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LOCATION BASED MODELLING FOR HERITAGE MOBILE APPLICATIONS

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Abstract

Recent strategies for increasing museum income have heightened the need to motivate visits. Consequently, ICT has been increasingly used in historical locations to educate and entertain visitors. This exploratory study concerns one such museum that is developing its understanding of these technologies through the perspective of visitors as the key stakeholder. It views the significance of historical landscapes' technologies that reflect the views of visitors. A quantitative study is conducted to explore preferred technologies and the way in which digital media can be presented in a natural environment, as well as how visitors prefer such experiences to be described. To define and assess the technologies in Dorset County Museum and Maiden Castle, data was collected using a survey in both locations. The results identified differences in visitors' perceptions regarding the importance of technologies in these museum and physical locations. The outcomes of this study can be applied to improve the effectiveness of technology in interlinked heritage landscapes through development of mobile or web prototypes.

Keywords: Heritage Technology, Museum Technology, Maiden Castle, Dorset County Museum

1. Introduction

Investigating strategies to generate more visitors with the intention of increase income is a continuing concern within UK's museums (Evans, 2013). One such approach is the utilisation of new digital and mobile technologies. This technology needs to improve visitor experiences in a natural manner. UK's museums are lagging behind in the digital revolution, impacting on their revenue generation and audience development. Consequently, opportunities exist for those wishing to innovate and invest in this sector. Interestingly, art and culture organisations in England have benefited from digital technologies to a greater extent than museums (Bakhshi, 2013). Examples of these technologies include standalone digital exhibits, using cloud computing to run software, hosting and storage of data or content, and digital experiences. (Steel, 2013).

This study investigates a design and implementation strategies required for new applications and systems, along with new infrastructure for UK's museums, in order to increase their revenue and to find new audiences (visitors). The cultural heritage sector has recognised the value of delivering different content and personalisation styles to different types of people (Falk, 2009). Moreover, some institutes already differentiate their offer, one example being the Tate Gallery who offer customised services tailored to the respective needs and preferences of children, parents and teachers (Jackson and Adamson, 2009). However, prior to embarking on a specific technological strategy, it is worth first exploring the differing views from various stakeholders.

Maiden Castle (MC) in Dorset is a famous Iron-age hill fort set in a prehistoric landscape which also has strong connections with more recent history and literature. The author Thomas Hardy lived nearby and wrote about life and heritage in the area. Dorset County Museum (DCM) is an independent museum and educational charity. The museum is owned and managed by the Dorset Natural History and Archaeological Society with financial support from Dorset County Council and West Dorset District Council. Open to anyone with an interest in Dorset's past, the Dorset Natural History and Archaeological Society is an educational charity with over 1800 members. The history of the society and the museum can be traced back to the mid-19th century (Dorset County Museum, 2013). Accordingly, this study will focus on Dorset County Museum as an independent museum and its associated links with Maiden Castle (MC) – a historical location managed by English Heritage.

This paper argues that there is a need for new technologies specifically in heritage landscapes and interlinked museums. The paper is organised as follows: Section 2 provides an overview of art and culture organisations and digital technologies, along with example of technologies used in historical locations. Section 3 explains the methods and approaches used to collect the data, and then section 4 presents the resulting data. Section 5 discusses the results and finally section 6 discusses the overall conclusions of the study.

2. Literature Review

Many cultural heritage institutions adapt web-based and mobile information tools in order to present their collection. Informational websites and mobile guides have been implemented to assist visitors on site - achieving low cost presentations (Ruotsalo et al., 2009; Petrelli and Not, 2005; Cheverst et al., 2000; Bianchi and Zancanaro, 1999; Opperman and Specht, 2000; Schmidt-Belz et al., 2003; Stock et al., 2007; Stock and Callaway, 2009). Mobile phones have been used recently to deliver context-aware cultural heritage information indoors and outdoors in MUSE and Smartmuseum systems (Ruotsalo et al., 2009). However, most have been specialised to a particular context. Hyperaudio was introduced to indicate interest during a visitor journey; leaving before the audio presentation ended indicates disinterest. It was also used in mobile guides in the late nineties, monitoring visitor movement and dynamically composing audio snippets on the basis of their current position. 'Entertain versus informative' is also highlighted (Petrelli and Not, 2005).

The GUIDE tablet PC application used to present information on points of interest in the city of Lancaster, UK, using cellular Wi-Fi technology for location sensing. User interest and the opening times of attractions used to select appropriate material for specific user context and profile. These indicate that there are respectable cases which pursue the visitors' interest hence helped in knowing their preferences. Concerning media, information was displayed as images and text in web pages in 2000 (Cheverst et al., 2000). The idea of Hyperaudio (interacting with the space) was extended in HIPS in which visitors were categorised according to their visiting pattern behaviour (Bianchi and Zancanaro, 1999). Alternative instance is a PDA which was used to capture the user position and an animated presentation was sent to the visitor to play. The main delivery medium for HIPS was audio; however, an extended version called HIPPIE (Opperman and Specht, 2000) produced dynamic text and image hypertext. Interestingly, both systems used Infra-Red (IR) technology for indoor positioning. Another PDA based system (CRUMPET) was used to provide dynamic and interactive maps that showed the visitor's

current position, recommendations, information about attractions, and visiting tips, based on their GPS data (Schmidt-Belz et al., 2003). Animation-based video clips were introduced in PEACH, in which a virtual character moved to the PDA from a large screen presenting information during the whole journey (Stock et al., 2007). It is clear that, introducing more dramatized information presentation into a smart phone as a museum visitor guide has been a major step for the museum sector. Visitors have been provided with different dramatic presentations of an exhibit in order to encourage discussion about their experience (Stock and Callaway, 2009).

However, there are issues presented in recent reports which show dramatic decrease in the heritage sector specifically museums. The museum and heritage sector has been hard hit by the post-2008 crash public sector cuts. This has required the sector to find replacement income streams. A number of domain reports presented the current state of the museum and heritage sector (Bakhshi, 2013; Evans, 2013; Steel, 2013; Arnold & Geser, 2008). A survey was conducted with 131 responded, representing 124 museums or museum services. For the period of July 2012 to July 2013: 49% of responding museums experienced a cut to their overall income; nearly a third (31%) had a decrease in school visits; over a quarter (28%) reduced their free events offer; almost a quarter (23%) reduced the number of temporary exhibitions; and almost a quarter (23%) saw their overall income decrease by more than 10%. Regarding the following year (July 2013 to July 2014), approximately two thirds of respondents were focused on generating more income (67%) as well as on fundraising (68%). In addition, almost half (47%) would be focused on encouraging more participation. 40% of respondents believe that the quality of service provided by their museum will increase over the next 12 months. This is a significantly higher level of confidence than reported in any previous surveys (2012: 36%; 2011: 13%). Interestingly, around half (51%) of the respondents who saw their annual income decrease are Local Authority Museums (LAM), which make up just under half of the sample. In addition, other types of museums are likely to have experienced a fall in income. Over a quarter of LAM (26%) are independent museums. Some comments from the independent museum sector include: “as a small independent around 60% of our income over the last 5 years has been donations”, “times are tough for most types of museums”, “So far in 2013 we are 40% down on 2012” and “fewer visitors brought in less income, a tough time for all” (Evans, 2013). It is evident that this is a time of change and increased financial pressure, requiring further investigation to uncover possible approaches for improving the situation, especially for independent museums. Furthermore, museums have faced a compromise between increasing access to and audiences for their collections and maintaining financial sustainability (Bertacchini and Morando, 2013; Feldstein, 1991; Fery and Meier, 2006). In this case, it is essential to emphasis on advertising and improving the quality of the visitor experience rather than increasing admission pricing, for example.

Marketing is one of the important components in financial sustainability, and plays a key role in independent museums. Nevertheless, 92% of arts and cultural organizations stated that marketing benefits most significantly from digital technology (Bakhshi, 2013, p.5). Accordingly, in terms of perceived importance, it is key to focus on developing the technology from a marketing perspective (to persuade visitors to use mobile technology). The majority of organisations report that digital technologies are essential to marketing, they have their own branded websites and over 90% are active on social media. Remarkably, different parts of the sector are experiencing different levels of impact from digital technology. However, just 37% of museums say that digital technologies have a major impact in terms of reaching a bigger audience, compared with 51% of arts and

cultural organizations. One of the most significant current discussions in the art and cultural sector is museums are less likely than the rest to expose positive influences from digital technologies, principally in relations of revenue generation and audience development (Bakhshi, 2013, p.5). It is becoming increasingly difficult to ignore the fact that museums are not as engaged with digital technology compared with other arts and cultural organisations. However, far too little attention has been paid to digital experimentation; research and development; which are the leading causes of enhancements in such sector (Bakhshi, 2013, Marty, 2008). These rather disappointing results regarding museum technology adoption and use require further exploration. The literature on heritage and mobile technology is also overly focused on museums and there is a gap in literature regarding the use of technology, specifically mobile devices, in wider heritage locations (e.g. Castles, monument).

Most studies in heritage sector have only been carried out in tourist cities. However, far too little attention has been paid to develop integrated approaches for heritage sites and ICTs to leverage the socio-economic benefits of cultural heritage for regions and towns (Marty, 2008; Arnold & Geser, 2008; Parry, 2005). It is beneficial to investigate and examine approaches to user-created content and metadata. Moreover it is significant to empower the non-professional end user in the study in order to collect substantial information.

While more in-depth research is required to fully address the viability and benefits of creating different experiential values for cultural visitors from the stakeholder perspective. This paper contributes to the literature on independent museum and interlinked landscape by providing technological approaches to motivate more visitors. In addition to highlights the implication of visitor experience by using mobile technology in historical landscape. Along with; creating a unique position and brand in the heritage sector to persuade visitors to visit interlinked locations.

3. Methodology

This paper is part of a progress research to investigate state-of-the art technologies in the heritage sector which aim in providing an in-depth understanding of visitor experience in interlinked locations. The data were collected using qualitative and quantitative approaches from multi- disciplinary stakeholders. This paper is focus on the quantitative approach. The purpose of this study is to identify the current technologies available in museums and in MC (the example heritage location Maiden Castle), and investigate whether available technologies are effective from the visitors' perspectives. In addition, the study explores the preferred technologies and media in these differing heritage locations. Importantly, the links between locations are explored, whether visitors are willing to visit MC if they are in DCM and vice versa. Correspondingly, media effectiveness is reviewed in order to motivate more visitors to visit - primarily as a tool for an enjoyable experience. The following research questions were formulated: RQ1 what are the preferred technologies, guide tours and media in the heritage sector as identified by museum visitors and historical landscape visitors? RQ2 what is the visitor perception of the quality of the museum and MC? RQ3 what are the preferred museum/historical landscape media with respect to technologies which aim to improve visitors' experiences?

The data collection was carried out using a visitor survey, unsystematically distributed in two interlinked locations; Maiden Castle and Dorset County Museum. The distribution was undertaken for random visitors regardless of the purpose of their visit (as a tourist, to

explore, to walk, on a vacation). The research was undertaken in two stages. The first stage was the construction and piloting of the questionnaires, based on outcomes from literature. Prior to early survey administration, the questionnaires were pilot-tested with a panel of experts. The expectations for technology for the two locations were then collected through the survey.

A quantitative approach was used to analyse the data from the survey (from visitors). Initially, demographic questions were asked (age, gender, language and town/country). The questions were then split in order to measure the main paradigms of the study: current technologies, guide/tour preferences, technology preferences and media preferences (Table-1). The measurement for current technologies was entered on a five-point Likert scale, with answer choices ranging from “Extremely well” to “Not at all well”. Further objectives were measured using tick-box options for the preferred answer to each question.

Paradigms (objective)	Item
Current technologies/facilities	How well is historical information presented in Maiden Castle (MC)?
	How well is historical information presented in Dorset County Museum (DCM)?
Guide/tour preferences	When walking around a historical location, I would prefer human guides
	When walking around a historical location, I would prefer headphones guides
	When walking around a historical location, I would prefer smartphone guides
	When walking around a historical location, I would prefer nothing
Technology preferences	While walking around MC or DCM, I would prefer information presented via book/printed description
	While walking around MC or DCM, I would prefer information presented via e-book
	While walking around MC or DCM, I would prefer information presented via smartphone
	While walking around MC or DCM, I would prefer information presented via tablet
	While walking around MC or DCM, I would prefer information presented via laptop
Media preferences	While at MC or DCM I would like to access artefact images
	While at MC or DCM I would like to access audio commentaries
	While at MC or DCM I would like to access historical videos
	While at MC or DCM I would like to access sound effects

Table1. The main paradigms of the study

The data was collected in two different locations: Maiden Castle (MC) and Dorset County Museum (DCM), between April and June 2014. This allowed for both comparison and linkage between MC and DCM, as many objects in the museum were earlier found in MC. Over this period of three months 49 responses were collected from DCM and 63 responses from MC - a total of 112 respondents. The collected data were analysed using a statistical package (SPSS statistics 20). Descriptive statistics were utilised to analyse the collected data and answer the research questions.

4. Research Results

The results from the descriptive analysis clearly show the differences between the visitor response to current historical information presented at MC (Figure 1) and in DCM (Figure 2). Overall, the technologies providing historical information in MC are less effective when compared with the technologies in the museum. Specifically, a greater proportion of respondents (43%) indicated that the technologies in Maiden castle were used moderately well compared with almost 5% who said they were used extremely well. On the other hand, surprisingly, about 56.5% of respondents from DCM felt that the technologies were used effectively but needed some improvement, compared with the lowest percentage (23%) which said they were used extremely well. In terms of slightly well and Not at all well, these were selected by 0% of visitors in this case.

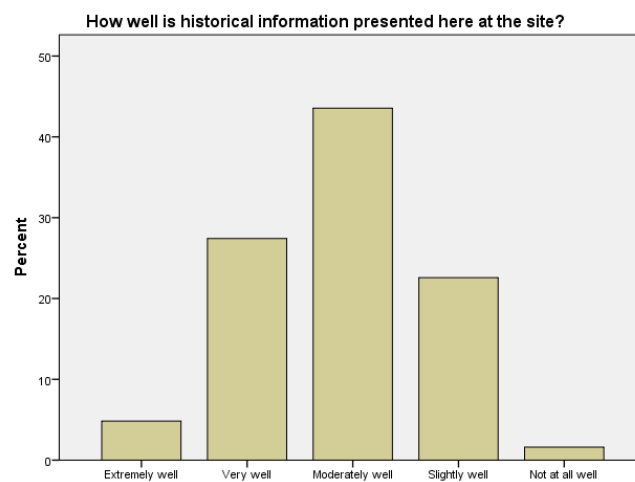


Figure1. Presentation of historical information in Maiden Castle

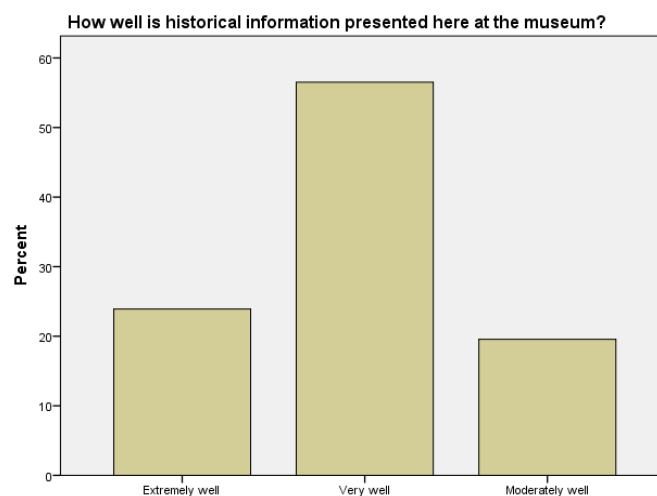


Figure2. Presentation of historical information in Dorset County Museum

4.1 Preferred guided tour and presentation tool/technology

Results (Figure 3) illustrate that the preferred guide for visitors at MC is a smartphone guide based on sound and visuals (34%) compared with human guides, sound based guides and other guides. Regarding presentation tools (Figure 4), approximately 38% preferred smartphones compared with a book (20%), an e-book (3%), a tablet (5%), or a laptop (1%). Therefore, it is clear that mobile technology is needed in this domain.

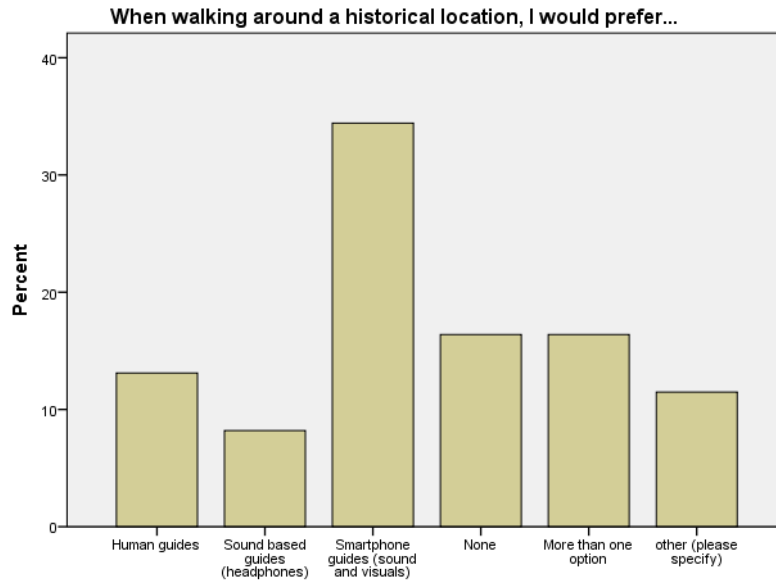


Figure3. Preferred guided tour at Maiden Castle

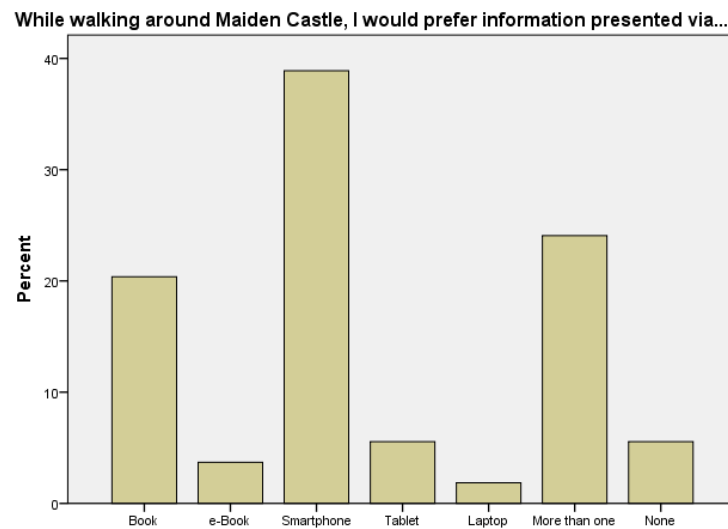


Figure4. Preferred presentation tool in MC

However, regarding DCM (Figure 5), the highest proportion of respondents (42%) preferred no guide while walking around the museum, and surprisingly (Figure 6) they prefer information presented as printed descriptions (approximately 70%).

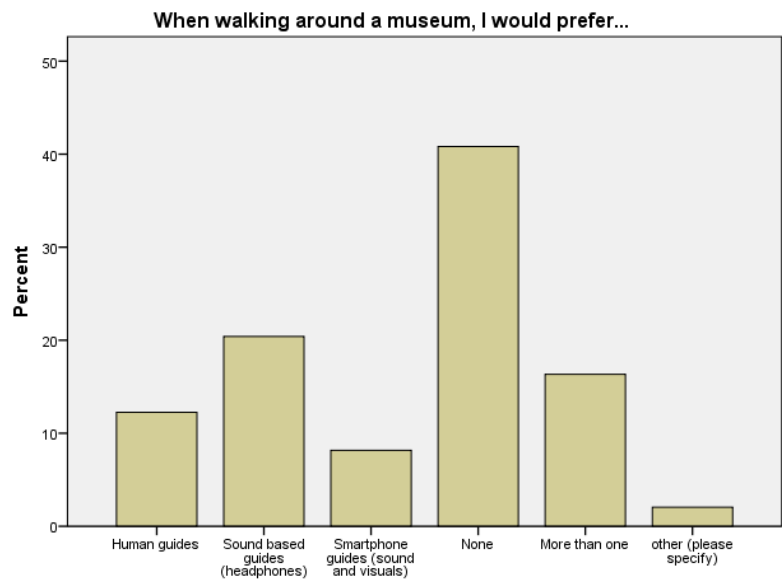


Figure5. Preferred guided tour at Dorset County Museum

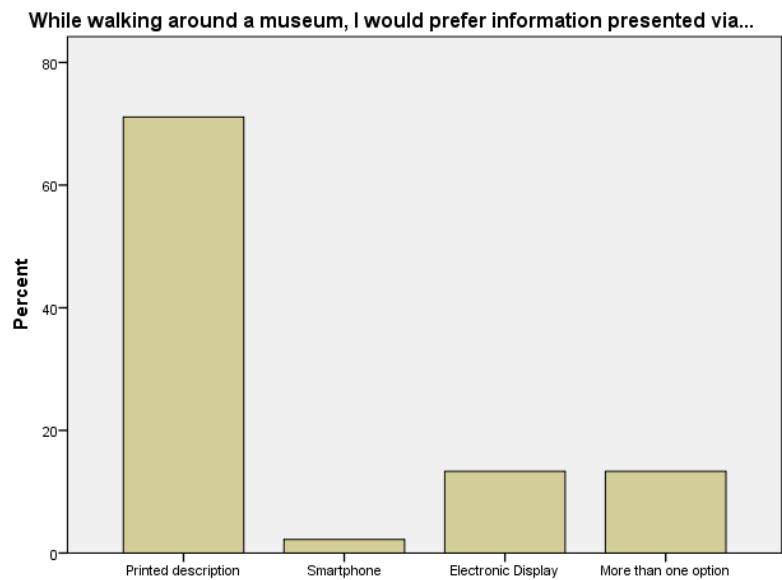


Figure6. Preferred presentation tool in DCM

4.2 Media preferences

Regarding preference for media (Figure 7), approximately 35% of respondents would like to access artefact images while at MC, and 33% of them prefer a mixture of different media. This made it clear that there was an opportunity whereby visitors would definitely like different type of media to enrich their knowledge about the historical landscape. Additionally, roughly the same proportion (35%) would like a mixture of different types of media, while they are walking around the museum (Figure 8). Regarding the unlabelled bars in both Figure 7 and Figure 8, these represent the percentage of visitors who kept these questions empty which are approximately 3% and 2% respectively.

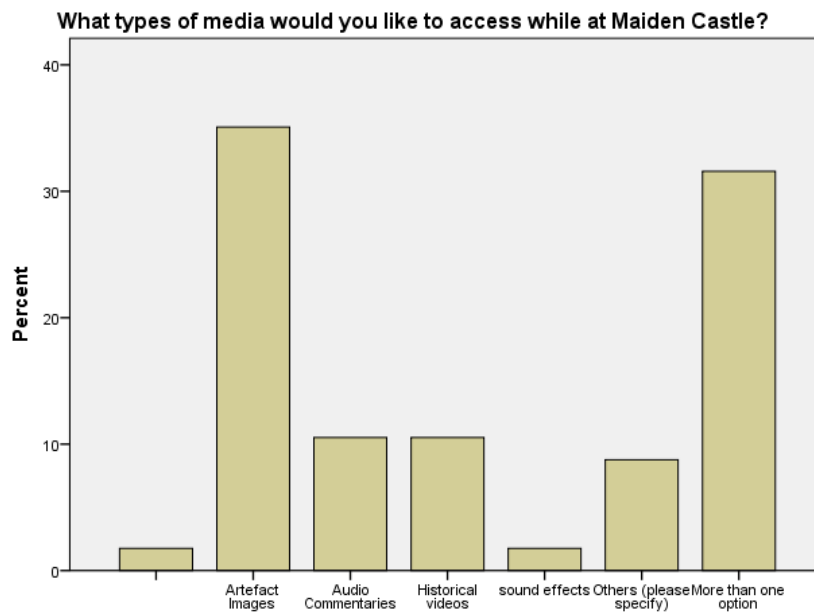


Figure 7. Preferred Media in MC

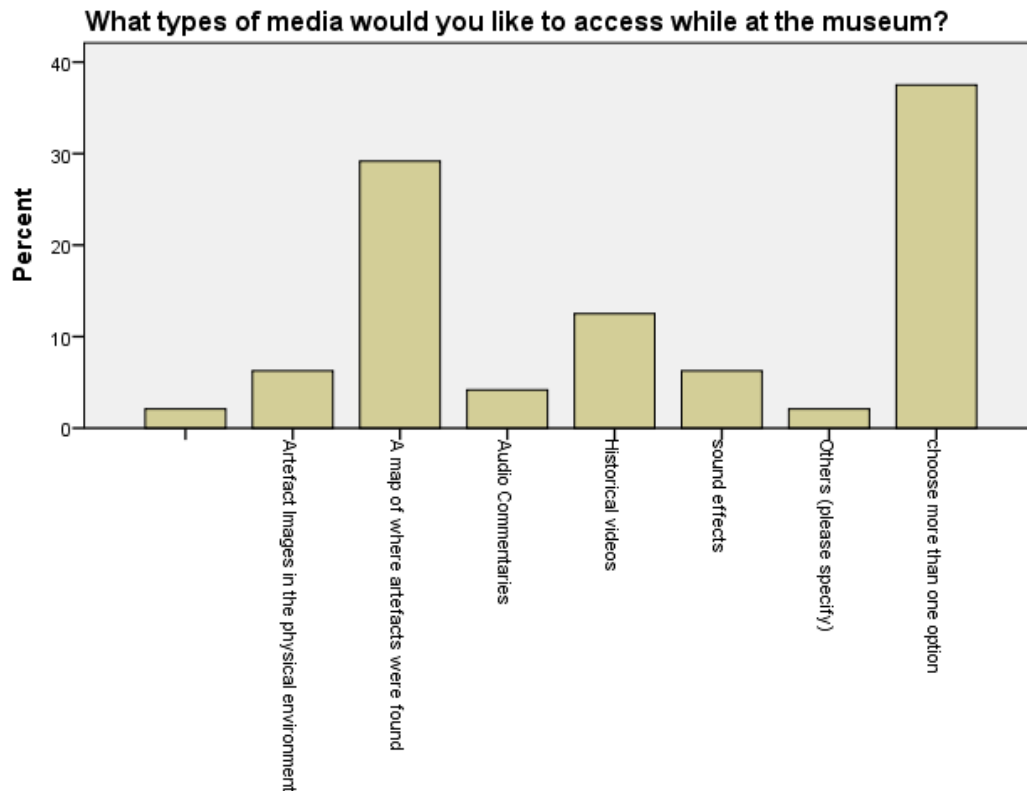


Figure8. Preferred Media in DCM

4.3 Visiting Maiden Castle and Dorset County Museum

Descriptive analysis in the following table presents visitor behaviour in Maiden Castle and Dorset County Museum (Table 2). This table compares the two locations. These results allow us to explore the visitor knowledge requirements at differing but related locations. The responses indicate that they had visited the corresponding location at least once or twice in the past are similar: 41.2% of MC visitors and 45.2% of DCM visitors. Interestingly, most visitors who went to MC (83.9%) had not visited DCM in the past and more than half (63.2%) were interested to know more about the museum. Furthermore, 62.2% of visitors who went to DCM had never visited MC and 67.4% were willing to investigate and discover the story of MC – in all likelihood to link what they found in the museum with the Maiden Castle site. There is a clear interest in the linkage between the two sites and in acquiring more knowledge and educational experience. This is also interesting evidence for interlinked locations, suggesting a need to investigate the best practices for increasing visitor numbers from a landscape with links to a museum, in this case Maiden Castle and DCM.

Knowledge requirements at differing but related locations	MC visitors		DCM visitors	
	Highest %	Number of visits	Highest %	Number of visits
In the past, how often have you visited the Location?	41.2	Once or twice	45.2	Once or twice
In the past year, how often have you visited the interlinked location?	83.9	Never	62.2	Never
In the next year, how often will you visit the interlinked location?	63.2	Once or twice	67.4	Once or twice

Table2. Visiting percentages in both locations

5. Discussion

Clear differences in requirements are found between the two heritage locations of a museum and a related physical site. Visitors at Maiden Castle prefer smartphone apps that present images of artefacts, along with sounds and visual objects, in order to gather more information about the location. A possible reason for this is the nature of the relatively empty and remote site with few objects and a lack of historical information around the site itself (only English Heritage signs). Despite its historical importance, there are few media artefacts or objects in the surrounding area. Consequently, many visitors appear to require more media content on their smartphones – a device that they carry. A contrasting picture is seen with museum visitors, with most respondents not wishing to hold anything or disturbing their walk around the museum. A printed description (on an exhibit) is typically preferred. A reason for this could be that historical information is traditionally presented in this form. However, most visitors would like to see visual maps showing where artefacts were found. Interestingly, this indicates that visitors wish to know more about the objects in the museum and are inspired to discover the original location of these objects and their historical contexts. A conclusion could be drawn for the need for a smartphone in both locations but for different reasons. For MC, the reason would be to show the history of the location and present the different stories surrounding the area; whereas for DCM the reason would be to demonstrate the relationship between each object in the museum and its source, showing where they were found. This relationship warrants further analysis.

6. Reflection and conclusions

This paper has explored state-of-the-art technologies in the heritage sector and the main issues and challenges for smaller independent museums. Much of the literature concerning technology innovation focuses on the impact of digital applications on museum visitor experience.

This study extends current literature and investigates the quality of visitor heritage experience and identifies opportunities to use technologies during their heritage visits. The study proposes technological approaches to encourage more visitors. Importantly, the study does not aim to evaluate specific techniques; rather it tries to learn more about currently employed media technology in relation to overall visitor experience. In addition, it aims to learn more about archaeological history and how best we can enhance visitors' experiences using mobile technology within an augmented landscape.

From the results, it is clear that there is a mismatch between visitor technological requirements in the differing locations – museum and physical landscape. Both categories agree about the lack of technology in Maiden Castle and moderator technologies in DCM. Both locations seek solutions to improve visitor experiences, emphasising that smartphones may be an effective way to motivate visitors. In addition, there is a need for more effective media elements in mobile devices that enhance visitor experiences with heritage locations and cultural contexts. In summary, different people require different styles of presentations depending on the location and environment they are in. Preference for digital media depends on the person, the situation and the place.

Further studies are required to better understand the optimal balance between visitor requirements and museum capabilities.

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