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How technology can influence museum visitor experience: A parameter-mapping approach to individual and group response optimisation

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ABSTRACT

Museums, wishing to optimise the experience of various groups of visitors, use feedback surveys to assess opinions of their visitors, including their expectations beforehand and considered view post-visit. Amongst key themes reported in these surveys are: the general success of a comprehensive museum offering (including multiple themes and locations); the desirability of engaging visitors emotionally; and, in the case of groups, the importance of shared experience both during the visit and in post-visit digestion of the learning and the impression left by the experience.

Technology emerges as an important vehicle to drive all these desired positive outcomes - the one currently indicating the most promise being personal mobile technology. In this paper, the authors discuss the issues which need to be considered in developing optimised museum experience for various target visitor groups, based around the application of this technology platform. As the basis for discussing how best to use such technology, the Contextual Learning Model of Falk and Storksdik (2005) is explored, which produces a set of parameters categorized as 'personal, socio-cultural and material (physical) contexts'. After explaining the implications of each of these contexts, a detailed example of the implementation of technology for the interpretation of one aspect of heritage is given – that of the interpretation of Chinese history for non-specialist foreign audiences using a comprehensive charting of the ebb and flow of the dynasties, styled by the present authors as DYNAMOST ™. This set of resources includes a range of personal mobile technology applications supported by live and recorded lectures and printed material. The authors finally consider the potential to apply this method more generally in order to assess 'How technology can influence museum visitor experience'.

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Ask visitors about their expectations of a museum visit and you will get different answers depending on whether they are a family, a group of adults or individuals. Visitor responses show three key views:

Firstly, the best museum is the one that presents a range of different types of objects and offers an interesting experience for visitors of all ages, with varying degrees of education, personal interests, and 'technical culture' (that is, ability in the use of technology in the cultural context).

Secondly, depending on the type of visit (individual or group), the visitor expects to be involved at a mental and even a physical level by the surroundings, decoration and artefacts. In other words, the expectation is for an interaction or personal engagement with objects and ideas presented at the exhibition.

Thirdly, people who visit museums in groups, whether families with children or a group of friends have expectations of shared experience; the group members with their different interests and level of knowledge process received information together but their experiences can be communicated between the group. Furthermore, they can 'feed-off' and influence each other, leading to synthesis of some new elements of group-wide experience[3].

There are other similar proposals for expectation. For example, that the museum can show the 'real thing' - or at least reproductions - so visitors believe there is an innate integration with objects, ideas and experiences offered in the museum. Secondly, the museum is seen as a medium for elective training courses often but not necessarily related directly to culture

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[3] Falk John H., D. Dierking, Lynn. *The Museum Experience.* Washington, D.C., Whalesback Books, 1992

and heritage themed subjects[4]. Not surprisingly, Coupon Loich notes in the preface to his book "Digital Technologies and Museums" that personal mobile devices are one of the first technologies that fully meet the objectives of museums in many of the above situations, and remain the most successful museum technology to date.

This form of media is a preferred personal choice as a means of educating visitors, acting like a well-trained guide and curator of the exhibition who can offer an individual experience for each visitor. Well-designed and wisely used digital technologies are an important tool to enrich the interactivity and educational properties of museums. Information technology can provide visitors to these institutions with inspiration and inquisitive provocations, regardless of different interests and level of knowledge.

However, there are some unanswered questions about personal mobile technologies. For example, what are the weaknesses of these tools? Is there proof that new technologies have an impact on the learning process and are more useful than traditional media? Our main thesis is that the key to ensuring that well-designed digital services (resources, tools) successfully fulfil their main task, namely to increase the educational potential of museums, lies in understanding the nature of the visitor and the mechanism by which people build opinions and gain a sense of the surrounding world.

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[4] Falk John H., Lynn D. Dierking, *Public Institutions for Personal Learning*. Washington, D.C., American Association of Museums, 1995

II THE CONTEXTUAL LEARNING MODEL

As the basis for discussing these ideas, we use the contextual learning model developed by John H. Falk and M. Storksdik[5]. This is not a model in the full sense of the word, as it does not pretend to predict outcomes, but only determines the learning or the creation of meaning as a complex phenomenon that depends on a series of circumstances. A continual dialogue is proposed between the individual and his/her environment, both physical and socio-cultural. The context model describes this dialogue as a process and product of the interaction time of three contexts: **personal, socio-cultural and material (physical)**. None of these contexts is stable or permanent, but each changes through the various stages of a person's life (see figure 1).
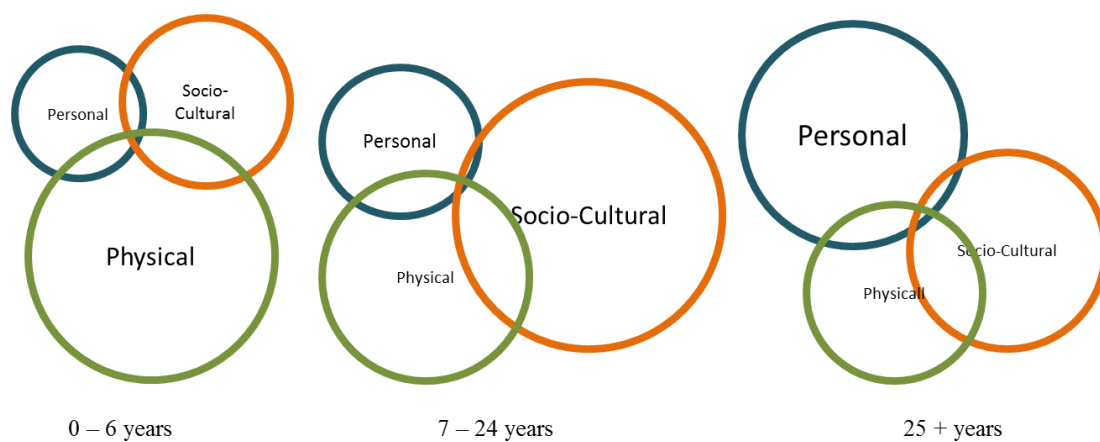

0 – 6 years	7 – 24 years	25 + years

Figure 1 Example of changes in building opinion from three contexts. Children under age 6 have no prior experience and build an opinion based on the world around them, while individuals attending school/University want to fit into the social group and graduates already rely on the experience and knowledge

The **personal** context presents a summary of the personal and genetic history that an individual brings and that helps in understanding certain

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[5] Falk John H., Storksdieck M. Using the Contextual Model of Learning to Understand Visitor Learning from Science Center Exhibition. In: *Science Education*, Vol. 89, 2005, p. 744 -78

situations. Life experiences and prior knowledge influence the creation of impressions in museums: examples can be found in numerous publications[6]. The essence of the motivation for visiting a museum is also important for building opinion and in firming up the 'sense' of the visit[7]. A more recent study suggests that the perceived control and degree of freedom also influences the expectation of museum visitors.[8] We can summarize that the personal context in the creation of meaning is defined by personal motivations and expectations, which in the case of museums means a short, pleasant and cultural experience. Also, the creation of opinion is strictly personal and influenced by accumulated knowledge, interests and beliefs. Finally, the control of the order of experiences and the 'learning journey', which we style as an 'experience-flow' is important to be designed to meet a range of target groups and individuals in an appropriate, and fundamentally non-uniform manner.

The **Socio- cultural context** views people as social creatures, the product of culture and social relationships. Therefore, the creation of meaning in museums must have a socio- cultural aspect and the end-product should include factors that could potentially influence the cultural values of the society cultural values whilst providing opportunities for self-learning

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[6] Dierking, Lynn D., Pollock W., *Questioning Assumptions: An Introduction to Front-End Studies*. Washington, D.C., Association of Science Technology Centers, 1998; Falk, John H., Adelman L., Investigating the Impact of Prior Knowledge, Experience and Interest on Aquarium Visitor Learning. In: *Journal of Research in Science Teaching,* Vol. 40, no. 2, 2003, p. 163–76; Gelman Rochel, Christine M. Massey Christine, McManus Mary. Characterizing Supporting Environments for Cognitive Development: Lessons from Children in a Museum. In: *Perspectives on Socially Shared Cognition*, (Washington, D.C., American Psychological Association, 1991) p. 226–56; Hein, George E. The Constructivist Museum, In: *Group for Education in Museums,* 1995, p.21–23.
[7] Graburn, Nelson H. The Museum and the Visitor Experience. In: *The Visitor and the Museum*, *Seattle: 72nd Annual Conference of the American Association of Museums*, 1977, p. 5–32.
[8] Lebeau, R. B., Gyamfi, Wizevich , P., Koster E. H., "Supporting and Documenting Choice in Free-Choice Science Learning Environments." In: *FreeChoice Science Education: How We Learn outside of School*, 2001, p. 133–48.

Although these factors would clearly influence the process of opinion forming and sense, to date there is no empirical research to support this. However, there are studies that show strong influence of the communication and collaboration of the individual as part of the social-group opinion forming. These studies prove that quality dialogue with people outside the social group of individuals, such as museum guides, moderators and even external groups and other visitors to the museum can influence the creation of opinion and perception gained from museum-based exposure. Impressions are formed from our surrounding natural world. The very perception of the world is the result of "dialogue" with the physical world[9].

The **Physical (material)** context is the third context in the theory to create a meaningful experience. Good design and architecture of the museum is a key component of the physical context of the museum's 'visitor-contract', *i.e.* the commitment to provide experience and education for the visitor, which is enjoyable and even entertaining. Large-scale solutions for space, lighting and atmosphere, but also solutions for the very arrangement of the exhibits are part of the physical context and a place for technology, software and information services.

As museums generally give visitors the freedom to walk through the space in any sequence, the museum experience is difficult to trace and cannot be easily replicated, and to great extent depends on the curatorial skills of the staff. In such an environment, it is proven that a positive evaluation of the

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[9] Astor-Jack, T., Whaley, K., K., Dierking, D. Lynn, Perry, D. , Garibay, C. Understanding the Complexities of Socially Mediated Learning. In*: In Principle, In Practice: Museums as Learning Institutions*, 2007 Липсват данни.; Wolins, I., Jensen, N., Ulzheimer, R. Children's Memories of Museum Field Trips: A Qualitative Study. In: *Journal of Museum Education*, 17, 1992, p. 17–27.

exhibition depends on how successfully visitors navigate within the space. Previous research found a link between feeling safe and navigating in 3D space when using stored knowledge[10]. Such 'intellectual navigation' results in a better understanding of the museum exhibition. Another positive effect comes from architectural elements such as lighting, colour, sound and accessibility arrangements.

Other research focuses on the technology processing of objects, labels and captions - one of the main foci of museums[11]. Not surprisingly, there is evidence that instructions in museums such as positioning, sequence, content media, labels and educational elements have influence on the perception of exposure[12].

Finally, although there are no specific publications on the subject, there is a theoretically convincing idea that creating a meaningful museum message, not only depends on factors such as visitors' level of prior knowledge but also on subsequent visit circumstances and other methods of reinforcing experience and knowledge. The training process is not instantaneous, but requires a quantitative accumulation and consolidation of facts. Therefore, certain experiences after visiting the museum can play an important role in the long-term effects associated with training. Most notably, to show the importance of the processes after the visit to the

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[10] Evans, G. Learning and the Physical Environment. In*: Public Institutions for Personal Learning*, Washington, D.C., American Association of Museums, 1995, p. 119–26.
[11] Anderson, David, Keith, B. Lucas. The Effectiveness of Orienting Students to the Physical Features of a Science Museum Prior to Visitation. In :*Journal of Research in Science Teaching*, 27, 1997, p. 485–495
[12] Bitgood, Steve, Beverly Serrell, Thompson, D. The Impact of Informal Education on Visitors to Museums. In: *Informal Science Learning: What Research Says about Television, Science Museums, and Community-Based Projects*, Dedham, Mass., Research Communications, 1994; Paris, S., ed. *Perspectives on Object-Centered Learning in Museums*. Mahwah, N.J.: Erlbaum, 2002.

Museum, the American Museum Association, established the prizes in the category "MUSE" - Extended Experience.

III THE MATRIX OF FACTORS FOR CREATION OF OPINION ON MUSEUMS

Within this triple-context model (personal, socio-cultural and material) a complex matrix of factors is seen to represent the creation of opinion. In this model, there are hundreds, even thousands of factors, some of which have been outlined and discussed in previous publications; others are not so obvious but can provoke further discussion on the topic. In order to reduce this complex scenario to a tractable set of factors, we propose to try to define twelve key factors or groups of parameters that have a strong impact on museums and the experience they offer, as follows:

Personal context
- Motivation and visit expectations
- Previous knowledge and experience
- Preliminary interests
- Choice and control

Socio- cultural context
- Cultural Backgrounds
- Dialogue in a social group
- Dialogue outside the social group

Physical context
- Preliminary organization
- Orientation in space
- Architecture and factors of the environment on a macro level

- Exposition design, technology and programmes
- Temporary exhibitions and events outside the museum

Previous studies show that these 12 factors contribute to the quality of the museum experience, although depending on the specifics of the museum and type of visitors (technical art gallery or museum, families or groups of the same age) the importance of each factor will vary[13]. Nevertheless, it is shown that each of these factors influence the creation of meaning for the visitor. The context model suggests that to create the absolute maximum of perception we must take into account all the variables simultaneously. In other words, all the factors are important, but their coverage is virtually impossible, in each situation a sub-set of key factors needs to be the focus for our analysis.

Even if one selects the "most important", they cover only 9% of variables important to create a sense. Therefore, the idea is to use a group of factors rather than a single one or specific ones. Namely linking factors to specific group of visitors is the best possible way to create a successful exhibition.

Research shows that the segmentation of visitors into traditional categories such as age, race or ethnicity, social group or level of education does not contribute to the creation of a useful sample. Conversely, the grouping of visitors according to their preliminary knowledge, motivation and interest in the museum offering does prove to be useful.

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[13] Falk John H., Storksdieck M. Using the Contextual Model of Learning to Understand Visitor Learning from Science Center Exhibition. In: *Science Education*, Vol. 89, 2005, p. 744 -78.

This kind of grouping allows one to experiment with different factors to determine which are important and which are not. For example, people with limited knowledge of the contents of the exposure, determine the quality of those objects as important, rather than the position and orientation in the exhibits. These findings show that **visitors with limited knowledge would be a key group for development of information transmitted by mobile devices**. For people with some prior knowledge of the subject matter of the exhibition this is not among the important factors. Since groups of visitors view the arrangement of exhibits as a more important factor than is the case for individuals, mobile devices can be a solution for this group as they allow early familiarity with the layout and 'feeling; of the museum, possibly even allowing the group to hatch a' plan of attack' for their visit. With this context, the examples below attempt to show that the technology can help to meet the needs of visitors.

To summarise, we can determine that the creation of meaning depends on many different factors. Even were all possible options to be considered, this would not be enough to get a clear and accurate picture of users. Half of our visitors will still have individual personal factors affecting their experience fundamentally.

We can say with certainty that the personal context- prior knowledge, motivation and interests of a person- are more important than any technique or innovation to anticipate learning outcomes. This does not mean that the physical context (what people see or do), whether they use digital technology or not, does **not** affect the educational purpose. Quite the contrary - such technology would increase the level of learning in the museum. Visitors would use them as a tool to alter individual visits in a way that meets their needs, depending on the previous accumulated

knowledge and interests. Personal and socio-cultural contexts are predictable but difficult to control. In contrast, the physical context depends mainly on the museum and its team. Therefore, here, technology would have the greater effect in influencing the material factors.

IV AN EXAMPLE OF TECHNOLOGY SUPPORTING HERITAGE INTERPRETATION: DYNAMOST ™

DYNAMOST[14] is a set of lectures and interactive smart digital materials used by the Confucius Institute (CI) at Bangor University, UK (www.bangor.ac.uk/confucius-instiute), to attempt to teach Chinese history by describing the historical flow of the 'Middle Kingdom' based on the ruling Dynasties of China which can be traced back through 4000 years from the present day to the first dynasty (Xià). The context for this activity is that the CI is a 'portal' on China for the people of north Wales and a catalyst for understanding and collaboration, with three target groups: schools (primary and secondary), Bangor University (staff and students) and community groups (ranging from young people to seniors). Although China is regularly featured in UK media reports, there is little understanding of Chinese history amongst any of these target groups, except for knowledge of some key episodes, of certain Dynasties such as the Ming, and of key sites such as the Great Wall and the Forbidden City, Beijing. Commentators on the portrayal of Chines in the West notice that Chinese history is often described either in a romantic, aesthetic, oriental discourse or as a disjointed set of events, culminating in a 20th century

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[14] The name of the program is a game of words. MOST of the Chinese DYNAstic history. Translation: "Bridge of China's dynastic history." The creators show that they are familiar with phonetic meaning of MOST (bridge), in Eastern European languages, and it symbolizes the strong links with partner institutions namely those of European countries.

Revolution. The CI believes that the unique continuity of Chinese history through many Dynasties offers a special opportunity to gain an understanding of the flow of history, which can lead to the beginning of a deeper, less caricatured, more balanced view of the country amongst Westerners. Also, the full Dynastic picture can give insight into the complex 'heart' of modern China, which is both a modern, global-facing economy and a repository of ancient culture and deep heritage memories.

In order to provide the basis for our three target groups to learn about Chinese Dynastic history, a comprehensive map of all Dynasties (Figure 2) has been produced, adapted from existing educational material.
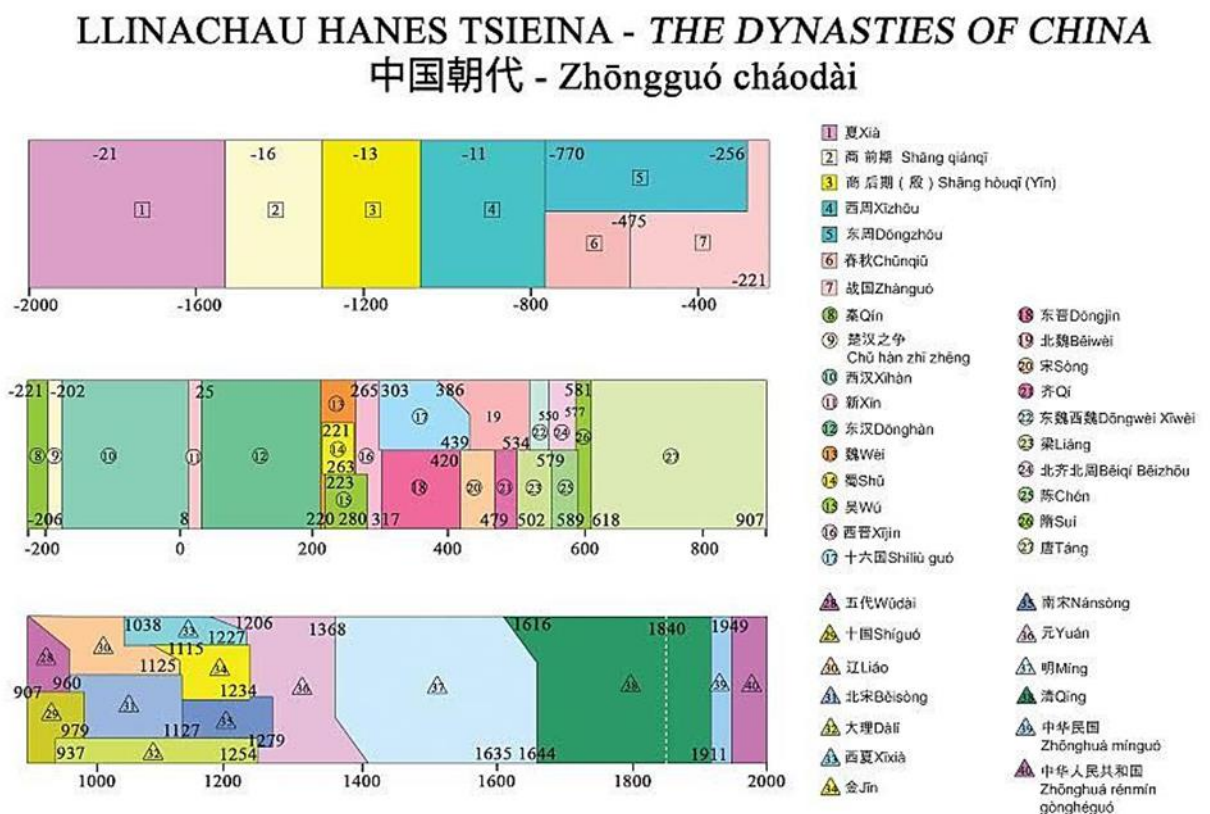

Figure 2 The Dynasties of China

This gives the user the opportunity to see all Dynasties in a single image and is presented to learners as an A3 sized paper full colour copy for individual usage; a very large (A1) framed copy is in a prominent position on as a permanent wall exhibit in the CI premises (Figure 3); a downloadable digital copy is available on the web site; and an interactive 'app' for smart phones gives users permanent, mobile access to customizable information about many aspects of Dynastic history as well as enabling the CI to present key stories, such as the links between China and the world through history, the trends in culture, belief systems and social structure etc.

Figure 3 The exhibit of the map in the Confucius Institute, Bangor University

The single Dynastic chart is divided conveniently into three periods, shown as three strips, the first being the well-known three ancient Dynasties. The key shows both the Mandarin name for each Dynasty and the pinyin roman characterisation with tones indicated. A set of 50-minute lectures designed for different target groups is under development and will be available as filmed live lecture, power point presentation voiced by the lecturers themselves and voice-over power point files in both male and female voices which will be presented initially in English but can be presented in other languages by suitable native speakers. A series of pilots are under way in partner institutions in Bulgaria, Russia the Czech Republic and Slovenia, for example. Lectures include both broad-ranging views (DYNAMOST Lecture 1 presents the whole of 4000 years of history in one session, for example) and specific studies, such as two lectures on the stories of the major HAN and TANG Dynasties.

A key feature of the mobile phone 'app' is that it 'comes alive (using LAYER software) when a chosen Dynasty is selected for study and it is customizable by the user to follow a number of desired 'learning journeys' based on key questions which can be developed and honed based on understanding the needs of different target groups. Techniques are being developed by these authors to enable the software to have a learning process in order to guide the user to new understanding, insights and appreciation of historical 'flow' with an essentially integrated view of whichever aspects of history s(he) chooses to explore in any given session.

The programme is branded as DYNAMOST ™ - styled as 'making the MOST of Chinese DYNAstic history. The name has the added advantage that 'most' means 'bridge' in most Eastern European languages (giving the ideas of the 'bridge to Chinese Dynasties') where many of CI Bangor's

strongest collaborations in developing historical interpretation are located. A significant feature of the implementation of mobile technology in this example is the way that the opportunities for enjoyable earning that it offers are actually influencing the content of the interpretative material and the flow of narrative woven around them.

V DISCUSSION AND CONCLUSIONS

The purpose of this article is to demonstrate the complexity of the museum experience whilst offering insight into how and why information and communication technologies, in particular mobile devices, can improve the museum experience and raise the level of understanding gained by all types of visitors.

Surely variables (factors) determining the physical context, design technology or software, organization and navigation through the exhibits and displays are important, but equally important is the personal and socio-cultural context of the visitor. And since the establishment of opinion depends largely on the user's experience within the four walls of the cultural institution, effective uses of a digital experience requires that it be embedded with the physical museum realization, and that it is relevant corresponds to satisfy the needs of individuals, community groups and cultural visitors . Furthermore, one of the outstanding features of digital technology is that the embedding of technology during the visit can, of course, be complemented by visitors using the technology before and after visits

The example given here of a new set of materials to interpret Chinese history, DYNAMOST ™, under development by the present authors, shows technology being woven intricately in the developmet of an

historical narrative and in fact guiding and informing the design and optimisation of historical materials. This will become an increasing trend as technology becomes more modular, interconnected, mobile and accessible.

The factor model of museum experience discussed here clearly offers a valuable 'taxonomisation' of this complex phenomenon and justfies further exploration, especially looking at how traditional heritage interpretation techniques can and do benefit from mobile digital technology.