

A Museum App to Trigger Users' Reflection

K. Kontiza¹, O. Loboda², L. Deladiennee³, S. Castagnos⁴, and Y. Naudet³

¹ The National Gallery, London, UK Kalliopi.Kontiza@ng-london.org.uk

² University College London (UCL), London, UK olga.loboda.13@ucl.ac.uk

³ Luxembourg Institute of Science and Technology (LIST), Luxembourg
{[louis.deladiennee](mailto:louis.deladiennee@list.lu), [yannick.naudet](mailto:yannick.naudet@list.lu)}@list.lu

⁴ Univ. of Lorraine - CNRS - LORIA, Nancy, France sylvain.castagnos@loria.fr

Abstract. This paper introduces a mobile museum guide that has been designed for the National Gallery in London with the special goal of triggering reflection of the visitor. We also present the results obtained from a first experiment. The underlying postulate is that visitors are more prone to reflection and more interested by the collection in a museum if they can discover it through other facets than those highlighted solely in the museum, and if this discovery is personalised for each of them. The smart guide includes means to personalise a visit by modelling the user preferences and behaviour, and builds recommendations for stories or groups of paintings based on the user profile and reflective topics.

Keywords: Mobile Guide · Reflective Topics · Recommender Systems.

1 Introduction

The CrossCult (www.crosscult.eu) aims to spur a change in the way European citizens appraise History, fostering the re-interpretation and reflection upon what they may have learned in the light of cross-border interconnections among pieces of cultural heritage, other citizens viewpoints and physical venues. Within the 4 pilots implemented in the project, there are a number of ways in which reflection is expected, either by considering our personal experiences by our examination and interpretation of history to understand current social phenomena and different viewpoints and/or to examine and reason by exploring reflective topics and stories which facilitate consideration of historical content and narratives. We present here results from one pilot, which relies on the latter approach and where personalised guidance is explored for reflection triggering.

After a short related work in Section 2, Section 3 presents the smart Guide Mobile application that has been designed and developed, highlighting the features involved in reflection triggering. In Section 4, the first user study we have conducted is presented, followed by Section 5 that discusses preliminary results. Future work is presented in Section 6.

2 Related Work

Even though 2018 has been declared the European Year of Cultural Heritage, many empirical studies show that the technological revolutions of the last 2

decades have upset visitor expectations in museums. In [3], only 63% of respondents saw art and design museums as culture. The main mentioned motivations for visiting a museum were to have fun, to experience and learn new things, to feel inspired and to interact with others. If the will of visitors to deepen their knowledge of art is not new [5], their wish to no longer be mere spectators seems much more recent [12]. Among the tracks and strategies mentioned in the report, mobile guides and cross-platform services are cited, especially for the educational opportunities that the experiences they generate provide among diverse audiences. Helal *et al.* showed that visitors expect from multimedia guides to get access to additional information and learn more about artists and exhibits [6]. Mann and Tung even pointed out that most of visitors felt that they explored the museum more when using a mobile guide [11]. In the same study, the authors highlighted the expectations as regards the guide to render the visit more entertaining and to provide personalised routing instructions in the museum.

To address these issues, recommender systems are becoming more and more prevalent in museums to personalise the visitor experience by providing interesting suggestions at the right moment, in the right order and through the appropriate interaction. As an example, Aroyo *et al.* introduce semantically driven recommendations for museums and semi-automatic generation of personalised museum visits based on visitors' model [2]. They propose to detect user preferences and compute from these preferences a personalised visit optimised by walking distance and art objects each visitor perceives as interesting. Osche *et al.* extend the number of dimensions to be consider in the visitor model, such as the crowd tolerance, the distance tolerance, or the technological intrusiveness [13]. Zheng *et al.* investigate ways to provide location-aware recommendation by exploiting the WiFi logs [17].

Although recommender systems have been exploited to provide personalised experiences to museum visitors, they mainly focus on precision and user satisfaction [8]. None of them has so far addressed the question of the reflection this experience can trigger on users.

3 The CrossCult App for the National Gallery

Pilot 1 takes place in the National Gallery (NG) in London, a large multi-thematic venue. The developed application is expected to engage users and encourage them to reflect on the information presented and the diverse works of art in the collection. This serves two purposes: (i) development of personalised gallery experiences based on user preferences, and (ii) self-discovery of the collection through three main reflection topics: 'Materials', 'Historical Events' and 'Social Connections' will reveal the interconnections at play. We provide here a quick overview of the Pilot 1 smart museum guide mobile app screens. After the user installs the app for the first time, she is presented with a short sideshow detailing the app main features. After logging, the user lands on the home page which provides access to different features.

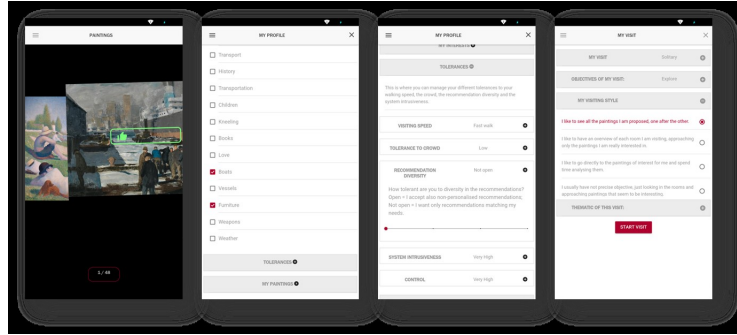


Fig. 1. The application profiling screens

An initial **profiling step** has been included (Fig. 1), so as to offer users the ability either to prepare or to tailor a visit; the user is initially invited to fill-in a form with questions about: (i) their general interests, (ii) their tolerances to different factors that might impact his/her visit experience (e.g. to the crowd). The second step of the profiling is delivered as a carousel of images, inspired by the UX of the famous Tinder app, where the user can swipe her way through a stack of pictures depicting paintings from the collection indicating their preferences; if the user likes a painting (swipe right) or not (swipe left).

The set of paintings presented to the user is curated to be representative of the NG collection diversity and is used to build a first *a priori* profile. The carousel of paintings constitutes a main element of the profiling screens (Fig. 1, left). When users choose to like, dislike or favour a painting shown in the carousel, their user profile is updated in the background with captured interests and preferences extracted from the painting meta-data. Once the user has filled in enough of the profile data, personalised recommendations are computed, delivering suggestions for groups of paintings to visit. When selected by the user for a visit, paintings from the chosen group are available on the map; however the route was not displayed at the time of experiments.

To help the visitor get a grasp of the Gallery size, the app includes a **digital map** of the different floors (Fig. 2, top right and bottom left). From the map, the user indicates her current position which is then used to generate routes to the different paintings of the collection. The map can be used to locate paintings within the gallery and ask for routing information. The app displays a picture of the painting along with core information such as the painting title, its production date and its author (bottom row). By clicking an information icon, the user can access more detailed information about the work of art and a textual description is available to provide some narrative storytelling about the painting itself. In visit mode, this description is complemented by extra narratives that are related to the selected reflective topic.

By clicking on a room on the map, the user receives a list of all the **paintings** currently **on display**, presented as a grid of pictures (Fig. 2, bottom right). Clicking on a picture leads to the **paintings details**. This layout is reused throughout the entire app when it comes to displaying “groups” of paintings. Currently managed groups are paintings from the same room, paintings from

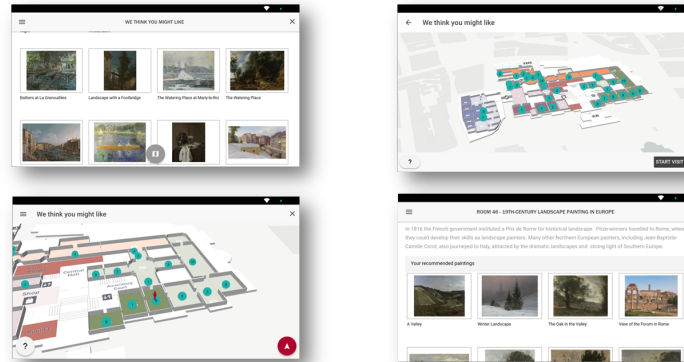


Fig. 2. The map, collection browsing and group presentation the same painter, recommended paintings (from the user preferences) and narratives/stories. These groups are also accessible from the Home page, by clicking the ‘Browse the collection’ button, which allows the user to browse the whole collection (Fig. 2, top left).

Finally, **recommendations** are accessible from the Browse collection screen or after configuring the visit. In both cases, a button allows to preview on the map where the recommended paintings are located in the museum and to start the visit. Once the visit started, the user is invited to indicate his current location to get access to the content present around him. An automated in-door location system is foreseen, but not yet operational.

4 User study

4.1 Data Collection and Evaluation Methodology

We have designed a series of controlled user experiments involving participants observation and post-experiment questionnaires, set around the different aspects of the app that needed to be tested and evaluated. Here, we were interested in (1) determining the extent to which the users are satisfied with the recommended groups of paintings, with recommendations given only by explicit profiling and (2) to begin to understand more about how and if the app stimulates reflections resulting from discovery of art via the group recommendations.

We grouped under this user study two small-sized experiments conducted out of the museum, using only the mobile app, to gather first feedback about usability and user experience, following the same experimental protocol. In total, 35 participants (valid questionnaires, all students, 20% postgraduate, 80% undergraduate, with one-third male and two-third female) were collectively given a short 15-20 minute introduction to the project. They were then asked to imagine they would start a visit at the National Gallery and think about the objective of their visit and what they would expect from it. During the second experiment, 4 participants were then engaged in a round table discussion for 30 minutes. Additionally, they were also shown around to the National Gallery and performed

a physical visit following the recommended group of paintings. The purpose of visiting the museum was to evaluate the user experience while following the recommendation during the physical visit and see whether it influences reflection more than with only access to digital content brought by the App. All participants were then asked to complete the post-experiment questionnaire.

The post-experiment questionnaire we used took into account the notions of ease of use, user satisfaction and learnability of the app. We used a Likert scale to determine if users agreed or disagreed with statements associated to main constructs of the analysis. We also asked a number of open-ended questions to gather more details related to the perceptions of the user towards the app and understand where the value of the app lies. The items in the questionnaire were adapted from the user acceptance of technology model (UTAUT) [15] and supplemented with questionnaire items common to the approach of evaluating technology such as the USE questionnaire [10]. The questionnaire was divided into four sections and asked the participants about their: (1) basic demographic data (e.g. age group, gender, educational attainment, residential status and nationality), data useful for the profiler and recommender systems (e.g. command of the English language, involvement in and knowledge of Art, use of recommender systems in everyday life), visiting preferences (e.g. frequency of museums visits, use of audio guides, objectives and motivations) and mobile habits (use of mobile apps, use of museum mobile apps, self-reported map reading abilities); (2) general thoughts about the app (whether they recommend the app and why); (3) overall user experience, the ease of learning, features assessment and learning outcomes and (4) final thoughts.

In order to begin to understand more about how and if the primary app stimulates reflections and to evaluate the reflection triggers, a set of questions from section (3) of the questionnaire have been designed and categorised using Blooms taxonomy and its revised version [9]. In particular, the taxonomy describes 6 levels for high-level cognitive processes that are hierarchically structured from lower (memory) to higher (creativity). According to Daudelin [16], reflection could also be treated as an upper level learning process. Finally, trackers were also implemented to capture the users interactions with the app.

4.2 Results

Generally, the participants recognised the value of the App and had a positive perception about it (90%). The testers mainly liked the user experience with the recommendations, with 74% of respondents slightly /strongly agreeing and agreeing that they were satisfied with the group of paintings recommended to them and 69% of users slightly /strongly agreeing and agreeing with the statement [Each painting in the recommended group was relevant regarding my interests]. With respect to the personalisation of the content during the museum visit, one of the key motivations for using the app was associated with the discovery and exploration of the collection in a free, user personalised way, i.e. not choreographed by the curator; a few users found the personalised content delivery mechanisms to be a more time efficient approach: *“you dont have to spend*

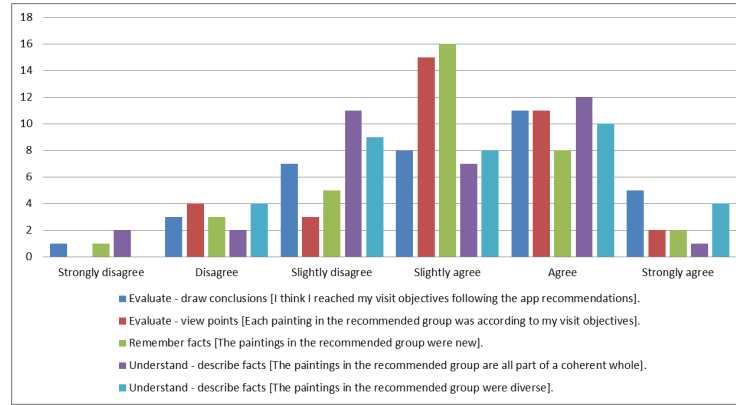


Fig. 3. Answers to statements related to reflection triggering by recommendations

your time finding what you want". The perceived value of the recommendations received a mixed responses, especially during the early experiments. One likely explanation for this is that this experiment occurred early on and purposely used a very small sample of paintings to determine efficiency of the recommender. At the same time, this highlights the need to evaluate with a more qualitative approach the perception of the recommendation system. Answers representative of those who found the recommendation process likeable were *"I liked that the paintings matched my preferences after a while"* and *"It recommends to you few masterpieces"*, showing the user's appreciation that it integrated lesser known works as well as the well-known masterpieces. Some users perceived a value in the recommendation system because it streamlined the process of discovering and viewing an interesting painting.

Concerning reflection, we consider four constructs that stimulate and contribute to reflection processes in our pilots, including influences from our prior learning processes [14], our personal experiences [4], our emotional responses [1] to both the app and its content as well as our personal interpretation of the content based on a users world view [7]. Reflection involves linking a current personal experience to acquire information and knowledge for new or existing learning and is driven by the process of combing cognitive and emotional information from different sources. It is a process that occurs when we act upon different information to synthesise and evaluate it. In order though to begin to understand more about how and if the primary app stimulates reflections and to evaluate the reflection triggers, the participants were asked the questions presented in Figure 3 and expressed their agreement or disagreement with the statements using a 6 point Likert scale, to trigger their reflection in regards to the outcome of the Recommender System and the feature of the recommended group of paintings in the App.

Both the diversity and coherence of the recommended group of paintings was understood by the participants with 20 out of 35 and and 22 out of 35

slightly/strongly and agreed with [The paintings in the recommended group are all part of a coherent whole] and [The paintings in the recommended group were diverse] respectively. In terms of the question related to the users memory processes 26 out 35 of participants slightly/strongly and agreed with the statement [The paintings in the recommended group were new] having quite successfully monitored that the Recommender System was updating the recommended group of paintings in the app according to their interaction. The participants were able to provide the following evaluations related with the recommended group of paintings: 28 out 35 of participants slightly /strongly and agreed with the statements that [Each painting in the recommended group was according to my visit objectives] and 24 out of 35 participants slightly /strongly with the self-observation statement that [I reached my objectives following the app rec.].

For the two higher level processes of 'create' and 'apply' information in new situations almost half of the participants provided a title for the recommended group of their choice, with different levels of creativity and details. Almost half of the participants matched the recommended group of paintings with the one of the two categories that were given to them; 'Materials and Techniques' and 'Social Connections'. When asked to provide an explanation for their choice some of the comments that describe the reflection process of the testers were "Techniques probably, because I was able to find the kind of art I was interested in without having to roam around", "I really don't understand these categories (...)", although almost half of the participants just answered that they did not know. Finally one participant reflected on his previous knowledge ("A selection by William Hogarth that I didn't know about before"), when asked [Which painting did you discover today that was recommended to you].

5 Conclusion and Perspectives

Due to the maturity of the app, we have been mainly concerned with evaluating the interactions that we believe will trigger the process of reflection more so than the reflections themselves. So far, we attempted to trigger reflection through the following user interactions with the app: (1) a reaction to art through likes of painting in the carousel, (2) personalised recommendations that stimulate interest in the artworks and their topics and (3) engaging with the paintings, group of paintings and stories descriptions. A promising number of participants were able to remember, consider, examine, compare and reason as a response to discover content and narratives, which is the underlying reflection purpose of Pilot 1. These preliminary results are encouraging to further investigate whether visitors are more prone to reflection and more interested by the collection in a museum if they can discover it through other facets than those highlighted solely in the museum and if this discovery is personalised for each of them.

In the next stage of the evaluation it is evident that there is a need to focus on the evaluation of the app to understand in more depth how it stimulates the process of reflection from the perspective of the recommender system. The results will now feed into how we refine the evaluation protocol for the next

phase, which will appraise the interactions that contribute to reflection and to qualitatively evaluate the form of reflection that is stimulated by the app in order to further investigate and analyse the users perceptions of the app and its ability to encourage them to think.

Acknowledgement

This project has received funding from the European Union’s Horizon 2020 research and innovation program under grant agreement No 693150.

References

1. Antoniou, A., O’Brien, J., Bardon, T., Barnes, A., Virk, D.: Micro-augmentations: Situated calibration of a novel non-tactile, peripheral museum technology. In: 19th Panhellenic Conference on Informatics. pp. 229–234. PCI ’15, ACM (2015)
2. Aroyo, L., Antoniou, G., Hyvönen, E., Teije, A., Stuckenschmidt, H., Cabral, L., Tudorache, T., Hage, W., Stash, N., Wang, Y.: Finding your way through the rijksmuseum with an adaptive mobile museum guide. *The Semantic Web: Research and Applications* pp. 46–59 (2010)
3. Cohen, L.: Culture track 2017 report. <https://culturetrack.com/wp-content/uploads/2017/02/CT2017-Top-Line-Report.pdf>
4. David, B., Ruth, C., David, W.: *Using Experience For Learning*. McGraw-Hill Education (UK) (1993)
5. Falk, J.: *Identity and the Museum Visitor Experience*. Left Coast Press (2009)
6. Helal, D., Maxson, H., Ancelet, J.: Lessons learned: Evaluating the whitney’s multimedia guide. In: *Museum and the Web (MW 2013)*. Portland, OR, USA (2013)
7. Kafai, Y.B., Resnick, M.: *Constructionism in practice : designing, thinking, and learning in a digital world*. Mahwah, N.J. : Lawrence Erlbaum Associates (1996)
8. Keller, I., Viennet, E.: Recommender systems for museums: Evaluation on a real dataset. In: *IMMM2015* (2015)
9. Krathwohl, D.R.: A revision of Bloom’s taxonomy: An overview. *Theory into practice* **41**(4), 212–218 (2002)
10. Lund, A.: Measuring usability with the use questionnaire **8** (01 2001)
11. Mann, L., Tung, G.: A new look at an old friend: Reevaluating the mets audio-guide service. In: *Museum and the Web (MW 2015)*. Chicago, IL, USA (2015)
12. Museums, A.A.L.: *Digital transformation in the museum industry*. <https://alm.axiell.com/wp-content/uploads/2016/07/Axiell-ALM-Digitise-Museums-Report.pdf> (2016)
13. Osche, P.E., Castagnos, S., Napoli, A., Naudet, Y.: Walk the line: Toward an efficient user model for recommendations in museums. In: *SMAP 2016*. Thessaloniki, Greece (2016)
14. Tobias, S.: Interest, prior knowledge, and learning. *Review of Educational Research* **64**(1), 37–54 (1994)
15. Venkatesh, V., Morris, M.G., Davis, G.B., Davis, F.D.: User acceptance of information technology: Toward a unified view. *MIS Quarterly* **27**(3), 425–478 (2003)
16. Wood Daudelin, M.: Learning from experience through reflection. *Organizational Dynamics - ORGAN DYN* **24**, 36–48 (12 1996)
17. Zheng, Z., Chen, Y., Chen, S., Sun, L., , Chen, D.: Location-aware poi recommendation for indoor space by exploiting wifi logs. *Mobile Information Systems* (2017)