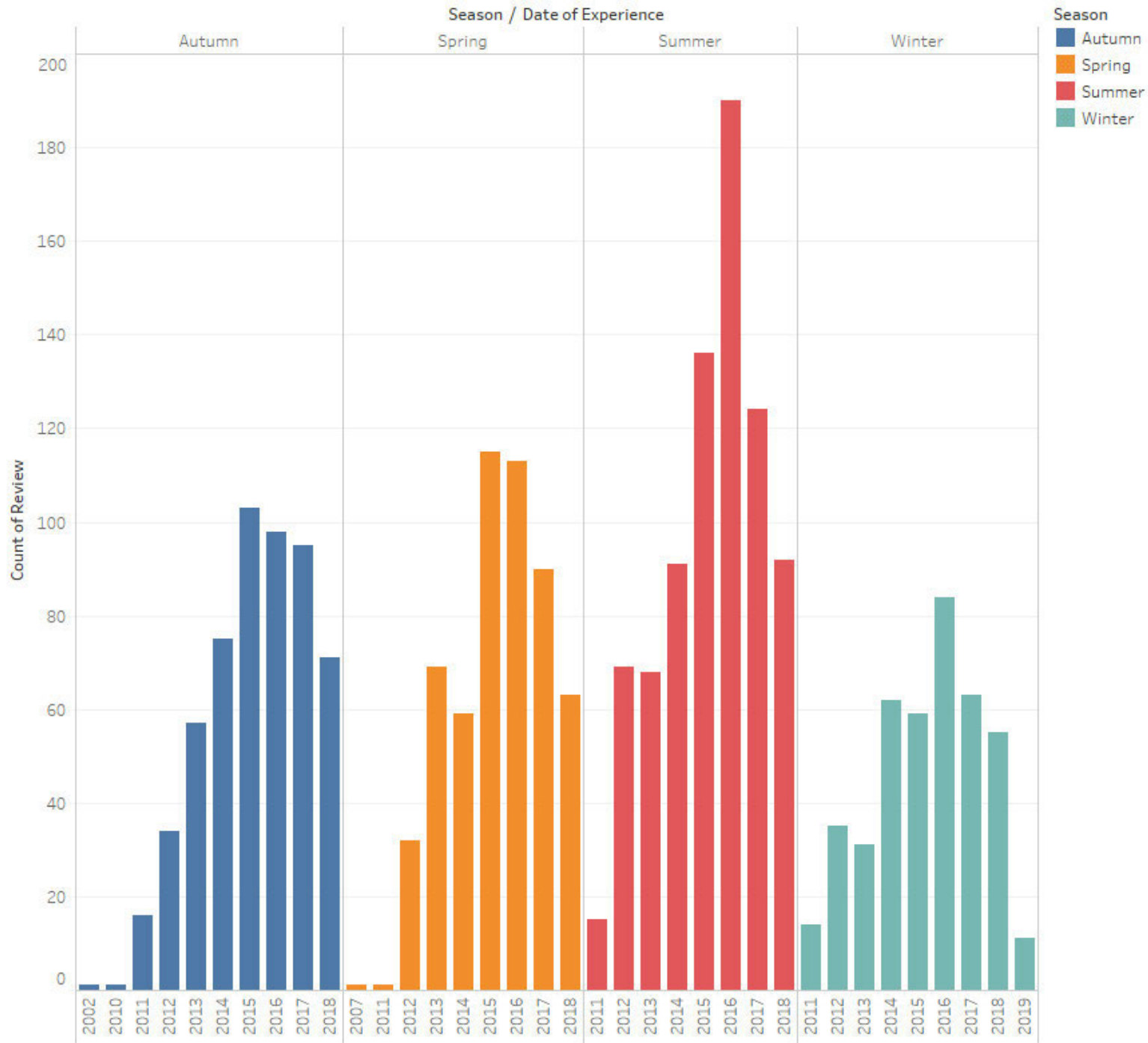
Number of Reviews Per Week: Exeter Cathedral





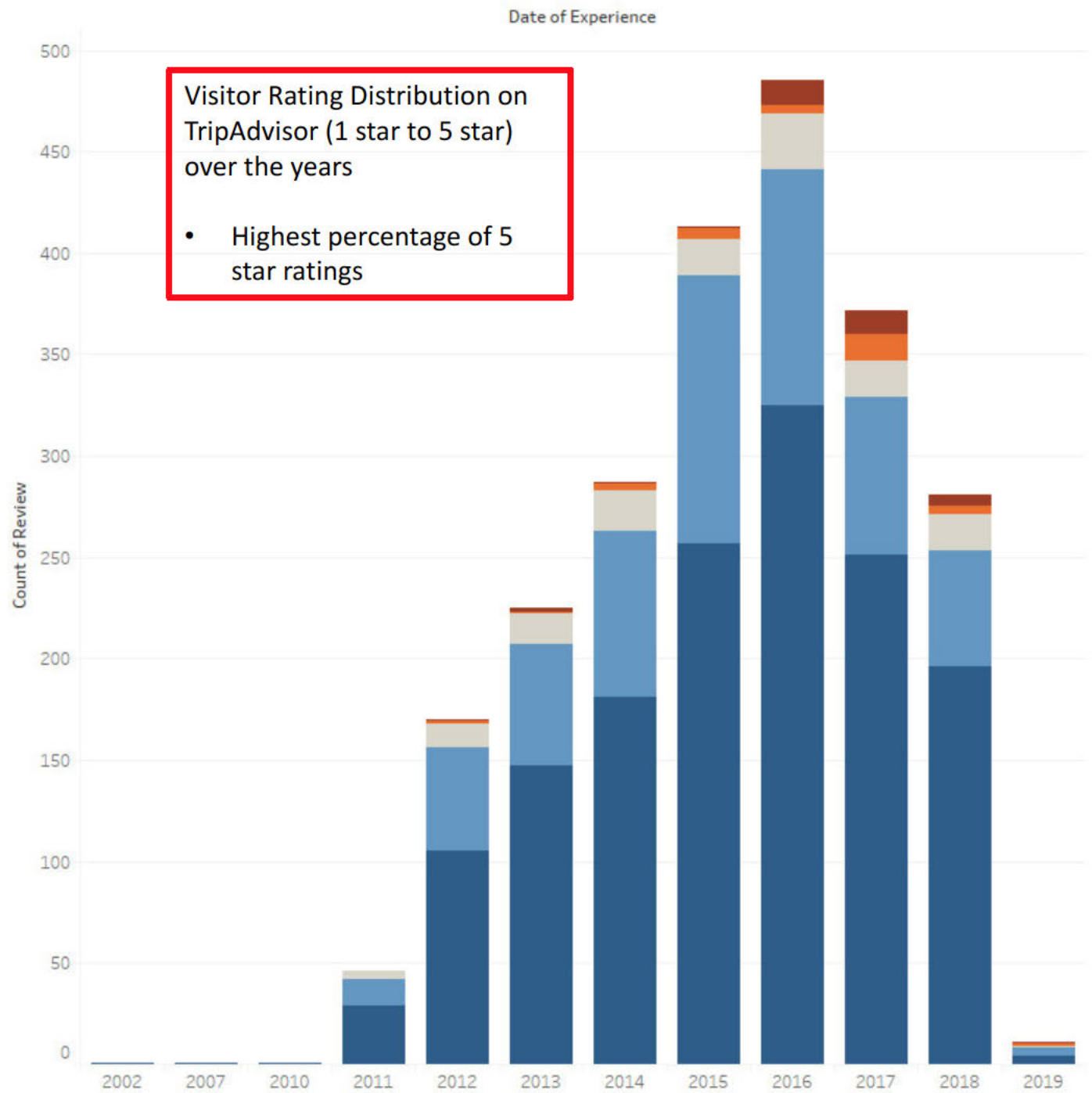
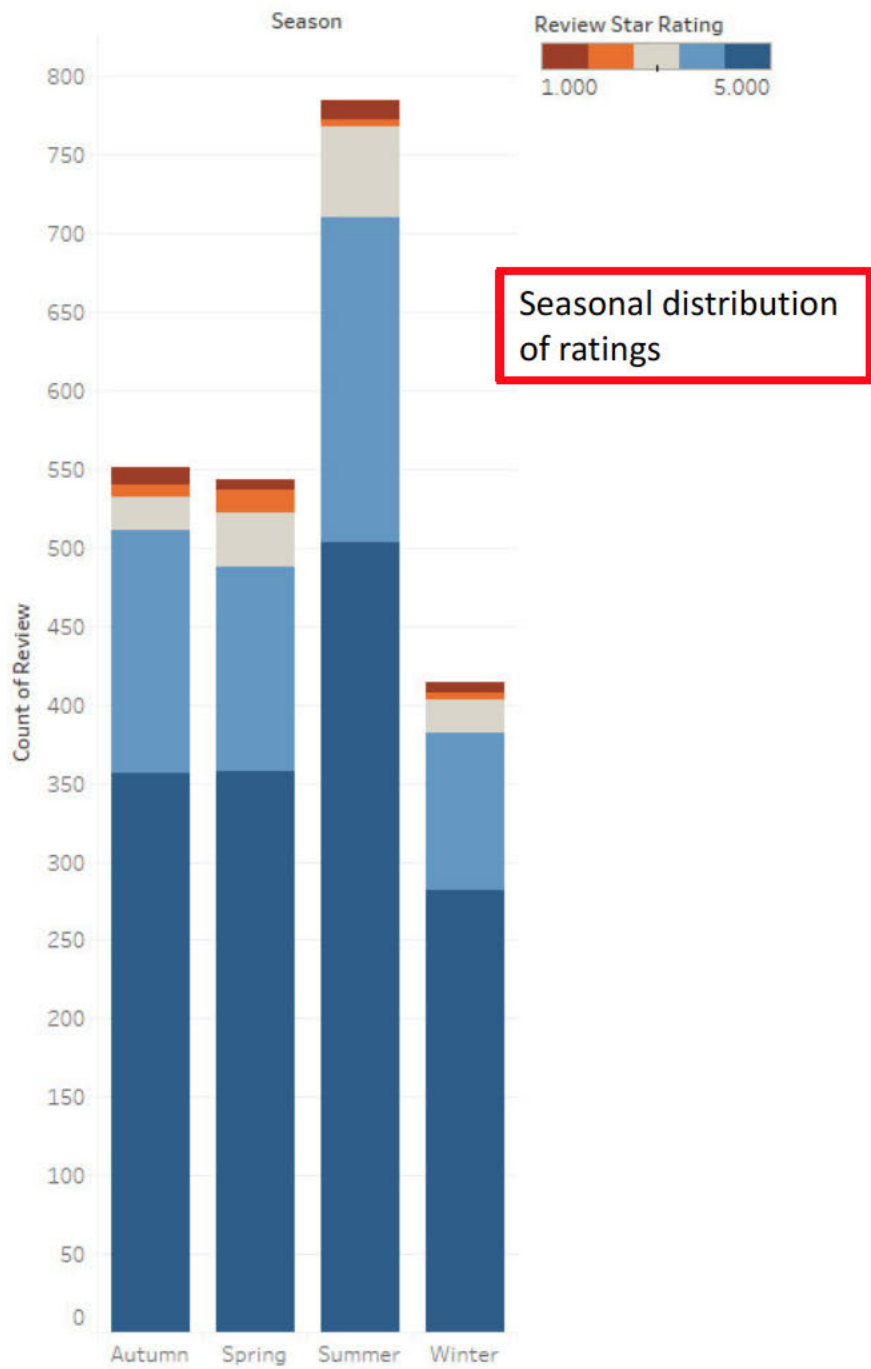
Seasonal Distribution of Visitor Reviews on TripAdvisor



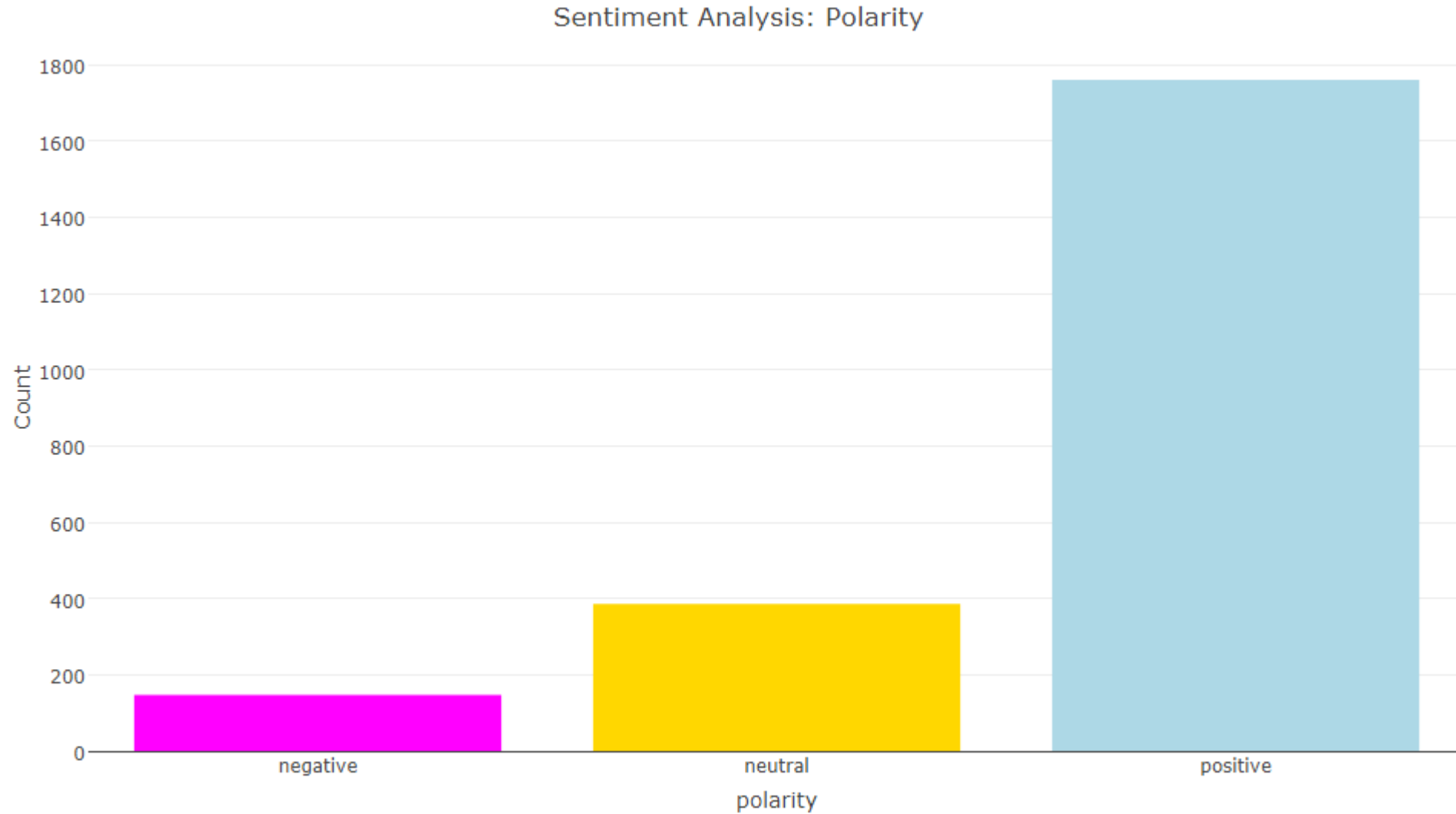


## Seasonal Distribution of Visitor Reviews on TripAdvisor split over time

- Highest visits can be seen in Summer (June to August)



- Sentiment Analysis of visitor comments on TripAdvisor for the sentiments: *positive, negative, neutral*.
- The comment dataset is observed to be mostly comprised of comments exhibiting positive sentiment.



- Emotion Analysis of visitor comments on TripAdvisor for the emotions: *joy, trust, anticipation, surprise, sadness, anger, fear, disgust*.
- Highest percentage of words in comments associated with 'joy' and 'trust' – i.e., positive sentiments.

