BRENDA Digital Tours: Designing a Gamified Augmented Reality Application to Encourage Gastronomy Tourism and Local Food Exploration

Ioannis Deliyannis, Sofia Maria Poulimenou, Polyxeni Kaimara, and Stamatella Laboura

Abstract

Local food is an essential component of the appeal of a destination for those who wish to experience culinary traditions and gain deep and authentic sense of a place. Within this context, the "BRENDA: Digital Tours" research project features the development of an urban game that focuses on the gastronomic and historical exploration of the Prefecture of Kilkis in Greece. It consists of a gaming environment that supports transmedia storytelling implemented via a fully-featured scenario that enables both virtual and actual exploration, augmented reality gaming, learning of local culture, recipes, and actual food tasting in connection with real-life businesses. This serious game is designed in an adaptive and expandable manner enabling scalable deployment while the end-user is presented with both a desktop-based and portable gaming experience. Each point of interest featured consists of multimedia content and linked gaming components including quizzes and augmented-reality missions. Their completion earns players virtual coins that can be used to purchase cooking ingredients which can be used to unlock and reveal local recipes, while they advance in the classes of the game. Completion of a recipe reveals the full recipe while it offers players the choice to visit a partnered local business and taste the recipe in situ, obtaining extra gaming points.

Keywords

Gastronomy tourism • Mobile augmented reality • Gamification design and implementation • Games • Learning • Cultural exploration

1 Introduction

Food and wine are expressions of local culture as well as part of the tangible and intangible heritage of a place (Garibaldi, 2020). There have been several attempts to define gastronomy/culinary tourism, such as the participation of tourists in activities related to food production or food consumption during their trip (Hall et al., 2004), travelling exploration in order to enjoy a destination's cuisine and gain memorable experiences (Wolf, 2006) or the experience of other cultures through food (Long, 2004). According to the World Food Travel Association, "Food Tourism, is the act of travelling for a taste of place in order to get a sense of place" (2020). All the above clearly indicate that seeking new experiences and local food exploration can be linked. In addition, visitors with culinary interests are credibly driven by the need to continually broaden their gastronomy knowledge and/or to experience different taste sensations (Kivela & Crotts, 2006). During travelling, an ordinary activity such as eating may be considered memorable or even categorised as an event, due to the memorable status of the setting or taste (Stone et al., 2018). Food tourism does not only relate to visitors' experiences on a site but also to post-travel impressions, such as satisfaction, return visitation, likelihood to recommend, and future behaviour (Stone et al., 2019). Over the last decade, policy-makers and scholars have given extreme thought on the role of food and gastronomy on local economic development (Cavicchi & Stancova, 2016). Food tourism also offers communities a manner to generate or increase income, creates new job opportunities and encourages the leads to indirect economic

I. Deliyannis (✉) · P. Kaimara · S. Laboura
Department of Audio and Visual Arts, Ionian University, Corfu, Greece
e-mail: yiannis@ionio.gr

S. M. Poulimenou
Department of Archives, Library Science and Museology, Ionian University, Corfu, Greece

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impacts and connects with other sectors of the local economy (Forleo & Benedetto, 2020). Traditional gastronomy as part of a destination's economic sectors has a constant need to innovate with products and techniques (Galvez et al., 2017). The enriching of the gastronomic experience in a destination may be used as a fundamental strategy which, in many cases, emplaces the destination in the tourist's mind.

It is also important to consider that the creation of personalized touristic experiences that are highly impacted by local gastronomy is expected to use any kind of current and future emerging technologies. The three main characteristics of these technologies are "connectivity", "data" and "smartness" enabling the interaction between devices, objects, persons and environment (Sigala, 2018). The research project "BRENDA: Digital Tours" encapsulates within its design the above three characteristics. The main organisational structure of its implementation lies heavily on transmedia content that directs the action via the gamification process designed specifically for this urban game. **The gamification experience combines elements that are normally difficult to combine within a single experience, guiding players to points of interest and reusing their connected stories to support the overall experience, discovering hidden elements via narration, exploring cultural culinary information, enabling food tasting and local business engagement. This combination creates integrated narratives presented with multimedia content and captures tourists' presence across the project's different experience stages, offering important information to local stakeholders about visitor's choices and behaviors.** Ultimately, we demonstrate how the framework employed for this case study can be re-applied to new areas of interest via minimal adaptation.

2 BRENDA: Digital Tours—About the Project

The case study of "BRENDA: Digital Tours" utilizes mini-games, AR technologies and gamification processes as its functional components, encouraging travellers to navigate and discover hidden treasures. Through gaming activities, travellers and locals as well involve in mnemonic paths to result in effortless and steady learning outcomes about Kilkis in northern Greece, an area rich in history and culinary tradition. It provides an immersive medium that engages the player to become part of the story, participate in and live the "myth". The transmedia story designed focuses on the gators of the local gastronomy in that remote area of Northern Greece. It is important at this point to indicate how the individual gaming elements and gamification process are linked together using transmedia. For this to be implemented throughout the game, we developed a backstory that enables the player to be immersed.

The backstory: Brenda, the main game character, is a 22 years old American girl that comes originally from Greece. Her grandparents immigrated to the USA in 1960. At the beginning of the game, Brenda introduces herself and her family story, explaining that she had a special love for cooking from a very young age, an inclination that she owes to her grandma Sultana, who was born and lived in Kilkis. Her grandmother was an excellent cooker and always made sure to cultivate the family's love and interest in their history through her narrations and the traditional dishes that she cooked for them with care and secrecy. Until the age of 16, Brenda could not understand why her grandmother preferred to cook alone in the kitchen and why she didn't reveal her recipes to anyone and why no one, no matter how hard she tried, could get close to the success of her creations, the delicious delight, the smell and the emotion she evoked from the most complex to the simplest dish. For the first time, on her 16th birthday, the grandmother called her for assistance in the kitchen and offered her the old leather cookbook as a gift, with an inscription on the book "Taste is memory". This book is supposed to be the key to the game as it includes a number of traditional recipes from all over Greece with magic abilities and whoever tastes these recipes at the place of origin, virtually travels to this place and to the memories of people that have actually lived there. The story behind this book is that there is long and secret Guild of Cooks from different parts of Greece called "Guardians of Memory". This Guild aims to keep alive the culinary traditions and the memory of the taste of Greece over the years. Even the greatest talent in cooking was not enough for someone to become Guardian of Memory. In order to understand a place's cuisine, it is essential to know and feel the place's history and culture. Thus, the revelation of the cookbook secrets would only succeed to the one that had special knowledge of their origins; culture, otherwise they could not initiate its magic.

The call to action between Brenda and each player is to transform the player into a member of the Guild. The player is handed over the "Magic Cookbook" by Brenda herself, who follows him/her in all the journeys, offering assistance and useful tips. The player's goal is to complete all the recipes after first gathering all their authentic ingredients and to do so they should explore the area and the given points of interest. A series of missions await the player in every point of interest and for every completed mission there is a reward in "coins of knowledge". These coins are the key to unlock all the recipes. Once players become engaged with the app, they are provided with a map view and a scenario that stimulates the player to either manually select and visit places (POIs) or complete digital tours that blend together culture, history and gastronomy. When players visit a POI and "complete" a cultural heritage route, gastronomical secrets are revealed in the form of complete recipes,

exploration trophies are gifted and virtual characters appear to surprise, challenge and even advance the knowledge of players. Local businesses become part of the game story by delivering AR experiences to visitors in food-related businesses by stimulating expedition, exploration and engagement to local cultural heritage. As part of the gastronomic exploration, the player is encouraged to taste the recipes or buy local products in one of the many restaurants and businesses that have partnered with the project.

The gamification process encourages players to participate in location-based gameplay based on the principle of scavenger hunts. Players search for hidden information and compete with other players in order to gain rewards and rank higher than their friends. This encourages the player to engage more increasing the interest of the player to complete more points while additional immersion between the user and the environment is provided by linking real points of interest and the virtual information via the use of AR gaming. Gameplay is either AR-based featuring missions where players win game coins by either physically visiting the location and identify using their mobile device the correct marker (building, sign, area, etc.) or by answering questions. Both those game-types link the game information to the narration offered at each point.

Clearly, the portability of this system on a mobile WEB/AR application combination provides a multisensory experience that makes storytelling time fun and exciting. The interest increases when users realise the system blends in a harmonious way cultural heritage information with local gastronomy in an interactive gamified manner that urges visitors, students, children and local people to actively take part in the story where game players are not observers or listeners of the story but participators. They actively take part in the story, which makes them gain a better understanding of the narrative. At the same time, animated game stories boost the imagination of children and all involved stakeholders (touristic visitors, habitats as well as local businesses) and instill in them a passion for local gastronomy as well as cultural heritage.

3 Existing Theory Bases on Virtual Experiences and Digital Tours

Living in the digital age, it is challenging to take advantage of the technology that can leverage hi-tech gadgets, such as smartphones and tablets, towards next-level storytelling, under the goal of enhancing the touristic attractiveness of a geographical region and boosting the educational value of local cultural heritage. Studies have shown that animated stories along with gamification techniques can stimulate the attention of tourists and children as well as enhance engagement to local and regional cultural heritage (Holloway-Attaway & Vipsjö, 2020; De Ascaniis et al., 2018; Mortara et al., 2014; Liarokapis et al., 2017). This is where augmented reality kicks in making storytelling interactive, linking location-based information with the virtual story. Gamification, in general, enhances tourists' satisfaction, with easy and fun access to additional services at the destination, such as customised products, better handling of their time during sight-seeing and virtual interaction with other tourists (Negruşa et al., 2015).

Tourists' interest in tasting local food while travelling includes several motivational and emotional dimensions. In 2012 Kim and Eves presented a motivational scale for tourists that wish to taste local food and beverages and with the aim to assist marketing communications towards this direction (Kim & Eves, 2012). Those motivational dimensions are the above: cultural experience, excitement, interpersonal relation, sensory appeal and health concern (Fig. 1). 'Cultural experience' is mostly associated with the tourists' desire to experience different cultures and the experience of new foods and dishes means experiencing new cultures (Testa et al., 2019). The destination foodscape in travelling is dynamic and food-related, involved with local everyday life and constantly "outside" the tourist-staged environment by a varying set of actors (Björk & Kauppinen-Räisänen, 2019).

The research project "BRENDA: Digital Tours" is about the development of interactive augmented stories for exploring a typically remote and isolated area in Northern Greece by exploiting the forefront of the immersive technological revolution. The general aim of the project is to deliver an interactive and immersive storytelling platform that can provide exposure of the area's touristic and gastronomic potential and can stimulate touristic attractiveness and enhance engagement from both visitors and locals.

4 Designing a Gaming/Gamification Environment That Supports Transmedia Storytelling

The concept of "transmedia" refers to a set of narrative and non-narrative elements that are systematically flowed across multiple platforms (Herr-Stephenson et al., 2013; Jenkins et al., 2009). Telling a story about a specific topic can be conducted by combining different types of media such as images, text, audio, video and music (Robin & McNeil, 2012). This process formulates the notion of transmedia storytelling. A term that is also commonly used in the literature is "cross-media". Although the two terms are used in a quite similar manner, and sometimes are interchangeable, their actual difference is that in cross-media approach, information is presented in many forms while transmedia allows the user to expand or even to change the content

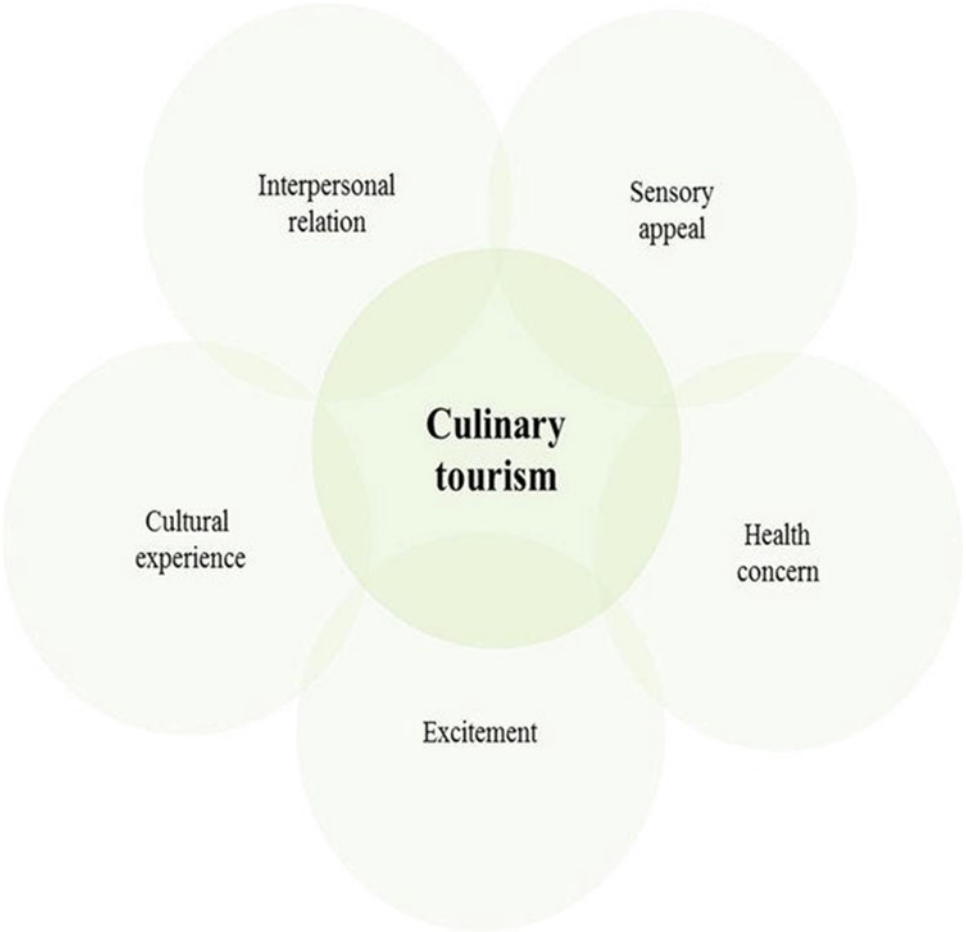


Fig. 1 The five motivational factors of Kim and Eves' motivational scale (Testa et al., 2019)

(Fiorelli, 2013). This feature can be harnessed by cutting-edge technology and smart devices, transforming the users to content creators and active constructors of their knowledge and their transformation to "prosumers", that are at the same time producers and consumers (Kaimara et al., 2020). Transmedia storytelling engages users through personal emotional involvement based on brain mnemonic system which means that users remember information more easily when presented in the form of a story (Raybourn, 2012). Simultaneously, story, as a method of representation, is a key structural element of games, which are the oldest way of human interaction (Prensky, 2001; Salen & Zimmerman, 2004).

Nowadays, there are many types of games using immersive technologies that encompass physical and virtual worlds, such as virtual reality (VR), augmented reality (AR) and mixed reality (MR). VR is a computer technology that uses realistic images, sounds and other sensory experiences, created with specific software in order to mimic a real or imaginary environment and to simulate the user's physical presence. AR as a variation of virtual reality that allows users to see the real world with virtual objects superimposed upon or composited with the real world and therefore AR could be supplement reality, rather than completely replacing it (Azuma, 1997). AR is a 3D interactive mobile technology based on computer-generated content, including detailed information about locations, events, or activities from the real world by combining images, sounds, texts, videos and animation through the fusion of 3D virtual objects into a 3D real environment in real-time (Kidd & Crompton, 2016). Typical examples of AR applications are found in museums and archaeological sites where travellers, especially when visiting for the first time, visitors may not be able to understand in advance that they will be involved in an "incidental learning" process (Deliyannis & Papadopoulou, 2017; Deliyannis & Papaioannou, 2014, 2015; Poulimenou et al., 2018a, 2018b). AR content provides interaction, permits users to explore the world through their success and mistakes and supports game-like activities. It is obvious that the whole process of using AR applications resembles a game.

Recognising the dynamics of transmedia storytelling and digital games, the "BRENDA: Digital Tours" system was designed on the basis of gamification to leverage the gaming

experience as well as players ability to supply content. Gamification is the use of game elements, game design, gameplay and mechanics in a non-game environment. Gamifying an activity furnishes motivation and increases people's interest in getting involved (Kaimara & Deliyannis, 2019). Gamification is the usage of game elements, game design, gameplay and mechanics in a non-game environment. such as business, education and social impact challenges (Deliyannis & Kaimara, 2019; Deterding et al., 2011). Gamification should not be confused with gaming, i.e. the process of playing by employing rules, score and achievements. Prensky (2001) concluded that on the one hand, games are fun and on the other utilize six key structural elements: (1) Rules, (2) Goals and Objectives, (3) Outcomes & Feedback, (4) Conflict/Competition/Challenge/Opposition, (5) Interaction, and (6) Representation or Story.

Rules: define the game as an organized activity.
Goals and objectives: the goal is defined first of all and the achievement of the goals is related to the motivations that push the player/student to play.
Outcome and feedback: ensure the measurement of progress in the game in relation to the goals, allow immediate knowledge if an action is positive or negative for the player/student.
Conflict and competition: are the problems that the player/student tries to face and solve, it does not have to be related to an opponent, but it can be a puzzle, the player himself in relation to the goals he sets or the time.
Interaction: refers to the interaction with the computer and its technical characteristics, but also to the social character of players, a parameter of which is collaborative learning.
Representation or story: refers to the narrative part of the game related to the theme, characters, environment and plot that can come from both the real and the imaginary world.

In addition to structural elements of games, an important feature of games is the "gameplay", that is, the way in which the game is played, and the "game mechanics" which are the tools with which the player must interact to perform game activities. Game mechanics refer to achievements, avoidance, countdown, rewards program, variable rewards programs, virtual objects, disincentives, up-to-date information, etc. (Fabricatore, 1990). These features are essential in order to maintain and enhance the motivation of players. It is obvious that even if games share the same structural elements and concept under the transmedia context, the gameplay and the game mechanics could be different.

5 Gamification Methodology and Gaming Features

The BRENDA application may be characterized as a serious game with the main goal to offer guided access to historical and cultural information, mainly related to local gastronomy. The application has been designed for the area of Kilkis in northern Greece which as a destination with high tourism seasonality. Despite the low tourism stream, Kilis is an area with a very interesting cultural local history and natural beauty. The purpose of the "BRENDA" creation had been the enhancement of the local cultural and natural heritage with the use of gamification features that may attract visitors who would not normally explore the area in a detailed manner.

The script of "BRENDA: Digital Tours" game focuses on the importance of local gastronomy as an integral part of the cultural heritage of a place and aims to highlight the relationship between taste and memory as well as the historical and cultural identity of a place. The player's progress in the game evolves into two main pivots: historical expedition and culinary exploration.

Each point of historical interest includes a series of game actions, which can include two types of missions:

WEB missions that can be completed remotely directly through the web application. These missions are in the form of quizzes and their purpose is to motivate the player to study the information provided for each point of interest in order to find the correct answer (or answers) to the questions. Augmented Reality (AR) missions, which require the physical presence of the user in a point of interest and can only be completed through the use of the AR application. AR missions enrich the gaming experience by encouraging users to physically visit a point of interest, offering in that way the maximum possible score to be achieved.

The application's main target groups are tourists and visitors but it is also available to anyone who wishes to explore and get familiar with the area of Kilkis. Therefore, possible users may also include newly adjusted residents who wish to learn more about the area (e.g. students, teachers, military servants, etc.), people searching for their future travel destination, local residents or ex-pats who wish to enrich their knowledge on the area, journalists, researchers, but also people with a special interest in culinary information and traditional cooking. The application environment is designed to be accessible and easy to use for people of a large age range, it can also be an ideal tool for a

cultural exploration of the place by school teachers and students, both in an educational context and in their free time. The system is multilingual and 4 languages are supported: English, Greek, German and Russian.

The players are presented with the introductory scenario and participate in the game as helpers of the central character, Brenda. Her character has a narrative, supportive, inspiring and informative role: She tells her story to players and presents them with the purpose and missions. She introduces players to the game process through a tutorial and gives them a long feedback on the results of their actions and their progress in the game. Players can visit various points independently and non-linearly and select and complete the missions that include each point in any order and at their own time. In order to create a larger stream of visitors to remote or inaccessible places, specific thematic routes (subsets of POIs) have also been created, the completion of which offers further rewards players. The completion of a route offers additional credit to users, which is made available when players complete all of the web missions, have gathered all the reward points for this collection of points and have answered the questions.

Figures 2, 3 and 4 display a mockup of the interface that the mobile users experience when using the game. The central image (Fig. 3, center) employs a map-based interface where game points can be selected followed by their short description. Toggling the view to the list selection (Fig. 2, left) displays the list of points available at the proximity while the point details are displayed (Fig. 4, right) when this is actioned through the menu.

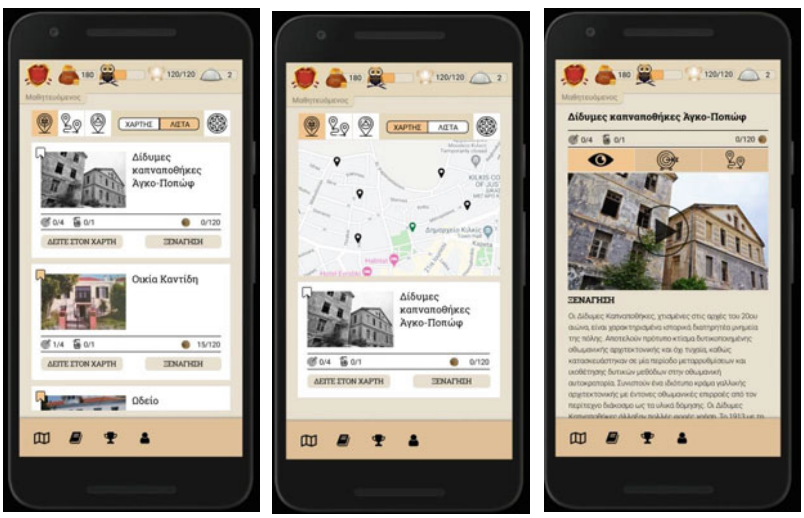
As the gamification process links the points of interest with recipes, it is informative to view how this is displayed throughout the system. Figure 5 presents the cookbook complete with full categorisation (Fig. 5, left), a selection menu allowing users to sample points according to their interests and pre-determined routes (Fig. 6, center) and finally, the quiz menu for each point where questions based on the narration are answered earning virtual coins that the player can use to complete recipes (Fig. 7, right).

The gaming overview of the application is described below: the user selects the point of interest through the map or the list of available options. All points can be independently viewed but some are also part of a route, allowing extra coins to be credited with its completion. Selecting or visiting a point triggers the video to be displayed which provides historical information. This information is used within the quiz game and provides useful information and hints about the questions that when answered credit the virtual coins. The coins are used to purchase virtual ingredients within the cookbook, complete and reveal recipes. When a recipe is revealed it is fully accessible and users are informed about all the available restaurants and businesses that they can purchase and sample it. The content of Figs. 1 and 2 are credited to Angeliki Vaxali.

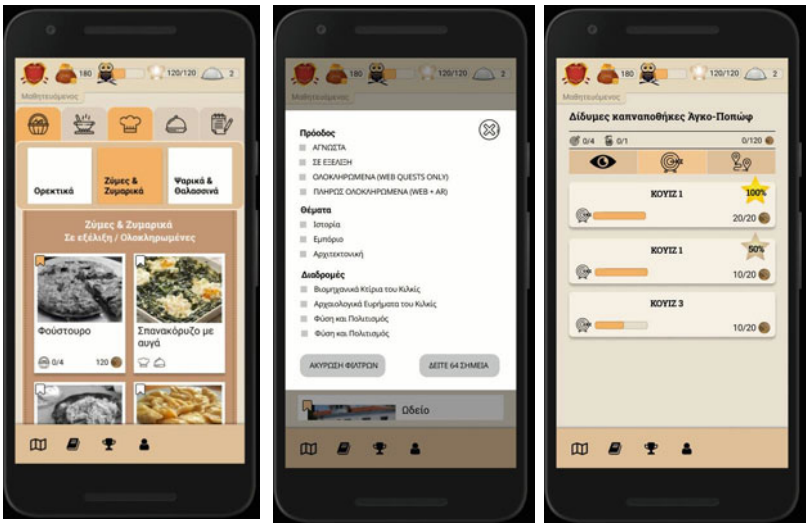
6 Result and Discussion

Following we present and describe the use case scenarios of the project operational and functional usability. The description of the use case scenario may assist in the identification of the main goals, the assessment and evaluation of the project feasibility. The use case scenarios are examined regarding the above user group: Tourists, Chefs and Food Tasters.

Use case scenarios for tourists: The main goal of this user group is to participate in an enjoyable tourism experience, with customized choices and the ability to propose and promote their own interests and preferences, creating a personalized portfolio. The functionality of these scenarios consists of:



Figs. 2, 3 and 4 The user interface displaying a list of points (left), point selection using the map interface (centre) and single-point information (right)



Figs. 5, 6 and 7 Overview of the cookbook menu (left), the point selection criteria menu (centre) and the quiz completion menu (right)

Thematic paths: a. Routes indicated—proposed by the administrator, which are either directly displayed or after applying specific filters, b. Routes indicated—proposed by other visitors/users of the application, c. New routes (customized), which are uploaded by a user of the application and approved by the administrator. Those routes should be accompanied by audio-visual content and tagging of specific products, recipes or POIs that are included in the way, d. Presentation of routes created by a user, a visitor, a guide or a historian.
Data collected during the use of the system: a. Number of routes that have been followed, when they have been followed and for how many times, b. Wish list/"to do" routes (calendar)
Preferences—reviews: a. Likes b. Favourites c. Shared d. Rating e. Following f. Followed by g. Questions—comments

The key feature of this module of the application is that users operate in a "social" environment, they have "friends", they can see the comments and updates of other "friends", interact with them and they can be followed or follow other users. When registering to the application, the basic information required to keep the user's profile fully updated and to allow "suggestions" for specific thematic paths and local products are as follows: Age—Resident of Kilkis/not—Resident of Greece/from abroad—Gender—Family status—Special disabilities—Means of transportation used—Preference options—Calendar—Seasonality—Cost range—Degree of difficulty—Learning possibilities—Gaming features—Privileges—rewards.

Use scenarios for "Chefs" and food tasters: The main goal of this user group is to present and "upload" recipes based on Kilkis' local products and to enable the user to monitor "Links" between routes and local materials for traditional recipes. The use case scenarios concerning functionality for gastronomy "chefs" and available to the user-tourist are listed below:

Gastronomy recipes: a. Recipes related to the cultural heritage of Kilkis, b. Recipes uploaded by other users, c. Creation of recipe and content and submission for acceptance on the platform, c. History of recipes read and "created" by a specific user, e. Search of recipes according to criteria.
Data collected during the use of the system: a. Number of recipes that have been "Followed", when and how many times, b. Wishlist/"to do" recipes (calendar)
Preferences—reviews: a. Likes, b. Favourites, c. Shared, d. Rating, e. Following, f. Followed by, g. Questions—comments.

The gaming/gamification process and storyline can be applied to other geographical areas or cases with minimal adaptation. The storyline has been designed so that the story can be extended, adjusted and include new characters that could introduce visitors to nearby areas of interest, to specific points of interest (e.g. a local museum) or specific tourist typologies. The gamification methodology can also be applied to different areas of interest creating job opportunities and start-ups for game entrepreneurs.

7 Conclusions

This paper presented the design of the functionality and the expandability of an urban gaming/gamification system designed to promote gastronomy and cultural tourism with the use of transmedia content. The creation of "BRENDA: Digital Tours" application and the implementation of the

overall project have evolved as an exemplar environment for multisensory visitor involvement in the field of experiential tourism. As gaming enhances tourists' interest in a destination and the co-creation of a personalised experience (Xu et al., 2016), this gaming-enabled system directs real-time visitor engagement with local culture as it is essential to visit a point of interest in order to gain the highest score and win the maximum earning points. In this manner, cultural sightseeing is enhanced while at the same time a fun virtual experience offers knowledge on local gastronomy and an incentive to visit local producers and service providers such as restaurants and shops. Furthermore, the end-system presents information and multimedia content to visitors in a scalable manner: points of interest and local food recipes that are normally not easily accessible on the web, are gradually revealed, thus adding extra value to the visiting experience. Interaction between visitors-players and the main game character, transform the seek for local gastronomy into an authentic experience while at the same time the main objects of the experience (recipes) generate personalized meanings for the visitor, connection to his/her values and creation of his/her own version of the experience, producing emotionally engaging layers to cultural tourism sites (Han et al., 2018).

The system implementation allows the collection of important data both of the user/player and the tourism site as well, such as preferable POIs, number of POIs explored, number of partnered local businesses visited, etc. This allows both game managers and businesses to customize their services according to visitors' preferences and commit to a more sustainable and responsible tourism manner. The interactive nature of the system allows it to be used in different ways and depth by different user categories while the information provided can be freely and directly accessed via the user interface. The use of new aspects into products and tourism services market enforces new economic objectives with positive social impact (da Silva Souzaa et al., 2017). In terms of destination management, the implementation of the project assists local stakeholders to understand the use of the integrated game design in the field of experiential tourism.

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