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Design Criteria for Pervasive Games in Historical Sites

Ahmed Hassan Emara[1], Adham M. Hany Abulnour[1], Mohammed Moustafa Ayoub[1]

[1]*Architectural Engineering and Environmental Design Department, Arab Academy for Science and Technology and Maritime Transport*

Abstract

Video games can be considered a strong asset in the tourism industry. It is a form of media that allows for interactive experiences. It also allows the virtual reconstruction of historical sites and cities that are difficult or impossible to reconstruct physically, thus, introducing historical sites to a new generation. Pervasive gaming (playing on site) can help augment the tourist's experience by using 21st-century technologies, such as augmented reality, to reconstruct the site virtually and to let the player experience the history of the sites in a more engaging way. This paper aims to provide stakeholders (decision makers, preservation professionals, and game designers) with a guide on how to start the development process of a pervasive game in historical sites for the purpose of promoting the Egyptian architectural heritage to the next generation according to their understanding capacity and expectations. This paper presents pervasive gaming as a platform for the virtual restoration of historical monuments as well as the revival of the intangible aspects of these sites, particularly the historical stories associated with them.

Keywords

Gamfication; Interactive storytelling; Augmented reality; Pervasive gaming; Location based games

1. Introduction

The preservation of historical sites In Egypt faces some issues, on the physical preservation front there are issues like inaccessibility, lack of funding, infeasibility, and so on. Attempt to preserve the historical sites by means of 3d scanning and photogrammetry leaves the issue of how to present these data to the public in a proper way largely unresolved, resulting in a large amount of raw data waiting to be presented to the public. On the other hand, the declining public concern for historical building and the feeling of alienation from the building and the individuals who erected it, and ignorance of the historic value of the monuments, led to a feeling of disinterest which resulted into actions like littering and vandalism. (Moustafa, 2011)Thus it is important to revive the history of historic places through innovative means. In the last decades, there has been a trend towards the active participation of people visiting historical locations. This trend has been partially sustained by a discernible shift from historical monument to heritage product that has resulted in encouraging the visitors request for more involvement. (Malcolm-Davies, 2004). Gamification can be the answer for the providing of such involvement. While the designing a game is a creative process and can be subject to intuition and creativity, it's important for the historical sites to be gamified in a way consistent with their physical and historical attributes. This is considered a common ground for the stakeholders to start the gamification process.

The methodology of this research comprises of the following:

-Analyzing the most successful pervasive games in the market and breaking down their game mechanics from their

game description and gameplay using the MDA framework.
-Reviewing the physical and historical attributes of the historical sites and assign proper game mechanics to each attribute.
-Testing the results against the analyzed games to verify.

2. Background

The use of games in the tourism industry is increasingly establishing itself as a futuristic way for marketing touristic attractions. Tourism is an industry that is based on creating personalized experiences and services, new technologies such as social media, smartphones, and gaming provide technological tools for developing such experiences. (Buhalis, Weber, & Zhang, 2015) According to the World Travel Market Report (2011) gamification is a major trend for the future of tourism, which is expected to draw in visitors from all ages. The current use of games by the tourism industry can be categorized into two types:
-Promotion games (play off location) mainly used for brand awareness, to attract potential customers, and to build up a destination or a company image. Examples are Thailand's (Smile Land Game, 2012), Cape Town, South Africa (The Real Time Report, 2012), Ireland (Tourism Ireland, 2011), and Nanjing, China (People, 2013). These games were developed by destination management organizations (DMOs) for destination marketing purposes. Many airlines like KLM, British Airways, and Virgin Atlantic have also developed games to advertise their brand to consumers.
-Pervasive games (play on location) are mainly used for more on-site engagement, to enhance tourists on- site experiences at the destination in entertaining and informative way. Most of the existing tourism destination games are based on the game mechanics of the classic treasure hunt. For example, REXplorer aims to make on-site tourists to explore and enjoy the history of the United Nations Educational, Scientific and Cultural Organization (UNESCO) world heritage city of Regensburg, Germany. Pervasive games are a type of games that mixes the virtual game world with the physical world, this type of games advances through gameplay by tracking the player's location (normally via mobile GPS) and guides him to the game's goals and objectives. Popular examples of these games are Ingress and Pokémon Go.
The popularity of pervasive games has increased thanks to games like Pokémon GO. These games are playful activities where location matters and where collaboration or competition between the players is an important trait. They are played in specific locations using networked mobile devices and result in the merging of digital and physical space. In these games learning about the physical and urban spaces is established on a new grounds and the interaction with the context of the surroundings is enriched and supported by the following characteristics: mobility, location awareness, interaction between the players and various ways of interaction with real-world objects. These characteristics render mobile games useful for situating playful learning activities in real contexts and as such they have been used in recent years to situate play in the relevant physical environment, employing this new relationship to space to support social, experiential and situated learning. The underlying idea is that with these games the players associate information with physical activities in the real world, experiencing immersion in a physical and social space, augmented with digital media. Learning through location-based mobile games needs not to be an explicit goal.
Pervasive games usually have some associated learning objectives, so questions are raised about how to design these games and how to achieve the learning objectives. Many location based city games have been inspired by traditional board or party games. However translation from physical to digital is not straightforward, especially when learning is involved. Characteristics such as story-telling, role playing and game play strategies need to be employed. Various design support tools have been proposed that provide an orientation to designers

3. Classification of Pervasive Games

For the purposes of this study, a classification by activity (gameplay) type will be made. This is by analyzing the games available in the market in the time of this study:

Treasure hunt (Search and find): The player has to find a virtual or physical object in a certain geographical location. Finding the location can involve searching roughly the given location. However, the player can also be guided to the place by the game using a navigation system provided by the game. The concept behind the Search-and-Find games is that the player has to reach a destination. This destination is always a fixed point in the game world that does not change. If no specific location is given, the player has then to choose from a range of locations which are fixed.

Territory defense and claiming: In this type of games, players find a certain location which might contain a certain object and aid each other in claiming said location, while the opposing team(s) tries to do the same. This requires the coordination of timing and movement between players. If more players are present at the location capturing it is done faster. The players are also required to defend said territories from other teams.

Scavenger Hunt: A scavenger hunt game is a party game where the organizers make a list of specific items and/or objectives which the participants aim to collect or complete. Participants may be individuals and/or small teams. The goal is to be the first to complete the list or to complete the most items on the list. Players can take photographs of listed items as proof or be challenged to complete the tasks on the list in the most creative manner. A scavenger hunt differs from a treasure hunt game, in that the latter involves the collection of one or several items in sequence, while a scavenger hunt primarily collects items in random order. This type of games is created and moderated by the users of the game.

Role playing game (RPG): Players impersonate or take control of digital characters in a literary setting. Players act out the of these characters roles within a narrative, either through linear story or through a process of branching storylines and/or character evolution. Actions taken in-game succeed or fail according to a system of rules and guidelines.

There are several types of RPG. A tabletop RPG is carried out through discussion, live action role-playing game is carried out by players physically performing their characters actions. In both types, an arranger called a game master (GM) decides on the rules and setting to be used, acting as moderator, while each player plays the role of a single character.

Narrative in RPGs are usually branching, allowing for freedom of movement and exploration and gives a more real life feel to the game.

4. The MDA Framework

The difference between video games and other entertainment products (such as books, music, movies, etc. . .) is that their consumption is relatively unpredictable (Hunicke, LeBlanc, & Zubek , 2004). The events that happen during gameplay and the outcome of those events are difficult to predict at the time the product is finished. The MDA framework breaks games into their components:

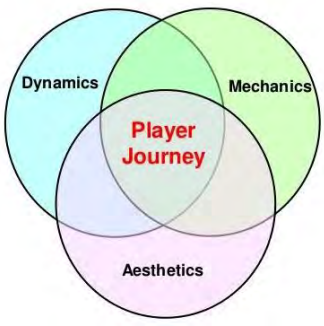

Figure 1. The MDA Framework

1. **Mechanics:** are the rules of the game. These rules define how the game is carried out, what actions the players can take, the victory conditions, the mechanisms for enforcing the rules, etc.
2. **Dynamics:** Describe how the rules are carried out over time, responding to player input and working along other rules. In programming terms, the "run-time" behavior of the game.
3. **Aesthetics:** describe the player's experience of the game; their enjoyment, frustration, discovery, fellowship, etc. In other terms, the factors that makes the game enjoyable. There are eight type of Aesthetics, including but is not limited to:

Sensation (Game as sense-pleasure): Player experiencing something completely unfamiliar.

Fantasy (Game as make-believe): Player experiencing Imaginary worlds.

Narrative (Game as drama): A story that drives and guides the player.

Challenge (Game as obstacle course): Creating a challenge or series of challenges that can be mastered. Contributes to the game's replayability.

Fellowship (Game as social framework): Creating a community where the player is a part of. Dominant in multiplayer games.

Discovery (Game as uncharted territory): Encourages players to explore and discover the game world.

Expression (Game as self-discovery): Encourages players to be creative. For example, creating avatars, customizing scenery, etc...

Submission (Game as pastime): Connection to the game, as a whole, despite constraints.

5. Determining the Most Successful Pervasive Games for Breaking Down Using the MDA Framework

By extracting the statistics of pervasive games currently in the market, the most dominant games can be identified. The selection criteria is as following

1. The study will focus on android users as they are the most common platform in Egypt (39.86% android users VS 5.49% IOS users by August 2017) (Stat Counter Global stats, 2017)
2. The study will list games with rating of 3.0 and above according to Google play store as game below that rating is considered unsuccessful and unapproved by its user's base.
3. The study will omit clones (games using the exact same gameplay) and will list game with more variations.

Table 1. List of pervasive games on Google playstore

No#	Game	Type	Downloads	Rating (Google Playstore)
1	Pokémon GO	Treasure Hunt	100-500 M	4.1
2	Ingress	Territory defense	10-50 M	4.3
3	Landlord Real Estate Tycoon	RPG	1-5 M	4.4
4	Zombies, Run	RPG	1-5 M	4.3
5	Geocaching	Treasure Hunt	1-5 M	4.0
6	SpecTrek Light	Treasure Hunt	100-500 K	4.1

Continued on next page

Table 1 continued

No#	Game	Type	Downloads	Rating (Google Playstore)
7	Resources - GPS MMO Game	Treasure Hunt	100-500 K	4.1
8	GooseChase	Scavenger Hunt	100-500 K	3.5
9	Turf Wars – Location Based Mafia	Territory defense	50-100 K	3.6
10	Munzee - Scavenger Hunt	Scavenger Hunt	50-100 K	3.9
11	Geoglyph	Territory defense	1-5 K	3.4
12	Clue Hunt	Scavenger Hunt	1-5 K	4.1
13	Trail of Treasures	Treasure Hunt	500-1K	4.1
14	Cats GO: Offline	Treasure Hunt	1-5 M	3.8
15	Color Planet Resources, GPS MMO	RPG	1-5 K	4.3
16	Father.IO - Tactical Map	Territory defense	1-5 M	3.7
17	The Magic GO	RPG	100-500 K	3.5
18	FPS Invaders GO	RPG	1-5 K	4.1
19	Piste et Trésor	Treasure Hunt	10-50 K	3.9

5.1. Breaking Down the Games Using the MDA Framework

The **mechanics** of each game is determined by describing the various actions, behaviors and control mechanisms offered to the player in game. Along with the game's content (levels, assets and so on) the mechanics support overall gameplay dynamics. This step develops the game concept.

The **dynamics** of the game describes the players experience with the games and the actions that emerged during gameplay using the games mechanics.

The **aesthetics** of the games describe the feelings and experiences of the players during and after gameplay. A game can be comprised of several aesthetics from the eight defined aesthetics.

Since the game dynamics are a byproduct of the game mechanics and aesthetics, the study will focus on breaking down the mechanics and aesthetics as game dynamics cannot be designed directly and are influenced by changes in game mechanics and aesthetics

Table 2. Breakdown for treasure hunt games

		Pokémon GO	Geocaching	SpecTrek Light	Resources - GPS MMO Game	Trail of Treasures	Cats GO: Offline	Piste et Trésor
Mechanics	Single Player	X	X	X	X	X	X	X
	Multiplayer	X	X		X	X		
	Search	X	X	X	X	X	X	X
	Capture	X	X	X	X	X	X	X
	Evolve	X						

Continued on next page

Table 2 continued

	Resource manage-ment				X	X		
	eliminate	X			X			
	Auction or bidding					X		
Aesthetics	Sensation	X		X				
	Fantasy							
	Narrative	X				X		X
	Challenge							
	Fellowship	X	X		X	X		
	Discovery	X	X	X	X	X	X	X
	Expression							
	Submission	X	X	X	X	X	X	X

For treasure hunt games, they are mostly single player oriented, with multiplayer activities on the side. Their core mechanics are search and capture for virtual artifacts. They promote discovery and usually have little to no narrative behind the gameplay.

Table 3. Breakdown for Territory defense games

		Ingress	Turf Wars	Geoglyh	Father.IO
Mechanics	Single Player				
	Multiplayer	X	X	X	X
	Search	X	X	X	X
	Capture	X	X	X	X
	Defend	X	X	X	X
	Ranking				X
	Eliminate	X			X
Aesthetics	Sensation	X		X	
	Fantasy	X			X
	Narrative	X	X		
	Challenge	X	X	X	X
	Fellowship	X	X	X	X
	Discovery	X	X	X	X
	Expression	X	X		
	Submission	X			X

Territory defense games are multiplayer games usually divided in teams. They require players to coordinate among themselves for the best outcome thus leaving little time for individual actions. Territory defense games are about social interactions and focused game play.

Table 4. Breakdown for RPG games

		Landlord Real Estate Tycoon	Zombies' Run	ColorPlanet Resource	The Magic GO	FPS Invaders GO
Mechanics	Single Player	X	X	X	X	X
	Multiplayer			X	X	

Continued on next page

Table 4 continued

	Role Playing	X	X	X	X	X
	Search	X		X	X	X
	Capture	X	X	X	X	X
	Ranking				X	X
	Eliminate	X			X	X
	Auction or bidding	X		X		X
Aesthetics	Sensation	X		X	X	X
	Fantasy		X	X	X	X
	Narrative	X	X	X	X	X
	Challenge		X		X	X
	Fellowship	X	X		X	X
	Discovery	X	X	X	X	X
	Expression					
	Submission	X		X	X	X

RPG games are usually single player games; they are driven by a cohesive narrative that sometimes branches into multiple paths. They incorporate multiplayer activities which can serve as a diversion from the main game, individual appearance and customization is heavily featured in these games.

Table 5. Breakdown for scavenger hunt games

		GooseChase	Clue Hunt	Munzee
Mechanics	Single Player			
	Multiplayer	X	X	X
	Search	X	X	X
	Capture	X	X	X
	Time limit	X	X	X
	eliminate			
Aesthetics	Sensation			
	Fantasy			
	Narrative			
	Challenge	X	X	X
	Fellowship	X	X	X
	Discovery	X	X	X
	Expression			
	Submission	X	X	

Scavenger hunt is similar to treasure hunt games with some differences; they are focused on team play and have no narrative at all. They are about team coordination and cooperation.

6. Designing process for historical sites games

To design a pervasive game in a historical site, the site is broken down to their tangible (physical features) and intangible (narrative) components. In the case of Egyptian sites, they are required to be promoted as both architecture and historical narrative. To this end, the historical site will be classified as following:

1- Site classification by fragmentation and the rate of built- in area: The following types of area can be grouped if they do not consider the activities (Boz´any, 2007):

a. Single building.

b. Multiple buildings near each other (e.g. with a common garden),

c. Multiple buildings far from each other's (e.g. in different cities),

d. Building or buildings near to each other's with a surrounding outer area,

e. One or more outer area(s) with no buildings.

f. Multiple outer areas with buildings.

2- Site classification by history

a. Person: A person of importance to political, economic, social or cultural development and building has a role in his/her life.

b. Event: An event important to political, economic, social or cultural development and the building has a role in the event.

c. Theme: An important theme (e.g. the seal fishery) to political, economic, social and cultural development and the building(s) has a relationship to this theme.

3- Site classification by function

a. Military

b. Civilian

c. Religious

6.1. Criteria for assigning the suitable game mechanics

The study will create criteria to which the stakeholders can assign suitable game type to a selected historical site by analyzing its spatial properties and narrative nature.

6.1.1. The spatial requirements

The search and capture mechanics dominant in treasure hunt and scavenger hunt games requires the tokens to be placed within a minimum distance of 160 m apart from each other to allow for GPS markers error margin (Geocaching, 2016), this rule may not apply if using physical markers as the case of the scavenger hunt game Munzee, which uses QR codes to be scanned by players as the searchable tokens. The spatial requirements for territory defense games is much larger than treasure and scavenger hunt games due to the territories being planned to accommodate many players in the same spot at one time and having multiple territories to be the subject of the game. RPG games require large area to house multiple activities and minigames.

In terms of site complexity, territory defense games require the least amount of complexity as the game play requires rapid movement which can be hindered if a lot of objects are in the way of players, but complexity is perfect for search and find mechanics as they provide the opportunity to discover and explore at an easy pace. Therefore, the core mechanics of the games can be mapped to the first classification like this:

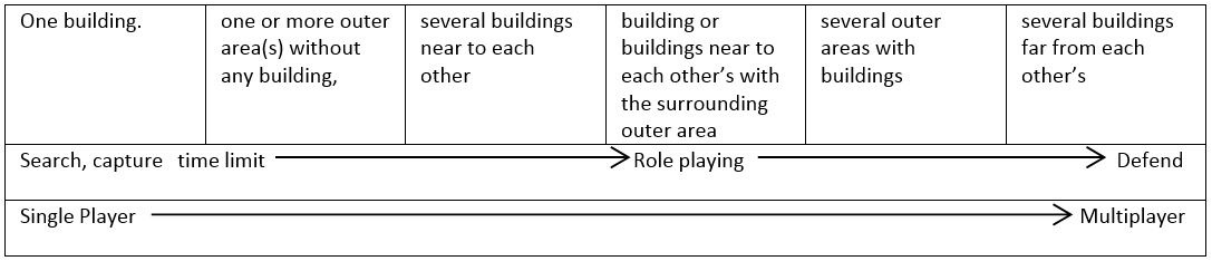

Figure 2. Mapping of game mechanics to site configurations

6.1.2. The narrative

Interactive storytelling in video games differs from traditional storytelling in books and movies that it can utilize branching storyline, which has one or more starts and multiple or open ended endings. To simplify the categorization of the narrative inside historical sites the research will focus only on the sequence of events and activities without looking at them chronologically or spatially (Azaryahu & Foote, 2008). So the narratives can be categorized as the following:

1. Linear narrative
2. Branching or complex narrative
3. Emergent narrative (story of the visitor)

Linear narratives, while can be told to groups, still experienced individually and social effect has little to no effect on the listener. On the far end, social interactions are essential for the formation of emergent stories.

This study argues that the simpler the narrative, the less social interactions are required. So narratives can be mapped to the eight items of game aesthetics like so:

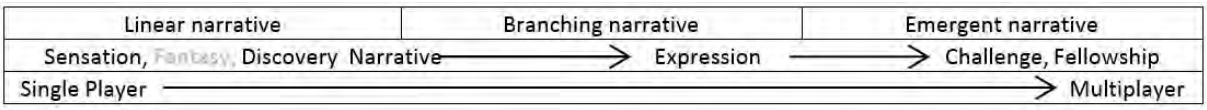

Figure 3. Mapping of game Aesthetics to site narrative

7. Application of game design criteria: The Karnak complex

7.1. Overview

The Karnak Temple Complex, consists of a combination of temples, chapels, pylons, and other structures. Construction of the complex began during the rule of Senusret I in the Middle Kingdom and continued into the Ptolemaic period, although most of the existing buildings date from the New Kingdom. The area around Karnak was the ancient Egyptian Ipet-isut ("The Most Selected of Places") and the main place of worship of the eighteenth dynasty Theban Triad with the god Amun as its head. It is part of the monumental city of Thebes. The Karnak complex gives its name to the nearby, and partly surrounded, modern village of El-Karnak, 2.5 kilometres (1.6 miles) north of Luxor.

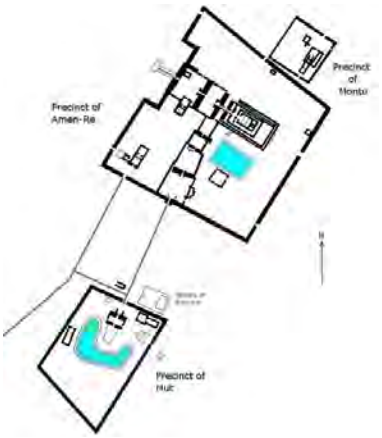

Figure 4. Map of Karnak, showing major temple complexes and sacred crescent lake of Mut

It consists of four main parts, largest part is the only one currently open to the public. The term "Karnak" is usually associated to the Precinct of Amun-Ra, because this is the part most visitors see. The three other parts, the Precinct

of Mut, the Precinct of Montu, and the dismantled Temple of Amenhotep IV, are closed to the public. There also are a few smaller temples and sanctuaries connecting the Precinct of Mut, the Precinct of Amun-Re, and the Luxor Temple.

7.2. Gamification proposal for the Karnak complex

Due to the precinct of Amun-Ra being the only part accessible to the public, the gamification process should take place in it. This part of the covers nearly 250, 000 m^2 and contains many structures and monuments. The main temple itself, Temple of Amun, covers roughly 61 acres. This puts this part of the complex at classification No# 4 of figure 5:

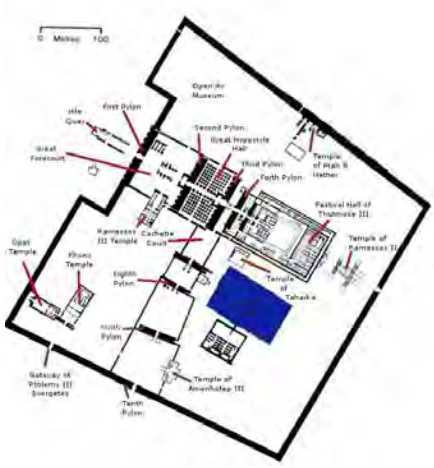

Figure 5. Map of Karnak, showing major temple complexes and sacred crescent lake of Mut

The History of the Karnack complex is a layered one, spanning from the middle kingdom to the late period. The figures featured in the temple consist of many deities and kings overlaid and intertwined with each other. This complex narrative gives the Karnack complex the 2nd designation in figure 2:

Table 6. Assigning game mechanics and aesthetics to the Karnak temple

		The karnak complex
Mechanics	Single Player	X
	Multiplayer	X
	Role Playing	X
	Search	X
	Capture	
	Ranking	
	eliminate	
	Auction or bidding	
Aesthetics	Sensation	Y
	Fantasy	
	Narrative	Y
	Challenge	
	Fellowship	
	Discovery	Y
	Expression	Y
	Submission	

Now comparing table 6 to table 4

		The karnak complex				Landlord Real Estate Tycoon	Zombies, Run	ColorPlanet Resources	The Magic GO	FPS Invaders GO
Mechanics	Single Player	X	⇨	Mechanics	Single Player	X	X	X	X	X
	Multiplayer	X			Multiplayer			X	X	
	Role Playing	X			Role Playing	X	X	X	X	X
	Search	X			Search	X		X	X	X
	Capture	X			Capture	X	X	X	X	X
	Ranking				Ranking				X	X
	eliminate				eliminate	X			X	X
	Auction or bidding				Auction or bidding	X		X		X
Aesthetics	Sensation	Y		Aesthetics	Sensation	Y		Y	Y	Y
	Fantasy				Fantasy		Y	Y	Y	Y
	Narrative	Y			Narrative	Y	Y	Y	Y	Y
	Challenge				Challenge		Y		Y	Y
	Fellowship				Fellowship	Y	Y		Y	Y
	Discovery	Y			Discovery	Y	Y	Y	Y	Y
	Expression	Y			Expression					
	Submission				Submission	Y		Y	Y	Y

This scenario has an 80% match to the ColorPlanet Resources RPG game, which contains single and multiplayer game modes, and revolves around the search for locations and artifacts and deploying virtual workers to harvest resources.

8. Conclusion and future research

The researches that inspired this paper mention the importance gamification as a novel way of recreating the touristic experiences and provided a starting point for this research to advance further and analyze the pervasive games available in the market by the time of this study. While the proposals presented by this study are by no means rigid, it presents a viable framework built on the understanding and data from apps market sources and careful analysis of their working components, it is the point of view of this paper that gamification of historical sites is essential to create memorable experiences and to reinvent the visitor experience in accordance with the 21st century expectations in order to invite recurring visitors to these sites. A more refined study should include the prototyping and testing of the proposed games on site to test their performance and their perception.

9. References

1. Adams, E., & Rollings, A. (2007). *Fundamentals of Game Design.* Pearson Prentice Hall.
2. Azaryahu, M., & E. Foote, K. (2008). Historical Space as Narrative Medium: On the Configuration of Spatial Narratives of Time at Historical Sites. *SpringerLink*.
3. Boz´any, A. (2007). Heritage site area type classification for Facility Management purposes.
4. Buhalis, D., Weber, J., & Zhang, H. (2015). Tourists as Mobile Gamers: Gamification for Tourism Marketing. *Journal of Travel & Tourism Marketing*.

5. Geocaching. (2016). *Geocaching Guidelines*. Retrieved from https://www.geocaching.com/play/guidelines

6. Hunicke, R., LeBlanc, M., & Zubek , R. (2004). MDA: A Formal Approach to Game Design and Game Research. *International Journal of Heritage Studies*, 277-293.

7. Malcolm-Davies. (2004). Borrowed robes: The educational value of costumed interpretation at historic sites.

8. Moustafa, S. L. (2011). Historic Cairo - Causes of deterioration and suggestions for preservation. In *Old cultures in new worlds* (pp. 762-767). Washington: 8th ICOMOS General Assembly and International Symposium.

9. Munir, A. (2014, September 10). *App Monetization: 6 Bankable Business Models That Help Mobile Apps Make Money*. Retrieved September 12, 2017, from http://info.localytics.com: http://info.localytics.com/blog/app-monetization-6- bankable-business-models-that-help-mobile-apps-make-money

10. Museum, T. B. (2016). *Fieldnotes Storytelling.*

11. Operating System Market Share Egypt. (n.d.). Retrieved September 22, 2017, from http://gs.statcounter.com/os-market-share/all/egypt

12. Sintoris, C., Yiannoutsou, N., Demetriou, S., & Avouris, N. (2013). Discovering the invisible city: Location-based games for learning in smart cities. *Interaction Design and Architecture(s) Journal*, 47-64.