PerAR: Augmented representation of the urban image in Beyoğlu district, Istanbul

Hacihasanoglu, Ilgi [1] Sener, Sinan Mert [1]

Keywords: augmented reality (AR); urban image; visual representation; sensorial perception of the urban environment; Istanbul

Abstract Information and Communication Technologies (ICTs) have serious impacts in our daily lives and habits and the effects of these technologies still rapidly increase during the last few decades. Especially wider use of technological tools, such as laptop computers, tablets or smartphones, points out an evolution towards a more mobile society. This transformation results in important progresses in diverse domains. Representation of urban environment can be considered as one of those areas that involve the use of Information Technologies.

Representing urban information may have several motives from making research to reach an effective solution for urban environments, using Geographic Information Systems or technologies like Remote Sensing; to making simulations in order to experience urban space that may also affect human sensorial perception, like in 3D virtual environments or Augmented Reality (AR). In this sense, visualization becomes one of the most effective methods of perceiving urban experience. Internet maps, mobile maps, 3D visualizations, street views, GPS, geo-tagging and Augmented Reality (AR) can be mentioned as some of the technologies that might facilitate visualization, visual perception and way finding in the urban environment. The increase in the number and the quality of the mobile instruments that provide tools for an easier perception of urban space is considerable especially during the last ten years.

From this perspective, this study aims to introduce a mobile application design named PerAR, that visualize urban experience in Beyoglu District (also known as Pera) in Istanbul, using mobile technologies and Augmented Reality (AR). PerAR proposes a hybrid design that includes first of all, a city guide departing from Lynch's urban image analysis in Beyoglu District to present a bodily experience of the urban environment, involving not only the visual experience but also other senses, according to the views of Pallasmaa and Norberg-Schulz. Secondly, inspired by de Certeau's "walker" and "voyeur" concepts, PerAR suggests an augmented reality application to re-animate the unseen in the urban area, such as ancient buildings or ruins, as well as future projections in urban space for the "walker" in order to reinvent the street level perceptual experience; and to simulate urban experience from a distance by tagging urban spaces and buildings to facilitate their perception for the "voyeur". The interface of the application is designed with Xcode Interface Builder, and the augmented content is provided with Layar and Poiz.

1. Architectural Design Unit, Architecture Dpt., Istanbul Technical University, Istanbul, Turkey

Introduction

This study aims to propose a new experience of sensing the urban environment using several technologies as well as Augmented Reality (AR). It is important to discover how the human being is experiencing the urban environment, to contribute to these experiences with technological progress. In this sense, the first chapter will discover sensory and mental processes of humans during urban experiences, and how these processes can be enriched with today's technologies such as Internet maps, mobile maps, 3D visualizations, street views, GPS, geo-tagging and Augmented Reality (AR). This chapter will also include a state of the art, referencing some projects and applications of the visual and sensory experiences in the urban environment.

The second chapter will give insights about the PerAR project, its philosophy, design and applicability. The current version of the work does not involve a full application, but an introduction to the application design. A hybrid design is proposed involving an interactive guide and an augmented reality application in relation to each other. The purpose of the project is to inform and to enrich the experience of the user without separating him/her from the sensory and embodied environment that is provided by the city.

Sensory Experience in Urban Environments: Contributions of Technology

Sensory experience of the urban environment is a very promising issue today. Environmental perception studies during the 1970's and 1980's generally concentrated on the visual involvement in perceiving and representing the urban environment. Therefore paradigmatically, environmental perception studies placed the human outside the environment, as a contemplator of it. However, perceiving the urban settlement cannot be restricted to only visual experiences. Perceiving engages the whole being with sensory experiences and mental processes.

Environmental perception and cognition research in architectural theory relies on the visual perception of the human eye, taken only as a spectator of the urban space. The studies about walking practice show that today, sensing is a holistic act that creates impulses for the body at once as Merleau-Ponty asserts in this passage.

"My perception is [therefore] not a sum of visual, tactile, and audible givens: I perceive in a total way with my whole being: I grasp a unique structure of the thing, a unique way of being, which speaks to all my senses at once"

Moreover, all the sensory activities are interrelated as Pallasmaa refers to Merleau-Ponty stating "*The senses translate into each other without any need of an interpreter, and are naturally comprehensible without the intervention of any idea."* (Pallasmaa, 2011).

Pallasmaa (2011) also asserts that Gaston Bachelard refers to the same phenomenon as *"the polyphony of senses"*. He further argues, "*The eye collaborates with the body and other senses. One's sense of reality is strengthened and articulated by this constant interaction*". In that sense, Pallasmaa criticizes the City of the Eye as being a city of distance and exteriority, and puts forward the Haptic City as the city of interiority and nearness (Pallasmaa, 2005).

Norberg-Schulz also refers to the city as a place that has something more intuitive than only visuality. Norberg-Schulz's *"Genius Loci is a Roman concept. According to ancient Roman belief every 'independent' being has its genius, its guardian spirit. The spirit gives life to people and places, accompanies them from birth to death, and determines their character or essence"* (Norberg-Schulz, 1980). As the soul of the place, "Genius Loci" defines a place that has a certain spirit and people experiencing this place recall it through the spirit of the place.

A restricted visual experience of the city is therefore excluding the olfactory, haptic and auditory experiences, however sensory perception of the urban environment is a holistic experience that can be discovered exclusively by being in the city as an explorer. Walking is such an activity that fosters our ability to perceive the city with multiple senses at the same time.

In his text "Walking in the City", Michel de Certeau (1984) differentiates the concept of walker from voyeur in terms of sensing the city. The voyeur, the one who observes the city from above is a described like a divine perceiver. The voyeur does not live a physical encounter with

the city. Only considered as an eye, the voyeur is the reader of the text that the walker writes in the street level. People can also become a part of the neighborhood they dwell or the street they walk. Michel de Certeau (1984) calls this becoming, writing urban text. They intertwine with the space they are walking through and from this intertwining emerge from their footsteps: These footsteps, irregular and of singular characters, help the walkers in finding themselves in a self-composed path. This is how they create their own experience of the city and how they contribute to the formation of urban experiences; their movements tie the urban fragments together and form a flow.

A whole process of becoming can identify the experience of the walker where all the senses of the human body are involved. This experience can be explained by the concept of embodiment. Although visual experiences are very important today as contributions to the digital media and technology, for a more comprehensive understanding of the environment and the sensation of embodiment, the current technologies have to be urged for a more holistic experience of urban environment. In this sense, integrating new technologies in the act of walking may be an interesting approach.

Visualizing the city became a very important issue today for many reasons such as recording/sensing the visual information of cities, representing cities and digitizing cities. The visual representation of cities becomes an issue that worth being uncovered. However, integrating urban physical and sensory experience to the digital visualization is a challenge: as the sensory experiences are momentary, the visualization of the urban environment must be in real-time and mobile. The information and visuals must move with the user, or it must be placed where the user is. The visualization must be layered in order to be perceived as a digital extension of the reality. This may result in the re-living or recalling the experience that was once lived or a totally new experience. This information must also be enriched with not only visuals but also written remarks or an informative guide for further explanations.

Digital representation of the urban environment started first with digitalization of maps. Internet maps and mobile maps are very widespread in our days, especially maps enriched with technologies like 3D visualizations or street views. However, visualizations reachable on the Internet can only be viewed in the front of a computer, therefore mobile applications are more suitable for people who want to reach up-to-the-minute information. Mobile maps and other applications such as involving traffic conditions or touristic information are very popular and increasing in number.

Another interesting aspect of visualizing urban environment is a technology named Augmented Reality. With augmented technologies, information or visual entities can be integrated in physical environments using codification systems like QR codes or using Augmented Reality broadcasters working with Location Based Services (LBS) such as Global Positioning System (GPS). One of the most known providers of this technology is an application called Layar.

“Before the advanced technologies of augmented reality, shape recognition was made via QR codes, abbreviated from quick response codes, where the principle is to recognize the texture of the QR code, and with the required application installed on the phone, and to request the server for what this tag carries as information” (Hacıhasanoğlu, 2012). QR codes, injecting digital information into the city, are tools, which help people to put information in the physical world, therefore to make a link between physical and digital worlds.

Artificial hapticity can be provided by augmented reality used in urban spaces. Augmented Reality providers that publish augmented visuals with the aid of GPS provide a good example for this practice. Layar, as the most known Augmented Reality provider has a variety of applications of Augmented Reality content on the physical world [Url-1]. This results in an artificial hapticity, a feeling of touching the space that does not exist in reality, an overall illusion.

Netherlands Architecture Institute (NAI) launched an application named Urban Augmented Reality that aims to visualize the past and the future of the urban environment. The purpose of the application is to show what is actually not there, using augmented technologies (Fig. 1).

"UAR, the NAI mobile architecture application, provides information about the built environment on the basis of text, image, archival material and film on an iPhone or Google Android (and on Nokia phones at a later stage). By means of advanced 3D models, right in the middle of the city UAR shows you on your phone what isn't there. The city as it once was – for instance by showing buildings that once stood there. The city as it might have been – by showing scale models and design drawings of alternative designs that were never implemented. And the city of the future – by showing artist's impressions of buildings under construction or in the planning stage"[Url-2].

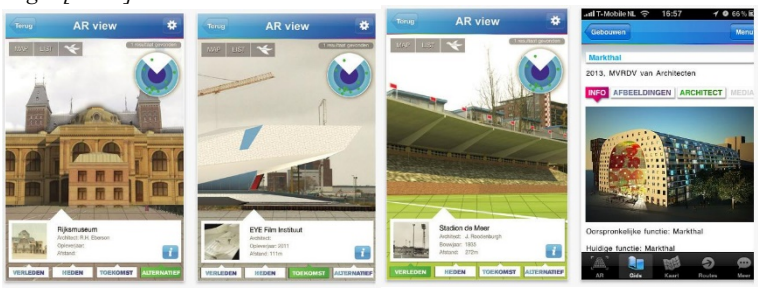

Fig. 1 NAI, Urban Augmented Reality Application

As one of the biggest problems that applications like UAR cannot solve is the lack of immersive effect of its interface. Tools such as Google Glass can be a good alternative to applications using smart phones or tablets in order to augment urban environment.

Google Glass technology provides Augmented Reality Content reached through very light glasses and a camera [Url-3]. It has many properties such as taking a picture, recording a video, voice recognition and way finding and additional features like answering questions and giving information about scheduled events without having to ask. This technology can be considered as a step to filling the gap of immersive sensation that can still be a lack for Augmented Reality applications on mobile devices (Fig. 2).

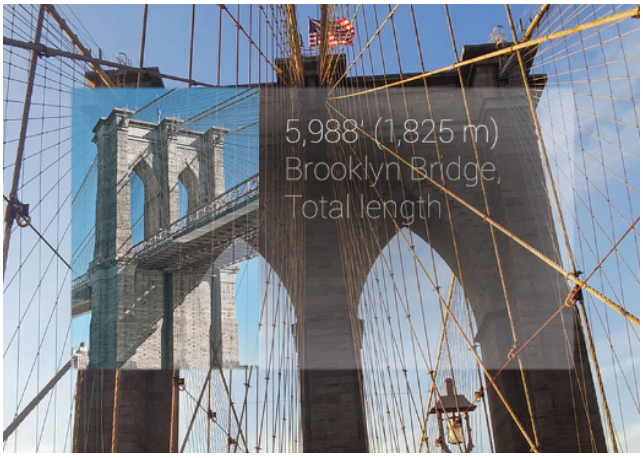

Fig. 2 Google Glass interface

Digital representations such as mobile maps or street views as well as more advanced technologies like Augmented Reality enrich urban experience in many ways. However, in order to live a sensory urban experience the goal is to keep the physical environment as a canvas and to have additional information reachable through a mobile device in case it is needed. PerAR is designed in order to meet this need.

Designing PerAR: A Tool Augmenting Urban Experience

PerAR project is the second version of GalatAR, design of the mobile application that provides urban experience of Galata district in Istanbul that was put forward as a Master of Science thesis named "Representation of Urban Image in the Information Age: A Case Study of Galata" by İlgi Hacıhasanoğlu under the supervision of Prof. Sinan Mert Şener (Ph.D.).

The PerAR interactive application is designed through two levels of representation: an interactive city guide where several paths, nodes, districts, edges and landmarks are mapped and represented onto a two-dimensional canvas and an Augmented Reality application design where two different kinds of experience are lived according to the "walker" and "voyeur" of de Certeau.

The interactive city guide (ICG) has a fragmented structure dealing with five different elements inspired Kevin Lynch's "Image of the City". The five elements of the urban environment are identified to analyze the city: the paths, nodes, districts, edges and landmarks, which permit an almost complete evaluation of the urban context. The paths constitute the main roads, walkways or transportation itineraries. The nodes are places that one or more paths overlap, and that are characterized by this overlapping. The districts are regions that are characterized by a common property that separates these places from their surroundings. The edges are the elements causing interruption or difference, such as walls, gates or shores. Finally, landmarks are special urban elements that possess particular importance, and which are identifiable as a result of a scale difference (Lynch, 1960).

The Augmented Reality application will be integrated with the most important landmarks or buildings of the surroundings and only a case study will be made in order to describe the purpose of the work. According to Certeau, experiencing the city at the ground level is more efficient than seeing a city from above. The daily experience and discovering give more insights about the overall aspect and the essence of a city that Pallassmaa and Norberg-Schulz mentioned about. To augment the urban daily experience, people may want to try different routes as they discover the area, and try to see the different layer of the city. With augmented reality technologies, they may augment the urban experience by seeing what was there before, or even what is not there yet, with the aid of smart devices.

This AR study does not aim to present a complete mapping and Augmented Reality application of the Beyoğlu area, it only aims to propose the idea of representing urban environment with interactive guide and Augmented Reality application as a combined procedure, for the case of Beyoğlu. For this paper, the content study will not be examined in detail.

ICG interface design is composed by four different modes, relating to each other: Map mode, routes mode, AR mode and information mode:

1. Map Mode: This mode provides a map version of the area, with an interface that has clickable content about some places and landmarks significant to the area. The functions expressed with different colors and pictograms appear on the map. When clicked, a label giving information about the place appears. The map mode offers some of the content published in the ICG: landmarks and nodes according to Lynch's analysis (Hacıhasanoglu, 2012).

This aspect of map mode generates a visual overview of the area, however does not infer to olfactory, auditory and haptic urban experiences. To satisfy those needs, users can add multiple sensory items as content on the map. Mapping also experiences like tasty foods or nice sounds are important in this mode, to provide a more personal and experience based content (Fig. 3).

2. Route Mode: The route mode appears onto the map mode, and it adds some routes that are significant to the area. When touched on any part of the route, it shows the roads and the places

that are related to that particular predefined route. This section shows the content for the paths, edges and districts in Lynch's analysis (Hacıhasanoglu, 2012) and also sensory experiences other than visual experiences can be mapped as content for the routes (Fig. 4).

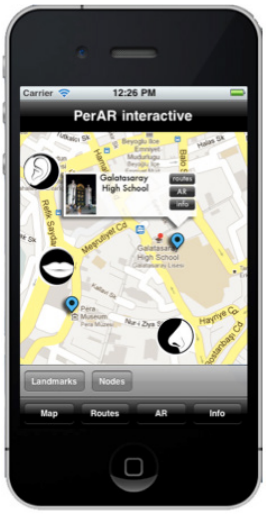

Fig. 3 PerAR interactive- Map mode

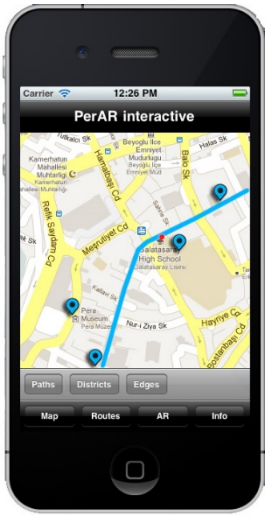

Fig. 4 PerAR interactive- Route mode

3. Augmented Reality Mode: This mode can also appear in two ways, when clicked on the AR link on a particular place label, or directly shifting to AR mode using the toolbar at the bottom. AR mode informs the user about the identity of the 2D or 3D AR contents. The information includes the name, the date, the architect and the current situation of the AR content. For example, The AR content is published for expressing a future projection of the place where the content is tagged. Like Layar, in the upper right part of the screen, the application informs the user about AR content in the same or other directions in the surroundings (Hacıhasanoglu, 2012) (Fig. 5).

Augmented reality application for "walkers" ("walker" as the term of de Certeau), aims to revitalize sensorial and visual experience of the walker without changing the street physically. The aim is to find buildings and monuments, which have interesting historical backgrounds, and which changed once or more than once in history. In the scale of the street, a "walker" can discover these buildings during daily urban experience in Beyoğlu, however it is impossible for them to know and perceive how this building has changed and in which context it used to be. Therefore, it will be interesting to experience the superposition of the buildings during their lifetime (Hacıhasanoglu, 2012). The second version of Augmented Reality could be perceived from a height just like the "voyeur" of de Certeau is practicing the city. Its aim is to visualize the placements of various landmarks, when seen from above and it is harder to recognize these landmarks from that perspective.

4. Information Mode: The information mode provides alternatively, when directly clicked from the toolbar at the bottom, a list that includes all the places according to their functions and types. Available information is shown when clicked on appropriate place from the list. On the page, a title which signifies the chosen place, a photo and detailed information appear. The information mode also gives links to map view, AR view and route view of the particular place, if applicable (Hacıhasanoglu, 2012) (Fig. 6).

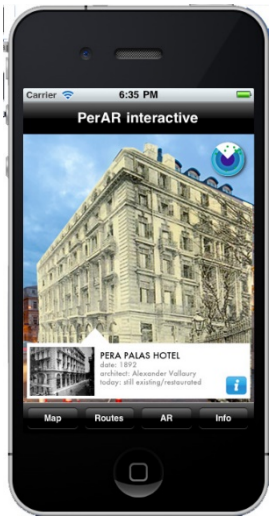

Fig. 5 PerAR interactive- AR mode

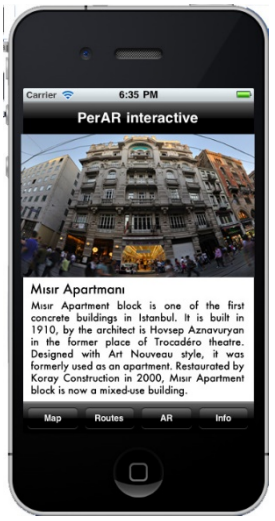

Fig. 6 PerAR interactive- Info mode

The design of the application aims to bring all the sensorial and visual experience together and try to enhance the experience of the citizen or tourist who uses the application. The combination and integration of the AR application to the interactive city guide can be challenging when programming the application because it needs another application to be launched in the PerAR application.

A further application of the sensory experience in the urban space would be with more haptic devices like Google Glass, where the user can manipulate items when discovering them. Sensory experiences could be mapped through voice, during real contact that will provide an embodied experience.

Conclusion and Remarks

In this study, a technological approach has been given in order to perceive the urban environment visually as well as to understand it with all of our senses. To perceive the city as a whole, real-time and mobile visualizations support momentary sensory experiences. Layered representations provide layers to make Augmented Reality be perceived as a digital extension of the reality. Enriching this information with written remarks or an informative guide is also important for this project. Therefore, PerAR is a proposition of an application design that not only visualizes the urban environment, but also enriches the sensorial experience of the user, yet with simple interface and informative content.

References

De Certeau, M. (1999). 'Walking in The City', in During, S. (ed.), Cultural Studies Reader, Routledge, Florence.

Hacıhasanoglu, İ. (2012). "Representation of the Urban Image in the Information Age: A Case Study of Galata", Unpublished M. Sc. Thesis, Istanbul Technical University, Istanbul.

Lynch, K. (1960). *Image of the City*, MIT Press, Cambridge.

Norberg-Schulz, C. (1980). *Genius Loci: Towards a Phenomenology of Architecture*, Academy Editions, London.

Pallassmaa, J. (2005). *The Eyes of the Skin: Architecture and the Senses*, Wiley Publishing, Padstow, Cornwall.

Pallassmaa, J. (2011). *The Embodied Image: Imagination and Imagery in Architecture*, Wiley, West Sussex.

[Url-1] http://www.layar.com/what-is-layar

[Url-2] http://en.nai.nl/museum/architecture_app

[Url-3] http://www.google.com/glass/start/what-it-does