

Encouraging persons to visit cultural sites through mini-games

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Abstract

Gamification has been recently proposed as a technique to improve user engagement in different activities, including visits to cultural sites and cultural tourism in general. We present the design, development and initial validation of the NEPTIS POLEIS system, which consists of a mobile application and a Web interface for curators, allowing the definition, and subsequent fruition by users, of different minigames suitable for open-air assets.

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1. Introduction

According to Istat, the Italian Institute of Statistics, in 2011, year of the last census, barely 28% of Italians, less than 3 over 10, declared they have visited a museum. The situation is even worse for archaeological sites, which were visited by 21.1% of Italians. Still, according to a study by the Italian Ministero per i Beni e le Attività Culturali - MIBACT (Ministry for Cultural Heritage and Activities), already in 2006, the turnover of activities related to cultural heritage and all its related activities created an added value of €167 billions and the employment of 3.8 millions of people ¹. These data, even if only limited to Italy – the country with the highest number of sites in the UNESCO World Heritage List – give an intuition of how much an increase in terms of number of visitors might impact on revenues for both the government and involved third parties. As a consequence, despite the financial crisis, the budget of MIBACT has increased by about 60% in the last five years, with a growth of about €one billion leading the spending forecast from €1.6 billion of 2014 to more

than €2.4 billion in 2018 ². Similar considerations can be applied to many other countries, especially to those ones willing to grow-up in the cultural and tourist service market.

In this area, it has been recognized how Information and Communication Technologies (ICT) could be a major driver for the growth. In particular, ICT should be not only employed for the promotion of the sites itself but also to offer an improved visiting experience. This can be extremely helpful especially for smaller sites, which represent the vast majority, e.g., of Italian sites, where tourists arrive a few or do not arrive, due to the fact that they are overshadowed by world-wide known sites (e.g., Uffizi In Florence, Vatican Museums in Rome, Tour Eiffel in Paris, etc.).

We depict a scenario where citizens, tourists and visitors have access to services providing a customized experience before, during and after their visit. Final users access provided functionalities through their own personal mobile devices (e.g., smartphones and tablets) and/or through devices made available by the site itself. Applications can exploit the user/visitor interaction through physical real itineraries, navigation/exploration of virtually rebuilt environments both

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¹Cf. http://www.beniculturali.it/mibac/export/MiBAC/sito-MiBAC/Contenuti/MibacUnif/Comunicati/visualizza_asset.html_1530921687.html

²Cf. <http://www.ilgiornaledellarte.com/articoli/2017/10/128402.html>

terrestrial and underwater, learning itineraries and knowledge based on the employment of mobile devices. These systems usually adopt a collaborative approach in order to support the co-creation of contents and services based on co-operation among cultural stakeholders. In particular, the design of visits is performed through a *collaborative authoring system*, to be used by cultural operators (and visitors themselves) to build multimedia, interactive, dynamic, adaptive, personalized, user-adjustable and exciting cultural itineraries.

Our contribution to this scenario is the definition, design and development of a mobile application, currently deployed on Android, and the companion authoring tool and back-end system, all together named NEPTIS POLEIS, that exploits *gamification* in order to encourage visits at cultural heritage sites.

Gamification [1] is a term introduced for the first time in 2010 by the American game-designer Jesse Schell, and it aims primarily at user engagement through dynamics borrowed from games. To better understand what pushes humans to play, it is necessary to introduce the concept of *intrinsic rewards*. These are represented by positive emotions, attentions to personal strengths and social connections. Through an active improvement of these qualities, a virtuous circle of self-motivation and self-rewarding is activated. These kind of rewards are mostly employed in videogames, giving a sense of “blissful productivity”. The principle at the basis of gamification is thus using the same game dynamics and mechanics (such as score, levels, rewards, achievements) in order to create and satisfy human desires and needs. By using gamification, we aim at adding new driving components that can draw the attention of users, pushing them to participating and fulfilling achievements, encouraging them to invest their time in cultural activities, modifying in fact their behavior.

Serious Games (SG) [2], i.e., games designed for educational purposes, are able to combine at the same time fun and instruction, allowing people to learn cultural content in an engaging way. The main goal of a SG applied to the cultural heritage context is the exploitation of its intrinsic feature to spread knowledge about art, history and culture. Designing a game from scratch is not an easy task; despite the playful purpose, there are hundreds of aspects and many critical choices to be addressed in order to have success. Authors in [3] illustrate the key steps for creating a (video) game, the main one being to consider the player and everything around him/her. During the design stage of a new game, it is very important to pay attention at the definition of what type of game experience one wants to convey and what emotions should be aroused. These decisions therefore define the target to which offer your own work. In addition to the most obvious and commonly considered differences in gender and age,

four macro-player categories are introduced, defined according to their preferences: *Achievers*, *Explorers*, *Socializers* and *Killers*. Furthermore, there are four essential elements which make up a game, and the more they are balanced among them, the more the game is balanced and it can offer a positive experience; these are the *story*, the *technology*, the *aesthetics* and the *mechanics*.

All these aspects have been taken into account while designing NEPTIS POLEIS, in order to find the right mix between the types of players and the essential elements to be included in our serious game, and in order to create an application that was intended for all ages. We developed a game that can offer both fun and educational aspects at the same time, which can create challenges that the player will be increasingly motivated to deal with and solve, with a special care to aesthetics to allow even those who are not familiar with games to be in a easy-to-understand context, suitable for a wide target of users ranging from children and teenagers to adults.

The application is designed not only for those who are already visiting a city, but also for those who are planning to travel. They can consult the application before organizing the trip and maybe choose the destinations with the most interesting itineraries. Then, NEPTIS POLEIS can be consulted while following the chosen path in order to interact with the proposed game elements. The NEPTIS POLEIS and the companion authoring tool have been designed to create cultural itineraries with the aim of letting people discover also non-mainstream places, by exploiting the passion of people for travelling and games.

The following of this paper is as it follows: Section 2 presents relevant initiatives, whereas Section 3 and 4 focus, respectively, on the mobile application and the authoring tool to be used for creating the elements of the game and the guided itineraries. Section 5 provides insights on an initial validation we performed. Finally, Section 6 concludes the paper with conclusions and future developments.

2. Similar initiatives

Smart systems for tourism and cultural visits usually employ the concept of current position (at different granularity) in order to provide custom services to users. Mobile devices integrate multiple sensors, each with distinct capabilities that can be used to infer and record information about the current position of an user. In open air spaces, such as archaeological sites and parks, the GPS technology can be fully exploited, while in closed spaces, such as museums and churches, it can suffer the fact that artworks are close to each other, and can not distinguish the precise artwork to which we are referring. Additionally, indoor environments are usually GPS-denied, thus making this technology

unusable. Due to these limitations, in closed spaced it is preferred to use other types of technologies, such as Quick Response (QR) codes or Bluetooth Low-Energy (BLE) beacons.

The latter two technologies have a completely different impact from the point of view of perceived user experience. Authors in [4] conducted two different controlled experiments in order to examine the effects of QR codes on visitors' engagement in museum-like spaces. The first experiment compares the effects of QR codes versus traditional display screens for providing information about the exhibits. The second experiment compares traditional (or one-way) QR codes with two-way QR codes as different methods for delivering information. Two-way QR codes allow visitors to search for information about the exhibit, as well as to contribute by posting comments. The results show that visitors prefer direct mechanisms for obtaining information about the exhibits, such as text on a panel or videos on a screen, rather than retrieve them through QR codes. However, they also found that two-way QR codes are a cheaper alternative for delivering digital content in museum-like spaces, especially for college-age visitors.

A similar experiment based on QR codes has been conducted in the Hecht Museum³, in which gamification based on treasure hunts among the various elements exhibited in the museum turned out to be a real success among children and their families. Applying a gamification approach to a museum exhibition can stimulate more people to visit it, involving them in a more exciting way with respect to classical exhibition.

Back in 2014, the Civic Museums of Palazzo Farnese in Piacenza have been the first Italian museums to have a dedicated app that uses the BLE beacon technology⁴. Approaching each artwork, a dedicated page appear on the user device without explicitly requesting it. Unfortunately, in the rooms containing many artworks, the performance of the system degraded because of signal interferences. For the installation of the beacons, in fact, the plan and morphology of the place must be evaluated because electromagnetic waves can overlap and create conflicts, thus showing wrong pages. Despite this, technological improvements in signal processing makes BLE beacons a promising approach in the field.

Starting since June 2014, visitors to the Philips Museum in Eindhoven, were invited to play an

interactive game called "Mission Eureka"⁵ as they walked around the exhibits. This game is played with an iPad that senses the location of visitors through BLE signals. The game allows to form teams composed of 1 to 4 people. Teams are presented with "challenges" that they have to solve, just like real researchers. It has been noticed, also in this case, that applying gamification, for example offering a Museum scavenger hunt with clues that pop up at every corner, makes the guests entertained, educated, and spend more time at the museum than ever before.

The solution proposed in this paper is principally designed to propose outdoor itineraries, as it is currently based on GPS to detect the location of the user. Noteworthy, the employment of QR or BLE technologies outdoor is not only expensive but also limit the possibility to add new historical sites in real-time and remotely.

Many mobile apps do exist that suggest cultural itineraries, showing maps with cultural assets, or points of interest, for various cities, both single cities (you can find more applications for the same city) and for the whole country, e.g., in Italy "Travel Art - Culture and Tourism" and "ITALY Tourist Guide and Maps - ZonzoFox", but they do not take any advantage of location-aware mobile devices or gamification. NEPTIS POLEIS allows instead the user to have all the points of interest identifiable in a single Google map, without having to access a different application every time you change the city, or place of interest. This also makes it possible to organize a game competition on a national level and not on a single city.

3. The mobile application

NEPTIS POLEIS mobile application can be downloaded and installed for free from Google Play⁶. As soon as the app is started, the user is requested to log in using a social network platform (Facebook, Twitter and Google are currently supported). The app requires the authorization to access the localization service that must be kept on in order to detect the current position of the user.

The homepage consists of a map centered on the current position of the user (see Figure 1). The app is annotated with the icons representing the various mini-games that the user can play. The user is allowed to click on the icons only if s/he is geographically close to the attraction corresponding to the icon.

³Cf. <http://mw2014.museumsandtheweb.com/paper/the-treasure-hunt-game-generator-a-system-and-its-application-at-the-hecht-museum/>

⁴Cf. <https://www.wired.it/mobile/app/2014/09/26/come-i-beacon-rivoluzioneranno-musei-e-spazi-culturali/>

⁵Cf. <https://www.philips.nl/en/a-w/philips-museum/activities/mission-eureka.html>

⁶Cf. <https://play.google.com/store/apps/details?id=it.neptis.gopoleis>

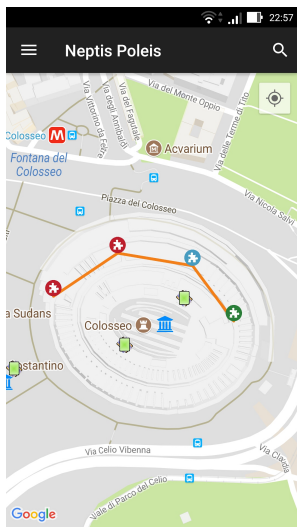


Figure 1. NEPTIS POLEIS homepage

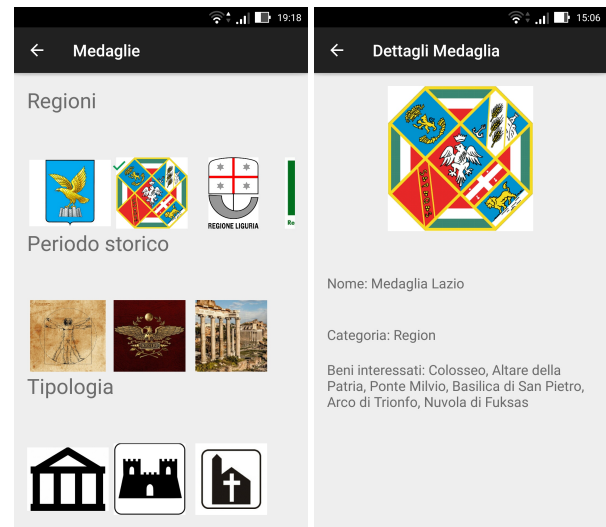


Figure 3. Visit them all mini-game

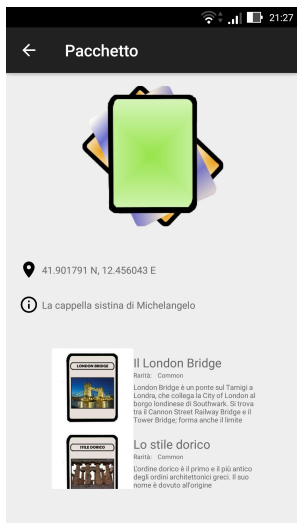


Figure 2. Treasure hunt mini-game

The NEPTIS POLEIS mobile app consists of 4 mini-games, each of which has been designed to target different age groups and types of players.

The “Treasure hunt” mini-game is aimed at a younger audience and follows the dynamics of a treasure hunt in which players look for collectible cards’ packets, very well-known to children. Packets composed of cards (see Figure 2) can be placed by editors in any place on the map. The opening of a packet is conditioned by the player’s position with respect to it. Only if the player is close enough, s/he can open the packet, otherwise s/he is notified of the distance. A packet contains a set of five cards with different rarity that can be collected, each of which represents the image of a cultural asset or a point of interest. In addition, the packet contains information

of interest on the cultural asset s/he is visiting and that could be useful to solve the various enigmas proposed during the “mysterious path” mini-game. Clearly the user is engaged in acquiring the information reported in the card, thus collecting cards enhance the learning of the user about the heritages.

The “Visit them all” mini-game follows a principle of “cultural assets collection”, focusing on traveling and visiting places of cultural interest around the whole national territory. It is suitable for young people and adults who are often traveling and/or visiting attractions: they aim to visit as many sites as possible and conquer *medals* that show their own progress in a specific category of cultural assets. A cultural asset can be considered as “visited” only if you are within the validity area associated with it and you tap on the corresponding icon. Moreover, by visiting cultural assets, the player has the ability to unlock and conquer medals. Medals (see Figure 3) are divided into three categories: *regions*, corresponding to the 20 Italian regions; *historical periods*, such as “Roman Empire”, “Ancient Greece”, “Middle Ages”, etc.; *types of structure*, such as churches, castles, museums, etc. A specific attraction may belong to any number of medals. A medal is conquered when all the attractions belonging to that medal have been visited.

The “Mysterious paths” mini-game is based on puzzles and is targeted to “gamers”, whose are much more oriented to the gaming world than to the cultural one. The player can explore stories, myths and legends about Italian cultural heritage accompanied by puzzles (see Figure 4) to which s/he has to find a solution, making use of the possibility of a clue on-site and/or a clue in exchange for a penalty. The clue on-site is more generic, while that with a penalty is more eloquent than the first

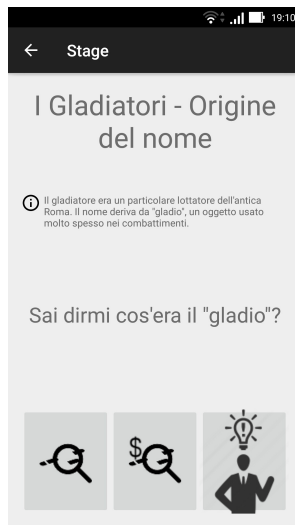


Figure 4. Mysterious paths mini-game

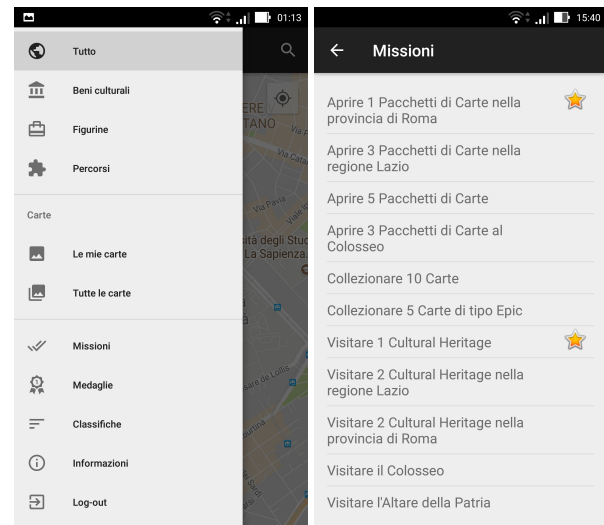


Figure 6. Navigation

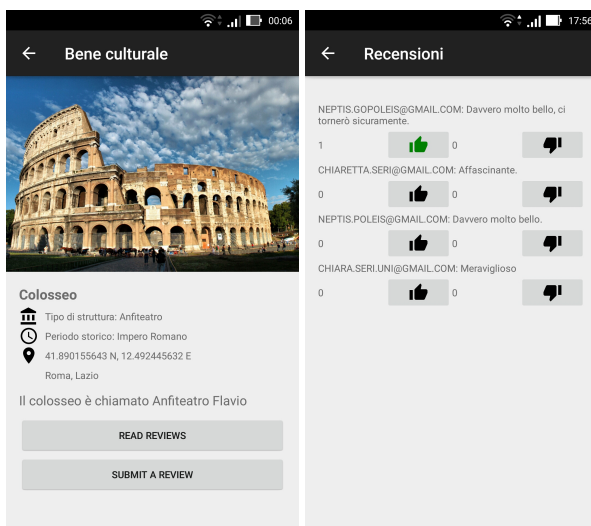


Figure 5. Cultural advisor mini-game

one. Mysterious paths are denoted on the map using poly-lines (see Figure 1 for an example). Puzzles on a path must be solved in sequence; when a player solves the enigma, s/he can access the next one. In this way, it is possible for the cultural operator to realize one, or more, guided cultural paths. Similarly to the other mini-games, the single puzzles/stages are accessible only if the player is geographically close enough. To distinguish which stages have been already resolved, which is the current one to be solved and which ones to be solved later, different colors are assigned to the icons on the map belonging to a path: *green*, already resolved puzzles; *blue*, the puzzle to be currently solved; *red*, the puzzles still to be unlocked.

Finally, the “*Cultural advisor*” mini-game is suitable for an audience unfamiliar to the gaming world, which, through a real “portable encyclopedia” that includes reviews and comments about the Italian cultural assets (see Figure 5), can use the application as a tool to gain knowledge about a specific attraction. This mini-game allows you to collect and display information about the cultural asset you are visiting, offering you the possibility to write a review and evaluate, positively or negatively, those written by the other players who have already visited it.

Through the application’s main menu (see Figure 6, left), a player can (i) view his/her album of cards, (ii) browse the entire collection present in the game, (iii) access the list of proposed missions, (iv) his/her medals collection, and (v) the general players leaderboard. Each mini-game rewards the winning player with a reward in virtual coins, simply called “*coins*”. These coins are the first indicator of progress within the game and are the criteria under which the general leaderboard is ordered, with the player who has collected the most of them in first place. To boost competition among players, it is possible to give access to “real” prizes, such as promotions and discounts to visit cultural places.

In order to improve the player’s involvement, *missions* were introduced (see Figure 6, right), i.e., simple goals that the player has to reach. The player is precisely instructed on what to do to accomplish a mission, so it is possible to create guided cultural paths that involve the user more. Even the accomplishment of a mission contributes to gaining coins. Missions can be associated with each of the mini-games and provide different types of granularity (e.g. “Visit 30 cultural assets”, “Write 15 reviews in Lazio”, “Collect 2 region medals”, “Open 5

packets at Colosseum” or “Complete 20 paths in the province of Rome”).

4. The authoring tool

The NEPTIS POLEIS authoring tool is a web application⁷ that allows to define all the elements of the mini-games. It can be used by two categories of users: *administrators* and *curators*. Each of them will have a custom interface listing all the supported operations, with a lateral menu to select the desired task and a main screen where the selected page is shown and can be edited.

An *administrator* is in charge of managing the gaming mechanisms and is thus enabled to create, edit and delete, cards, medals, missions, view the leaderboard, consult game statistics and players’ statistics. S/he can also enable cultural organizations willing to exploit the application, by allowing persons responsible for information about their places of interest and integrating them with the available mini-games, in order to extend the participation to the game to as many organizations as possible.

Thanks to the possibility to consult players’ statistics, administrators are able to determine the flows of affluence and to obtain information about user engagement, changing and improving what engages users less, promoting and increasing those activities users like most. The same mechanisms allow to carefully design missions that guide players not only through mainstream sites (such as Uffizi or Vatican Museums) but also in less renown places.

Missions, see Figure 7, are a key part of the game because their accomplishment allow players to earn reward coins, thus making a big step forward in the overall leaderboard, as well as to win medals, which is an element that requires a lot of participation in the game and is rewarded with the highest prizes.

Game stats, see Figure 8, involve not only mini-games but also medals and missions, and through drill-up/drill-down operations allow administrators to have a national, regional, provincial or on a specific cultural heritage/medal/mission view of the game elements that have been inserted until that moment. Players’ statistics are structured in the same way as those for the game with the only difference that each game element shows how much it was “played” (e.g., how many players have completed a specific enigma or path, or visited a given cultural asset, etc.).

The *curators* are those who take care of one or more specific cultural assets and, therefore, are able to insert the various elements of the game (see Figures 9–10), and have the opportunity to create mysterious paths to

encourage users to participate and continue the path until its completion.

Specifically, through the left side menu, curators have the ability to insert, edit and delete cultural assets, places of interest, cards’ packets, draw validity areas of any form (circular and polygonal shapes), and cultural paths (see Figure 11) with their related puzzles for each stage. Each of these elements is assigned with geographic coordinates by positioning its marker on a Google map by exploiting the APIs made available by Google.

In addition, curators are also able to remove reviews that do not meet certain standards (e.g., politeness). The various cultural assets managed by the curator are shown on the homepage in different widgets, see Figure 12. Other features of the cultural asset are also specified at the time of creation, in addition to geographic coordinates (latitude and longitude), such as the historical period, type of structure, whether or not it participates in any of the three types of medals.

In each mini-game, it is possible to insert an element of the game simply by right-clicking on the Google map presented, then the corresponding coordinates are automatically detected based on the chosen position. It also possible to drag the marker in order to reach a more precise position. The current draggable marker is denoted with the green color, in order to make it distinguishable with respect to the others, that instead are fixed and editable by clicking on the corresponding edit-icon.

5. Validation

A preliminary validation of NEPTIS POLEIS has been performed by a class of 10 master students, aged between 26 and 35, 6/10 of which are males. All the participants made at least one cultural trip during the year, mainly in Italy and Europe. They were all familiar with Google maps to orient themselves in a city. About half of the participants downloaded in the past an app on their smartphone to know more about the destination city and in the last year visited at least once a city, a museum, a cultural asset or an exhibition. They are incline to follow an itinerary in less known cultural areas. Moreover, their relationship with (video) games is excellent and they are habitual players.

The participants were asked to download and install the application from Google Play, follow the cultural itinerary containing the Colosseum on the map until it was completed and then fill in a questionnaire. As a consequence, all the players provided answers about the same set of game elements. All the participants interacted with the mobile app in order to complete the path, therefore solving all the various puzzles proposed. In addition, participants were asked to provide their comments about current features and feature missing to

⁷It is accessible at the URL : <https://neptis-poleis.diag.uniroma1.it/NEPTIS-Poleis>

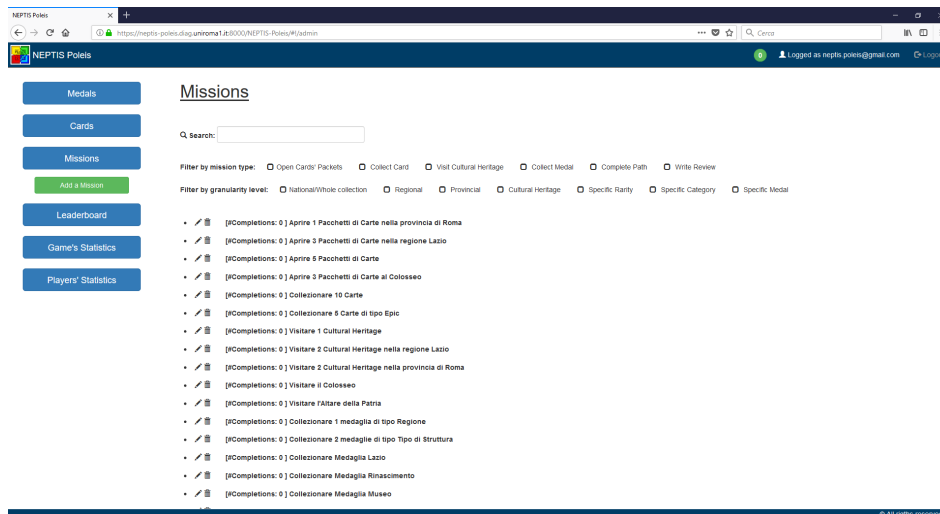


Figure 7. Missions

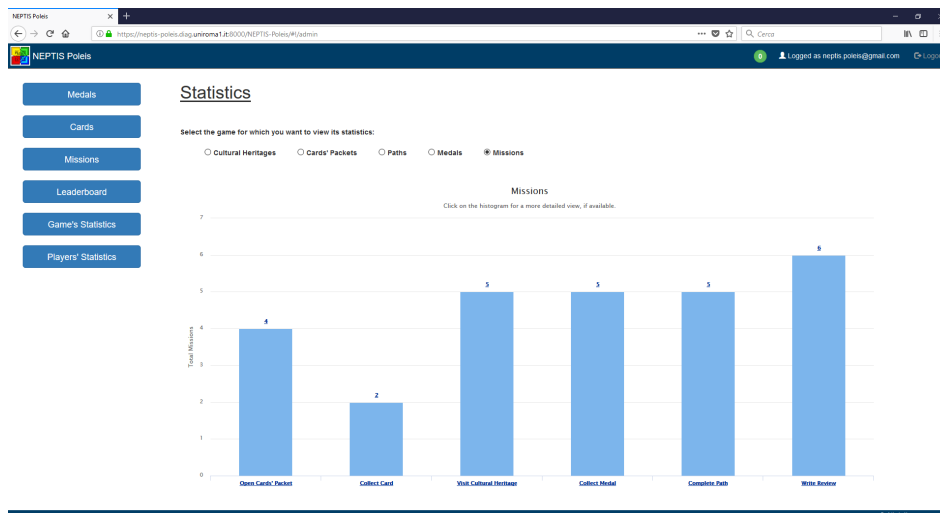


Figure 8. Game stats

be implemented. The results of the questionnaires are depicted in Figure 13.

All participants considered their first gaming experience with the application to be satisfying and have not found any particular problems in using it, even though they reported issues to understand functionalities in the very first minutes of use. In particular, users found difficulties in identifying the initial point of the itinerary and suggested to enlarge that specific icon or put some particular symbol beside it in order to highlight it more clearly.

Participants reported that while solving the puzzles proposed during the itinerary and opening the packets of cards they have learned information that they did not know before. Missions stimulated them to complete

the itinerary. They also admitted they would repeat a similar experience while traveling in other cities.

If the creation of game elements was put in the hands of competent curators and therefore able to make them learn, in a fun way, everything that is on a paper tourist guide, but also curiosity, anecdotes and things that are not there, everyone would prefer our application compared to one of the most provided tourist guides. In case they find themselves having to organize a trip, more than half of the interviewees would check if there are interesting itineraries in the eligible destinations.

The fact that there are coins in the game that move the leaderboard encourages them to play to climb it, the possibility of turning coins into discounts on entrance tickets of places of interest participating in the project, would encourage them to play and exploit them. The

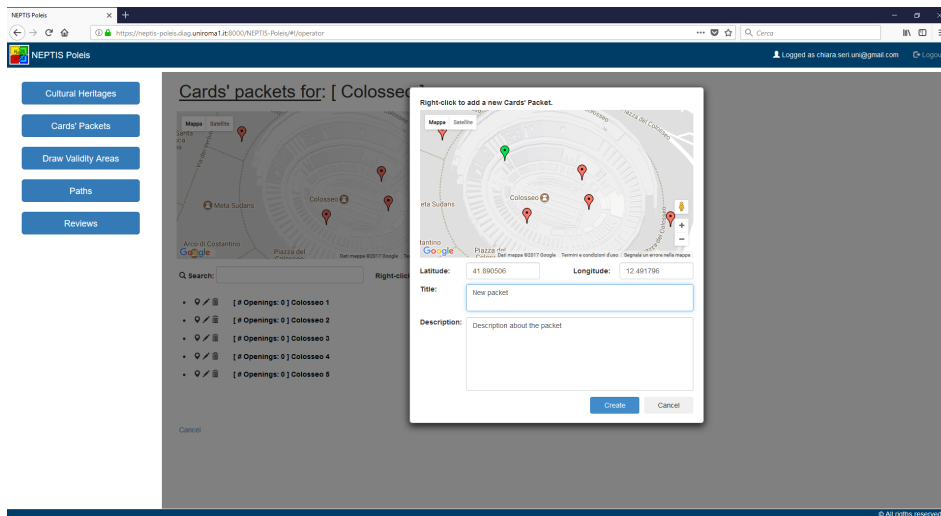


Figure 9. Geographical positioning of a cards' packet

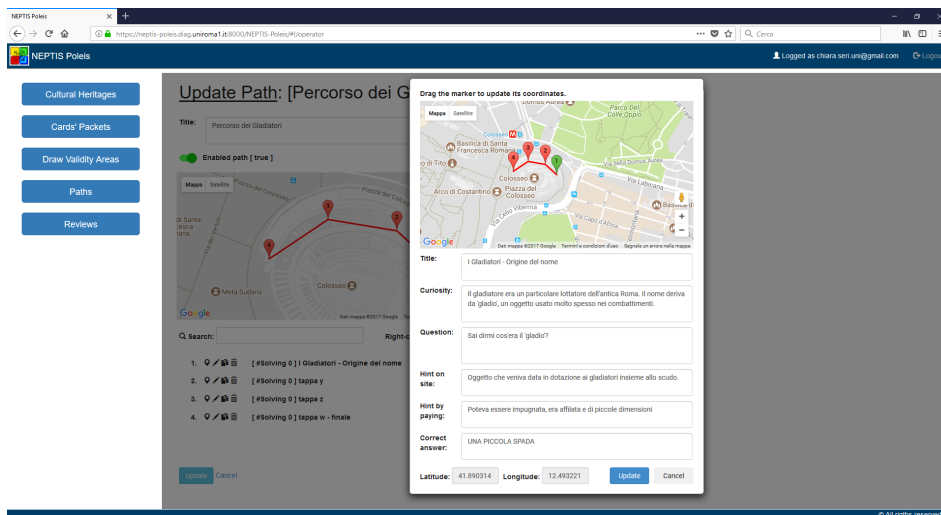


Figure 10. Enigma creation

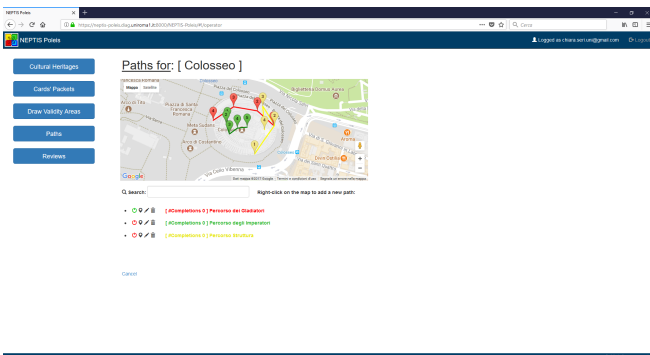


Figure 11. Cultural paths for Colosseum

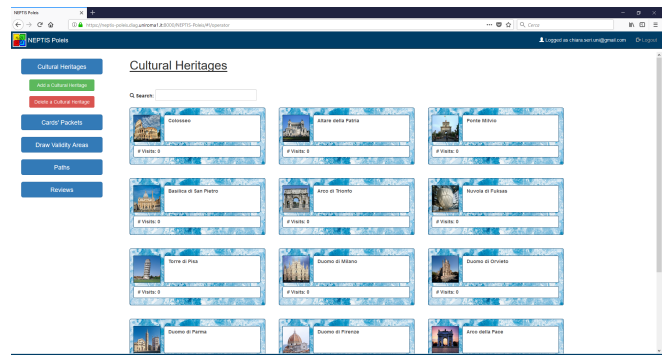


Figure 12. Cultural assets

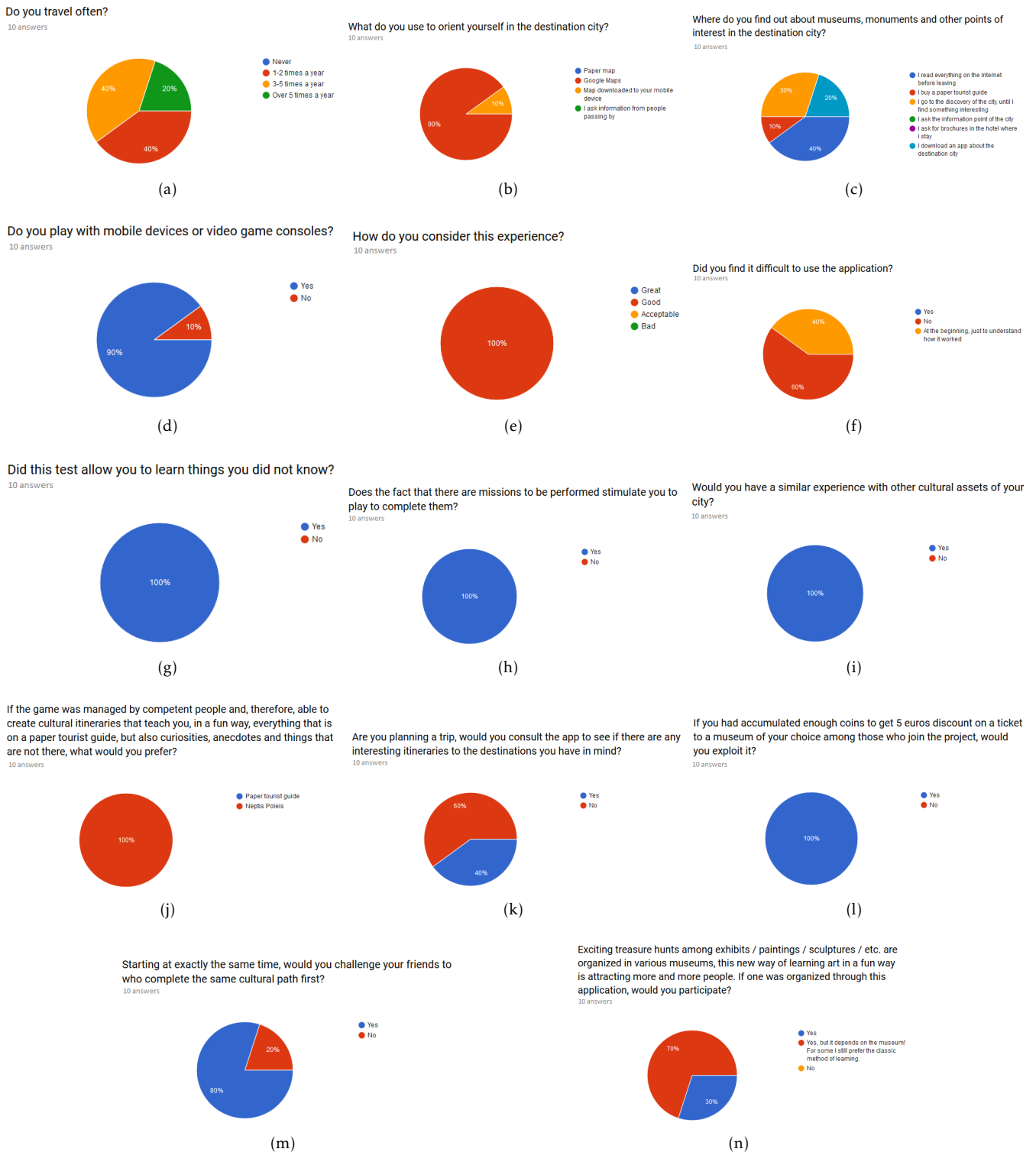


Figure 13. User questionnaires results

fact of being able to share their successes in the game on social networks is not important for about 4/5 of the interviewees, but they would willingly challenge their friends at who ends up a cultural path first.

The possibility offered by an hypothetical museum to participate to real exciting treasure hunts, would stimulate them to participate, but this depends a lot on the type of museum. For some museums they

would prefer the classic approach, without any use of gamification.

Users highlighted few bugs and feature improvements. Among these latter, it has been requested that the path between one stage and the following ones in a path should follow the road and not to create a direct segment between two points. Additionally, participants proposed that once they finish a path they would like to have suggestions on others of the same type nearby. Finally, the possibility to challenge other players with their own cards (cards have been very appreciated by participants) was requested by about 1/3 of the interviewees.

6. Conclusions and Future Works

In this paper, we presented a mobile application with companion authoring tool that applies the concept of gamification to the world of cultural itineraries. In particular, the app provides users with different mini-games, configurable through the authoring tool, targeted to make cultural visits more engaging by applying techniques taken from the world of games and puzzles.

The validity of the solution has been preliminarily tested through a user questionnaire proving that the proposed approach is promising. The participants to the validation suggested possible improvements that will be taken into account for future developments.

At the current stage NEPTIS POLEIS is imagined as an application to be employed outdoor with the employment of a GPS. Nothing prevents anyway to extend the applicability of the approach to indoor spaces (e.g., museums, churches, basilicas), by using QR codes or BLE beacons as location sensing technology, as discussed in Section 2. This can be done as the structure of mini-games is fully compliant with indoor spaces or outdoor spaces where attractions are concentrated in a

small area. Especially mysterious paths are particularly suitable for museums where sequential paths represent most of the visits.

From the point of view of engagement, coin rewards can be converted into prizes. For example, accumulated coins can be converted into discounts for museums' or cultural assets' tickets who adhere to the NEPTIS POLEIS ecosystem.

It has been planned to integrate the possibility to publish the results obtained on the social networks, in order to stimulate competition among friends. Future works also include the development of an iOS app, and the introduction of new location-based mini-games.

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