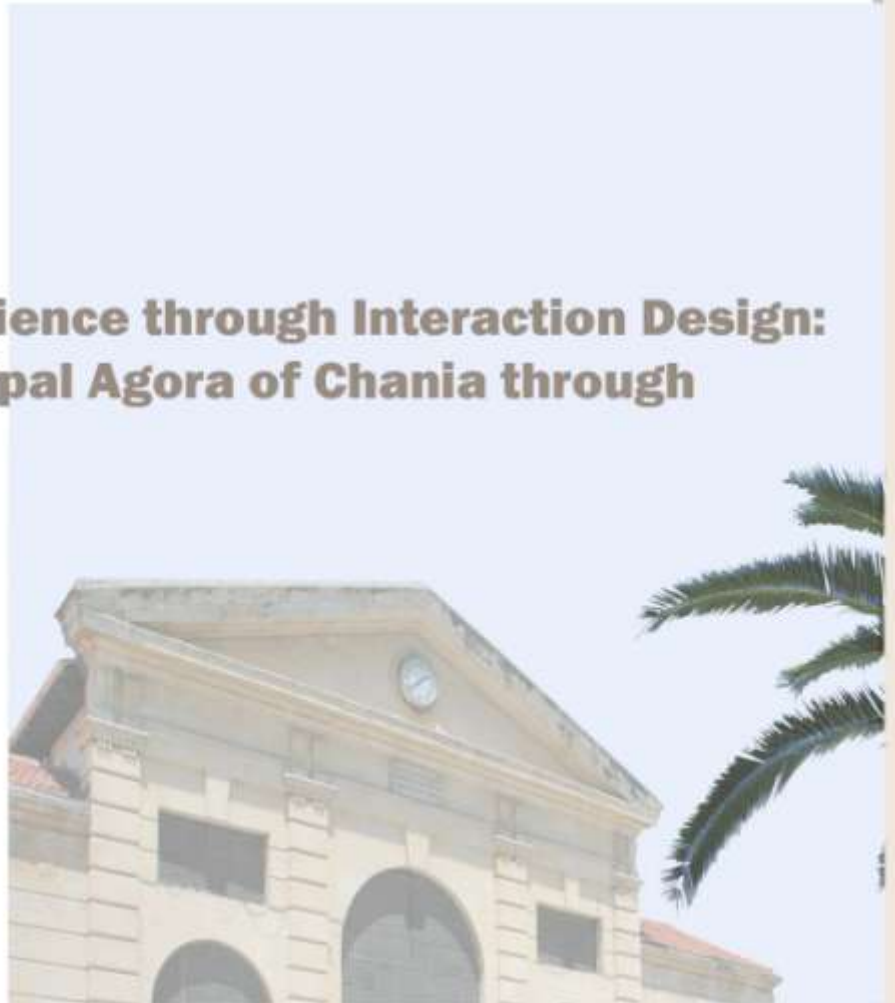




Technical University of Crete  
School of Architecture

Postgraduate thesis:

**Enhancing User Experience through Interaction Design:  
Rethinking the Municipal Agora of Chania through  
narratives.**



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Research : Dania Panagiota

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## Abstract

The Municipal Market of Chania commonly known as the "Agora" is a historic building in the city of Chania in Crete, Greece. It is a building full of memory and representative elements of the city's history. Being a significant point of interest for tourists and visitors, the "Agora" is used as a central market on a daily basis, thus creating a commercial hub, fully integrated into the everyday life of the citizens.

Based on the ongoing research of enhancing the user experience at the Municipal Agora of Chania (Karagianni et al, 2019), we highlight the idea that the Agora can be rethought as a building, monument, experience and journey. Using the conceptual approach of designing through narratives (Lehman, 2018; Achten, 2019), we delineate the process of integrating new technologies into the process of architectural design. Following that premise, the Agora is rethought as a commercial hub and as a historical monument. Previous research on the building experience through technology and IoT has shown that users experience lack of orientation and absence of comprehension regarding the historical and architectural value of the building (Karagianni et al, 2019). A new augmented reality application is designed to enhance user experience in a twofold way: on the one hand, to provide an overall improved experience of the Agora and tweak the interaction between user and the building; on the other hand, to create a layer of understanding the architectural and historical value, independent of the commercial layer of the Agora.

In order to achieve interactivity within the Agora, our study focuses on two main axes. Firstly, we make use of the research results in the work of Karagianni et al (2019), to create conceptual narratives based on geometric and morphological elements of the building aiming at pointing out the optimal route towards enhancing the overall visitor experience. Secondly, we provide to the visitor the experience of re-live the place as it was or to make him understand better the composition, the structure of the space and its importance in the city site, exploiting AR dynamics, developing a system that uses marker-based and markerless tracking techniques, superimposing virtual elements onto the real environment of the Agora.

The suggested route is a five point 'journey' into the cross shape monument. The journey starts at the main entrance of Agora, continues through the main corridor, from the beginning to the center and to the end of it, and finally drives you to the secondary corridor of the cross. The aim is to give the opportunity to the visitor to enjoy the experience of the Agora as a monument, as a significant market for the locals and of course to understand the importance of its architectural design which is not obvious because of the scale of the building. By re-inventing the building experience and redesigning the route we manage to offer the visitor an exploration of the whole building and the enjoyment of the dual role of Agora.

## 1. Rethinking the Municipal Agora of Chania

### 1.1. History of Agora

The Municipal Agora of Chania is a building that carries a long and important history. Nowadays it is known as "Agora". The idea for this cover market came to the fore in 1908 where the city wanted more space for its market out of the narrow roads of the old city. It is part of renovation and landscaping projects of the city. The Agora was constructed under the drawings of engineer Drandakis, between the period of 1909 and 1913, where it started its use for the first time. It is a building of 4.000 m<sup>2</sup>, surrounded by an area of 17.2000 m<sup>2</sup>.

The most interesting part of this construction is the chosen placement, which was on the fortification. Until the end of the 19th century, the fortification was the boundary of the city, literally and metaphorically, because it was inextricably linked with the black page of the history of the city. Therefore, they wanted to extract a big percentage of the fortification and create at its position big projects for the city, such as the Agora, schools and the conservatory. Thus, Agora built on the bastion of Piatta Forma, after its demolition and the embankment of the trench.



Image1: Working on the bastion of Piatta Forma, [izoimetatosxoleio9.weebly.com](http://izoimetatosxoleio9.weebly.com)

This project was very important for the city, because of its placement, that connected the old city with the new and for the connection with the main roads that linked the city with the whole island. The importance of this project was underlined by the year of its inauguration (1913), the year that the island of Crete connected with the whole Greece<sup>1</sup>. The prime minister of the county, Eleutherios Venizelos was the one who signaled the grand opening for the Agora and a new era for the people. Agora was signed as a monument in 1980.

From an architectural view, it is designed as a cross shaped building, with references to Byzantine period and with renaissance elements. It is constructed by cement, with some details of carved porphyry, brick and steel elements mainly for its cover. The two main corridors vary in height, length and width. With the differentiation of the height they achieved a better lighting and ventilation for the building. Along these two corridors exist 76 shops, where you can find traditional products, meat, fishes, dairy products, vegetables, herbs, souvenirs, cooked food, coffee and more others.



Image 2, 3 and 4: The expand of the benches, through the years, [1\\_gr.pinterest.com](http://1_gr.pinterest.com), [2\\_flashnews.gr](http://2_flashnews.gr), [3\\_tripadvisor.com.gr](http://3_tripadvisor.com.gr)

From the images above we can observe that through the years the markets into Agora expanded their benches on the corridors. As a result, nowadays the corridors of the Agora seem to be smaller than they really are designed.

From this small chronology, we can conclude that the passing of the time altered not only the appearance of the building but also the memory of the people for its importance.

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<sup>1</sup> Kotsaki Amalia, Martha Loukia, Papagiannopoulou Despoina, *Crete 1913-2013: Architecture and Urban Planning after the Union*, Cultural Center of Chania - SAH, Chania 2014

## 1.2. The survey: "Enhancing user experience in public spaces by measuring passengers' flow and perception through ICT. At the case of the municipal market of Chania "

### 1.2.1. The aim of the survey

The need to highlight the dual role of Agora drove us into the research of other cases in which this highlight has been achieved through new technology, in order to transform a building or a monument into attractive places. With this though we discussed the case of the Municipal Agora of Chania. Based on a survey, "Enhancing user experience in public spaces by measuring passengers' flow and perception through ICT. In the case of the municipal market of Chania"<sup>2</sup> (A. Karagianni, V.Geropanta, P. Parthenios, R. Porreca, S. Mavroudi, A. Voyatzis, L. Margiori, Ch. Mpaknis, E. Papadosifou, A. Sampani), we track down the results of the experience that different kinds of users had into Agora, in order to understand the needs of the visitors and the preferences about visiting an indoor market established into a monument. Before the experiment with the visitors takes place, they present a theoretical background that explains the use and the users of this market.

They observed two types of users. The first type is locals or regular users. The locals use Agora, as a market to be supplied with products of everyday needs, such as vegetables, meat, fish, or cheese, but also go to Agora for socialization, to meet friends, drink or eat something at the small corners that provide this opportunity. The second type is the occasional users or visitors, who want the experience of a local market or taste traditional products. Also the

building is a monument and becomes an attraction for them. In terms of use, it varies. In this survey we find uses such as practical (everyday commercial activity), social (meeting with other locals), informational (information from kiosk around the place and especially the center), emotional (the architecture of the building and the feelings of walking through), sensory (the exchange of indoor and outdoor, and how one affects the other), and motivational (the presence of the building that provoke curiosity about its history and its connection with the city).

The survey was based on the feedback that they took from two groups that they visited at the same time, the Agora. The first group was (traditional users) entered immediately into Agora without any other information about it and only with the equipment to measure their movement into the place. The second group (tech users) was formed by a team that through a laptop connected to the internet, surfed into the platform Crete 3D. They entered Agora after 15 minutes when they explored the monument through the platform and took valuable information about it. Both groups entered by the central northern entrance and they were told to meet again after their tour at the same place. After their tour they answered to especially formed questionnaires. The aspects that treat these questionnaires are the reasons of the visiting, the experience and in the end the interaction between user and space.

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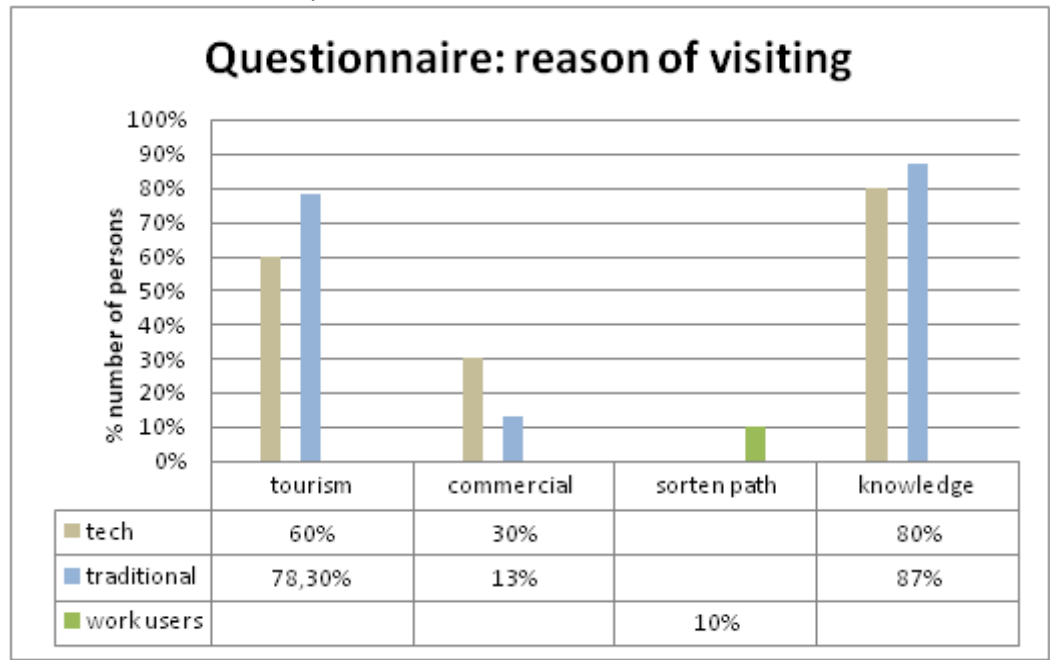
<sup>2</sup> A. Karagianni, V.Geropanta, P. Parthenios, R. Porreca, S. Mavroudi, A. Voyatzis, L. Margiori, Ch. Mpaknis, E. Papadosifou, A. Sampani "Enhancing user experience in public spaces by measuring passengers' flow and perception through ICT. At the case of the municipal market of Chania " Research Advancements in Smart Technology, Optimization, and Renewable Energy, IGI-Global, 2019

Based on these we tried in our survey to realize the results and their importance, to analyze them in order to set some critical questions and finally to make the right decisions with the aim of improving the experience into Agora.

1.2.2. The results of the survey and the upcoming questions

Reason of the visiting

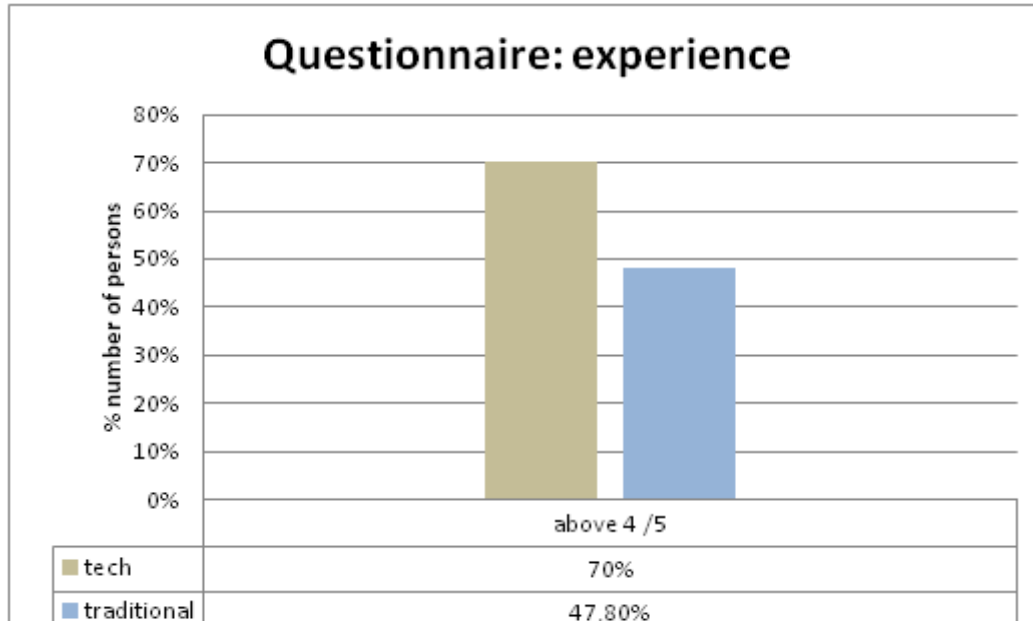
The first axe of the questionnaire was addressed to the reason for the visiting.



The percentages difference between the users. We realize that for both groups the purpose of visiting is oriented towards tourism and the curiosity about what is the real identity of the building, except from the obvious, a market. We observe also a percentage that the people use the Agora to shorten paths. The fact is that these answers came only from the work users, that they are very familiar with the orientation of the Agora and the surroundings. Taking into consideration these answers we came up with the result that most people are not aware of the dual role of this building. Of course it is the main Market of Chania, but this market is established into a building that is mentioned as a monument, because of its history and its architecture, facts that to most people are unknown.

The experience

The second axe of the questionnaire was the experience.



experience		
traditional	positive	appreciation of Agora as a monument flow of the tourist that added livehood into the space
	negative	bad ventilation bad odors lack of thermal comfort within the space

experience		
tech	positive	combination of architecture, tourism, technology chance to reivent the monument in a different way
	negative	bad ventilation bad odors crowded (suffocating space)

In general terms the experience of the visiting was positive. One of the most positive points was that the users appreciated the building also as a monument; even though they were part of the group of the traditional user even of the tech users. The tech users, who had already had a quick 3D experience about Agora, appreciated the dual role and reinventing it. In this way, we understand that even some interesting information about a place, before you visit it, gives the visitor the stimuli to observe more details and these details now can be more comprehensives.

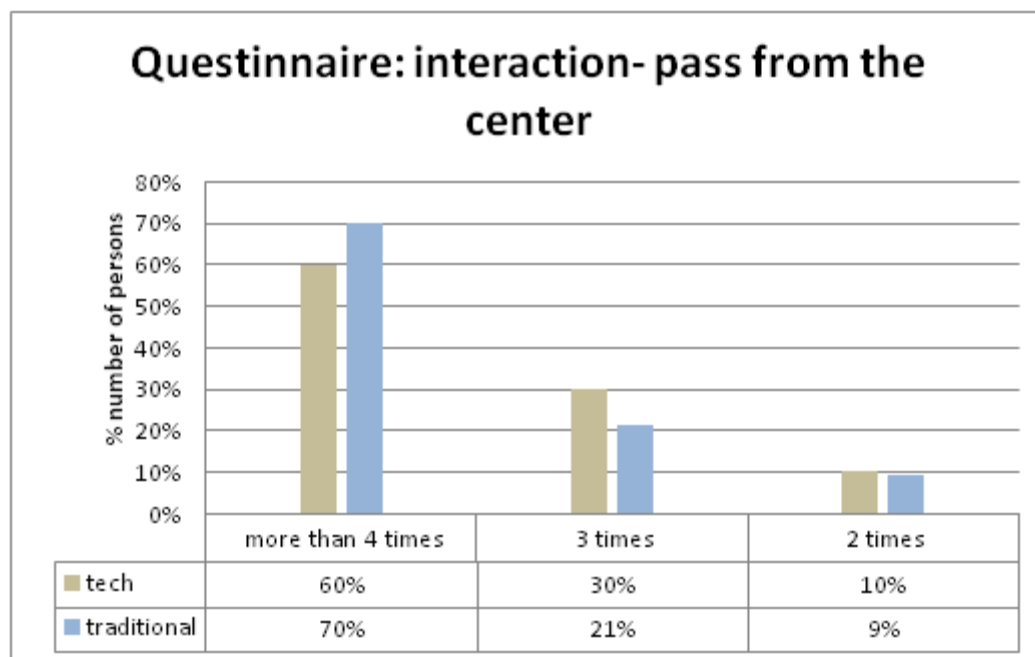


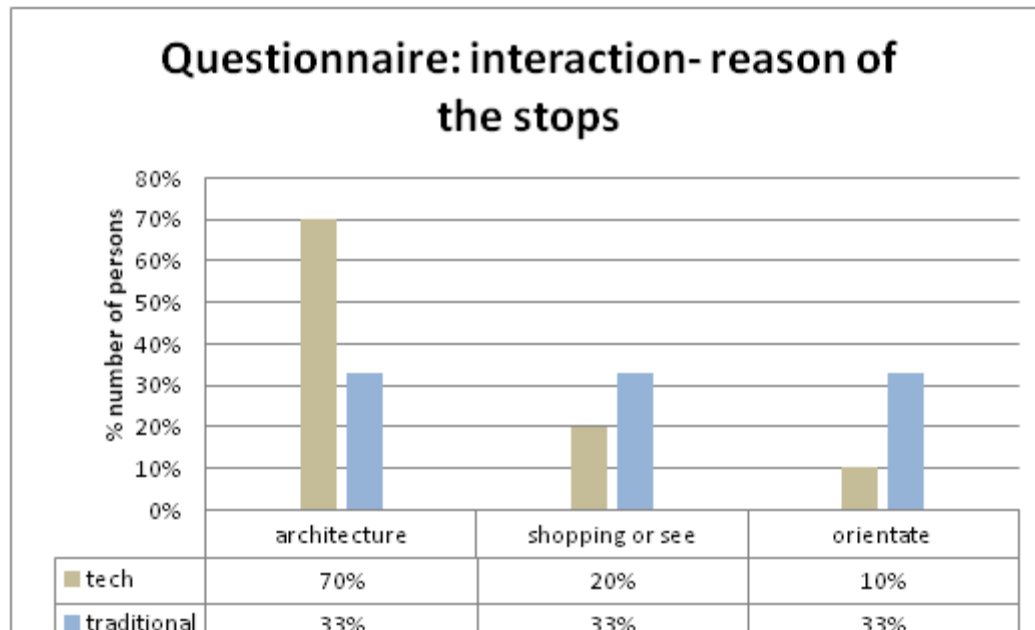


To this experience we cannot eliminate the negative opinions, reference to the ventilation, the odor, the lighting and the materiality. Without doubts the market has to be restored, an idea that we take into consideration as important as it is the need to appreciate the building as a significant landmark in the city. But the way to highlight the building is not only the restoration. The enhancing of new technologies will help more directly the visitor to understand the monument and its values.

#### Interaction between user and space

The last axe of the questionnaire was the interaction between the building and the visitor.





After these results we can observe that the visitors gave a big significance in the center of the building. The reason is because at the center they had the opportunity to get some information for it, from the kiosk information placed there. Also the vision of the center could orientate them about where the main entrance was and maybe this gave them the sentiment that they were not lost in the Agora. The cross shape of the building and the symmetry of it does not facilitate the orientation of the visitor into a very large space. Furthermore, we can observe that the interest about the architecture of the building was quite big. Thinking of all these we understand the need for more information about the architecture design of Agora and the need of the orientation in and out of it.

## 2. The idea of Enhancing User Experience

Taking all the results into consideration, the first dominant conclusion is that the users that had the technology as a helper, had a most essential experience and understood better the place, which in fact has a dual role. But unfortunately, most of the time, this dual role is not obvious. In nowadays the way we understand the visiting of a place has changed a lot in comparison with other decades. The technology surrounds us with many options about visiting, knowledge and consuming. Thus, we are not any more satisfied by visiting and seeing a place. We want more information and stimuli to better appreciate it. The advance of the technology jumped into our everyday life and is here to stay. This affects not only our life but also the experience of a place, therefore architecture and designing.

The main idea of the improvement came from the analysis of the survey that we developed before (Karagianni et al, 2019). This research examines the relationships between interactive design strategies and the process of architectural design. This idea of rethinking the architectural design through interaction is not new. A very innovative idea, based on this relationship between interaction and architecture, came into progress with the paper of Maria Lorena Lehman, introducing a very progressive idea for the "Future-proofing the

public library”<sup>3</sup>. The most important in this survey is the fact that she attempts to conserve the old way of thinking of a library and how it can work nowadays with the influx of the technological knowledge and tools that we have at our disposal. By this point of view she declares that the purpose is not to vanish the benefits of a library but how a new design of architecture can give to the old one a brand new way of experiencing it in macro and micro way. This approach is very important for the designing part with the new technology, an approach that we took into consideration when we started to rethink the case of Agora. The role of its one (library, monument, etc) cannot be detached from the old experience. People need to see the old references in order to understand the new ones. The old must become the conduit to the new. The entrance of technology has not to be the pitfall but on the contrary has to be the tool of a brand new flourishing experience for all the people, in order to gain more about visiting a place.

Lehman claims that *“libraries are places where the information can be evaluated and propagated, but the technological systems in most of them are obsolete”*. As a result, the people are no longer interested in going to a library for flourishing their knowledge, as the same with a monument without any stimuli of its importance like Agora. The aim of the future library or monument or any other place, is to be designed in a way that the people can interact the most.

Another theme that concerns Lehman is the library as a building. The building itself has to become the helper to this interaction. The proposals that are given as examples in this survey, lead us to a new way of thinking, a new way of designing common things such as a library. The general purpose is that the future library can offer experiences that the visitors can enjoy only there, experiences that they will not be able to achieve at home, at work or anywhere else, through virtual or augmented reality. In this way any place with the help of technology, can be turned into an instrument as important as it was in the past, as well as designing with the technology can transform the entire building into a fertile ground for the development of new ideas and the acquisition of an experience that you will surely want to live constantly.

Inspired by the future library, we thought about a future monument. The most important in this case is to hold the dual role of the Agora, as a commercial hub and as a historical knowledge thinktank. The main difference between this thought and the future library, that we presented above, is that here all the efforts about rethinking the place is that we are not designed from scratch, but we try to flourish the experience with the new technology into an existing place with specific character.

From the survey (Karagianni et al, 2019) we get that Agora is more interwoven as a commercial center than a monument, if you never visit before or if you have not any other feedback. The aim is to equalize the two characters of the building and it will be possible only if we feed the audience with stimuli of the new technology. A passing through of this building has to stop being boring and only for commercial reasons. Even though people, who live years in the city of Chania, ignore the historical background of the monument and they cannot estimate the value of the building as it is. Of course we have to respect the aspect of a commercial center because it is a habit for all the community. The introduction of new features into Agora doesn't mean that we vanish the old ones.

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<sup>3</sup> Maria Lorena Lehman, *Future-proofing the public library*, PUBLIC LIBRARY QUARTERLY, VOL. 37, NO. 4, p. 408–419, <https://doi.org/10.1080/01616846.2018.1513256>, 2018

The need to introduce new features into Agora comes from the question about how we can enhance the experience of the visitor, based on the observations that they made about their visiting at Agora (Karagianni et al, 2019). We understood that the more information they take, the more they appreciate the place they visit. We do not mention information by a book or a kiosk, but information through new technology, such as 3D models or augmented reality. The other question that came up is how we can make sense of the dual role of Agora, without weakening one of them. We have to equalize these two roles in order to avoid the extinction of the value of Agora as a monument. Another very critical question is how we can orientate the visitors into Agora and out of it. The placement of Agora has a big importance in the history of the building, but most of us ignore it. To the survey we analyzed, exists some diagrams about the movement of the users.

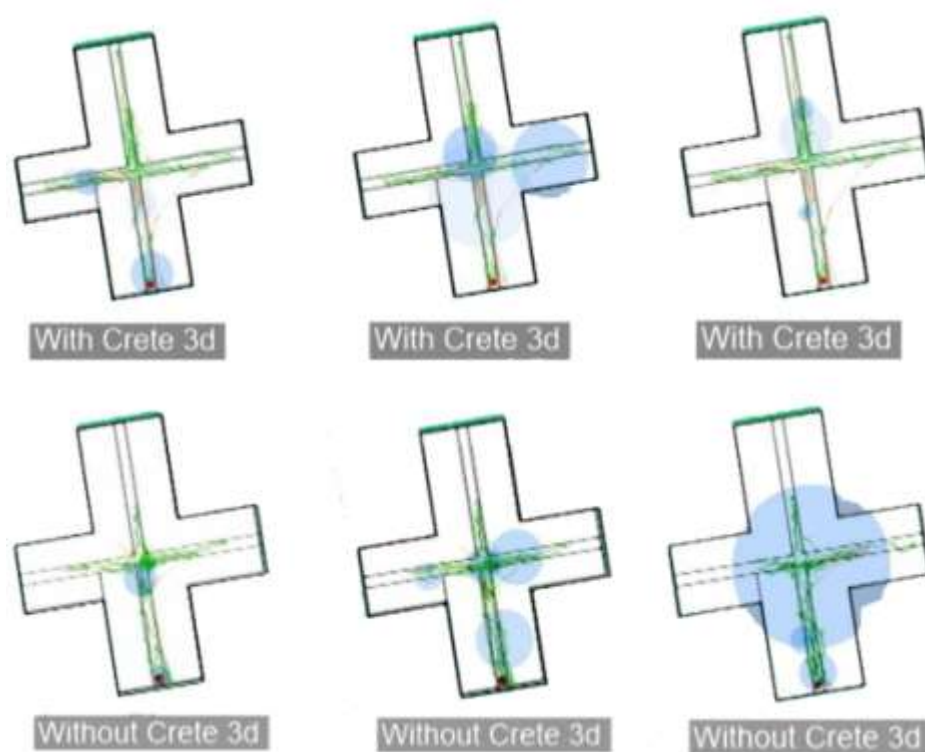


Image 5: User movement pattern, ICT users and non ICT users, Karagianni et al, 2019, *Enhancing user experience in public spaces by measuring passengers' flow and perception through ICT. At the case of the municipal market of Chania*

From them we conclude that most of the users did not cross all the corridors but they stayed mainly around the center and the main entrance. This is because to the second corridor exist some fish and meat shops and the odor is peculiar, but also the fear of getting lost, holding them to the “known” way of the main entrance. A person enters into a symmetrical place with no stimuli and direction. As a result is to avoid passing through the 2 corridors and missing the experience to see and enjoy every corner of the building. The question here is how will attract users across the whole spectrum of Agora.

The aim was to find the way to answer these questions and give the visitor a unique experience in Agora. The information that he has to obtain in order to understand better the dual role of Agora and also its importance in the city is going to become a narrative into that place. We tried to narrate a story through a designed route into Agora, where the user is able to reinforce his knowledge about the history, the placement, the architecture and

finally about the building itself. The conductor to that knowledge was the AR technology, which helped us with a creative way to narrate the story of the building, from its beginning to nowadays and to its future.

### 3. AR technology

To better estimate this kind of a technology that we chose for our survey, we have to analyze it. There are a lot of definitions about Augmented Reality (AR) technology. In simple terms, this technology uses digital information, such as images, videos, audio<sup>4</sup>, or even 3D models and presents them into the real world with the help of a device, such as a smartphone, a tablet or even wearable AR glasses. Thus, AR has the ability to enhance an immersive experience and transform an environment into a new place of exploration and knowledge<sup>5</sup>. AR technology presents one more recent application history. Nevertheless, it appears for the first time in 1962, in a motorcycle simulator designed by Morton Heiling<sup>6</sup>. This stimulator was the first effort for a multi sensory experience. After that we notice some innovations in the field of the AR technology in the years of 1968 and 1975, and a sequel of efforts in the '90s and '00s, until today with a very big impact of the AR in some fields. For example, AR technology is well used in fields like industry, education, advertisement, art, gaming, tourism, military and social media.

Concerning the field of architecture and design, AR technology is not so widely used. We find a very big interest in its use but mostly for educational reasons or decoration. Although, the last few years, a lot of surveys have been done in order to expand the use of technology for the benefits of construction<sup>7</sup>, architecture, design and culture. At these surveys we observe a comparison between Virtual Reality (VR) technology and AR technology. This is conceivable because VR is commonly used and it became more familiar for the users. But in this comparison we observe a net lead of AR. First of all, VR creates a total virtual environment in which the user cannot have any stimuli of the real world around him<sup>8</sup>. It is a totally immersive technology that needs very specific equipment, with admittedly a big cost, a specially designed space for the user and a sensation of lost connection with the surrounding. On the other hand, AR technology achieves a blend of virtual and real world that gives the opportunity to the user to rich his knowledge, to compare and to distinguish the real and the virtual<sup>9</sup>. Furthermore, one of the most important benefits of the AR is its equipment. The AR can be easily used into mobile devices that we all carry. Additionally, the application for its work into a mobile or tablet is easy to download, without any difficulty in using it and even more importantly without any internet connection<sup>10</sup>. Especially in the field

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<sup>4</sup> Greg Kipper, Joseph Rampolla, *Augmented Reality: An Emerging Technologies Guide to A*, Syngress, USA, 2013

<sup>5</sup> Jeremy Kerr, Gillian Lawson, *Augmented Reality in Design Education: Landscape Architecture Studies as AR Experience*, <https://doi.org/10.1111/jade.12227>, 2019

<sup>6</sup> Jeremy Kerr, Gillian Lawson, *Augmented Reality in Design Education: Landscape Architecture Studies as AR Experience*, <https://doi.org/10.1111/jade.12227>, 2019

<sup>7</sup> Juan Manuel Davila Delgado, Lukumon Oyedele, Peter Demian, Thomas Beach *A research agenda for augmented and virtual reality in architecture, engineering and construction*, Advanced Engineering Informatics Volume 45, <https://doi.org/10.1016/j.aei.2020.101122>, August 2020

<sup>8</sup> Andrew Joshua Ancira, *Architecture 2.0; Representing the architectural future with new technologies*, Cornell University, May 2020

<sup>9</sup> Andrew Joshua Ancira, *Architecture 2.0; Representing the architectural future with new technologies*, Cornell University, May 2020

<sup>10</sup> Huseyin Uzunboyulu, Ezgi Pelin Yıldız, *Augmented reality research and applications in education*, New Trends and Issues Proceedings on Humanities and Social Sciences, Online, 11, pp 238-243, 2016

of our cultural heritage<sup>11</sup>, AR can offer a serious percentage of innovations, in relation to the strict, outdated and sometimes controversial concept of restoration so far.

Although, the little experience on the AR technology, especially on the architecture field, provokes some limitations. Most of them orient to the technological limitation because of the lack of the knowledge<sup>12</sup> of how we use this technology to our benefit. Interaction through AR remains a question we are trying to answer, in collaboration with other fields such as programmers. Furthermore, another limitation is the time that we have to spend in order to achieve this interaction, though numerous tests with both designers and users in order to claim that it is successful<sup>13</sup>.

The research focuses more and more to find as much as possible the most naturalist approach of AR. Thus, today we have a classification about AR technology. This classification involves three axes marker-based AR, markerless AR and location-based AR<sup>14</sup>. To begin with, marker-based, (otherwise Target Image), is a method of recognition, which is the system recognized with a camera, a target of 2D, such as an image, a QR code, colored or monochrome, and it can reveal all the information that we included. Markerless AR is the detection of a plane ground in real-world without the help of an image, but mainly based on the shapes. Location-based AR uses mostly GPS, velocity meters or accelerometers that are connected to the AR system and can track objects that they are aligned.

To achieve the development of the AR, we used a cross-platform, Unity. Unity is very commonly used for developing games into 3 dimensions, 2 dimensions, virtual reality or augmented reality games. But its use expands also in other fields like architecture. Thus, with the help of this platform we arrived to create augmented reality for the monument of Agora. We built the whole project for Android.

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<sup>11</sup> Yueyun Fan, Yaqi Zheng, *The Application of Urban AR Technology in Cultural Communication and Innovation*, HCI International 2020 – Late Breaking Papers: Virtual and Augmented Reality, Springer, 2020

<sup>12</sup> Juan Manuel Davila Delgado, Lukumon Oyedele, Peter Demian, Thomas Beach *A research agenda for augmented and virtual reality in architecture, engineering and construction*, Advanced Engineering Informatics Volume 45, <https://doi.org/10.1016/j.aei.2020.101122>, August 2020

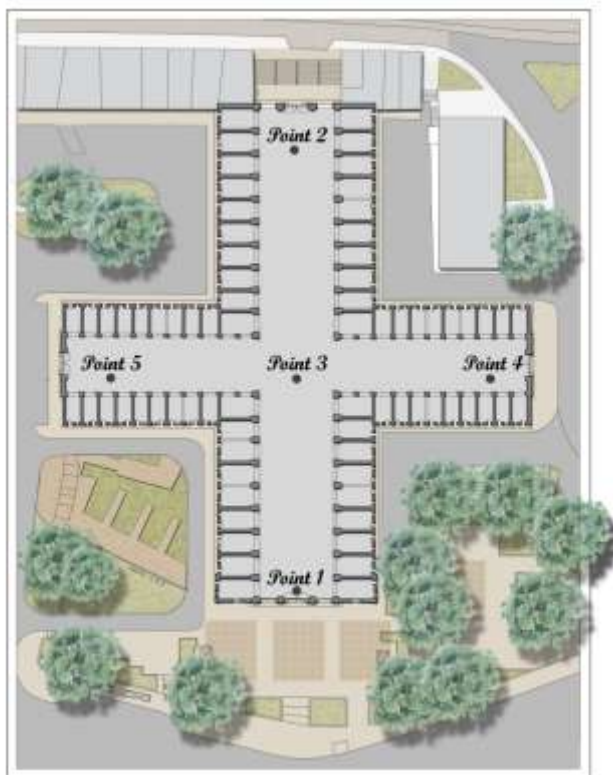
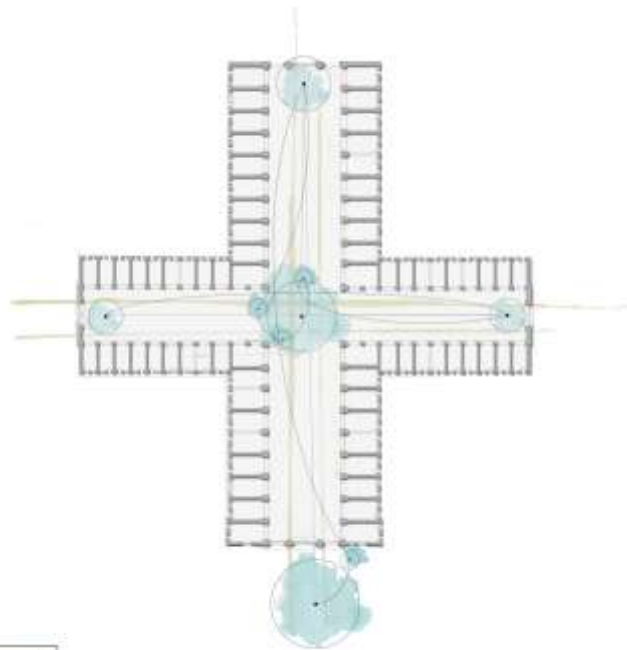
<sup>13</sup> Konstantina Sdravopoulou, Juan Jesús Gutiérrez Castillo & Juan Manuel Muñoz González, *Naturalistic approaches applied to AR technology: an evaluation*, Education and Information Technologies volume 26, p. 683–697, Springer, 2020

<sup>14</sup> Chih-MingChen, Yen-NungTsai, *Interactive augmented reality system for enhancing library instruction in elementary schools*, Computers & Education, Volume 59, Issue 2, p. 638-652, September 2012

#### 4. The narrative: Route into agora

The narrative into Agora, tried to carry out all the features, which we came to rush after the evaluation of the two surveys we presented before (Karagianni et al, 2019, Lehman, 2018). This thought was realized through a designed route, for the whole building.

To begin this narration, we had to think which story we want to tell and how to find a way to reinforce the “weak” places into Agora that most of the users in the survey of Karagianni et al, 2019, did not use. With the story of our narrative we wanted to remind the users the glorious history and the importance of the building in the city, its architectural value, as well as to help



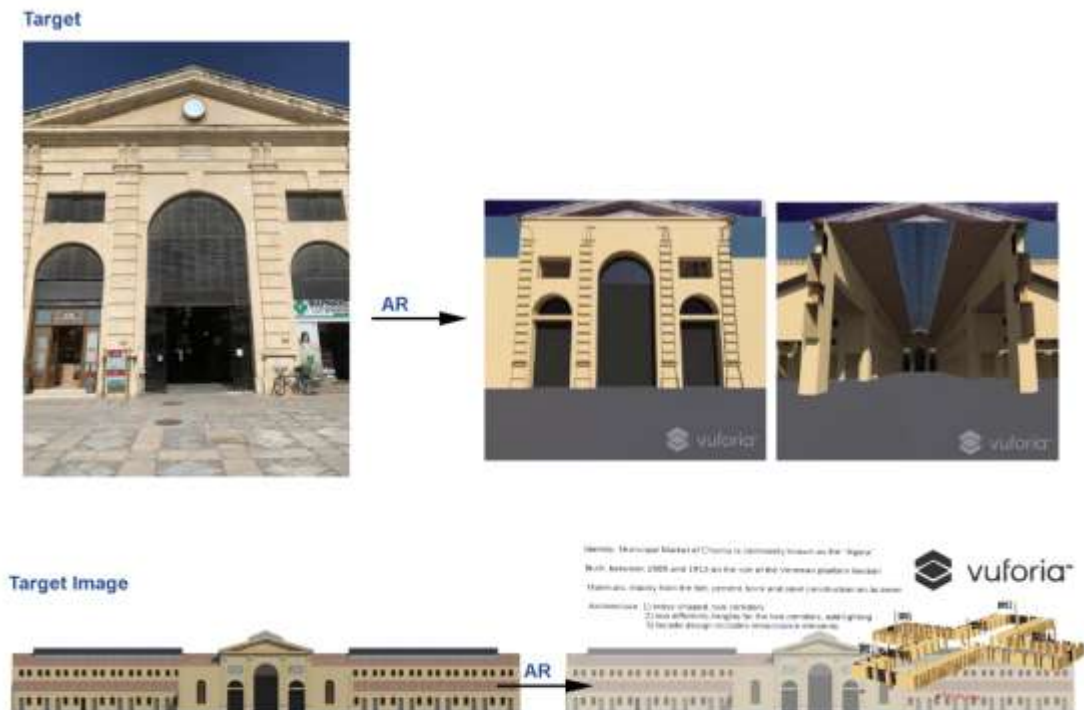
the user to orientate. The narrative involves 5 points, in a form of a route across the whole building. Its point aimed to offer different and interesting information about Agora. The experience in Agora is redesigned with augmented reality, in order to offer a different way of looking at this place. The aim was, the visitor to appreciate the dual role of Agora, as a market and as a monument as well as to emphasize through this walk the size of it, and to interact with the place in a way that he will reinforce his knowledge about the monument and live and the same time Agora with its dual role, something that is confusing in nowadays with the lack of stimuli and information.

##### 4.1. Point 1\_ the main entrance

From the results of the paper of Karagianni et al, 2019, we notice that the users, who came into Agora with some information of the 3D Crete platform, had a better experience of the place. Thus we decided to insert at this first point an overall view of the building which made the users understand better the scale and the shape of Agora. With a video screen through AR technology the users have the opportunity to see the section of the Agora and obtain a first impression of the inside. As passing the main entrance, they find an image target in which we transmit through AR technology some important information about the history of



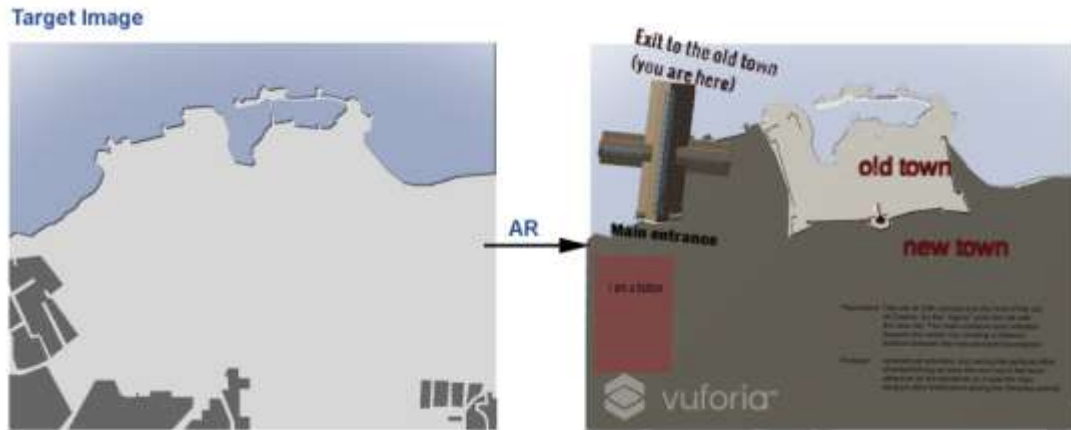
the building, its materiality and its architectural design. In this way, the user can appreciate the dual role of Agora, as a monument and as a market, as well as to have a first impression of the whole building. In this information we give them feedback of the route and the position of the others points.



#### 4.2. Point 2\_ exit of the Agora

The idea of the point 2 came from the fact that the most users of the paper of Karagianni et al, 2019, and especially those who did not have any information about the place, did not visit the south part of Agora. In this way we wanted to reinforce this place of Agora, in order the users obtain a whole experience of the building and its size. In this point we aimed to make the users understand the importance of the position of Agora. The Agora can be considered as a strong connection into the new and the old city. It is really fascinating to enter from the new city and to have the ability to exit to the old. Through a map and AR technology we tried to highlight this connection and to give more historical information about the Monument. Additionally, at this point we enter the opportunity to interact with a virtual button. The press of this button pops up a 3D model of Agora in which we added more information about the monument and the orientation.





#### 4.3. Point 3\_ the center of Agora

The center was selected as one of the most important points of the route, because at the paper of Karagianni et al, 2019, we observed its high visitation. Even nowadays at the center of the Agora we find a kiosk of information, which becomes a pole of attraction for the visitors who want to learn more about the place. In these terms we wanted to maintain this role of the center, because it is a custom that we do not want to eliminate but we tried to reinforce it. Furthermore, from the center the users have an overall look of the building which is really impressive. Therefore, the center became a very significant point of the route in which we tried to present the Agora as it was and a future proposal, in comparison with the existing situation. The AR technology helped as to superimposing virtual elements into the real environment of the Agora, and made this comparison come true. We tried to show to the users the original situation of the building, a future proposal and all these by looking at the same time as today's situation. In this way we aimed to create a chronological evolution through 3d models and the real world. The new proposal aims to give Agora its glamour, by highlighting its place. We focus on the symmetry of Agora, which is one of the major architectural elements, and we try to offer this symmetry again not only at the space but also at its markets. We tried to propose identical markets in order to highlight the building and its architectural values. Furthermore, at the center we propose some public spaces, where the visitors can interact with the building and learn more about its history, though new technologies, such as AR and VR technology.

Additionally, the lack of treatment at the building, made some very beautiful architectural elements less impressive, such as the roof. Also the big scale of the Agora, in comparison with the narrow corridors because of the expansions of the market benches, maybe not let the users to raise their head and enjoy this architectural detail. Thus, with the AR technology we tried to pop up in detail the roof of Agora, and give some information about its structure.

Target



AR

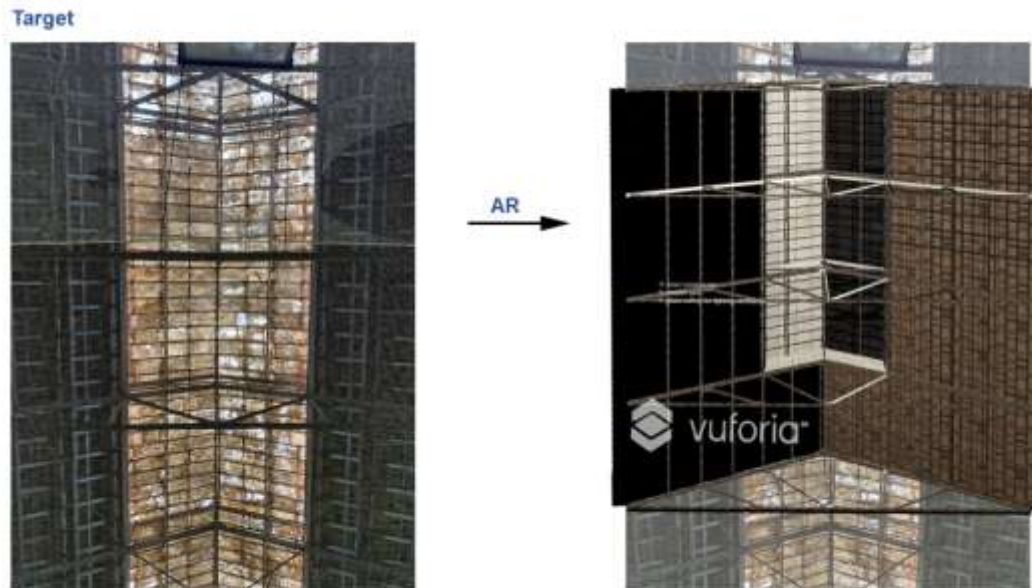


Target



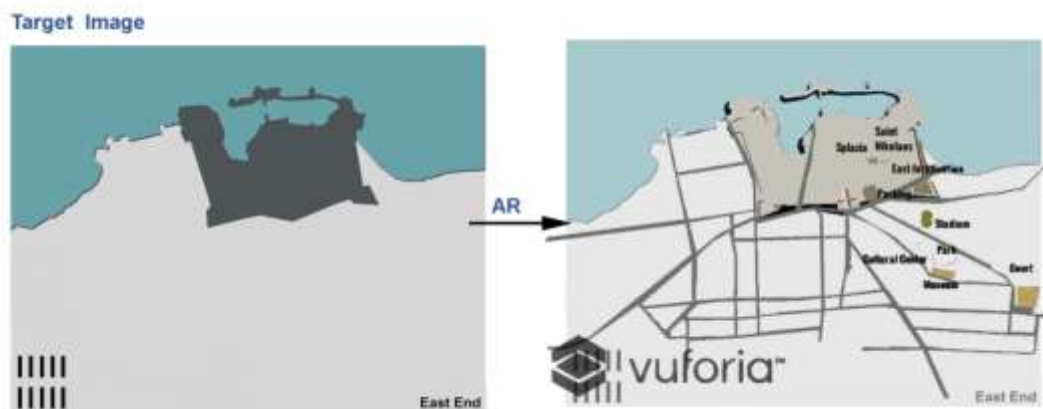
AR

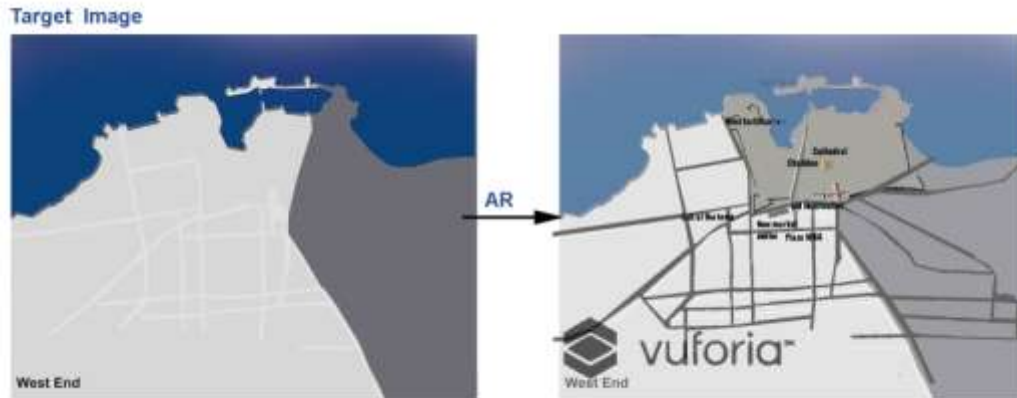




#### 4.4. Point 4 and 5\_ east and west end of Agora

These points are placed to the second corridor of Agora. One major theme of the survey of Karagianni et al, 2019, was the orientation of the users not only in but also out of Agora. With the help of the other points, the user now can perceive more the orientation of the place and of the main corridor. But the problem is that they had no information about the connection of the Agora with the surroundings. Thus the purpose of these points was to orientate the user concerning the landmarks and the facilities of the city of Chania. Each point is situated at the east and west exits of the building. There the users, using the AR technology can comprehend a part of the morphology of the city around Agora. By showing them some roads, some facilities or landmarks we aimed to help them to continue their visit in Chania without returning to the main entrance for being oriented.





## 5. Experiment

### 5.1. At the laboratory

The idea of the route needed to be edited before the final experiment took place at the building of Agora. To create 3D models we used a lot of platforms of 3D designing, like 3Ds Max, Revit, Sketchup and Autocad. After we obtained the models we needed in order to use them for the AR technology, we started to build the project on Unity, which we analyzed above. As we already mentioned this program has not a very large history in the field of Architecture. Thus, we faced several problems, which some of them were solved but others made us change our designing plan.

At first, we had to decide the kind of technology of the AR, that is, if we were going to work with marker-based AR or markerless AR. In the beginning we started with the “traditional” use of the marker based AR. But we wanted to create a sensation of the whole building and not only to show some features of it. Thus, we tried to extend the use of the marker based AR, by building one of our points into a representation of some parts of the building. In this way we achieved to track our model by targeting the building and not only a photo of it.

As we continued with the project we arrived to find the way of a total markerless point. But we realized that the unity does not be compatible with all the devices concerning the markerless point. Thus, the parts of the projects that were designed with markerless points may not be able to be seen by all users because of the compatibility of their devices.

### 5.2. Into Agora

The experiment was based on 15 visitors, in that they used a tablet where it downloaded the application of our project. The visitors were aware of the use of this application and they found every point by marks on the ground, which they pointed out the place of every point of the route. Additionally, they did not have a limitation of time. The major problem was the first point because of the sunshine that reflected on the screen and they were not able to see all the features. Because of the period that the experiment took place – February-, the place was not so crowded, thus the visitors had a better experience of it. After their visiting they were asked to complete a questionnaire based on their experience at Agora with the use of the application. This questionnaire has 4 sections. The first one is based on the level of knowledge that they have concerning Agora and if it was the first time of visiting. The second section based on their opinion about visiting Agora and experiencing it through this

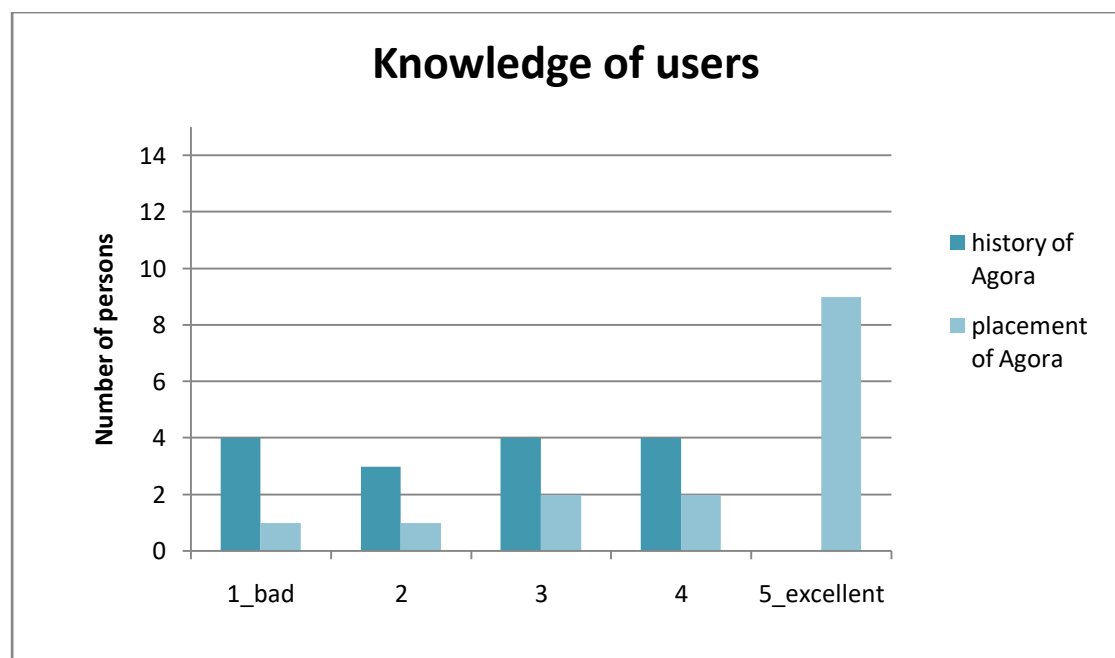
application. The third part of the questionnaire focuses on the evaluation of every point that they followed into the place. The fourth and the last part is a small evaluation about the technology of AR and asks from the visitor what they want to see more in the application, in order to experience the monument of Agora.

## 6. Results of questionnaires

Based on the answers of the questionnaires we are going to quote all the results for every section.

### Section 1

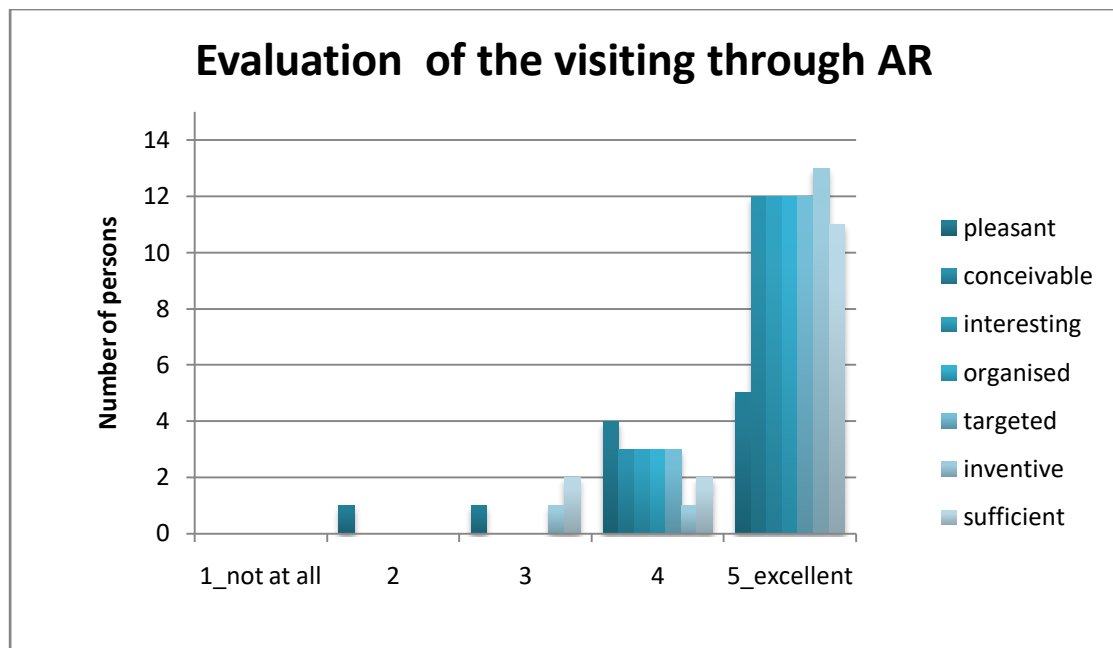
All the users answered that they had already visited the place of Agora before the experiment. At the question about their level of knowledge we received the followings:



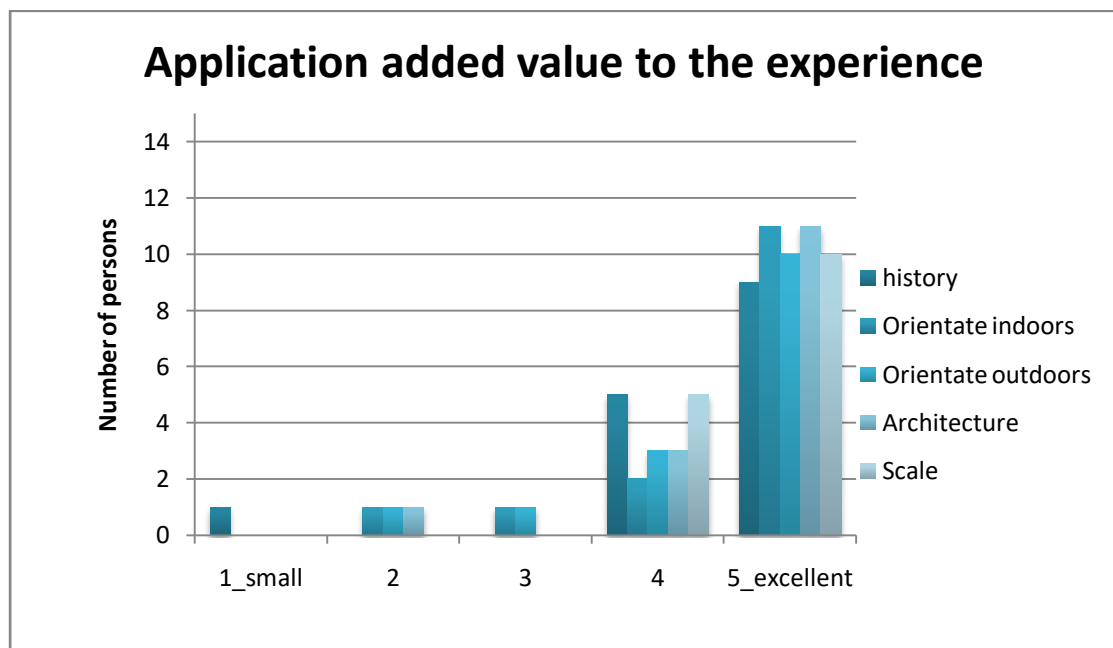
Based on the fact that all users had visited Agora before, they were concerned about the placement of Agora into the city. But on the other hand they are not so informed about the history of the building. Additionally, to the question if they are aware of the dual role of Agora, all the users answered positively.

### Section 2

This section was orientated to appreciate the experience of the users into the place of Agora using the new application with AR technology.



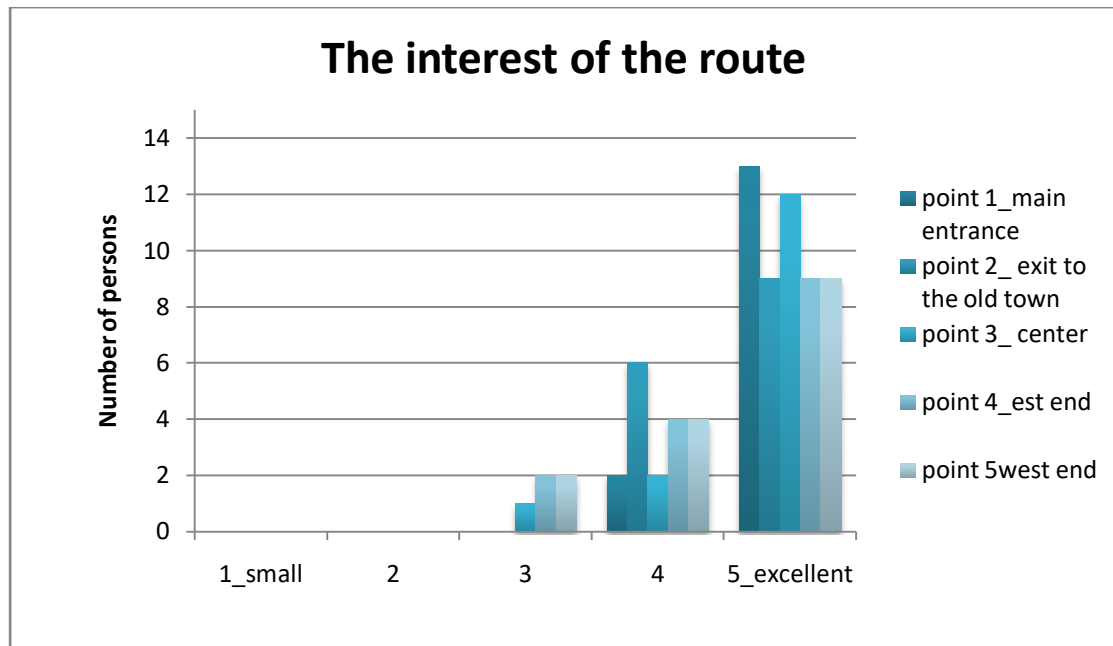
Based on the observation of the graph, the users characterized the use of the application positively. Most of them concentrated on the inventive character of the application.



Concerning the help of the application, for the most of the questions that we posed, we observe that it was really helpful for the visitors, and mainly for the orientation into the monuments, as well as for its architectural value.

### Section 3

In this section we focused on the points of the route that we proposed though this narration. We have to notice that all the users mentioned that they visited all the 5 points of the route.



From the answers, we observe a general interest in the whole route. But the most interesting parts of it, was the point 1, which is situated at the main entrance, and the point 3 which is situated at the center of Agora. After these answers, we asked the users to inform us about the enrichment of the knowledge from every part and all the users evaluate this over 3, with the most of answers placed at the level 5 of the evaluation.

#### Section 4

At this section we tried to be informed about the AR technology, concerning its use and its interest. All the users found the AR technology very interesting and also quite easy to be used anywhere.

## 7. Conclusions

Through the questionnaires we achieved an evaluation of the experience of the users, concerning the building but also of the application with AR technology. Except from the evaluation, we tried to learn their interest about every point, as well as their desires concerning the enrichment of the application. These answers helped to export more conclusions about their experience.

Based on the graphs above we observed a very large interest about point 1. This point is the beginning of our route, just in the main entrance of the building. The visitors by using the application at this point, helped out to appreciate the main entrance of Agora compared with its architectural details and its scale. Furthermore, through the application they understood the whole place of Agora with the section video. Some of them also found very interesting the information they read about the building and that was a very helpful element for them to appreciate its value better. Additionally the 3D plan with the indication of the following points helped them to be informed for the whole route into the place.

For the second point, the users perceived its importance, because they testified that through this point they were able to understand first of all the placement of the Agora into the city and the importance of it. They claimed that this point helped them to be orientated and to realize the importance of this exit that leads you towards the old town.



The third point is one of the most rated. The users had a lot of aspects about this evaluation. They found quite interesting the fact of a new proposal for the monument. Furthermore, the 3D representation of the original state of the monument helped them to understand its scale and some architectural details. Some of the users claimed that because of the markets on the ground floor and their expansion on the corridors, they did not realize the symmetry of the frames above, but through the application could observe this beautiful architecture design. The superimpose was very attractive because they were able to experience the pass, the existing and a future state of Agora. Another interesting element for the users was the 3D representation of the roof. Most of them found very interesting the explanation of the materiality of the roof, information that reinforces their question about the construction of the building.

For the following points at the east and at the west end of Agora, the opinion was almost identical. This is normal because the role of these points is the same, the orientation to the city. They found it very helpful to have a map with all the facilities and the landmarks of the city, depending on the exit that you choose. They claimed that it was very helpful concerning the orientation for the entire city and not only for the old one.

At the end of the questionnaires we posed a question about a further use of the application or ideas of its enrichment. Most of them were very interesting, something that proves that the users react positively when they have new stimuli about a place. Firstly, some users were excited about the future architectural proposal, so they suggested a series of proposals that they will be able to choose and become part of the restoration of the monument. Others claimed that they wanted a 3D representation of the whole building. This idea seems to describe a more immersive experience because of our familiarity with the VR technology, as we already explained. A lot of users found the application very innovative and inventing, thus their desire is to be applied in more monuments in order to become more attractive. One very interesting idea was based on the information of the monument. Some of the users wanted more historical information about Agora, and the fascinating thing is that they proposed a narrator that you can listen to even in more than one language and to have the ability of collection. Some users supported that this idea will be very useful for disable persons. Another fascinating idea was the deepening in the construction details of the monuments and its static carrier, though the AR technology.

Summarizing, after conducting the experiment and its results, we observed that the use of a new technology into a place that the people cannot be able any more to appreciate its value because of numerous facts, can really be enhanced. The idea of something “new” into something “old” is the perfect stimuli for the users and it is an opportunity to attract more people in our monuments. It is a pleasant way to reinvent the monument and collect information without being stuck in old books or searching everywhere on the internet. The monument “speaks” to you and this interaction is more constructive. Of course the AR is not so advanced in these fields and most of the users are not so familiar, but it is a challenge that seems to be accepted by the users and by the entire research community. The technology advances, therefore our perception about architectural design has to advance as well. The architectural design must be interactive and this can be done only by using the facilities that the technology offers to all of us.



## 8. References

1. Andrew Joshua Ancira, Architecture 2.0; representing the architectural future with new technologies, Cornell University, May 2020
2. A. Karagianni, V.Geropanta, P. Parthenios, R. Porreca, S. Mavroudi, A. Voyatzis, L. Margiori, Ch. Mpaknis, E. Papadosifou, A. Sampani, *Enhancing user experience in public spaces by measuring passengers' flow and perception through ICT. At the case of the municipal market of Chania*, Research Advancements in Smart Technology, Optimization, and Renewable Energy, IGI-Global, 2019
3. Anna Karagianni, Vasiliki Geropanta, Panagiotis Parthenios, *Exploring the ICT Potential to Maximize User - Built Space Interaction in Monumental Spaces The case of the municipal agora in Chania, Crete*, SUSTAINABILITY +CULTURAL HERITAGE - Volume 2 - eCAADe 37 / SIGraDi 23 | p. 603-610, 2019
4. Chih-MingChen, Yen-NungTsai, Interactive augmented reality system for enhancing library instruction in elementary schools, Computers & Education, Volume 59, Issue 2, p. 638-652, September 2012
5. Fatemeh Moradi, Mikael Wiberg, *Getting It Going: Explorations at the Intersection of Moving Bodies, Information Technology and Architecture*, N.S. Dalton et al. (eds.), Architecture and Interaction, Human-Computer Interaction Series, DOI 10.1007/978-3-319-30028-3\_6, Springer International Publishing, Switzerland 2016
6. Greg Kipper, Joseph Rampolla, *Augmented Reality: An Emerging Technologies Guide to A*, Syngress, USA, 2013
7. Huseyin Uzunboyulu, Ezgi Pelin Yildiz, Augmented reality research and applications in education, New Trends and Issues Proceedings on Humanities and Social Sciences, Online, 11, pp 238-243, 2016
8. Jeremy Kerr, Gillian Lawson, *Augmented Reality in Design Education: Landscape Architecture Studies as AR Experience*, <https://doi.org/10.1111/jade.12227>, 2019
9. Juan Manuel Davila Delgado, Lukumon Oyedele, Peter Demian, Thomas Beach A research agenda for augmented and virtual reality in architecture, engineering and construction, Advanced Engineering Informatics Volume 45, <https://doi.org/10.1016/j.aei.2020.101122> , August 2020
10. Konstantina Sdravopoulou, Juan Jesús Gutiérrez Castillo & Juan Manuel Muñoz González, Naturalistic approaches applied to AR technology: an evaluation, Education and Information Technologies volume 26, pages683-697, Springer, 2020
11. Kotsaki Amalia, Martha Loukia, Papagiannopoulou Despoina, *Crete 1913-2013: Architecture and Urban Planning after the Union*, Cultural Center of Chania - SAH, Chania 2014
12. Maria Lorena Lehman, Future-proofing the public library, PUBLIC LIBRARY QUARTERLY, VOL. 37, NO. 4, p. 408-419, <https://doi.org/10.1080/01616846.2018.1513256>, 2018
13. Nemanja Memarovic, *Community Is the Message: Viewing Networked Public Displays through McLuhan's Media Theory*, N.S. Dalton et al. (eds.), Architecture and Interaction, Human-Computer Interaction Series, DOI 10.1007/978-3-319-30028-3\_8, Springer International Publishing, Switzerland 2016
14. Rachael Luck, *What Is It About Space That Is Important in Interaction? Let's Take the World from a Situated Point of View*, N.S. Dalton et al. (eds.), Architecture and Interaction, Human-Computer Interaction Series, DOI 10.1007/978-3-319-30028-3\_3, Springer International Publishing, Switzerland 2016

15. Panagiotis Parthenios, Anna Karagianni, Angeliki Christaki, Sofia Mavroudi, Marilena Mochianaki Karampatzaki, Evangelos Nitadorakis and Ioannis Rousogiannakis, *Combining Indoor Positioning Systems (IPS) with Structure from Motion (SfM) 3D Point Clouds in Cultural Heritage*, VISUAL HERITAGE 2018 | CHNT 23, Structure from Motion (SfM), Virtual + Augmented Reality, Vienna, Austria, 2019
16. Vasiliki Geropanta , Anna Karagianni , Panagiotis Parthenios, *ICT for user-experience transformations in Sustainable - Smart Tourism Projects VR, AR and MR in Rome's historical center*, SUSTAINABILITY +CULTURAL HERITAGE - Volume 2 - eCAADe 37 / SIGraDi 23 | p. 593- 602, 2019
17. Yueyun Fan, Yaqi Zheng, *The Application of Urban AR Technology in Cultural Communication and Innovation*, HCI International 2020 – Late Breaking Papers: Virtual and Augmented Reality, Springer, 2020