User Profiling: Towards a Facebook Game that Reveals Cognitive Style

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Abstract: This paper presents an innovative approach based on social-network gaming, which will extract players' cognitive styles for personalization purposes. Cognitive styles describe the way individuals think, perceive and remember information and can be exploited to personalize user interaction. Questionnaires are usually employed to identify cognitive styles, a tedious process for most users. Our approach relies on a Facebook game for discovering potential visitors' cognitive styles with an ultimate goal of enhancing the overall visitors' experience in the museum. By hosting such a game on the museum's webpage and on Facebook, the museum aims to attract new visitors, as well as to support the user profiling process.

1 Introduction

Looking for fun ways to attract and engage museum visitors prior to their visit, two main requirements came up immediately: i) to entertain the future visitor and make her interested in the museum and ii) to use any information possible to personalize her visit once in the museum. Especially in regards to museums, personalized applications 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 (Gaeta et al. 2007, Muntean et al. 2007, Wakkary et al. 2006). In addition, a typical museum visit lasts a few minutes (Falk et al. 1985, Serrell, 1998) and visitors might only visit once. Thus, the personalization processes need to be quick and efficient. For all the above reasons, an increasing number of museums and cultural institutions around the world are using personalized applications. Ardissono and Petreli (2998) provide a detailed survey of the field of personalized applications in cultural heritage.

To achieve our first goal, i.e. to entertain the future visitor and make her interested in the museum, it was decided to use social networks and particularly Facebook, as one of the most popular networks in Greece (note that the application is developed for a Greek museum), both to approach future visitors and to use the penetration abilities of the

network to promote our application. For this purpose, it was also decided to create the application in the form of a game, similar to the popular games played on Facebook. Additionally to supporting learning (serious games) or the solving of complex task (games with purpose), games can also provide information on players and their psychological and cognitive profile. The literature on the subject of extracting a user's cognitive style from gaming is very limited and in fact to the best knowledge of the authors this is a novel approach.

For our second goal, i.e. the quick and efficient extraction of user profile information that can be used later on during the actual museum visit, it was decided to implement a Facebook game in order to extract the user's cognitive style. Cognitive style is a person's preference and habitual approach to the organization and representation of information (Riding et al. 1998). Cognitive style provides information on users' behavior and way on thinking rather than on their own personal preferences and can thus be used to infer personalization rules that would fit all users having a same cognitive style. Resulting user stereotypes can be sufficient to provide pertinent personalization. Our postulate is that knowing the cognitive style of visitors gives enough information to personalize their visits, in particular on the kind of (generic or linked to museum's exhibitions) things they like and in which way information should be provided to them. As an example, a cognitive style might tell us whether a user prefers information delivered to her in audio rather than image format, with more or less details, etc.

The work described here is highly novel for two main reasons: 1) It suggests new, alternative and fun ways to gather data needed for personalized interfaces (with the use of a game) and 2) it moves towards the exploitation of rich social network data, provided directly by the user. It is also important to note here, that the novelty of the proposed research imply that the authors have been mainly working with hypotheses, trying to match different gaming aspects to cognitive style dimensions.

In order to assess individuals' cognitive styles, a known, valid and reliable tool is MBTI (Myers-Briggs Type Indicator) (Briggs-Myers et al. 1985). The MBTI is based on Jung's theory of psychological types. Individuals are described 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.

2 The Game

The goal of the player is to create her own museum, populate its exhibitions and decorate it according to her preferences. To do so, the player must collect as many objects as

possible, in order both to complete the exhibitions. Certain objects in all exhibitions can only be collected from a physical visit at the museum whereas others can be collected by playing mini games such as puzzles, dice throws, etc.

During the first part of the game, the player needs to make some decisions before she can start playing; involving her character in the game and the different tools and equipment she wishes to carry. In particular the player decides about the avatar she wants to use in the game, its traits, the pet following the avatar and the tools she might need. Each character, tool and pet corresponds to different values of the cognitive style. Tools and pets have different abilities that can be used in the game.

After the player has chosen her artifacts for the game, she is directed to her empty museum space that she needs to populate with items and decorate as she pleases. There are three museum templates that the player can choose from, each one corresponding to three different visiting styles. Veron and Levasseur (1989) identified four types of visiting style, based on the visitors' movement in the physical space of the museum. Visitors were placed in the following groups: ant visitors, fish visitors, butterfly visitors and grasshopper visitors. These metaphors showed the nature of the movement, whether for example a visitor approaches exhibits, moves in the centre of rooms, avoids visitor traffic, etc. For the purposes of the game, three different museum templates are designed that the player can choose from. Information about players' visiting style preference can be used later during the players' actual- physical museum visit. Finally, there are also three decoration styles to choose from (i.e. classic, modern, pop). The visitor can choose between a selection of floors and wall papers, a selection of frames for her items, different lights, etc.

In order to collect the items for her museum exhibition, the player can move in front of the empty showcases and frames and complete mini games to win items. Prensky's (2005) classification of games is used here to describe games of low complexity (i.e. mini games). The player can choose between games of different types (i.e. luck, skills, knowledge, memory, brain games, etc.). Figure 1 shows a game avatar moving in the museum and Figure 2 shows a selection of mini games the player can choose from in order to win an exhibit. The items she can collect if she wins a game are from different thematic categories (i.e. depending on the museum exhibitions the items can be from exhibition number 1, 2, etc.) and the player chooses which one she prefers. The choice of items can also provide some information about the player's interests for the real museum exhibitions and later during her museum visit, the application can guide her accordingly. The game is available at http://apps.facebook.com/mymuseumstory/ .

Fig.1. A game avatar in the game environment. **Fig.2.** Selection of available mini games for an exhibit.

3 Method

There are certain concepts used in the game (i.e. game preference, choice of avatars, pets and tools, etc, all presented below), all of which are hypothesized to be correlated to different cognitive style dimensions. Since the concepts described and used here have not been studied in the past, the design was based on a set of different hypotheses. The player can choose from all the categories described below, allowing us to make assumptions about her cognitive style. In particular, the following choices a player can have in the game might correlate with different cognitive style dimensions: choice of games, choice of avatars, choice of pets, choice of tools, choice of detailed or general view in Gestalt images (Kennedy, 1974), choice of game background music, choice of game environment decoration style, choice of fashion items to dress game avatars, number of friends and posts-comments on Facebook .

So far, we tested some of the above hypotheses with a small sample of 51 users, all first year students of the Department of Computer Science and Technology, University of Peloponnese. All our participants were Facebook users and gamers. Students were asked to complete a short version of the MBTI questionnaire in order to identify their cognitive style. After that, students were asked to choose between different aspects of the game that correspond to the different hypotheses. Although this is a particularly biased sample, this was only a pilot study to see whether certain tendencies can be identified, together with possible game problems.

4 Pilot Study Results

From the initial studies it was found that some of the different avatars, pets and tools used could correctly predict different cognitive style dimensions. For example there were very high correlations between the choice of the TV persona and Extraversion axis in Cognitive style, the Engineer and Sensing axis, etc. Other choices were not very good predictors and avatars like Artist and Diplomat did not seem to correlate with dimensions of the cognitive style. Investigating further into the issue, it was realized that avatars, pets and tools need to be accompanied by a small descriptive text to stress the main stereotype they represent.

Similarly, there were indications that different music preferences might reflect different preferences on the Cognitive dimension Judger-Perceiver, with Judgers preferring Classical music and Perceivers preferring Contemporary.

Indications that Perceivers might prefer Adventure and Risk games, Extraverts might prefer Collaborative games) and Introverts might prefer Fantasy games were also found (x^2 (2, 8.130) = Pearson .01.)

Finally, significant results were found between decoration preferences and cognitive style (x^2 (2, 5.883) = Pearson .05.), since Judgers seem to prefer classic decoration style and Perceivers have preferences for more contemporary decoration.

4 Conclusions

So far, we have tested more than half of the different game features against the cognitive style dimensions and important correlations were found, implying that the designed game could indeed reveal players' cognitive styles with the necessary improvements. However, the small and biased sample used only allows for the identification of tendencies which require in depth further studying. The novelty of the described work and the lack of previous studies implied that we have designed game features based on hypotheses. However, if our efforts are successful, then a very promising road opens. The vast numbers of social network gamers implies that there might be immense data available for exploitation; data that could be directly used for the creation of personalized applications. In social networks users voluntarily and over a long period of time, feed their personal space with numerous types of information about themselves. Access to this information might also imply effective personalization for different types of applications, spanning from single use systems (like the one described here) to complex multi use systems of different purposes.

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