

The role of augmented reality in revitalizing the tourist space of the built heritage via perception

Zainab Abood Hussein¹, Saba Sami Al Ali²

^{1,2} Department of Architecture, Al-Nahrain University, Iraq

ABSTRACT

Successive Technological innovations have provided new possibilities for activating tourism in the built heritage sites. Augmented reality (AR) technology is considered is emerging as one of the technologies witnessing great demand from the authorities concerned with the places of built heritage. Therefore, there is a need to study this technology and its potential to improve the perception of the tourist space in order to activate it in tourism where this topic was not covered in previous studies. The aim of the research is to develop a theoretical framework that explains the perceptual aspect of augmented reality and its role in revitalizing the tourist space of the built heritage. The research thus goes to review previous studies on the relationship between built heritage and augmented reality technology, then it presents the basic concepts about revitalizing the tourist space and the perceptual aspects of augmented reality technology, indicators of the conceptual framework are extracted and discussed. The framework represents a tool in enhancing the design and construction of augmented reality models for the built heritage, as well as the possibility of using it to assess the perceptual aspect of these models with the aim of revitalizing the tourist space.

Keywords: Augmented reality, Architectural heritage, Built heritage tourism, Tourist space, and Space perception.

Corresponding Author:

Zainab Abood Hussein
Department of Architecture
Al-Nahrain University, Iraq
Email: Zainabarch3@gmail.com

1. Introduction

Built heritage is among the most important elements of attraction for local and international tourism. These environments need interventions to meet the demand for efficient and contemporary tourism use. International organizations, such as UNESCO, (ICCROM) and ICOMOS, have issued multiple legislations and charters to regulate conducts of dealing with these environments. These charters emphasized the dynamic relationship between tourism and heritage, and the need to enhance the role of local and international tourism in cultural exchange. Augmented Reality (AR) technology is one of the technologies that are witnessing a demand from the concerned authorities to revitalize the tourist spaces of the architectural heritage. According to the augmented reality market is expected to grow at a compound annual growth rate of 79.6% between 2015 and 2023, with the tourism and logistics sectors achieving a high growth rate [1]. The current research focuses on this technology and explores its potential to enhance perception of the places of heritage to create rich tourist experiences with the aim of stimulating local interest towards this technology as one of the tools to activate the tourism of the built heritage in Iraq. Thus, the research turns to investigate the presented knowledge and explore the approaches that are addressed in the relationship between built heritage tourism and modern technological techniques and applications, especially augmented reality technology. Then two main topics are discussed; the elements that help revitalising the tourist space and the characteristics of the perceived space. Authors then move to combine both sets of elements to extract the conceptual framework of the role of augmented reality in revitalizing the tourist space via the perceptual aspect.



2. Literature review

Previous literature approached the role of digital technologies, including augmented reality, in activating heritage sites. Some studies focused on the heritage site itself, such as the study of [2, 3], which stressed the role of digital technologies in the protection and inheritance of heritage, education of heritage, preservation and documentation. Other studies focused on the role of augmented reality as an attraction, interaction and communication tool. All mentioned the enhancement of the experience, communication, access to information, advertising tourism resources, and guidance [4]. While De la Rosa pointed at its role in improving user satisfaction, increase the intention index for repeat visits and improve understanding and interpretation of heritage [5]. As for [6], they focused on the capabilities of augmented reality to create interaction between the visitor and the destination and the competitive advantage of a real and virtual visit [7, 8] as a tool that generates meaning, knowledge and interpretation of the destination and thus supports the educational experience during the actual visit, such as The study of [9] brought up aspects of technological innovation, he proposed as innovation concerns; (interpretation - enhancing meaning - services). Another approach in literature focused on presenting the types of innovative applications in the creation of augmented reality, to be used which are before after and during the visit. These applications targeted several goals, including ease of access guidance to sites, information about buildings and creating a distinctive experience [10]. As for the study [11], presented the potential of technology in public tourist destinations using smart applications in the pre-travel, during and post-travel phases that contribute to creating a space for joint creativity, physical and virtual creativity, and value creation through consumer interaction with technology and ease of access, and a similar study [12], which dealt with augmented reality in heritage sites as a tool that works to intensify the dimensions of the tourist experience (education - beauty - escape - entertainment) for a real visit and before the visit. And a study [13] that focused on augmented reality (AR) technology as a new tool for providing technology-enhanced tourism experiences, increasing the sustainability of attractions in tourism, and enhancing actual experiences on site (educational and entertainment). Some studies also dealt with aspects of achieving interactive experiences and communication between the visitor and the site, and behavioral intentions towards the destination from various aspects such as the study of [1] which dealt with the effects of augmented reality on Behavioral trends of visitors in legacy sites through the perception of (perceived advantage - satisfaction and behavioral intentions - aesthetic experience and perceived advantages) as for the study of [14]. It dealt with achieving interaction between the visitor and the tourism space of the heritage through smart applications based on the smartphone that provide (perception of space and communication, support for learning, entertainment, art, games and creation of interactive spaces) through the actual visit. The current research seeks to be among the studies that show the importance of augmented reality technology in supporting the built heritage as a tourist space through perception [15]. The research is also concerned with the techniques that activate this tourist space during the actual visit to the site by exploring the capabilities of augmented reality technology that can be used on site and not virtual - remotely. Although previous studies showed the types of support and improvement provided by this technology in the tourism experience, they did not focus on the specific role of AR in improving the perception of space or how to focus on improving certain aspects with architectural characteristics, which can be sensed by the architect thus A role in illuminating new features in augmented reality technology.

3. Concepts of the tourist space

There is a set of terms that refers to the tourist space. It could be considered as an intangible dynamic structure, where this characteristic appears through the relationship and interaction between its components, and the change is at the level of the physical space through the addition of elements and the continuation of transformations in the tourist space itself from the moment it was discovered by the tourist [16]. The tourist space was also described according to [17-19] as a sub-space and a distinct part of a geographical space, that is, as a tourist space regardless of its size, character and characteristics. The boundaries of the space are determined by the presence of the tourist infrastructure within a specific space. A third concept of the tourist

space is a "specific physical structure", that has distinctive and unique characteristics distinguishing it from other non-tourist places. The current research goes with the last definition, so the tourist space of a built heritage is represented by a location, or a group of buildings and structures with a distinctive cultural character, and a unique value, which symbolizes the history of people and reflects the style of a particular era. They are specific physical spaces that can be remodeled with augmented reality technology.

3.1. Revitalizing the tourist space

Studies indicate a set of indicators related to the activation of the tourist built heritage spaces. These indicators will be addressed in the following paragraphs:

3.2. Quality and authenticity of the attractions

Site quality means the availability of tourism services and facilities in the heritage sites and goes beyond that to preserving the archaeological site and distinctive features, in addition to being unique in historical, cultural or aesthetic characteristics that are not available in other places. As for authenticity, it requires that these services and facilities be consistent with the characteristics of the heritage sites and other elements of attraction and do not contradict them. A study [20] confirms that many tourists today are looking for authentic experiences related to different cultures and dates, as it is a representation of the historical time and place within the original or reconstructed site. The perceived authenticity of a heritage site is a measure and determinant of tourist satisfaction. Thus, the quality and authenticity of the heritage tourism space is seen as a decisive factor that has an impact on the overall appreciation of tourists [21]. Therefore, the quality and authenticity of the attractions lead to the creation of the concept of the brand and the image in the tourist places. According to the study of [22], the places of the built heritage have a major role in enriching the tourist offers and representing the tourism identity that remains in the memory by knowing the aspects in which the historical building is presented as a tourist brand.

3.3. Social interaction, uses and activities

Building social interaction is a characteristic that is difficult to measure but must be achieved with an unambiguous quality. Usually the purpose of providing a tourist space for heirloom places is to encourage people to do leisure activities, and to create social interactions between people by providing places for performances, exhibitions and leisure activities that all encourage social contact [23]. The Burra regulation of ICOMOS Australia indicates that "the activities that take place in the place bring about social interactions that are friendly to the place, which is an essential building block in the establishment of any tourist activity, in addition to its role in making the place lively and unique, with its own identity and becoming more famous." The tourism activities associated with the built heritage contribute to the revitalization of the tourist space, its uniqueness, diversity and constant frequency (Article 26, The Burra Charter, The Australia ICOMOS charter for the "conservation of places")

3.4. Comfort and general perception

Research considers this characteristic of the basic components of a successful tourist space in the places of the built heritage. Perceptions about safety, the surrounding context, the attractiveness and personality of the place are above all in people's minds, as well as tangible issues such as the presence of comfortable places and others.

3.5. Access and visibility

The success of the tourist space is linked to the availability of transportation, which is of great importance in serving visitors to ensure them the necessary transportation to discover the place. (Ramlee et al, 2016, p190 show that the ideal tourist space should be smoothly accessible, high visibility for the public, clear entrance, and provide barrier-free access, so access is very important to connect people to the heritage attractions and their interaction [23]. Zajadacz shows that the successful space in terms of tourism and socialization is the one that is visible and easily accessible, and is linked with the surroundings, whether visually or physically [24].

3.6. Activation of the space with storytelling

Telling stories about places and historical events that the place was exposed to can contribute to the process of visualizing the place by the recipient or the tourist, linking the narrated events with the existing buildings and formal elements, and building a consensus between the narrated story and the existing existing structure. The perception of the story will differ from one tourist to another depending on the parts that affected him, as these stories and events enhance collective memory and attract attention, as they contribute to the preservation of society and the physical structure through their role in revitalizing tourist places [25]. The elements of revitalizing the tourist space for the built heritage described above are interconnected with each other, for example, the uses, activities and social interaction contribute to making the brand. The brand and activities also play a role in increasing the quality and authenticity of the attractive experience by reflecting the identity and preserving the features of the site and the history of the place. As for the narrative, it is also linked to brand making and it contributes to the quality and originality of the attractions by preserving the existing physical structures of the site and the events listed and enhancing originality by enhancing memory and contextual relevance. Alongside the components explained above, a new concept emerged in tourism, which is the use of contemporary technologies as innovative methods to revitalize the destinations of heritage. AR technology represents one of the smart tourism technologies that will be explained in support of the elements of tourism revitalization.

4. Augmented reality technology

“Augmented reality (AR) refers to a live display of a real-world environment whose elements are combined with computer-generated augmented images to create a mixed reality. It includes supporting virtual layers of the physical form, allowing the opportunity to see additional knowledge about a diverse phenomenon in multimedia forms, where the real-time world is achieved with computer-generated objects, so that the user visualizes reality with virtual reality in the same place [26]. It is an interactive experience of a real-world environment in which real-world objects are enhanced by computer-generated perceptual information, sometimes through multiple sensory modalities, including visual, auditory, tactile, and olfactory. Figure (1). Tourism has specifically taken advantage of this new technology to enhance the experience of tourists and visitors by providing information about destinations, attractions, services, cultural history and archaeological sites in an engaging, engaging and educational way [27-31]. From a technical perspective, AR is often associated with wearable computers, or portable smart devices". The dominance of the real surroundings is a major aspect of AR when compared to AV (Augmented Virtual Reality) in continuous virtual reality [32]. The design of the augmented environment is done by programs such as (Adobe Photoshope) and 3DMAX as well as media players, etc.[29].

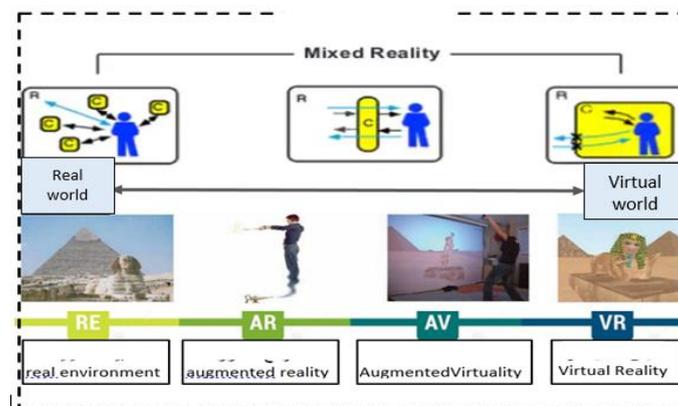


Figure 1. Reality and Virtual Communion Source/ Authors arrangement based on sources

4.1. Perception and the characteristics of perceptible spaces

The concepts of perception were mentioned in a number of studies, including the study which indicated that the process of cognition takes place according to certain needs of the human being that leads him to a certain

behavior based on the opportunities available in the environment. The behavioral field is that space that is directly related to the self and the topics around it, in which a kind of motive arises. Tensions arise that remain continuous until they end with satisfying the needs of the tensions and directing a specific behavior. As for (Maltin, 1988) it was shown that perception is the process of organizing sensory data in the form of sensations to increase our awareness of the environment around us. Perception is the ability to bring the external world into the inner mind and then begin to form readings about the outside and after those readings form values for things (Maltin, 1988, p38) As for the perception of space, whether architectural or urban, it is defined as the process of obtaining information from the surroundings, which is a purposeful process in which truth and understanding meet, and that the sense of space and urban form will be achieved when forming a perceptual relationship between man and his environment. The specific mass of this space and as a result the sensory-visual impression will be formed, which is embodied in the form of a mental image of the shape of the space, but this perceptual relationship expands in the architectural and urban spaces to include the different human senses (from smell, touch, hearing, and vision) [33]. Figure (2) shows the stages of the cognition process.

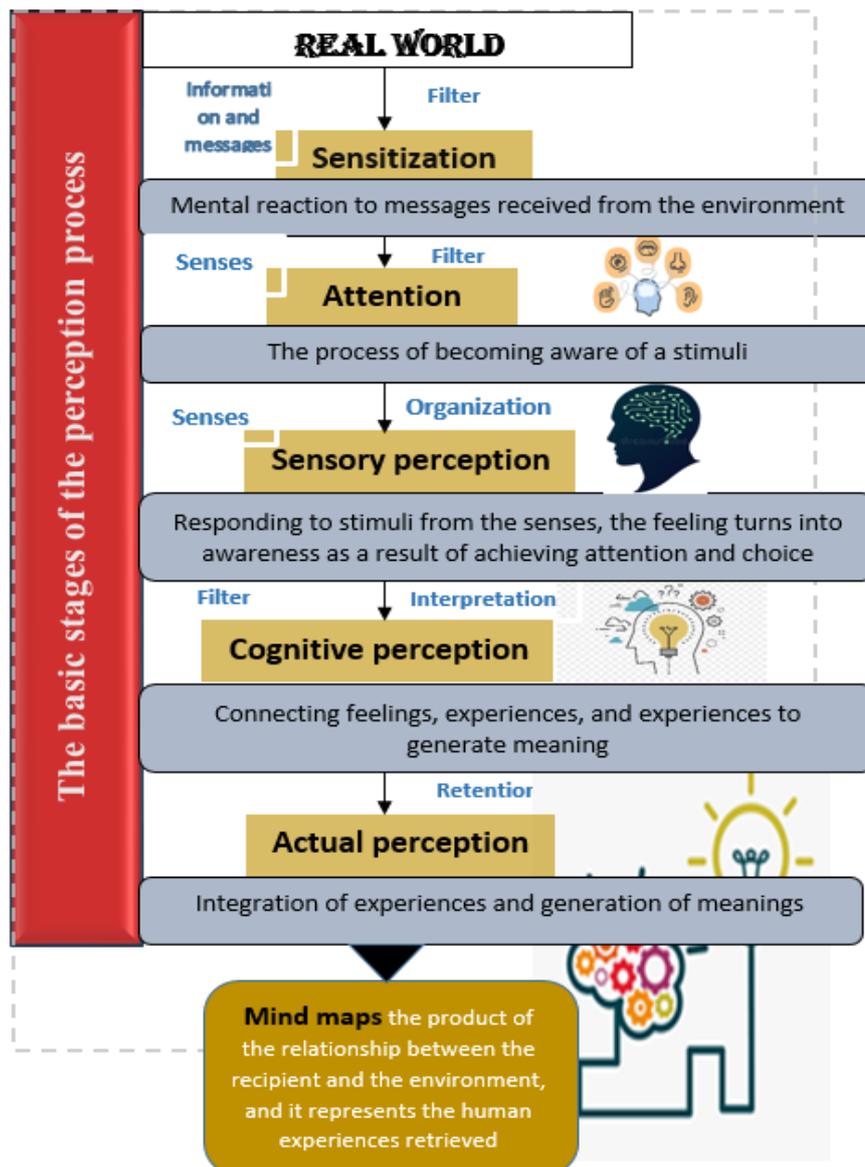


Figure 2. Stages of the perceptual process Source/Authors

4.2. Characteristics of the spaces perceived by the recipient

There are three characteristics that space carries that help the receiver perceive space, which are (formal, relational, and sensory), and the following is an explanation of them according to a group of studies:

First is Formal characteristics which they are considered one of the most important characteristics influencing the process of perception and helping to understand and assimilate the surrounding environment and spaces, where [34] defines the architectural form as the point of contact between mass and space, as the characteristics constitute the space and give it the spirit and value, and these characteristics are materials and color And light effects and shadows [35] indicates that the shape is defined through (the body that represents an image through which the shapes can be classified and defined, as the body has a set of visual properties related to the shape itself and relational properties resulting from the relationships of shapes and blocks with spaces that represent the visual properties) Where the form includes (color - size - texture - light effects - individuation - simplicity) while the relational characteristics include (direction - location - stability of shape - continuity - proportion and proportion - scale).

Secondly, relational characteristics that stand for the spatial relations of the environment affect the perception, as the structure of the path and the path structure play a role in fragmenting the perspective vision and providing an opportunity for monitoring and reflection, thus encouraging the recipient to complete the path. The relations between the mass and the space of the perceived scene represent reciprocal patterns between the stimulus and its neighbors, that is, the reception of forms must take place within their environment and their neighborhoods as intended interactions. (Rappaport) stresses the importance of relationships to achieve richness and suspense in the environment. In [36], they refers to the relationships as (overlap - juxtaposition - interconnection and containment)

Thirdly Emotional characteristics (sensory) that represent what the recipient feels in the process of perceiving the surrounding environment. The sense vocabulary has been defined as a mental reaction to messages received from the external environment through the senses, and this response can be visualized as a conceptual structure in the human mind that depends On knowledge, expectation and experience, sensory characteristics can be clarified through the following vocabulary: - (a sense of visual continuity - arousing attention and suspense - arousing interest and surprise - multiple viewing angles - a sense of visual diversity - a sense of pleasure - meanings and names - a sense of spatial containment). It is clear that there are basic aspects in the perception process that can be affected by the development of technology, represented by (the recipient and identifying the most important perceptive characteristics of the space). The advent of augmented reality as a new brings out the importance of reconsidering our perception of space in light of the development of techniques used to revitalize the tourist space.

5. Discussion

The research discusses how to enhance the perception of tourist space in augmented reality based on what was previously explained of the basic elements for revitalizing the tourist space and the perceptual characteristics of the spaces. Therefore, the research extracts a set of indicators that represent its conceptual framework as follows: (Enhancing the perception of the quality and authenticity of the attraction):

Successful attractions are authentic when they provide a sense of place, interpretation, and activities that prolong the visit .The uniqueness of the site is also indicated by the distinctive historical, cultural and aesthetic characteristics and features. Other qualities are relevant as well such as clarity of the values associated with the building or place in addition to appropriateness and harmony with the surrounding context and non-dissonance with it. To achieve these qualities, the role of augmented reality (AR) technology as a tool for restoration, reconstruction and visualization is evident by reproducing virtual copies in their own places in the real world within the tourist space itself. The three-dimensional model built through augmented reality can provide cognitive properties that contribute to improving authenticity and originality factors. It needs to be characterized by the clarity and purity of the shape and its edges, clarity of the viewed elements, and other dimensions (texture-color-shape-light). Thus (improving formal characteristics) is one sub-indicator identified here. Harmony with context could be named as another sub-indicator. This is achieved when AR model illustrates previous neighborhoods or surroundings of the built form and hiding the dissonant ones, in addition to suggesting the appearance of the original local materials. A third sub-indicator can be extracted, namely: preserving the characteristics of the site or building. This is found as AR technology can detect the buried layers of history of the space, the visual reconstruction according to the previous stylistic characteristics and the original architecture, and the abolition of additions that may have distorted or confused the final form of the building. Some authors shows that the information provided by AR generates knowledge of heritage and reveals the history of the destination through its capabilities in highlighting the shape and its architecture and revealing the missing parts. AR technology also allows

(improving sensory properties) by generating a sense of pleasure, interest and visual continuity because of its capabilities to complete the missing forms of the building depending on the clarity and sequence of presentation, which raises the viewer's previous experiences and enhance the generation of meanings. The role of (AR) also becomes clear in creating highly satisfactory tourism experiences through (brand delivery), an additional sub- indicator to include. Thus, a set of secondary indicators become clear: improving the perception of formal characteristics, appropriateness and consistency with the context, preserving the characteristics and features of the site, improving the perception of sensory and emotional characteristics and finally confirming the brand) An example to validate this indicator is the experience of the Erbil Citadel in Kurdistan, where the Augmented Reality Application (ARBELA Layers Uncovered -ALU) was developed on the smart phones of the Erbil Citadel. Heritage mode provides information about the traditional and local architecture of the buildings (houses and public buildings) that exist today in the Erbil Citadel and have a historical value as the tourist can use the rebuild function to see the 164 missing buildings or components in their true former form, architectural style, local former materials and location within the context where the sign Indicates this as soon as it is activated and holds the phone's camera towards the real surrounding scenes. Thus, the application allows enhancement of the perception of the characteristics of the shape and its architectural style, as in Figure (3) it shows how a three-dimensional model of a reconstructed part appears in its original location and how the enhanced form settles within its true context and merges with it [37].



Figure 3. 3D model of a part reconstructed in its original location for the Erbil Citadel [37]

5.1. Enhance perception through social interaction, uses, and comfort

The role of augmented reality appears as a tool in enhancing social interactions by creating shareable and entertaining spatial experiences included in the application of augmented reality (such as finding lost items, or video games). As well as adding cultural educational experiences such as inserting information and questions about heritage which can be shared and answered by groups. As for improving social interaction through perception of aesthetic experiences, this is achieved by clarifying the characteristics of the architectural style of the space and contextual alignment. These experiences contribute to revitalizing the tourist space. It is not limited to a group of people, but to different groups and ages, and even special cases of people with special needs. Demir showed that augmented reality technology serves as a tool to help them, as voice and tactile technologies help physically disabled people to discover the heritage area without hindrances [38]. For example, augmented reality technologies can act as screen readers for the visually impaired and similarly hard of hearing people will be able to get the most out of their visits using assistive AR technologies. On the other hand, augmented reality technology supports the awareness of the available supporting services and facilities, such as stores or transportation, thus supporting convenience and general perception by providing information to the user about destinations and increasing knowledge of heritage through ease of safe use. (educational-entertainment-aesthetic) for different groups and ages, and the promotion of supporting services and facilities). An example is an augmented reality experience in Yenkapı.

The mobile game application Yenikapı Explorer is proposed. It is a popular location-based social networking application, mostly used on smartphones. This mobile game is a virtual system of ancient beings which brings modern day players and historical figures together. In the archaeological excavation areas of Yenikapı, each virtual item belongs to a specific time period. Players simply have to answer questions related to each object. These questions are determined from historical events. Thus, Yenikapı Explorer acts as a cognitive contest that enhances the perception of learning interactively and entertainingly. It also allows connection to popular media platforms such as Twitter, Wikipedia or Facebook to encourage visitors to contribute to Yenikapı's social forums and websites. This social platform will become an important part of social memory.

5.2. Enhancing the perception of access, visibility and linkage to heritage places

Augmented reality technology supports flexible access through its role as a guiding tool. It improves the perception of access and circulation to archaeological tourism sites. Augmented reality provides geo-location in real time; Thus, mobile-based AR applications help people find their way, find places, and direct users. In some major heritage cities, augmented reality applications have proven effectiveness in facilitating navigation and place finding by providing comprehensive travel guide applications that provide people with location-related information. Therefore, AR will enhance the user's perception of access to the site through the amount of attractive information such as geographical information and places of services. This data is in the form of videos, websites, QR codes and SMS and can be read at the expense of augmented reality technologies, and users can also pass on their own knowledge about anything related to the location. AR - 3D Models are characterized by the clarity of space relations with each other, the way of entering the space, the clarity and sequence of the visual scene, enhancing the connection with the surrounding visually and physically. An example is the Turku, Luostarimäki application for guiding in Turku. It helps the user to navigate (using a map and compass) This application uses 2D image tracking if the user is standing in the correct place and leads to a historical image enhancement, the inclusion of explanatory texts describing specific objects in the scene, thus enhancing the awareness of flexible access to the geographical location and information related to it, as in Figure (4)

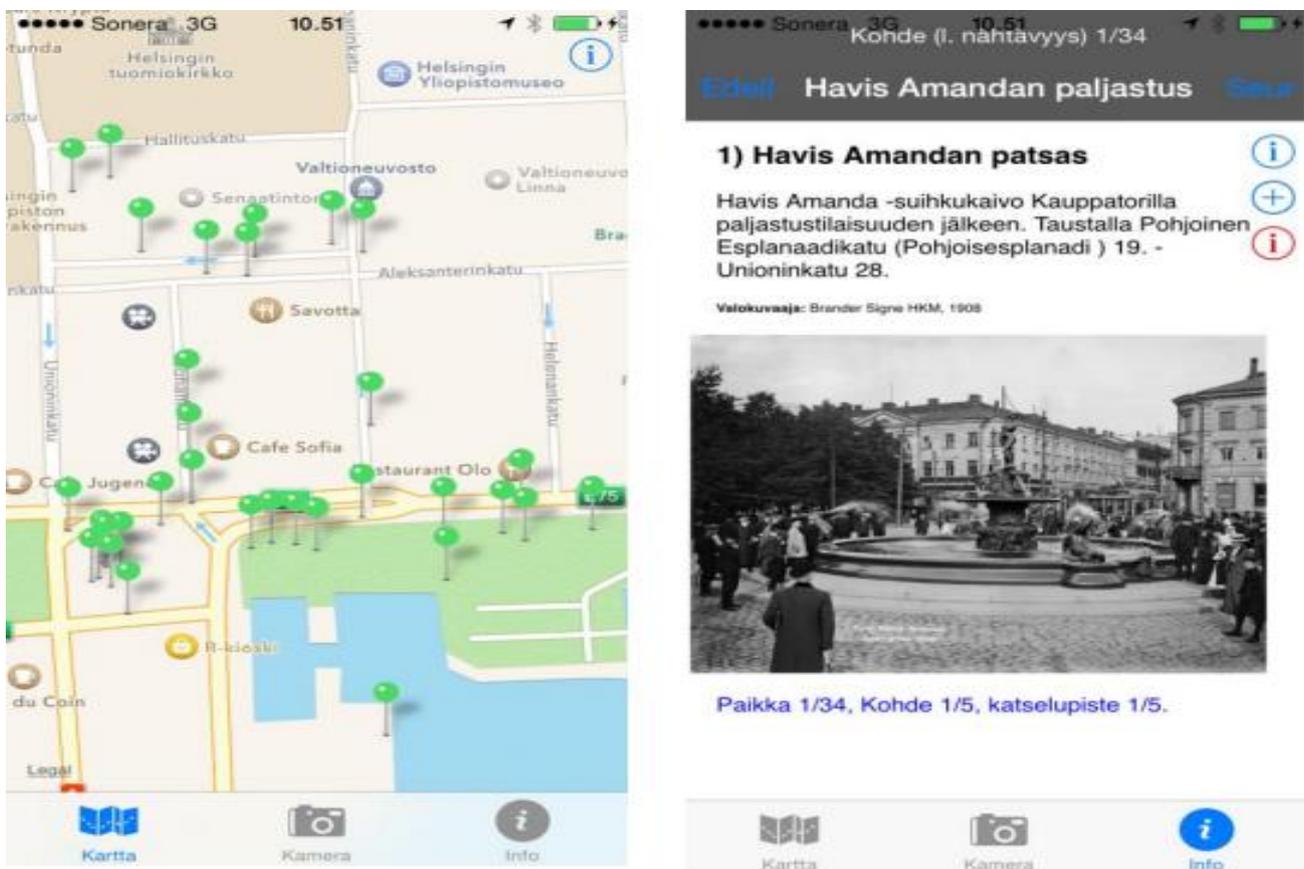


Figure 4. Turku, Luostarimäki application for guiding in Turku [39]

5.3. Enhancing perception of the narrative

Augmented reality has a role in the process of visualizing the place through the ability to enhance the narrative of historical events associated with the place, and linking these events with the existing environment. The formation of mental images results from perceiving the form generated in the 3D model and its elemental relations. Also evoking sensory feelings supported by information in the form of texts, images or audio media, all interconnected with the formal elements and the displayed scenes. Furthermore, the design of the visit sequence and the clarity and sequence of the visual presentation provides smooth, understandable sequence of augmented reality scenes. Demir, Y. Explains that simulated ancient characters and other objects can help create a more comprehensive presentation of heritage sites [38]. In addition, the literal context can be used with old information and images of a more stimulating environment thus enhancing collective memory. Thus, two sub indicators are extracted here (enhancing the clarity of the formal elements existing with the events narrated, and enhancing the collective memory). An example is the Chicago Riverwalk AR Experience. The Riverwalk AR Experience focuses on a single block between N. LaSalle Street and Clark Streets; The site of the Iceland disaster in 1915. To display a digital graphic novel of the disaster, a series of augmented images appear at the site where you see Eastland rolling at the quayside taking into account the level of destruction as shown in Figure 5, which shows images from the historical archive superimposed on a live phone camera broadcast. The site was chosen because of the importance of this historical event and because of the abundance of media available in the archive which includes newspapers, film reels where textual content is added to the experience as well as the addition of audio, visual and narrative text annotations to guide the user towards the desired content thus enhancing the perception of the story of the place through the overlay of binary images Dimensions with real scene and audio-visual narration [40].



Figure 5. Chicago 0, 0 Riverwalk mobile augmented reality application [40]

6. Results

The results represent the extraction of the conceptual framework for the role of augmented reality in activating the tourist space through visualization through the discussion of the previous paragraphs. Figure 6 shows a summary of the conceptual framework.

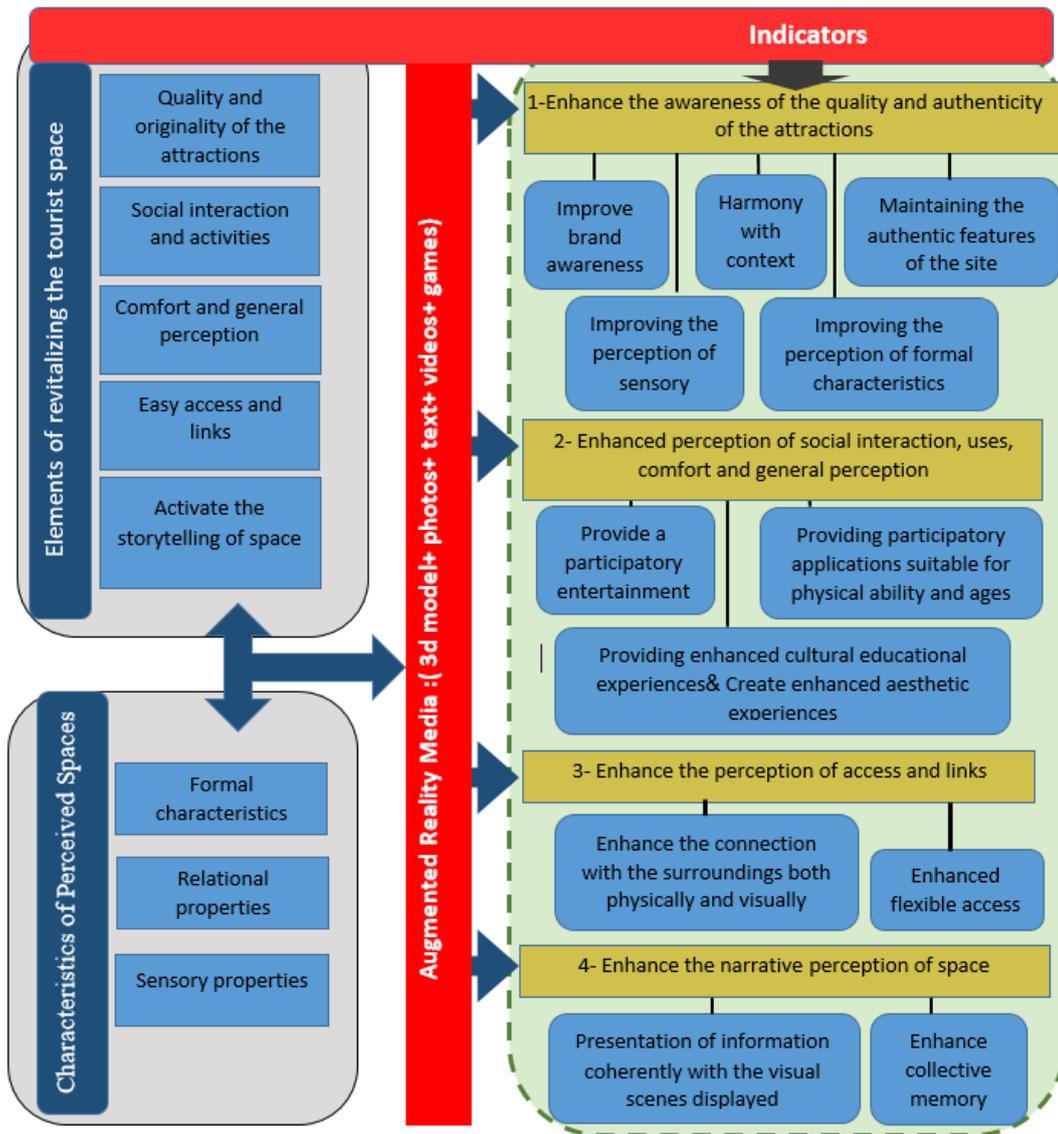


Figure 6. conceptual framework of the role of Augmented Reality in revitalizing the tourist space via perception

7. Conclusion

Places of the built heritage are distinguished resources for tourism activities and events that generate an enjoyable experience to achieve the tourist's satisfaction in the recreational, service and cultural aspects. By discussing a set of elements that activate the tourist space (the quality and authenticity of the attractions, social interaction and activities, comfort and general perception, access and visibility and the narrative of the space), and the most prominent perceptual characteristics of the spaces (formal, relational and sensory), the research arrived at formulating a set of indicators that show the potential of Augmented Reality technology in improving the perception of tourist space through the elements that promote its activation. These indicators firstly include improving the perception of the quality and originality of the attractions by building a three-dimensional model with a clear shape and edges and that complements harmoniously the site and its historical characteristics and clarity (texture - color - lighting), thus improving the perception of formal and sensory characteristics and enhancing the brand. The second indicator is enhancing the Perception of space through improving social interaction, uses, comfort by promoting activities that prolong the visit (educational - recreational - aesthetic) such as providing educational experiences through applications that include inserting information about heritage as well as providing recreational aesthetic experiences through clarity of architectural style and applications of games and puzzles. The third indicator is perceiving ease of access and visibility through guiding applications

and comprehensive travel guides. And finally the indicator of perceiving the narrative of space by enhancing the clarity of formal elements existing with the events narrated, providing information in the form of texts, audio recordings or video games, and providing a plausible sequential visit.

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