

Developing a web App to provide personalized feedback for museum visitors: a pilot research project

Sviluppare una web App per fornire feedback personalizzati ai visitatori di un museo: una ricerca pilota

Antonella Poce^a, Maria Rosaria Re^b, Francesca Amenduni^c, Carlo De Medio^d, Mara Valente^{e,1}

^a *Università degli Studi di Roma Tre*, antonella.poce@uniroma3.it

^b *Università degli Studi di Roma Tre*, mariarosaria.re@uniroma3.it

^c *Università degli Studi di Roma Tre*, francesca.amenduni@uniroma3.it

^d *Università degli Studi di Roma Tre*, carlo.demedio@uniroma3.it

^e *Università degli Studi di Roma Tre*, mara.valente@uniroma3.it

Abstract

There is a growing attention toward the designing of personalized learning experience in the context of museum education. Personalized learning paths could be crucial to enhance museum accessibility and social inclusion. In the context of the *Inclusive Memory* project a Web App was developed to detect museum visitors' profiles and to provide them inclusive learning paths. In the present work we will present the results of a pilot experience carried out within the Tito Rossini university painting collection at the Department of Education of the Roma Tre University, by involving 15 post-graduate students (F = 13; M = 2; Average age = 36). At the beginning of the lesson, participants were required to fill in the first questionnaire through the web-app. Then, they visited the Tito Rossini exhibition and eventually filled in the second questionnaires about their preference. Generally, participants reported a general interest for the exhibition and appreciated multimodality. Some association among users' preferences, personal traits and fruition styles within the exhibition were detected.

Keywords: personas; museum; web-app; personalization.

Sintesi

Si registra una crescente attenzione verso la progettazione di esperienze di apprendimento personalizzate nel contesto dell'educazione museale. I percorsi di apprendimento personalizzati risultano cruciali per favorire l'accessibilità e l'inclusione sociale nei musei. Nel contesto del progetto *Inclusive Memory* una web-app è stata sviluppata per rilevare i profili dei visitatori del museo e per fornir loro percorsi di apprendimento inclusivi. Nel presente lavoro verranno descritti i risultati di un'esperienza pilota svolta all'interno della collezione di opere di Tito Rossini presso il Dipartimento di Scienze della Formazione dell'Università degli Studi di Roma Tre, coinvolgendo 15 studenti post-laurea (F = 13; M = 2; età media = 36). All'inizio della lezione, i partecipanti dovevano compilare il primo questionario tramite la web-app. Successivamente, i partecipanti hanno visitato la mostra di Tito Rossini e alla fine hanno compilato il secondo questionario in merito alle loro preferenze. In generale, i partecipanti hanno segnalato un interesse per la mostra e apprezzato la multimodalità. Sono state rilevate alcune correlazioni tra le preferenze degli utenti, i tratti personali e gli stili di fruizione all'interno della mostra.

Parole chiave: personas; museo; web-app; personalizzazione.

¹ Poce coordinated the research. Research group is composed by the authors of the contribution that was edited in the following order: Poce par. 1, 2.2, 4; Re par. 1.1, 1.2; Amenduni par. 3; De Medio par. 2; Valente par. 2.1.

1. Introduction

Museum education is related to informal education, which is achieved through several tools in museums (panels, tags, museum apps, museum web site, audio guides). In this regard, it has to be reminded that informal education is the first and the steadiest way of learning in people's life, therefore "an enormous learning reservoir and could be an important source of innovation for teaching and learning methods" (European Commission, 2000, p. 7). It is not without reason that the most important guidelines for the development of lifelong learning in education promote the synergy between formal, non-formal and informal education for a more efficient development of a person, in terms of knowledge and skills. As Galliani states (2012), promoting *integrated educational environments*, which start from communication experiences through technologies, social software and social media, can have an extremely high potential at social and educational level in terms of soft skills development. The idea of lifelong learning allows the development of new museum research methods and approaches in which the users' education is a wide, complex and social process (Gibbs, Sani, & Thompson, 2007).

In the context of museum education, there is a growing attention toward the designing of personalized learning experience supported by the use of digital technologies (Falk, Heimlich, & Bronnenkant, 2008; Not & Petrelli, 2018). More and more, museums and cultural institutions use mobile applications to provide personalized learning paths in order to enhance user experience, attract new visitors and fulfill special needs of different kinds of visitors (Gaeta, Gaeta, & Ritrovato, 2009). Personalization is based on the idea that an application can be designed to understand the user's needs, to provide the most relevant and efficient learning path in terms of visitors' educational needs. Its efficacy relies greatly on the validity and reliability of data collected about the user profile. Visitors' profile can be also defined as *personas*, an aggregate of target users who share common personal characteristics (Miaskiewicz & Kozar, 2011). By inferring users' educational needs, motivations, and personality digital applications could provide visitors an adapted learning scenario within the museum environment. In the field of cultural heritage and museum education there are two main approaches for building *personas*: (Roussou, Katifori, Pujol, Vayanou, & Rennick-Egglestone, 2013): the explicit and the implicit approach. While in the explicit approach the visitor is directly asked to answer different kinds of questions, in the implicit approach the profile is built through the study of visitors' behaviors in the museum. Examples of implicit approaches are visitors' pattern of movement in the museum and eye-tracking. (Antoniou & Lepouras, 2010). The explicit approach can be further classified in two kinds of approaches: *explicit-direct* approach and *explicit-indirect* approach. In the first case, users are required to answer questions concerning his/her museum interests and favorite pieces of arts within the museum. However, it was shown that users do not appreciate to be directly inquired through these kinds of questions (Mac Aoidh, Bertolotto, & Wilson, 2012). On the other hand, in the *explicit-indirect* approaches, questions are not directly linked to the museum' contents. It was shown that *explicit-indirect* approaches could improve visitors' engagement and curiosity towards museums (Antoniou et al., 2016). Furthermore, the *explicit-indirect* approach allows to reduce the number of items in a questionnaire because the indirect questions can be used to infer users' personal traits. For example, previous research showed that artistic preference is correlated with personality traits. (Chamorro-Premuzic, Reimers, Hsu, & Ahmetoglu, 2009). Thus, by asking questions on art preference, it is also possible to detect useful information to create a personalized learning path.

Providing users' personalized learning paths could be crucial in the context of museum accessibility and social inclusion (Karimi, Zhang, & Benner, 2014). For this purpose, our research group in the context of the Inclusive Memory project decided to develop a Web App aimed to detect museum visitors' profiles that can be used to provide inclusive learning paths. In the present work we will present the results of a pilot experience carried out within the Tito Rossini university painting collection, based at the Department of Education of the University of Roma Tre. The Tito Rossini permanent exhibition was chosen for this experimentation because it was equipped with different kinds of digital devices designed by the Center for Museum Studies to enhance the development of transverse skills, physical accessibility and social inclusiveness.

1.1. The inclusive memory project

The Inclusive Memory project, financed by the University of Roma Tre, was founded on the awareness that social inclusion, especially in democratic terms, should be developed also through those institutions, such as museums, that are dedicated to cultural development. The project fosters the construction of a shared and collective social memory through an inclusive system within the museum. The core of this project is a close connection between new teaching methodologies and the implementation of new digital tools, in order to encourage the development of transverse competencies within museums' users, especially for the social disadvantaged groups.

Conservation, valorisation and promotion of cultural heritage play a key role in the process of economic development of local activities and, in general, of the social system. The implementation of digital technologies and their related applications significantly contribute to the improving of economic conditions and to social development.

The Inclusive memory project is rooted in the consideration that museums are more and more regarded to as educational places, not only in terms of the permanent and temporary exhibitions they offer, but also with reference to the idea of social and cultural integration. In fact, over the years, the attention towards museum didactics with regards to museums' visitors defines users' experience as the new core of the current research in the field (Nardi, 2014; Parry, 2010; Poce, 2018). At the same time, the idea of learning is not definable anymore as the mere acquisition of knowledge: learning means to acquire new competences and skills which are developed and benefited from all over one person's life. The idea of lifelong learning allowed the development of new research methods and approaches in which the learner's education is a wide, complex and social process.

1.2. The Tito Rossini exhibition

The Tito Rossini's permanent exhibition is located at the Department of Education University Roma Tre, in the centre of Rome. Devoted to University teaching staff rooms, administrative staff's offices, the library staff's offices, and the reception room of the library itself are located in the building. The Rossini's permanent collection was donated to the University by the artist in 2018. At the beginning, the exhibition did not provide cultural mediation tools, except from small labels containing basic information (name of the author, the title of the painting and the date of production).

In order to offer a new receptive approach of the collection itself, new mediation tools have been designed and realized within the Inclusive memory project activities. The Centre for Museum Studies of the Department of Education realized these innovative mediation tools aimed at supporting visitors learning experience within the exhibition. The tools were

realized within the master course in pedagogical studies. Five different works of art were selected by the master students attending the module *Experimentalism, Museum and Reading*.

Mediation tools created for the exhibition are heterogeneous and multimodal, characteristics which allow multiple and individualized visits. For each one of the Rossini's paintings considered, the following fruition proposals have been produced:

- description of the work of art from an art history point of view;
- an audio description of the work of art linked to a QR code;
- a short story acted, recorded and stored in the QR code;
- a musical track.

In a previous research (Poce & Re, 2019) it was shown a positive overall evaluation of the innovative mediation tools realized within the Tito Rossini project. In this research, we will see whether the results are replicated with a different target group.

2. A pilot research: detecting *personas* through a profiling web-app

Hereby, a pilot experience carried out within the Tito Rossini exhibition will be described. The main goal of the experimentation was to collect preliminary data to build *personas* to be involved in inclusive learning paths.

The research questions which guided this pilot research are the following:

- how participants assess the visiting experience at the Tito Rossini exhibition?
- are there any association among users' preferences, personal traits (e.g. extroversion/introversion) and fruition styles within the exhibition?

In order to answer the following research questions, a web-app was created to detect the Tito Rossini exhibition visitors' profiles by adopting an explicit-indirect approach. At the moment, the web-app includes two kinds of questionnaires. The first questionnaire was designed to be filled by the participants before the visit and the second one after the visit. The web-app allows to access to the both questionnaires through QR codes.

The use of QR codes in the web-app were made to allow its use by any type of mobile device equipped with a camera regardless of the operating system. Initially, the user is profiled through the first questionnaire aimed at identifying the user *persona* through implicit questions. During the visit, the user can take advantage of the multimedia contents offered through his/her device. For the five selected paintings it is possible to listen to the soundtrack and narrative inspired by the paintings. At the end of the experience, users are asked to fill in the second questionnaire. Answers to the questionnaire are recorded on an external database for future analysis. In addition, we log the number of views for each QRcode and how many times music and stories have been downloaded and listened until the end without interruptions.

In the first questionnaire, items were built starting from a tool developed for a similar purpose in a museum context, the Acropolis Museum in Athens (Antonioni et al., 2016). In addition, we introduced items aimed to detect extraversion-introversion dimension by adopting items from the Big five questionnaire (McCrae & Costa, 2004). Participants were asked to express their level of agreement with 12 statements (see an example in Figure 1).

Example of item for the extroverted dimension	I can easily start a conversation with people that I do not know
Example of item for the introverted dimension	I am uncomfortable when I am with people and I do not well

Figure 1. Examples of items that assess the disposition to establish new contact and be actively involved in social communities.

This personality dimension was chosen because it predicts the disposition to create new social bonds and to be actively involved in social communities. Thus, it could help to detect information on visitors with higher marginalization risks. The first questionnaire presents the following structure (Figure 2):

Section	Description
Personal data	Age, gender, nationality, prior visits.
Artistic preference	Classical taste vs modern art inclinations vs Pop Art; Realistic vs abstract vs romantic style.
Linguistic preference	Formal vs first person narration vs informal using questions.
Favourite activities and mood in museums	Listening to stories, playing games, creating artistic objects.
Extraversion/Introversion	Disposition to establish new contact and be actively involved in social communities
Narrative preference	Social narrative vs naturalistic narrative

Figure 1. Questionnaire' structure created to profile museum visitors.

After the visit, the participants were required to fill in the second questionnaire which was adapted by a previous evaluation tool described in Poce and Re (2019) aimed at detecting visitors' preference on paintings and mediation tools.

2.1. Choice of the works of art: an explicit indirect approach

As stated by Antoniou and colleagues (2016), the questionnaire was carefully designed to inject an element of excitement and therefore increase positive involvement in the profiling process. Items were carefully designed in order to be as much interactive as possible. In the following table (Figure 3), an item designed to detect users' narrative preference is shown.

The decision to include the metaphysical mannequins of Giorgio De Chirico (*Ettore e Andromaca*) and the suspended atmospheres of Carlo Carrà (*Pino sul mare*) in the items is based on common features present in both these painting and similarities with the work of the artist Tito Rossini. For example, human figures within their paintings are not always represented. However, when human figures are not explicitly portrayed, their presence can be still strongly felt. In his paintings, Tito Rossini tell us his personal experience, that of a childhood and an adolescence made of simple things, softened by the scent of the sea and warmed by the August sun. His story emerges powerfully, his emotions emerge sharply, although the author's moments in the paintings appear imperishable, still, immobile, in mid-air, intimate and personal. Giorgio De Chirico deliberately chooses to depersonalize the human figure by assimilating it to dummies without faces or arms, and this emerges in a powerful manner in *Ettore e Andromaca* (Figure 3) where the strong embrace of the couple about to part is prevented precisely by the lack of limbs, but in this case it is the work itself that *exudes* the strong feeling that unites them. The loss of identity embodied by faceless puppets, the awareness of the loss of affections and roots before facing Achilles in battle, link the drama of the two protagonists of Trojan mythology to that of

contemporary migrants with the difference that Hector struggles conscious of sure death, while the latter persist in life expectancy.



Which of the following stories would you like to continue?	
<p>Coming back or farewell? Greetings between two mythological figures, you are the one supposed to figure out the past and/or the future of such an encounter. Follow up their journey and discover the events that influenced such a meeting.</p>  <p>Giorgio De Chirico. <i>Ettore e Andromaca</i></p>	<p>A seaside, a house facade, a maritime pine with a naked and smooth log. A clothes horse in the middle like a painter's easel, with a white cloth on. In the back an entrance in a cape [...] discover more on such a place [...]</p>  <p>Carlo Carrà. <i>Pino sul mare</i></p>

Figure 3. An example of item designed to detect visitors' narrative preference developed in our questionnaire.

Life also animates the work of Carlo Carrà *Pino sul mare* (Figure 3), we do not see human beings in the canvas but we imagine that they live in the huge house in the foreground, that they spread out towels to dry in the hot sun of a summer day or they put the boats back in the cave dug into the promontory in the background. Everyone can live in Carrà's painting, everyone can enjoy the blue sea, all breathe clean and light air. The sense of expectation, the indefinite temporal, the feeling that something should happen, that someone enters the scene does not arouse agitation and anxiety as in the case of De Chirico, but it is a slight, gentle, quiet wait.

In order to investigate linguistic preference, a provocative question was asked starting from a representation of Medusa realized by the contemporary artist Marcello Malobresti (2018)². In this piece of art, the main character is not a nymph, daughter of the god of the sea, but a man who thanks the sea for the opportunity of rebirth. A migrant boy, coming from the Ivory Coast, wearing a helmet covered with shells from which, however, his gaze emerges, a look that, like Medusa's, petrifies because it has the power to transfer the pains and hardships experienced by the man; it reminds us of the sea that kills, the shipwreck and the too often sad fate of migrants.

² Retrieved from <http://www.marcellomaloberti.com/publications/>

This way the sea, a central element in the work of Tito Rossini, is understood as a common social memory near and far, past and present; home of contemporary stories that trace and recall ancient stories, common destinies of men and women.

2.2. Methodology

15 post-graduate students (F = 13; M = 2; Average age = 36) were involved in the pilot experience. Participants attended a session within a module named *Teaching methods and digital tools in museum heritage education* at the Department of Education of the University of Rom Tre in July 2019. At the beginning of the session, participants were required to fill a questionnaire through the web-app. After that, they had the opportunity to visit the Tito Rossini permanent exhibition for approximately 60 minutes. Participants were invited by the lecturer to use QR code to access to the paintings' written and audio descriptions, short stories and music tracks. Participants were also video-recorded and videos will be used for further analysis based on their pattern of movement in the exhibition. After the visit, participants filled in a second questionnaires in which they were invited to express their preference on paintings and mediation tools. Participants answers were automatically recorded by the web-app and converted in an excel-sheet. To guarantee participants' privacy, the data were collected anonymously and the pre and post-questionnaire were coded for matching. Association among users' preferences in terms of art, literature and mediation tools were calculated through the use of contingency tables realised by employing the statistical analysis software named Statistical Package for Social Sciences (SPSS).

3. Results

The participants' group was composed by seven people with a Master Degree (46.7%) and eight people with a Bachelor Degree (53.3%). Eight of them are professionals in the field of cultural heritage (53%) and 40% are students in the same field and only one participant work in another field (Figure 4). Ten out of 15 participants had never visited the Tito Rossini permanent exhibition before. In addition, ten participants did not know the artist before the visit and only one participant reported to know Tito Rossini very well.

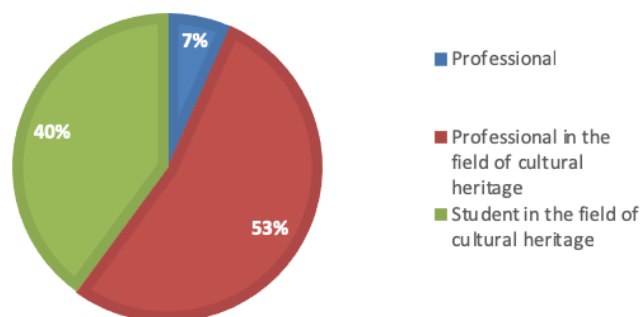


Figure 4. Participants' occupation.

Our first research question would like to investigate how participants assess their visiting experience at the Tito Rossini exhibition. It is possible to notice that participants reported contrasting opinions regarding the exhibition. After the visit to the Tito Rossini exhibition, most of the participants reported curiosity towards the painting collection (8; 53%). On the

other hand, 20% (3) of participants were bored during the exhibition and some of them felt restlessness (Figure 5). 53.3% (8) would suggest to visit the exhibition to other people, whilst the rest would not.

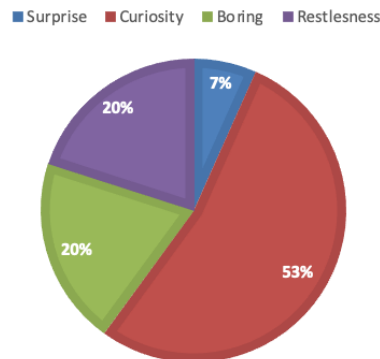


Figure 5. Emotions reported by participants after the visit to the Tito Rossini exhibition.

On average, participants reported a general interest for the exhibition (Figure 6). Multimodality is generally appreciated. Short stories and music tracks did not receive a high average score (less than 2.5 out of 5) and this suggest there is still room for improvement. In the next section, we will show whether difference in the exhibition general evaluation could be explained by other factors.

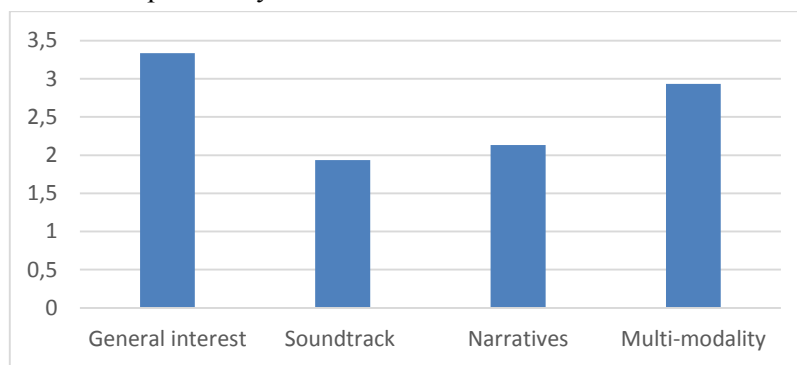


Figure 6. Level of satisfaction reported by visitors. Participants were required to express their level of satisfaction on a Likert scale (from 1 = not satisfied to 5 = completely satisfied).

In our second research question, we wish to investigate association among users' preferences, personal traits, especially personality traits, and fruition styles within the exhibition.

	A few extroverted	Quite extroverted	Very extroverted
Abstract Parthenon Agenor Asteriadis (1897-1977)	2	0	1
Realistic Parthenon Louis Dupre (1810-1837)	0	4	1
Romantic Parthenon Lykourgos Kogevas (1887-1940)	1	3	0
Realistic Monnalisa Leonardo Da Vinci (1503-1504)	0	8	2
Monnalisa Marcel Duchamp (1919)	3	2	0

Figure 7. Association among extroversion dimension and art preference.

In the contingency table (Figure 7), it was shown that in our group it is possible to detect a tendency between higher extroversion and preference for realistic art. For instance, ten out of fifteen participants, who prefer *Realistic Monnalisa* painted by Leonardo Da Vinci, are quite or very extroverted. On the other hand, lower extroversion seems to be more related with a romantic art preference and contemporary art, such as *Monnalisa* by Marcel Duchamp.

Moving on the preference for Tito Rossini paintings, it is shown a general relation between the appreciation of some paintings and extroversion dimension (Figure 8).



Figure 8. Tito Rossini painting. From the left to the right: *La luna sul terrazzo* (The moon from the balcony) *L'ora della rivelazione* (The time of the epiphany); *Al mattino* (In the morning).

Painting n. 2 and painting n. 3 are generally the most appreciated. However, two out three few extroverted prefer painting n. 2. Painting n. 5 was endorsed only by one person with a low extroversion level (Figure 9).

	A few extroverted	Quite extroverted	Very extroverted
Painting n. 2 <i>La luna sul terrazzo</i> The moon from the balcony	2	4	1
Painting n. 3 <i>L'ora della rivelazione</i> The time of the epiphany	0	5	1
Painting n. 4 <i>L'arco rosso</i> The red arch	0	1	0
Painting n. 5 <i>Al mattino</i> In the morning	1	0	0

Figure 9. Association among extroversion dimension and the preference for Tito Rossini paintings.

In addition, we explored the possible association between extroversion dimension and the preference for a specific fruition modality (Figure 10). Two people with higher extroversion level tend to prefer to visit the exhibition without the support of multimedia technologies, such as audio descriptions of the painting, short stories and music tracks. On the other hand, people with lower level of extroversion seem to prefer multimodality. More specifically, they appreciate combining the fruition of the painting while they listen the narration produced for that painting and soundtrack. Human guide is tendentially preferred by people with moderated level of extroversion.

	A few extroverted	Quite extroverted	Very extroverted
Without multimedia	0	1	1
Painting + soundtrack + narration	2	1	1
Painting + narration	2	2	0
Human guide	1	8	0

Figure 10. Association among extroversion dimension and the favorite fruition modality.

4. Discussion and conclusive remarks

More and more, museums and cultural institutions use mobile applications to provide personalized learning paths in order to enhance user experience, attract new visitors and fulfill special needs of different kinds of visitors. In this pilot research, we tested a web-app developed to detect museum users' profiles in order to provide them personalized and accessible learning paths. The web-app allows to access to two kinds of questionnaire through a QR code technology. Both the questionnaires were built adopting an *explicit-indirect* approach because it has the potential to improve visitors' engagement and curiosity towards museums (Antoniou et al., 2016). We tested the web-app with 15 post-graduate students who visited the Tito Rossini exhibition at the Department of Education, Roma TRE university, in July 2019.

The first objective of this pilot research was to see to which extent participants enjoyed the Tito Rossini exhibition. Most of the participants reported curiosity towards the exhibition but a significant percentage reported boredom and restlessness. More than half of the participants would suggest visiting the exhibition to other people, whilst the rest would not. It would be useful to understand better what are the reasons of the reported contrasting opinions regarding the exhibition. These preliminary results were presented by the guiding lecturer in the second part of the module in September 2019 and feedback from the participants was collected to be integrated with the data presented here.

The second objective of the research was to collect preliminary data to build *personas*. Despite the number of participants does not allow any generalization, relations among artistic preference, personal traits and fruition modality was detected. It is interesting to note that for instance in contingency table (7), it is possible to detect a tendency between higher extroversion and preference for realistic art. Moreover, ten out of fifteen participants, who prefer Realistic Monnalisa painted by Leonardo, are quite or very extroverted. On the other hand, lower extroversion seems to be more related with a romantic art preference and contemporary art. We explored also the possible association between extroversion dimension and the preference for a specific fruition modality (Figure 9). Two people with higher extroversion level tend to prefer to visit the exhibition without the support of multimedia technologies, such as audio descriptions of the painting, short stories and music tracks. On the other hand, people with lower level of extroversion seem to prefer multimodality.

From our perspective, the methodology here presented has the potential to improve the quality of learning path personalization in the museum and heritage context. In future research, we are going to extend the group of participants and to include in our experimentation target groups at marginalization risk. The data collected will be used to establish *personas* and to create learning paths personalized for each *persona*. In addition, we are going to use also data collected through an implicit approach, such as the users' logs within the web-app (e.g. number of views, times spent to listen to the narratives and music). Finally, videos will be used to calculate time spent by the visitors on each painting in the whole exhibition. We are implementing an automatic recognition system for the automatic extraction of these data through the use of anonymous badges to be distributed inside the museums exploiting the surveillance cameras, when allowed.

Reference list

- Antoniou, A., & Lepouras, G. (2010). Modeling visitors' profiles: A study to investigate adaptation aspects for museum learning technologies. *Journal on Computing and Cultural Heritage*, 3(2), 71–89.
- Antoniou, A., Katifori, A., Roussou, M., Vayanou, M., Karvounis, M., Kyriakidi, M., & Pujol-Tost, L. (2016). *Capturing the visitor profile for a personalized mobile museum experience: an indirect approach*. In F. Cena, M. Desmarais, D. Dicheva, J. Zhang (Eds.) In 24th ACM Conference of User Modeling, Adaptation and Personalized Interactive Environments (HAAPIE), Halifax, Canada. Retrieved from: http://ceur-ws.org/Vol-1618/HAAPIE_paper1.pdf
- Chamorro-Premuzic, T., Reimers, S., Hsu, A., & Ahmetoglu, G. (2009). Who art thou? Personality predictors of artistic preferences in a large UK sample: The importance of openness. *British Journal of Psychology*, 100(3), 501–516.
- European Commission (2000). *Lifelong Learning in Museums. A European Handbook* Bruxelles. <http://online.ibc.regione.emilia-romagna.it/I/libri/pdf/LifelongLearninginMuseums.pdf> (ver. 10.12.2019).
- Falk, J. H., Heimlich, J., & Bronnenkant, K. (2008). Using identity-related visit motivations as a tool for understanding adult zoo and aquarium visitors' meaning-making. *Curator: The Museum Journal*, 51(1), 55–79.
- Gaeta, A., Gaeta, M., & Ritrovato, P. (2009). A grid based software architecture for delivery of adaptive and personalised learning experiences. *Personal and Ubiquitous Computing*, 13(3), 207–217.
- Galliani, L. (2012). Apprendere con le tecnologie nei contesti formali, non formali e informali. In P. Limone (Ed.), *Media, tecnologie e scuola: per una nuova Cittadinanza Digitale* (pp. 3-26). Bari: Progedit.
- Gibbs, K., Sani, M., Thompson, J., (Eds.). (2007). *Musei e apprendimento lungo tutto l'arco della vita: un manuale europeo*. Ferrara: Edisai.
- Karimi, H. A., Zhang, L., & Benner, J. G. (2014). Personalized accessibility map (PAM): A novel assisted wayfinding approach for people with disabilities. *Annals of GIS*, 20(2), 99–108.
- Mac Aoidh, E., Bertolotto, M., & Wilson, D. C. (2012). Towards dynamic behavior-based profiling for reducing spatial information overload in map browsing activity. *Geoinformatica*, 16(3), 409–434.
- Marcello Maloberti. <http://www.marcellomaloberti.com/publications/> (ver. 10.12.2019).
- McCrae, R. R., & Costa Jr, P. T. (2004). A contemplated revision of the NEO five-factor inventory. *Personality and individual differences*, 36(3), 587–596.
- Miaskiewicz, T., & Kozar, K. A. (2011). Personas and user-centered design: How can personas benefit product design processes? *Design studies*, 32(5), 417–430.
- Nardi, E. (2014). *Musei e Pubblico*. Milano: FrancoAngeli.
- Not, E., & Petrelli, D. (2018). Blending customisation, context-awareness and adaptivity for personalised tangible interaction in cultural heritage. *International Journal of Human-Computer Studies*, 114, 3–19.

- Parry, R. (2010). *Museums in a Digital Age*. New York, NY: Routledge.
- Poce, A. (2018). *Il patrimonio culturale per lo sviluppo delle competenze nella scuola primaria. Cultural Heritage and the Development of XXI Century Skills in Primary education*. Milano: FrancoAngeli.
- Poce, A., & Re, M. R. (2019). Developing users' soft skills in higher education through university painting collections. The Tito Rossini project. In E. Cicalò, D. Basso, S. Brusaporci, M. M. Moretti, M. Lo Turco, A. Luigini, ... D. Villa (Eds.), *2nd International and Interdisciplinary Conference on Images and Imagination IMG 2019. Book of Abstract*. Alghero: Pubblica.
- Roussou, M., Katifori, A., Pujol, L., Vayanou, M., & Rennick-Egglestone, S. J. (2013). A life of their own: museum visitor personas penetrating the design lifecycle of a mobile experience. *CHI'13 Extended Abstracts on Human Factors in Computing Systems*, 547–552. Paris, France. ACM.