Balancing Adaptivity and Customisation:
In Search of Sustainable Personalisation in Cultural Heritage

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Abstract. Personalisation for cultural heritage aims at delivering to visitors the right stories at the right time. Our endeavour to determine which features to use for adaptation starts from acknowledging what forms of personalisation curators value as most meaningful. Working in collaboration with curators we have explored the different features that must be taken into account: some are related to the content (multiple interpretation layers), others to the context of delivery (where and when), but some are idiosyncratic ("match my mood", "something that is relevant to my life"). The findings reveal that a sustainable personalization needs to accurately balance: (i) support to curators in customising stories to different visitors; (ii) algorithms for the system to dynamically model aspects of the visit and instantiate the correct behaviour; and (iii) an active role for visitors to choose the type of experience they would like to have today.

Keywords: Personalisation in Cultural Heritage, Sustainability, Customisation, Adaptivity, Personalisation by design.

1 Introduction

In a scenario of digital content delivery for the Cultural Heritage sector, either online or onsite, mechanisms for appropriately adjusting what is presented to the user and how is now seen as a necessity, to accommodate different visit motivations, expectations, and needs [3]. A co-design process where curators, designers and computer scientists work hand in hand is required to guarantee that user-system and personalisation requirements are properly spelt out and that the design of IT solutions meet both the curators and the visitors' needs and expectations.

In the meSch project[1] [8], museum experts and curators are active players of an investigation that aims at designing personalisation technologies that support the tangible and embodied interaction with exhibits and spaces augmented with digital content. Personalised content will be revealed if and when conditions are right, e.g. visitors have reached the right time in the storyline, or a group of them is acting in a certain way, or another smart object is close by. In such a rich scenario, the design of a

[1] http://mesch-project.eu/

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component delivering personalisation services across different heritage types needs to face strict sustainability requirements related to: the reusability of the main functionalities in different contexts (e.g. onsite vs. online interaction); portability to different physical sites (e.g. indoor vs. outdoor), hardware devices (e.g. wearables), and different domains; the implementation of relevant forms of personalisation both in content and in interaction; proper support for curators to retain their pivotal role in creating the stories and the multiple layers of interpretation; easy tuning and maintenance.

This paper presents a methodological approach for spelling out the requirements for a sustainable personalisation architecture to support the complex scenario outlined above. It is based on the meSch experience in collaborating with curators and museum experts to understand and shape personalisation in a way that is meaningful to them and to visitors, that is sustainable to implement, and effective in managing the complexity of context-awareness. Section 2 describes how cultural heritage professionals were active players in investigating the meaning of personalisation and the different features that must be taken into account. Section 3 then explains how the output of the co-design process has been translated into requirements for the implementation of a personalisation component, where complementary approaches are adopted to allow for content to be controlled by curators (customisation) and context to be controlled by the system (adaptivity) [7].

2 Personalisation: What Does It Mean for Cultural Heritage?

Personalisation for cultural heritage has been a topic of research for many years [1], however no common understanding is shared across the community on which features should be used and for which aim. To propose a personalisation architecture that can be used for different instantiations of personalised visitors' experiences and heritage types we need first to gain a broad understanding of what personalization of cultural heritage could be. To this aim we conducted two complementary studies and integrated the results to define the requirements for such a generic approach. The first study is a meta-analysis of the literature that classifies the features used in different personalisation systems and which model they feed. The second study is a user-centred qualitative study of what personalisation means for cultural heritage professionals.

2.1 Personalisation: Features in the Literature and Their Use

In order to determine which features have driven research so far, and the computational approaches adopted, an extended reading of the existing literature was undertaken. Milestone works in the field of visitor studies were used as starting point; technical papers describing implemented solutions evaluated with final users in onsite settings complemented and completed the set. Overall 41 features were classified according to the static/dynamic nature of the information and to the subject they refer to such as: (i) the visitor (e.g., age, disabilities, personality [4], background knowledge, motivations, expectations [2], interests [9], visiting style [6], previous visits

and available time,…); (ii) the interaction and social context (e.g. location and proximity [5], group social interactions [6], visit history,…); (iii) the environment (e.g., physical layout [5], weather conditions, crowding, noise,…); (iv) the content (e.g., narrative threads, story plot [9], …). In the comparative analysis, for each feature multiple pieces of information were collected across different papers: what the feature is; its possible values; a justification of its relevance in personalisation and the opposite, i.e. why such a feature should be ignored in the actual implementation; a discussion on the suitability of the feature for onsite and online scenarios; technical requirements or possible implementation solutions for computing the feature values at runtime.

The survey showed that usually implemented systems concentrate on the modelling and evaluation of a specific complex feature (e.g., visiting style) or on a subset of easy to model features (e.g., age, stereotypes, location), possibly leaving out other personalisation dimensions highly valued by curators (e.g., motivation for the visit). A clear indication of a strategy for actually prioritising the many possible features when coming to the decision of which personalisation to implement is still missing and, we believe, much needed.

2.2 Personalisation: The Perspective of Cultural Heritage Professionals

To complement the analysis of the literature, we conducted a user-centred qualitative study aiming at understanding what personalisation means for cultural heritage professionals. During a co-design workshop that brought together 10 curators, 7 interaction designers and 8 computer scientists (only 2 with experience in personalisation), we asked the participants to contribute their thoughts on what must be changed in a visit to achieve personalisation. We briefed our participants and explained our aim as to collect the broadest set of personalisation features that could be used to personalise "content" in "context"; we used these two terms to broadly direct participants' thoughts. A total of 176 annotated post-its was collected. The content of the post-its was at different levels of granularity with some very precise features such as 'age' and other much open such as 'no information but emotion'. A thematic analysis was applied to systematically classify the post-its and create an affinity diagram: similar features were aggregated under a single label and a question was used to make the interpretation clearer; groups of labels were then aggregated under the same theme. In this way from a large number of small clusters a total of 20 classes (or themes) were created (8 entries were not classified as they had no similarity with others, such as 'hermeneutics' or 'intended educational goal'); the 20 classes were further aggregated in 3 larger sets that map the Content, the Context and the Visitor, as shown in Table 1. When comparing the two sets of features, literature vs. user-generated, we can see that some occur in both sets such as 'age' or 'short time' or 'interest', but overall there are many more differences than similarities. We explain this by the small number of respondents with experience on personalisation systems (2 people) in the group of 25; for all the other 23 participants it was an exercise of imagination, on "What could personalisation be? How would it manifest itself? What do we need to model?". The result is an unexpected and exciting range of challenges and opportunities.

Table 1. The 3 sets and 20 classes created out of the 176 entries suggested at the co-design workshop. In () the number of occurrences of similar concepts; in '' examples of the entries.

Content	
– Type (11) 'written text', 'spoken text'	– Perspective (9) 'fun vs. information seeking'
– Source (4) 'visitor's generated', 'curator's view'	– Narrative (11) 'stories as multiple connected points'
– Background (10) 'what is it? How was it used?'	
Context	
– Proximity (4) 'what is near?'	– Alone/group (6) 'lonely visitor', 'first date'
– Time/length (5) 'visitor just killing time', 'short visit'	– Environment (9) 'no power', 'no WiFi'
– Visit history (14) 'multiple visits, same museum', 'personal history'	– Devices/technology (11) 'enable digital shadows', 'own device, e.g. phone'
	– Engagement (6) 'touch', 'activating the senses'
Visitor	
– Take away (4) 'collect objects, virtual, physical'	– Mood/emotion (8) 'mood selector, what I want'
– Leave (4) 'leave a message – comment!'	– Social interaction (11) 'who is around?', 'force social interaction'
– Unexpected (7) 'surprise me! Suggest me some content!', 'I believe in coincidence'	– Human body (5) 'age', 'disabled, special needs'
– Me (15) 'personal interest', 'how is the content related to my life?'	– Attention (4) 'current attention span', 'don't distract me too much from the content'

As it could be expected, the larger sets of entry refers to 'me' and the 'visit history', however features generally considered worth implementing in the personalisation literature such as 'visiting style' and 'personality' have not been mentioned at all in our sample. Intriguing is the large number of terms generated that is novel and has never been addressed by implemented personalisation. 'Unexpected' (7) and 'mood' (8) clearly indicate an interest for interactions that are different from what is generally provided by technology designed for cultural heritage, that is to say they point toward emotion rather than information. A similar call for affective engagement is found in other entries such as 'how is this content related to my life' classified as 'me'. From an implementation point of view this affective direction is a serious challenge that, we believe, must be addressed by other means than computation; in our research we use design. The user-generated features also show the importance given to the direct engagement of visitors with objects, that is a new and different take on personalisation for cultural heritage currently seen as a challenge [1].

The three sets of Content, Context and Visitor, point at three major ingredients that shape the visit experience. In meSch, we use these as the building blocks for a personalisation architecture that supports: the curator-supervised customisation of the content and of the overall visitor experience; the system-controlled adaptivity of the content to the context; and forms of visitors' driven customisation [7].

3 Personalisation: How Can It Work?

Via co-design important guidelines for a personalisation architecture were defined.

1) *Prioritize and group features*. Not all the features produce the same benefit, or are easily portable across different settings. Features that are simple to acquire and to model (like age) can in principle be taken as the basis to infer automatically what might be interesting for that user; but the risk is that the corresponding stereotypes oversimplify user needs and preferences with the danger of offering a sub-optimal experience thus diminishing the value of personalisation. It can be more convenient to consider complex features (e.g. visitor motivations or interests for current visit) that are highly valued by curators [3] and have proved to be more effective in representing the visitor's expectations, behaviour, and visiting style, being therefore helpful to model various aspects of personalisation simultaneously.

2) *Keep curators in control of the customization of stories and the experience*. There are aspects of personalisation that curators deem important to be under their control, like the provenance and the type of content used, the multiple layers of interpretation and perspectives available, the type of experiences that relate to their museums mission statements. Heritage already offers personalised content to different visitors (particularly for educational purposes) and this level of control should be maintained if we expect heritage professionals to adopt personalisation systems. They have to be comfortable in building and visualizing the structure of the stories, with the alternative perspectives and thematic threads, and the different levels of detail. Facilities should be available to match the variability in content with the desired interactions with objects/space and social interactions, to shape the intended experience.

3) *Keep the instantiation in context as a separate phase*. Curators need to be relieved from the burden of fine-grained modelling of the visit context and history, with the implementation of automatic adaptivity mechanisms that instantiate the system behaviour properly. By keeping the rules for runtime, context-aware instantiation of adaptivity separated from the structuring of narratives and experiences, it is possible to decouple the curator authoring task from the physical architecture, facilitating the reuse of exhibition templates with different hardware setups. Thus the heritage professionals will focus on the personalisation they are already familiar with (different stories for different visitors) and leave the system to deal with a dynamic context.

4) *Bootstrap by design*. Instead of asking the visitor to fill in questionnaires to match them to a hypothetical interest profile or delaying the personalisation until enough live-data of the visit has been collected, the visitor can be granted an active role in controlling the experience that is delivered. This can be done for example in a purposefully designed 'introduction' section where the visitors are offered multiple experiences (or stories) to sample, thus allowing them to choose the type of visit that best matches their motivations and expectations for the visit. The clear advantage is in avoiding mismatching and building upon a solid foundation (visitor's choice).

4 Conclusion

Shaping personalisation in a scenario of tangible and embodied interaction for cultural heritage involves challenges that go well beyond the requirements of implementing content personalisation for portable mobile guides. Through an inspiring co-design process, we reinforced our belief that there are aspects of personalisation that curators explicitly wish and need to be in control of. The curator-supervised customisation

grants more portability across different content domains, as the personalisation component requires a lighter content data model. The system then monitors the state of the context, updates its model, and dynamically adapts whenever multiple options apply. By decoupling the low-level management of the context from the higher levels, we support a more sustainable porting to different hardware configurations. An additional important finding was that interaction design can become a powerful means to get the visitor into the personalisation loop: purposefully designed interactions empower visitors to control their experience, bootstrapping multiple personalisation features at the same time and relieving the system from complex log-based guessing or rigid stereotyping. These requirements are currently being put into action in the on-going implementation of the multilayer personalization component of the meSch system.

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