# Connecting physical space, human personalities and social networks

## The Experimedia Blue Project

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**Abstract.** The Experimedia Blue project aims at enhancing the visiting experience before, during and after the actual museum visit. Using a novel methodology, museum visitors' cognitive styles are extracted through a short quiz onsite or a Facebook game offsite. The system's recommendation component provides personalised information to the user combing museum characteristics, visitor's behaviour in the museum and elements of user's personality. Being a work in progress, initial results have been encouraging and final experimentation phase is expected in spring 2013.

Keywords: museum, cognitive style, social network games, user profiling

## I. INTRODUCTION

Museums are spaces that people visit for learning and entertainment purposes. Visitors want to leave the museum having purposefully spent their time there. In addition, museums typically have a variety of items on exhibition. What each visitor is interested in seeing varies and it can be related to visitor personality and special interests, situational factors like available time, as well as space attributes like space size, etc.

A problem often faced by museum visitors is that, in the course of their visit, they may lose time viewing items that do not interest them and miss those that do, due to time restrictions, or perhaps the tiredness that inevitably occurs during the visit. In parallel, the audio/visual explanations often provided to visitors regarding the exhibits, may not always be tailored to their specific cognitive preferences and available time, for example giving too few or too many details. Missing important exhibits, viewing items that the visitor is not so much in and receiving not suitable exhibit explanations may significantly lower visitor experience.

We therefore need an adaptable solution that would help visitors identify the items that match their interests the most and to provide them with explanatory material that is suited to their particular cognitive and learning needs. Adaptability is adopted here, rather than the adaptivity approach, due to evidence from past research showing that it is more appropriate for museum technologies [1, 2], allowing differentiated levels of user control. The Experimedia Blue project develops an adaptable smart recommender system that suggests people which item they should see next, as they move from museum room to room using space characteristics and visitor movement within these spaces (visiting style methodology [16]), based on the visitors' cognitive style [10, 13, 14], and determined as such by a custom-made social network application ("My Museum Story"). In addition, information provided is matched to the visitor's cognitive needs and preferences, a process known as personalization of information.

Especially in regards to museums and museum learning, personalized interfaces can be a valuable tool in the management of the multi-dimensional museum learning content, as well as an attempt to cover the visit needs of a diverse audience [6, 9, 17]. One way to achieve this goal is to use personalized applications, which seem to provide a solution to a few museum problems, like visitor fatigue and avoidance of information overload [11]. In addition, a typical museum visit lasts a few minutes [4, 15] and visitors might only visit once. Thus, personalization processes need to be quick and efficient.

Furthermore, museums mainly use single-use applications. It is important to separate between single-use and multi-use systems since optimal personalization practices and methods differ between the two. The former can adapt in a longer period of time compared to the latter and personalization for the single-use systems is not only faster but possibly cruder, since there seems to be a trade-off between time efficiency and accuracy [11]. In addition, in single-use systems like the ones typically used in museums, one cannot obtain the necessary information by recording and post-analyzing user actions [2, 12].

Therefore, user model profiling is an important aspect for museum personalized applications [7]. Over the years there have been a few attempts to solve the problem of making efficient user models in museums and cultural institutions. These efforts can be either explicit, meaning that the visitor is aware of the process (e.g. asking the visitor what she wants to see next) or implicit, meaning that the visitor is not aware of the process (e.g. observing visitors' moving patterns in the museums and correlating those to the cognitive needs of visitors, [2]). Moreover, the explicit approaches can be further split into to two categories: direct and indirect. Asking directly the user about her specific museum interests and where she would like to go next, is an example of a direct approach or asking the visitor to set her own profile [5]. Indirect approaches also ask users different questions, but these questions seem to be indirectly relevant to the museum content.

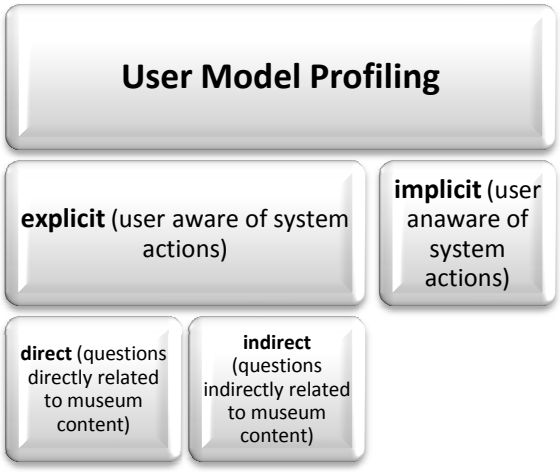


Fig. 1. Types of user model profiling

To address the issues of user profiling, different approaches have been used. For example, Bonis et al. [3], asked visitors to customize avatars, hypothesizing that this process might reflect individual traits. The PIL project uses information previously gathered from the user's interaction with a webpage, collecting information prior to the visit [7]. The visitor's moving patterns within the museum was another way to gather valuable information, since research shows a correlation between physical movement and cognitive needs [2].

In particular, our previous research [1,2] has shown strong positive correlation between the visitor's movements from exhibit to exhibit, in terms of both path and speed of movement, and their particular cognitive processing needs. Therefore, the final outcome of the Experimedia Blue project is expected to both improve our ability to match visitors to cognitive profiles and, most importantly, to considerably improve user experience within the museum, by offering personalized routing and exhibit descriptions based on the cognitive needs of each visitor.

In these endeavor, the main research questions to be answered are:

i) "Which impact does the modeling of visiting to cognitive style have in terms of the visitors' quality of experience (QoE)?"

ii) "Can we perform a more accurate modeling, i.e. can we model the identified visiting styles to additional axes of the visitors' cognitive profile?"

iii) "Can we accurately predict visitors' movement, to enable curators optimize exhibit positioning inside the physical museum space?"

iv) "What is the correlation between the visitors' online behavior and their actual museum visit?"

v) "Can the linking of the social network-supported online environment ("My Museum Story" Facebook application) with the physical museum space (actual visit) provide us with more accurate prediction of the visitors' cognitive style and preferences?"

The Experimedia Blue project supports the user experience in 3 phases: before, during and after the museum visit. The main expected impact of the BLUE project is targeted towards the end users, in terms of improvement of their museum experience. Several aspects of the user experience are addressed in terms of space and time, as well as in terms of content accessibility. The former aspects are addressed by optimizing the movement of the visitors by routing recommendations that best suit their visiting styles. The later aspects are addressed by personalizing the content description that is provided to them according to their topics of interest and the form in which such content is conveyed to them so that it triggers the highest interest depending on their cognitive style.

## II. METHOD

As mentioned above the Experimedia Blue project aims at enhancing the visitor experience before, during and after her visit. In order to retrieve one's cognitive style, the visitor can choose either to play a game in social media (i.e. Facebook) prior to the visit, specially designed to extract cognitive style based on player's actions or to answer a small quiz once at the museum and before the main visit starts. Both applications are based on the Myers-Briggs Type Indicator (MBTI), using the cognitive style dimensions provided and attempting to match gaming elements and/or quiz questions to these dimensions. MBTI is a well used, valid and reliable tool that follows Jung's theory of personality types and described individuals using four dimensions: extraversion-introversion (individual's focus of attention), sensing-intuition (the way an individual gathers information), thinking-feeling (the way an individual makes decisions) and judging-perceiving(the way an individual deals with the external environment). The combination of the four dimensions offers 16 personality types. For the different sets of questions that describe the different dimensions, an abstraction procedure was followed, since we tried to keep the elements that best and stereotypically describe the different personality types for both the game and the quiz. For example, in the game the player chooses avatars that they correlate with

different cognitive style dimensions. Similarly, in the quiz the participant chooses between different photos that she likes the most, choices that also correlate with MBTI dimensions.

Once cognitive style is extracted by using either way (before-visit game or onsite quiz), a recommendation process starts, using the visitor's cognitive profiles. In addition, based on the visitor's further actions and also physical movement within the museum space, the system updates the user profiles and can provide more accurate information. Knowing that physical movement of the visitor and cognitive processing correlate [2], the recommendation system can suggest different exhibitions, routes and activities, providing different content based on the visitor's profiles. Museum space attributes are also considered (i.e. architectural elements, etc), as well as affecting factors like visitor traffic in certain locations.

After the visit, the user can again access their social media account to use museum material and create a personal diary of visit (with a choice to publish or keep it for private use). Figure 2 shows the components of the Experimedia Blue system and the connection to the cognitive style.

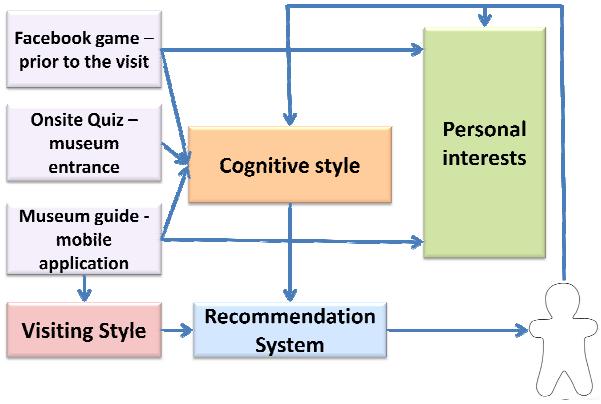


Fig. 2. Experimedia Blue components

## III. RESULTS

Although this is a work in progress, a few pilot tests have been conducted and initial results are available. So far, different gaming aspects have been correlated to cognitive style dimensions. For example, one gaming aspect, i.e. player's decoration choices, shows a high correlation with the Judger-Perceiver dimension in MBTI, with a significant $x^2$ value [$x^2$ (2, 5.883) = Pearson .05]. In addition, other gaming features, like the player's choice of avatars in the game, seem to have a good predicting value of the different MBTI categories, with success rates spanning from 28.5% to 100%. Figure 3 provides examples of the different avatars the player can choose from during the game.

Once the game is completed and running on Facebook, the Experimedia Blue experimentation phase will start. A number of experiments are planned in order to test the effectiveness of the proposed methodology. We are planning to engage students of the Department of Computer Science and Technology, University of Peloponnese, in order to possibly match their cognitive styles (already known, since students have completed a short version of the MBTI questionnaire) to the style extracted by the Facebook game. In addition, the students will also have to answer the quiz questions for the same reason. A second phase of data collection will require the students to visit the museum (Foundation of the Hellenic World, http://www.fhw.gr/fhw/) and test the recommendation system as well. The student population, although not representative of the general population, is ideal for our purposes, not only for practicality reasons but also because we are looking for Facebook users and especially Facebook gamers. With penetration levels of social media use exceeding 95% within the university student population [8], our sample is expected to reliable provide data.

Due to possible sample biases, since we will mainly rely on student data, the experimentation phases will be also open to the wider public, provided that they will choose to participate. The museum visitors participating, other than our students, can fall into two categories, the ones that have used the Facebook game before their visit and the ones that will use the onsite quiz for the initialization of the personalization process.

After the visit and the use of the mobile application within the museum space from both groups (students and general public), a number of interviews will evaluate the recommendations provided during the visit. Both data collection phases are expected to be carried out in spring 2013.

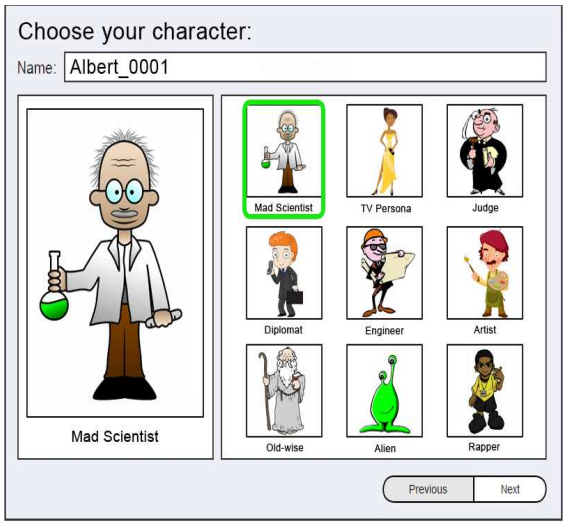


Fig. 3. Avatar choice screen

## IV. CONCLUSIONS

Experimedia Blue is an attempt to connect physical space attributes, human personalities and social networks. The project investigates novel ways to extract museum visitors' profiles and use them in order to provide personalized information. Viewing the museum visit as a process that starts before the actual visit and finishes long after that, social media were employed to provide a continuation of the visit, in digital space. The visitor can use material from her visit, to create personal diaries of the visit, publish

them on social media and share the experience with friends. Since this is a work in progress, many things remain to be studied and hopefully, the two experimental phases will provide the necessary data for further exploitation of the field. If our efforts are successful, then a very promising road opens. The vast numbers of social network users implies that there might be immense data available for exploitation; data that could be directly used for the creation of personalized applications for spaces of different characteristics, like museums.

## ACKNOWLEDGMENTS

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