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Location-based games and Cultural heritage: a review of practices

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Abstract. This paper aims to study the variety of gameplay mechanics present in location-based games related to cultural heritage education, understanding the current state of art of practices in the field. First we conduct a literature review about the characteristics of location-based games, and then we search for references of these games related to the field of cultural heritage. We analyze these systems in order to recognize which types of game mechanics are present, and how they translate into game patterns. The results point to a predominance of a scavenger hunt game pattern, using quizzes as the main mechanic. This research discusses the potential of location based technologies to contribute to the process of cultural heritage education, in order to help building future experiences in the field.

Keywords: Video game design, Location-based games, Gameplay mechanics, Cultural heritage, Heritage education.

1 Introduction

This paper aims to study the variety of game patterns present in location-based games related to cultural heritage education and to understand which game mechanics are present. Location-based games use urban space as a space of play (Lemos, 2010) and the game progress is related to the users' position and mobility in space. When it comes to cultural heritage, this type of game can help foster users' engagement with their surroundings, raising awareness by associating stories and facts to buildings and places, using play as a facilitator.

We conduct a literature review about location-based games where authors propose classifications of these games based on common characteristics among them, such as the works of Avouris and Yiannoutsou (2012), Kiefer et

al (2006) and Lehmann (2012). Then we search for references of these games related to the field of cultural heritage. We analyze them in order to recognize which types of game mechanics are present, and how they translate into game patterns. The criteria adopted for this selection includes the possibility of actual testing and availability of information about the games (in cases where testing is not possible).

2 A structure for location-based games

From Huizinga (2007 [1938]), we can draw the definition of play as free, consented activity taken as "non-serious" and outside of regular life, but highly intense and capable of absorbing of the player's attention; it is practiced within specific spatial and temporal boundaries, according to certain order and certain rules.

This sum of characteristics – to which we could add some more from Huizinga itself, such as not being specifically productive in economical terms, for instance, and being an end in itself – is not entirely present, or at least present in the same amount, in every game. Location-based games, for instance, tend to challenge – or play with – spatial and regular life boundaries. By doing so, they help us see ordinary objects and buildings differently, for instance as part of a different, more valuable narrative. In Jacob and Coelho's words:

"A Location-based game is a game that uses the player's physical location, usually via a GPS sensor module, as an input or as a base for the generation of the game level or access to location-specific information (such as maps, weather, or location-based services." (Jacob; Coelho, 2011)

Lemos (2010) defines locative mobile games as games that use the public space as boardgame, using location-based services and technologies for action and development, in which place is integral to rules and actions of the game. In the formulation used in this study, location-based games (LBG) refers to games mediated by digital devices, where the outcomes of digital interactions depend upon non-trivial actions (cf. Aarseth, 2001, in relation to cybertext or ergodic literature) performed by the user in a specific physical space.

As stated, the constitution of the space of play is not always easy, as LBG tend to blur the lines between it and the daily space. Lemos (2010) also points out that there are many traditional games that use public space (hopscotch, street football, hide-and-seek), and they all temporarily transform space through play, as described by Huizinga (2007 [1938]). Digital mediation, however, tends to reinforce the simultaneous superimposition of spatialities, and the rather seamless passage from the space daily life and that of the game.

Kiefer et al (2006) propose a systematization of location-based games based on three design dimensions the authors identify by analyzing examples of these games. These dimensions are *game environmental embedding* (how the game world is embedded through players' perspective), *game concepts* (or, as the authors state, *the abilities a player must have and the tasks he or she must solve for winning the game*) and *spatial temporal* (whether the location or time the game activity can take place are determined or continuous).

Avouris and Yiannoutsou (2012) analyzed a pre-determined selection of location-based games and proposed a classification based on their educational focus, categorizing them into three groups. The first group the authors denominate as *Ludic Tradition*, which is composed by games that are built with entertainment as the main goal. The second group the authors call *Pedagogic Tradition*, in which games are designed with explicit learning objectives. The third group is composed by games designed for both objectives of entertainment and education, called *Hybrid Tradition*. The authors state that the games in this group are *usually built for a wider audience by institutions outside formal education establishments, related to cultural heritage, for example cultural and historical societies, museums, tourist boards, etc*. (Avouris and Yiannoutsou, 2012)

Lehmann (2012) analyzes location-based game patterns based on users' mobility in space. He proposes four categories: *Search-and-Find*, where players have to reach a fixed destination; *Follow-the-path*, similar to the previous pattern, although the focus is not the destination itself, but the route leading to it; *Chase-and-catch*, where players have to reach a moving object in the game (e.g. another player); and *Change-of-distance*, where the goal is to get close to a location or further away.

3 Location-based games for cultural heritage

When dealing with Cultural Heritage subjects, therefore, location-based games (LBGs) will most of the times fall under the Pedagogic or Hybrid Traditions. It could also be argued that they fall under Bogost's definition of persuasive games (2007), in the sense they try to instill not only knowledge about cultural heritage objects, but also raise awareness about these objects among players. Malpas (2006) points out that the role of heritage education is to enable us to recognize what is already our own, showing us something about ourselves and the world to which we belong. LBGs involve the active discovering of information that is immediately connected to the surrounding environment, our attention drawn to it in great measure by our engagement in the superimposed digital layer and the level of immersion dictated mostly by our possibilities of action within the interface system.

Cultural heritage LBGs most common tools for playing are smartphone applications – and a few websites. These games can be published in their own apps, as well as in authoring platforms. Due to their digital nature, these applications make it possible to automatically correct users' input, and interpret signals captured by the device's sensors, such as GPS. They also allow information to be made available locally according to the user's position and their progress in the game. These characteristics differentiate digital locative games from their analog versions.

These games can be played at any time according to the players own schedule – or on scheduled times, usually with a human mediator. They can be played solo, in groups, or in competing teams; hence they can be competitive (even when played individually, by means of public scores), cooperative, or isolated, that is, when the players are aware only of their own performance.

They can be published by companies or cultural institutions; the authoring systems can be open or proprietary, also owned by individuals, companies of educational and cultural institutions; the actual games developed in such systems can be individually or company authored. The publishing system makes these games part of the tourism industry and many of those are promoted in tourist attraction tickets websites. Paid games may be replayable for free or not.

Among examined games, the most usual pattern employed in cultural heritage seems to be the Treasure/Scavenger hunts mechanics, where users must find certain objects or pieces of information by overcoming certain challenges. In this case, information about heritage objects is earned by the effort of the player, instead of being freely available, which tends to make the player more likely to cherish it and remember it – even in the cases the information has little effect on gameplay.

A slightly different approach is presented by the self-named location-based "escape rooms". They derive their names from the physical version where people use props and decipher clues that help them unlock the door of a specially prepared room. As the location-based versions are almost invariably played outdoors (or at least in public spaces), they share with their non-digital counterparts the need to perform the activities and solve the puzzles under a specific time. Therefore, they are more akin to scavenger hunts with a time limit.

4 Selection of cultural heritage LBGs

In order to build our analysis, we select a few examples of location-based games that deal with cultural heritage. It is a qualitative approach, based on the possibilities of experiencing the game (or having enough documentation

about them, when playing was not possible) and the range of game mechanics covered.

DemonumentaRA(Fig. 1) is an application conceived by members of the Faculty of Architecture and Urbanism of São Paulo University (FAUUSP). It was an interactive exhibition, focusing on monuments related to the celebrations of Brazilian's Independence and 1922's Week of Modern Art in São Paulo. A series of displays with QR codes were distributed at Praça do Relógio da USP, and when users scanned them with the app, digital models of the monuments were unlocked, making it possible to see them in augmented reality.

Resiliage Summer School 2024 (Fig. 1) is the 6th edition of a game developed to be played as a group activity in the "Cultural Heritage in Context – Digital Technologies for the Humanities Summer School", promoted by the research group headed by prof. Rosa Tamborrino, from the Politecnico de Torino. This year's theme was "SHEroes Resilience Summer School: Empowering Women in Disaster Risk Reduction through Heritage".The objective of the game, mainly designed by team member Pelin Bolca with Naylor Vilas Boas, is to help users get familiarized with the city and foster group engagementat the same time. Challenges take mostly the form of quizzes, but include also wayfinding and photo upload.

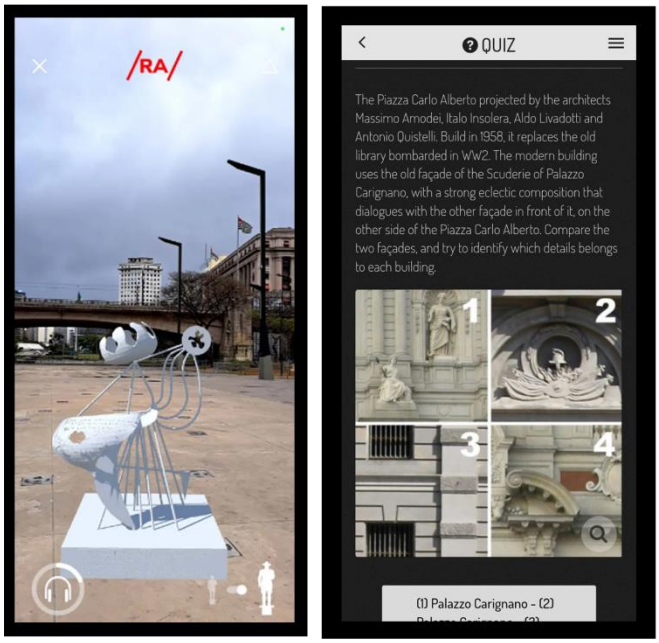

Figure 1. Screenshots from LBGs studied.From left to right: DemonumentaRA and Resiliage Summer School 2024. Source: Authors' collection, 2024**.**

The Secrets of Belem (Fig. 2) is a game available at Coddy Games platform, and it is an itinerary where the challenges unlock trivia about historical places in Belem, Lisbon.

Turin escape game (Fig. 2) is available at World City Trail closed platform, and it consists of an itinerary where the challenges (also in the form of quizzes) unlock trivia about heritage sites and buildings in Turin.

Urban game Turin (Fig. 2) is a game available at Enigmap website. It consists of a series of points of interest with challenges associated to them, and users can choose the order in which they visit the points.

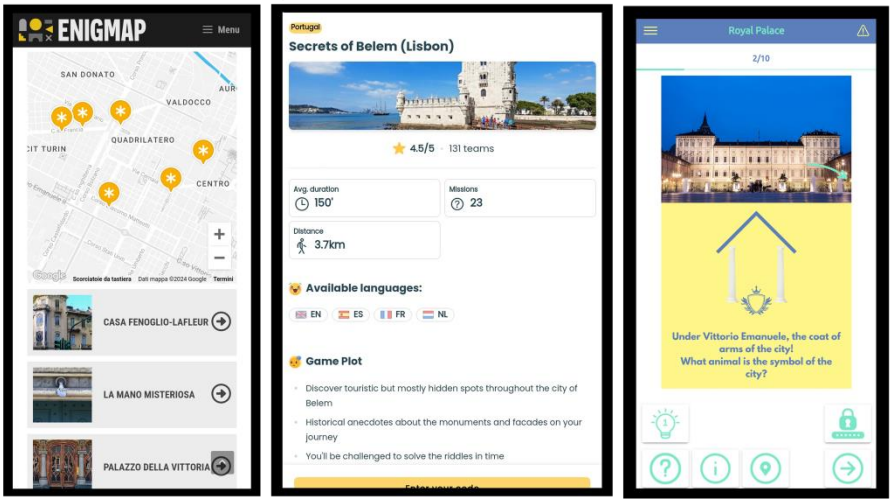

Figure 2. Screenshots from LBGs studied.From left to right: Urban Game Turin, The Secrets of Belem, Turin Escape Game.Source: Authors' collection, 2024.

Romantic Turin (Fig. 3) is a game published in Questo, a closed authoring platform aimed at cultural tourism. It follows the fictional story of Valentino, a character on a journey to find the whereabouts of his romantic interest, while guiding the players on historical sites in Turin. The game is composed of challenges, generally in the form of quizzes, and pieces of the fictional story, related to the place where the challenges are located. Some challenges include following directions to find a specific location, triggered by GPS position proximity.

Verona – Amor (Fig. 3) is part of a series of location-based games developed by WhaiWhai, an Italian company focused on solutions in cultural tourism. It is an itinerary that guides the players through different heritage sites in Verona, while recounting the story of a fictional descendant of the Capulet family. It consists of a guidebook, where the story is scrambled in

numbered excerpts, and a Whatsapp chatbot. It informs the players the numbers of which parts of the narrative should be read, while giving them challenges in the form of quizzes to solve.

Walk 1916: Women of the Rising (Fig. 3) is an application developed by Haunted Planet Studios, a company based in Dublin specialized in location based augmented reality (AR) serious games, focused in cultural and historical settings. The game takes place in Dublin, with its thematic centered in the participation of women in the Easter Rising in 1916. Players have to visit heritage sites in search of historical pictures, which are available to see in augmented reality.

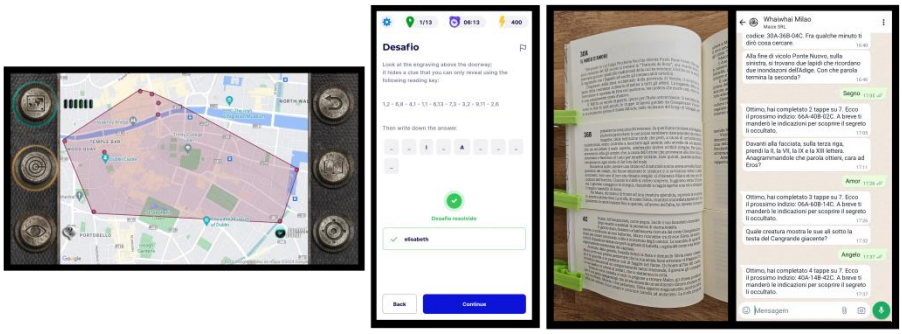

Figure 3. Screenshots from LBGs studied.From left to right: Walk 1916: Women of the Rising, Verona – Amor, Romantic Turin.Source: Authors' collection, 2024**.**

5 Analysis of cultural heritage LBGs

The games studied provide a good range of possibilities for cultural heritage education. In Table 1, we see a summary of their features.

There is a predominance of the scavenger hunt game pattern among the games analyzed, with examples of escape room game pattern. Quizzes, or knowledge tests, are the most prominent mechanic present in the games. They consist of a question presentation (text-only or multimedia) that must be answered by direct text input or multiple choice. The answers are automatically corrected by the system. To solve quizzes, players usually must search for the answers in the surroundings, on urban elements (building facades, street signs, etc.), or in the general knowledge about the history of the place. Some variations include multiple choice answers that present images instead of texts – so the player can choose which photo belongs to a specific building, for instance.

Table 1. List of games and their characteristics. **Source:** Authors, 2024

Games (1st release year), authors	**Game pattern**	**Game mechanics**	**Tools used (System/Publisher)**	**Route Linearity**	**Fictional or non-fictional setting**
demonumentaRA (2022), by Giselle Beiguelman, Luís Felipe Abbud, Bruno Moreschi (coordinators); FAUUSP	Scavenger hunt	QR code scan, AR object visualization, complete a set of entries	Smartphone single game app (Unity)	Non-linear	Non-fictional
Resiliage Summer School 2024 (2018), by Pelin Bolca and Naylor Vilas Boas	Scavenger hunt	Quizzes (multiple choice, text entry), Media upload, GPS positioning recognition, earn points, user rank	Smartphone multi-games app (Actionbound)	Linear	Non-fictional
Romantic Turin (2023), by Marcogabber	Escape Room	Quizzes (text entry, multiple choice), earn points, user rank	Smartphone multi-games app (Questo)	Linear	Fictional
The Secrets of Belem (n/a), by Coddy Games	Scavenger hunt	Quizzes (text entry), earn points, user rank	Smartphone multi-stories app (Coddy Games)	Linear	Non-fictional
Turin Escape Game (n/a), by World City Trail	Escape Room	Quizzes (text entry), earn points, user rank	Smartphone multi-games app (World City Trail)	Linear	Non-fictional
Urban game Turin (c. 2020), by Enigmap	Scavenger hunt	Quizzes (multiple choice, text entry)	Website (Enigmap)	Non-linear	Non-fictional
Verona – Amor (2009), by Francesco Mazzai	Scavenger hunt	Quizzes (text entry)	Whatsapp chatbot - previously SMS, printed book (WhaiWhai/Maizie.io)	Linear	Fictional
Walk 1916: Women of the Rising (n/a), by Haunted Planet Studios	Scavenger hunt	GPS position recognition, AR object visualization, complete a set of entries	Smartphone single game app (Haunted Planet Studios)	Non-linear	Non-fictional

Other challenges might involve media uploads such as images, videos and audios recorded in the playfield; but they are normally not automatically judged or graded by the system, but be later reviewed by the game organizers (as in ActionBound). They constitute a motivating and engaging challenge, for they demand active and creative participation.

As for recognizing user's position, games most commonly adopt GPS tracking – some challenges are based on the user reaching a predetermined position not shown on the map by following directions, for instance. To a lesser extent, other strategies for controlling user position are involved, such as target recognition strategies (QR codes, for instance); and, indirectly, many challenges also provide some control of user's location, due to the need to be physically in the places in order to solve them, and how usually one is made available when the previous is solved.

To help motivate users to proceed with the activity, some games adopt strategies of awarding scores to players based on their success in solving challenges. Escape room games usually attribute higher scores to players who can complete challenges under a specific time. Some games establish rankings among players, highlighting ones with higher scores, thus creating a competitive environment. Instead of scores, some games (especially scavenger hunts) reward players by unlocking certain instances of a database that were previously hidden.

Regarding narrative structure, the majority of games studied use a linear narrative, which unfolds over a route with well-defined beginning and ending points. In this type of structure, users must follow the points spatially in the order in which they were originally conceived. Linear structures also help writing and following linear narratives, fictional or not. When the structure is non-linear, users can choose the order in which they visit the points. They present all the points of interest in the map beforehand, and their sense of unity comes from completing the map. Finding out the next stop in the game is actually a satisfying and motivating part of the process, be it as a challenge in itself or a reward.

Among games studied, there is a predominance of non-fictional settings. In our experience playing these games, fictional settings help weaving linear route points, giving a greater sense of unity. They also help fostering empathy with the characters represented and their stories. Non-linear structures tend to work best with non-fictional narratives, as they usually are focused on explaining facts about the objects they highlight, responding to a broader theme rather than to a strict narrative focus. Non-fictional narratives, however, also work well with linear settings – as seen in previous works (Authors, 2023).

Apart from Enigmap, which uses the browser, all games studied are played in proprietary apps, and were built using a PC-based back-end. Some systems, such as Questo and ActionBound, allow for other users to create their own games, and it is possible to publicly identify at least the user that published the game. Whaiwhai also allows for clear identification of authors,

printed on the cover of the books and in their website. Works that come from research projects usually have some credits page with further information, in the app or outside it. Games promoted by tourism-related companies, like Coddy Games and World City Trails, usually have no authors associated with specific games. Enigmap announces itself as a non-profit organization for promoting locative games, but there is no identification as individuals or even usernames.

Most individual scavenger hunts allow for pauses during games, even returning on another day. Even some escape room games have this feature, usually in-between challenges. To return to the game, however, it may be necessary to go back to the place where the game was turned off, instead of the next point in the list, for instance. They also usually include some sort of mechanism to skip a difficult challenge, usually with a penalty. Although it does not include penalties, even demonumentaRA, which has less features of competition (even against oneself) and more akin to free play, keeps track of discovered statues for the user, helping to create a sense of completion.

6 Discussion

The categories help mapping creation possibilities. From the start, it seemed that the more culture heritage information is related to the story or set of points, the more memorable and engaging the game would be. Stories in locative games, in order to be enjoyable, must also respond to locations (and their relative positions), distance, and challenges. Location and distance mean that a story must be told in a comfortable (walking) order; but points of interest are already in place, and sometimes it is necessary to add minor stops to help.

When the game is mostly composed of questions about heritage objects, the quality of the questions is very important. There is a delicate balance between too easy and uninteresting and too difficult and discouraging, which is especially harder when there is no easy way to adjust the level of difficulty for quizzes, as it usually means simply making a different question, so they are generally formulated with a generic non-specialist person in mind. Another issue is that it is not easy to create a seamless dialogue between challenges and information/story cards; even if story immersion is not the main goal, it helps when questions, locations and stories are integrated and actually helping the player to improve his or her knowledge about the place. Such crafting, in the current systems, is undervalued, at least when it comes to know the authors behind them.

Even when restricted to simple direct answers, or because of that, challenges demand a lot of creativity, ranging from noticing details in statues and facades to more deep trivia knowledge about the city history. It is also worth noting that said facades and statues might be altered or obstructed due

to restoration, construction works, or other events that are part of the daily life of the city (Questo, for instance, has an in-game option for the player to signal this kind of obstacle to the system managers).

It is possible to say that AI chatbots might assume a very important role in the near future of the field, from helping adjust the level of the difficulty and the language appropriate to specific audiences to perhaps developing variations of challenges for better replayability.

In this study, we examined a selection of LBGs to understand how they depict urban cultural heritage. Playing some of these games also helped us perceive their role in fostering care and engagement with the urban environment and its lore, and developing a general attitude of attention to the city's heritage. Future studies might also explore the creation in different systems and how each interface affordability affects game development.

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References

Aarseth, E. J. (1997). Cybertext. The Johns Hopkins University Press.

Avouris, N., &Yiannoutsou, N. (2012). A Review of Mobile Location-based Games for Learning across Physical and Virtual Spaces. JUCS - Journal of Universal Computer Science, 18(15), Artigo 15. https://doi.org/10.3217/jucs-018-15-2120

Bogost, I. (2007). Persuasive Games: The Expressive Power of Videogames. The MIT Press.

Huizinga, J. (2007). Homo ludens: O jogo como elemento da cultura (5oed). Perspectiva.

Jacob, J. T. P. N., & Coelho, A. F. (2011). Issues in the Development of Location-Based Games. International Journal of Computer Games Technology, 2011(1), 495437. https://doi.org/10.1155/2011/495437

Kiefer, P., Matyas, S., & Schlieder, C. (2006). Systematically Exploring the Design Space of Location- based Games. Pervasive 2006 Workshop Proceedings, 183–190.

Lehmann, L. A. (2012). Location-based Mobile Games: State of the art and future challenges for developing location-based games for mobile devices. TU Berlim. https://www.grin.com/document/187510

Lemos, A. (2010). Jogos móveis locativos: Cibercultura, espaço urbano e mídia locativa. Revista USP, 86, 54–65. https://doi.org/10.11606/issn.2316-9036.v0i86p54-65

Malpas, J. (2006). Cultural Heritage In The Age Of New Media. Em T. Kvan & Y. Kalay (Orgs.), New Heritage: Beyond verisimilitude (p. 167–181). Faculty of Architecture - Univ. of Hong Kong.

Meliande, M. C. P., & Paraizo, R. (2023). The remains of Morro do Castelo: Locative gaming and digital heritage in Rio de Janeiro. *Blucher Design Proceedings*, *11*(2), 883–894. https://doi.org/10.5151/sigradi2022-sigradi2022_121