

Personalisation of digital museum guides through implicit recognition of visitor personas

Moneerah Almeshari, John Dowell, Julianne Nyhan

University College London
London, United Kingdom

{moneerah.almeshari.17, j.dowell, j.nyhan}@ucl.ac.uk

Abstract. Digital museum guides promise a transformed visitor experience through greater engagement with the museum content and activities [1]. Realising that promise turns on the personalisation of digital guides, particularly in museum contexts where rich content is accessed by a highly diverse visitor population [2]. Since users of a museum guide are typically first time users and since their usage is for a relatively short session, personalisation must use initial interaction data to associate the user with a particular persona and thereby infer other facts about the user's preferences and needs. Two research aims follow: first to better understand the requirements of different visitor personas, and second, to develop methods for unobtrusively detecting a user's persona from their interactions with a guide and their activity in the museum space. This paper presents the design of a research programme for: first, investigating mechanisms for automatic adaptation of digital museum guides based on identifying a visitor's persona category from interaction data; second, exploring the requirements of different visitor categories to derive the user interface adaptation, and; third, investigating the effectiveness of this adaptation on the museum visitor's experience.

Keywords: Adaptive mobile guide, Automatic user modeling

1 Introduction

Personalisation in individual access to Cultural Heritage has been an active topic of research and practice for more than 20 years [2]. The importance of personalizing guidance and support to museum visitors during their visit has been acknowledged by many studies and the effect of differences between visitors on their experience of the setting is well recognised [3]. Since digital mobile guides are able to provide a rich array of facilities to users such as, information about objects, recommendations, navigation and tours services, it is important that they are provided adaptively to enhance the visitor's experience rather than being a source of distraction [1].

This position paper outlines a proposal for a study to investigate mechanisms for enabling automatic adaptation of museum mobile guides based on visitor category detected implicitly from the user's activity. Examples of users' activity when interacting with the mobile guide include: the first menu choice; the sequence of choices;

gestures, and; information viewing behaviour. This can be supplemented with features of behaviours inside the museum, such as: position; time spent in front of objects, and; exploration style. The study exploits an established taxonomy of museum visitors (i.e., personas) that distinguishes visitors based on their visit motivation as: Explorers; Facilitators; Experience Seekers; Professional/Hobbyists, or; Rechargers [3]. In addition, the study explores the needs and preferences of different visitor persona categories as the basis for variant UI adaptation where the focus will be on interaction style and information presentation adaptation. Finally, it investigates the effectiveness of this adaptation on museum visitors' experience.

2 Related Work

Adaptive Mobile Guides (AMG) are mobile apps that have the capability to tailor their interface elements, services, content and recommendations for individual users based on the context and/or user profile [1]. AMGs seek to provide the right service or content presented in the most suitable way in the right place at the right time to the right person [1]. Employing AMGs to support visitors in exploring museums is one of the active topics in the Cultural Heritage field. Several projects, including CULTURA [4] and CHIP [5], have studied the provision of personalized services to museum visitors using mobile guides in museums.

A user model is the basis of personalisation and consequently, the quality of the user model directly affects the quality of the personalisation [6]. User models can be constructed implicitly or explicitly [6]. Although building a user model based on explicit information can be more reliable and less challenging, studies have found that users prefer tailoring the interface without being asked a series of preliminary questions [7]. HyperAudio [8], Hippie [9], PEACH [10] and CHIP [5] are examples of projects that adapt mobile guides in museums based on values detected implicitly during the user's visit.

HyperAudio uses the museum visitor route and position to infer his/her interest and knowledge [8]. Hippie models user knowledge based on the user interaction with the interface when presenting content [9]. Positive evidence of knowledge is detected when the user views the whole content whereas, not viewing or skipping content is interpreted as evidence of a lack knowledge [9]. Hippie uses the user model to predict the information need of the visitor at different points in the museum and to make recommendations [9].

Hippie models user interests based on the user's navigation of both the physical and informational spaces [9]. For example, detecting that the user has stopped in front of an object for a certain time and his/her behaviour in viewing information about that object using the mobile guide comprise two predictors that can infer about the user interest [9]. Level of interest is inferred from the time spent in front of an object and from the viewings of information pieces about the object provided by the mobile guide [9]. CHIP adapts recommendations and tours to individual users based on their interests [5]. However, it requires the user to create their tour in order to initialize the user model and then update the user model automatically based on the user behaviour

inside the museum [5]. PEACH [10] models a user's interest from their physical behaviour inside the museum.

Categorizing museum visitors and understanding their needs assists in the development and the personalisation of information systems [11]. Different studies have been conducted to categorize museum visitors based on different aspects such as, expertise, age, motivation and exploration style [11]. Attempts to detect a visitor's category implicitly by sensing their behaviour inside the museum have been reported, such as, [12] which studied detecting a visitor's exploration style, and [13] which differentiated between categories of pairs of visitors based on their behaviour.

3 Research Proposal

The next challenge in this field, we believe, is the development of museum mobile guides that spontaneously adapt by detecting a visitor's persona category implicitly from their interactions both with the museum and the guide itself. We propose a research programme to address this challenge.

A questionnaire has been developed for use as an instrument to categorize museum visitors into one of the five categories noted earlier [3]. Five factors have been extracted from [3] to differentiate between different personas, viz: visit motivation; visit success criteria; social aspects; number of visits, and; knowledge of museum content. The first stage of the programme is to validate this questionnaire.

The requirements of different groups will be investigated to lead the mobile guide adaptation. Visitors' interactions with the mobile guide and their behaviour while exploring the museum will be observed and captured to identify patterns from their activities which can be used for automatic detection of the visitor persona. For example, the visitor exploration style and their mobile guide menu choices might be a source that can be used to differentiate between visitor personas, model the user and subsequently lead the mobile guide adaptation. After identifying these patterns, mechanisms that can detect these behaviours automatically will be developed.

Evaluation of the investigated mechanisms and the effect of mobile guide adaptation on the visitor experience would be conducted at the last stage of the study. Adaptations might include providing more detailed information to some visitors and more explanations of basic information to other visitors. The Mobile Multimedia Guide Scale (MMGS) and Museum Experience Scale (MES) developed by [14] will be used to evaluate the effectiveness of the adaptation on the visitor experience.

This research aims to investigate the following questions:

Q1. How can user modelling methods distinguish between the personas of users of walk-up-and-use mobile guide systems?

Q2.1. Can different user personas be detected automatically using interaction logs and/or users behaviour inside a museum?

Q2.2. Do individual visitors have characteristic behavioural pattern when exploring the museum and using the guide? If so, what are they and how can they be captured and used to adapt a mobile guide?

Q3. How should the user interface of a mobile guide adapt to accommodate the needs of different visitors in the museum?

Q4. How does this adaptation enhance the visitor's experience inside the museum?

To address these questions, the following set of objectives has been set in Table 1.

Table 1. Research Objectives.

Objective	Method:
1 <i>Differentiate between museum visitors based on their motivation of the museum visit.</i>	1, Questionnaire that can work as a tool to classify museum visitors within the five categories identified by Falk [3].
2 <i>Identify the requirements and needs of the five visitor classes.</i>	1, Design prototype of an adaptive mobile guide. 2, Questionnaire survey. 3, Short interviews with museum visitors. 4, Observation.
3 <i>Evaluate the correlation between visitor categories and their preferences.</i>	1, Develop a digital interactive mobile guide with different features intended for different persona. 2, Questionnaire from the previous study to identify the visitor persona. 3, Observation. 4, Interviews with museum visitors. 5, A questionnaire that enables the visitor to rank different guide features.
4 <i>Investigate how to detect visitor category implicitly.</i>	1, Field study that analyses users' behaviour of different categories inside the museum. 2, Analysis of visitors interactions with the guide.
5 <i>Evaluate the relation between implicit information and visitors categories found from the previous study and investigate mechanisms that can be used to detect visitors categories automatically.</i>	1, Apply mechanisms that can collect information of the defined parameters to identify the visitor category, 2, Field study where the proposed mechanism can be tested.
6 <i>Evaluate the effectiveness of the adaptation in improving visitor experience.</i>	1, Questionnaire, 2, Short interviews.

4 Conclusion

In conclusion, three contributions are expected of the proposed research. First, identification of interactions and behaviour patterns that can be used to differentiate between different museum visitor groups. Second, identification of mechanisms and parameters that can be used to detect the visitor persona group implicitly. Third, requirements of different groups and the associated adaptation features.

References

1. Emmanouilidis, C., R.-A. Koutsiamanis, and A. Tasidou, *Mobile guides: Taxonomy of architectures, context awareness, technologies and applications*. Journal of network and computer applications, 2013. **36**(1): p. 103-125.
2. Ardissono, L., T. Kuflik, and D. Petrelli, *Personalization in cultural heritage: the road travelled and the one ahead*. User modeling and user-adapted interaction, 2012. **22**(1-2): p. 73-99.
3. Falk, J.H., *Identity and the museum visitor experience*. 2016: Routledge.
4. Hampson, C., et al., *The CULTURA Project: Supporting Next Generation Interaction with Digital Cultural Heritage Collections*, in *Progress in Cultural Heritage Preservation: 4th International Conference, EuroMed 2012, Limassol, Cyprus, October 29 – November 3, 2012. Proceedings*, M. Ioannides, et al., Editors. 2012, Springer Berlin Heidelberg: Berlin, Heidelberg. p. 668-675.
5. Roes, I., et al. *A personalized walk through the museum: The chip interactive tour guide*. in *CHI'09 Extended Abstracts on Human Factors in Computing Systems*. 2009. ACM.
6. Frias-Martinez, E., et al., *Automated user modeling for personalized digital libraries*. International Journal of Information Management, 2006. **26**(3): p. 234-248.
7. Gauch, S., et al., *User profiles for personalized information access*, in *The adaptive web*. 2007, Springer. p. 54-89.
8. Petrelli, D. and E. Not, *User-centred design of flexible hypermedia for a mobile guide: Reflections on the hyperaudio experience*. User Modeling and User-Adapted Interaction, 2006. **16**(1): p. 85-86.
9. Oppermann, R. and M. Specht. *A context-sensitive nomadic exhibition guide*. in *International Symposium on Handheld and Ubiquitous Computing*. 2000. Springer.
10. Stock, O., et al., *Adaptive, intelligent presentation of information for the museum visitor in PEACH*. User Modeling and User-Adapted Interaction, 2007. **17**(3): p. 257-304.
11. Walsh, D., P. Clough, and J. Foster, *User Categories for Digital Cultural Heritage*. 2016.
12. Zancanaro, M., et al. *Analyzing museum visitors' behavior patterns*. in *International Conference on User Modeling*. 2007. Springer.
13. Dim, E. and T. Kuflik, *Automatic detection of social behavior of museum visitor pairs*. ACM Transactions on Interactive Intelligent Systems (TiiS), 2015. **4**(4): p. 17.
14. Othman, M.K., *Measuring visitors' experiences with mobile guide technology in cultural spaces*. 2012, University of York.