THE FACTORS THAT INFLUENCE USAGE OF MOBILE AUGMENTED REALITY APPLICATION

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ABSTRACT

THE FACTORS THAT INFLUENCE USAGE OF MOBILE AUGMENTED REALITY APPLICATION

With the increasing use of smart devices, augmented reality (AR) technology has become widespread in mobile devices. As with user interaction technologies, there are factors affecting the use of applications in mobile augmented reality (MAR) applications. In this research study, the factors which affect the use of mobile augmented reality were investigated. Although AR and MAR were generally investigated during the research period, Augment, the application, was used in the survey and interview part of the research study. The interview, which consists of three different parts, and a quantitative experimental study were conducted. 139 variables were obtained from articles and interviews. As a result of the studies, 22 of these variables were selected. In the study, 47 questions were asked to examine the 22 concepts. In the quantitative experimental study, 146 participants answered questions. The survey data was collected by a web based form.

As a result of this study, the most important factor that influences usage of MAR application is security and privacy. The following factors are ease of learning, visual quality of the application 3D model, and ease of use. To sum up, it is recommended that designers, and application developers consider these five variables when designing or developing a MAR application.

Keywords: *Augmented Reality, Mobile Augmented Reality Applications, Design Factors, User experience*

ÖZET

MOBİL ARTIRILMIŞ GERÇEKLİK UYGULAMASINDA KULLANIMI ETKİLEYEN FAKTÖRLER

Akıllı cihazların kullanımının artmasıyla birlikte artırılmış gerçeklik teknolojisi mobil cihazlarda yaygınlaşmaya başlamıştır. Kullanıcı etkileşimli teknolojilerde olduğu gibi mobil artırılmış gerçeklik uygulamalarında da uygulamanın kullanımını etkileyen faktörler mevcuttur. Bu çalışma kapsamında mobil artırılmış gerçeklik uygulamasında kullanımı etkileyen faktörler araştırılmıştır. Araştırma sürecince genel olarak AG ve MAG incelmiş olsa da araştırmanın anket ve görüşme kısmında Augment uygulaması kullanılmıştır. Üç ayrı kısımdan oluşan görüşme ve nicel bir deneysel çalışma yapılmıştır. 139 tane değişken okunulan makalelerden ve görüşmelerden elde edilmiştir. Yapılan çalışmalar sonucunda bu değişkenler içerisinden 22 tanesi seçilmiştir. Anket çalışmasında ise elde edilen 22 kavramın incelenmesini sağlayacak 47 soru sorulmuştur. Nicel deneysel çalışma kapsamında 146 katılımcı soruları cevaplandırmıştır. Anket verileri internet tabanlı form aracılığıyla toplandı.

Bu çalışmanın sonucu olarak da, MAG uygulamasında kullanımı etkileyen en önemli faktör güvenlik ve gizlilik olmuştur. Takip eden faktörler ise öğrenme kolaylığı, uygulamadaki modelin görüntü kalitesi ve kullanım kolaylığı olmuştur. Sonuç itibariyle, bu beş değişkeni MAG uygulaması tasarlarken veya geliştirilirken tasarımcıların/yazılımcıların göz önünde bulundurması tavsiye edilmektedir.

Anahtar kelimeler: *Artırılmış Gerçeklik, Mobil Artırılmış Gerçeklik Uygulamaları, Tasarım Faktörleri, Kullanıcı Deneyimi*

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CHAPTER 1

INTRODUCTION

Mobile augmented reality a rapidly developing technology and the number of conscious users is increasing day by day. Moreover, many company giants have begun to use mobile augmented reality both in advertising campaigns and product promotions. For example, Coca-Cola released a new advertisement "Bir Başkayız Biz" in May 2019. With this ad, the QR code on the boxes are scanned and special animations start to play with MAR app of Coca-Cola.

Augmented reality can be used in many areas from entertainment to health. Its current most preferred application areas are the gaming and education sectors because the applications offer users new and advanced experiences when they are playing a game or studying, which attracts users.

Mobile and fixed are the basic categories of augmented reality systems. A mobile system provides mobility to the user so the user can move freely. Naturally, a fixed system is the opposite, so the user cannot move when using the fixed system (Kipper, 2013). However, this study focuses on mobile augmented reality applications and the one application used; Augment.

Even though, there are a lot of research fields related to MAR applications, the research topic of this study is finding the factors that influence usage of mobile augmented reality application.

1.1 Definition of Problems

Although there are better solutions to the technical problems of mobile augmented reality systems, there are still a few problem areas. Security, application's speed performance, display screen, and location tracking are example of ongoing problems (Yu et al, 2016).

Acceptance of the new technology by user is one of the factors which affects the achievement of it. As this area is excepted to grow in importance quickly because of technologic developments and research, acceptance and usefulness, it is important to determine what the main constraints are by users for the acceptance of augmented reality (Bhutta et al, 2015)

When we think about usage of Augment (selected application) in Turkey, application language is one of the important problems. On the other hand, users generally have issues with 3D model's scale and rotate command. If these problems can be solved, MAR applications may gain acceptance.

1.2. Aim of Study

The aim of the study is to examine the factors that influence usage of mobile augmented reality application.

The other aim of the study is determining the constructs which are considered by application developers and companies.

1.3. Research Questions

The study was written based on the following research question: " What are the factors that influence usage of mobile augmented reality application?". But there are also many other questions. These are:

1. What are the key function requirements when using MAG application?
2. What are the aspects to be considered by application developers and companies?

1.4. Methodology

The research methods of this study include an interview consisting of three different parts and a quantitative experimental study. The first part of interview was done with 4 tech-savvy people. Other parts of interview were done with 8 people from

different demographic profiles. Lastly, the quantitative experimental study method was done with 146 individuals.

1.5. Structure of Study

The study consists of six chapters. These are the introduction, literature review, framework, methodology, findings, and lastly conclusion.

The introduction includes a definition of the problem, the aim of the study, and the research questions. In the literature review chapter, augmented reality, mobile augmented reality, and Augment (MAR application which was used in interview) are explained in detail. In the third chapter, taxonomy of MAR usage factor and hypotheses about the study results are described. In the methodology chapter, the process and methods of study are described. In the findings chapter, information collected from interviews and the quantitative experimental study are explained. In the last chapter, the conclusion of the study is presented in accordance with all collected information.

For this study, Augment, which is one of the MAR apps, was chosen because the application can be reached easily in commonly used operating systems and it has a wide range of 3D models.

CHAPTER 2

LITERATURE REVIEW

2.1. Virtual Reality

The definition of augmented reality goes through the Encyclopedia Britannica as follows: " the use of computer modeling and simulation that enables a person to interact with an artificial three-dimensional (3-D) visual or other sensory environment".

2.2. Virtual Reality versus Augmented Reality

When comparing augmented reality and virtual reality technology, AR has two core advantage which are better sense of reality and better interaction. If necessary to explain, VR technology simulates the real world in the computer environment and gives the users an immersive feel. On the other hand real and virtual world is an organic integration in AR technology so that AR has a better sense of reality. And second advantage is, in VR environment the user is an inactive position but in AR environment s/he is an active position so AR has better interactivity (Yang, 2011).

Figure 2.1. illustrate the differences between the augmented reality and the virtual reality. As seen in the figure, augmented reality technologies enhance real life but virtual reality technologies take the user to a virtual world.

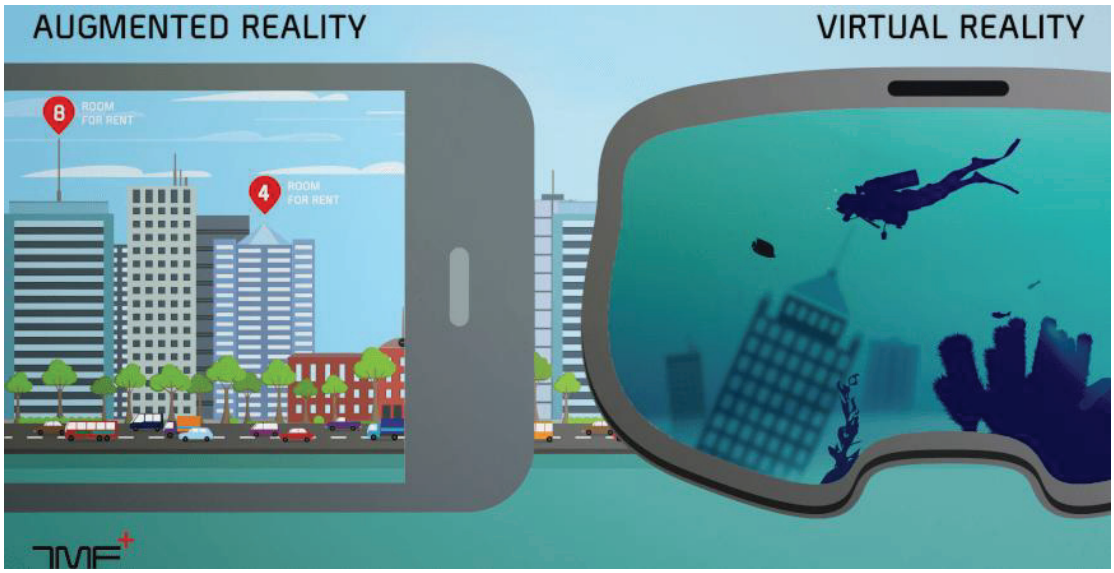

Figure 2.1. Augmented reality vs Virtual reality (TMF, 2017)

2.3. Augmented Reality

The definition of augmented reality goes through the Encyclopedia Britannica as follows: " Augmented reality, in computer programming, a process of combining or "augmenting" video or Photographic displays by overlaying the images with useful computer-generated data.

According to Madden (2011) the definition of AR is;

1- Computer graphics should combined the real environment

2- User should interact with models/objects in real time

3- Models/objects should be tracked in real time

4- Images/objects should be recognized

5- Context/data should be provided real time

The notions of a "Virtuality continuum" refers to the mixture of classes of substances offered in any special case. As shown in the figure 2.2., real environments are illustrated at the begging of the continuum and virtual environments on the opposite side. At the left side, describes environments comprise of only real objects, and contains

such as what is observed through a conventional video display unit of a real environment scene. At the right side, describes environments comprise of only virtual objects, as an example, it may be a conventional computer graphics simulation (Milgram et al, 1994).

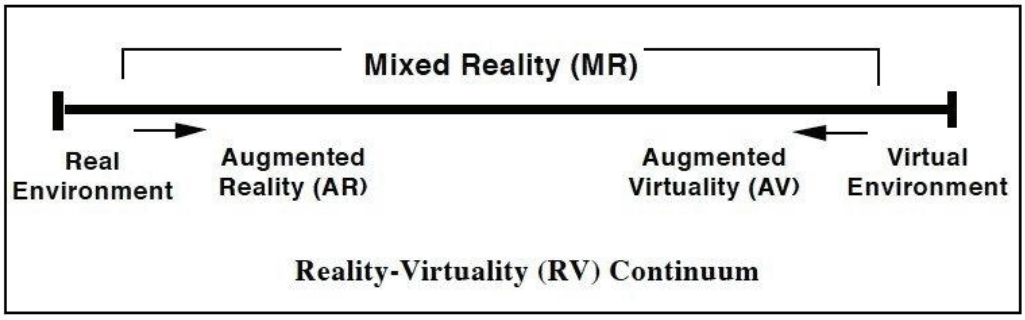

Figure 2.2. "virtuality continuum" representation (Milgram et al, 1994)

The aim of augmented reality is increasing the perception and information of a real world. It can be done by attaching digital knowledge corresponding with this environment. Generally this knowledge is visual but in addition to this it can be auditory and haptic. In most AR app, the user envisions virtual images/models etc. with smart glasses, headsets, video projectors, and mobile devices such as mobile phones, tablets (Arnaldi et al., 2018).

Augmented reality divided into two main types: mobile and fixed. The differences of these two type is; a mobile augmented reality allows mobility to the user so s/he can move easily when using the device (Kipper, 2013).

Augmented reality will be the eighth mass media forecasted Raimo van der Klein who is the founder of Layer (Peddie, 2017).

2.3.1. Types of Augmented Reality Systems

There are different kind of AR systems which are helmet (like helmet in Iran Man movie) , head-up display smart- glasses (like Google glass), projection, specialized

and other. On the other hand, AR systems divided in two main categories which are wearable like helmets, contact lenses etc. and non-wearable like smartphone, Pcs, etc. (Peddie, 2019).

For enriching the real world with augmentations, a software application, which using one or more different hardware components, must be constituted on the equipment. There are two main augmented reality software implementation types which are marker based (like QR code, barcode) and markerless augmented reality (Kamphuis et al, 2014).

Jon Peddie also has prepared the classification of augmented reality as shown in the Figure 2.3. According to figure, AR systems are divided into two. These are wearable devices like smart glasses or watches, and non-wearable devices like mobile phone, PC. Their usage is shown in the Figure 2.3.

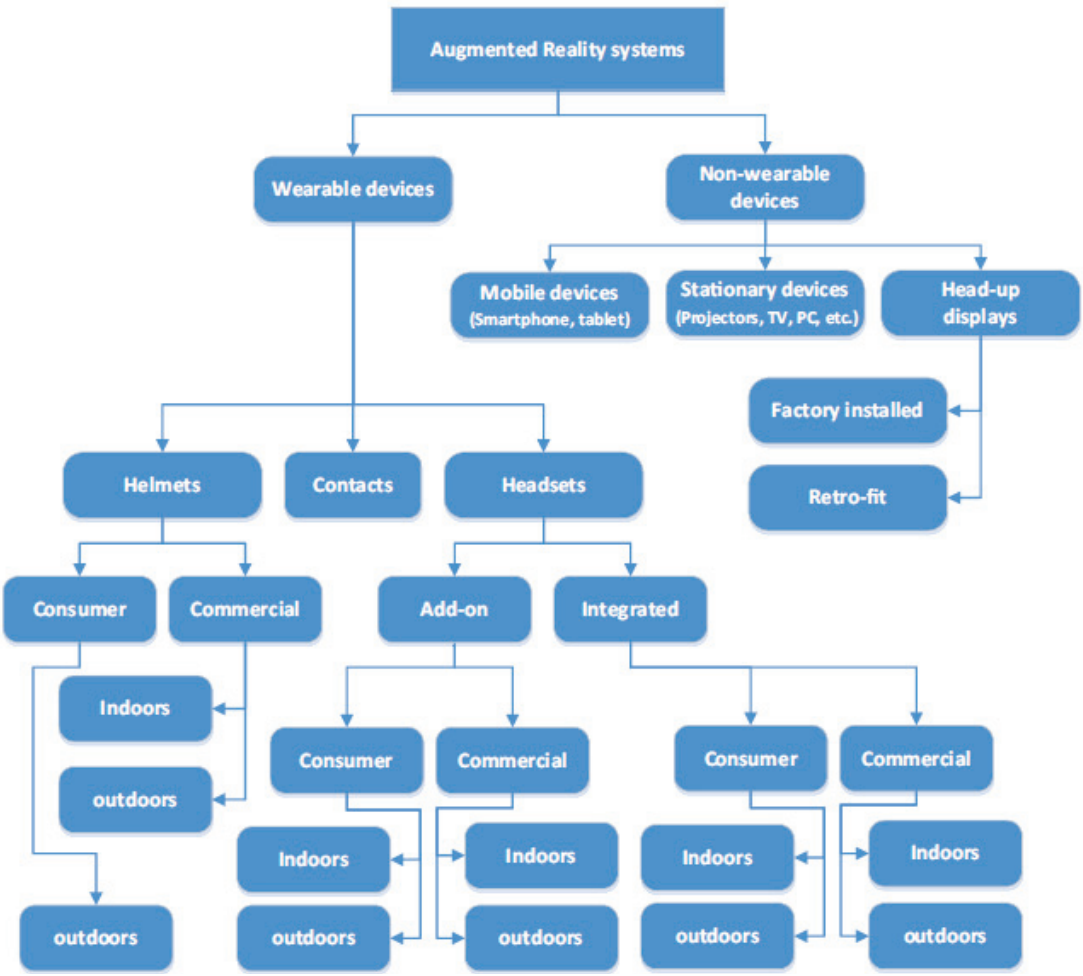

Figure 2.3. The classification of augmented reality (Peddie, 2019)

2.3.2. Augmented Reality Methods

There are four main augmented reality methods (Kipper, 2013). These are;

- Pattern (marker, QR code, barcode)
- Outline/ image recognition (like face, hand)
- Location (like navigation systems)
- Surface (like table for games)

Methods have different advantage. Advantage of pattern based methods is overcoming the problem that arises from registration. As well the extra capacity will not be necessary since information is stored in QR codes (Kipper, 2013).

2.3.3. Components of Augmented Reality.

Displays, tracking technologies, interfaces, registration systems, hardware and software are the essential components of augmented reality. New challenges and limitations will occur due to AR technologies, that are rapidly improving and commercially findable. In spite of the growing in AR and the great body of improvement and research, a few challenges and problem existing and need to be discussed (Bhutta et al., 2015).

Firstly the basic components required for both fixed and mobile environments are divided into two which are hardware and software. After that, hardware divided into six. First one is a device, such as computers, a pc, and mobile device, second one is a monitor or screen, third one is a camera, forth one is tracking and sensing systems like gps, compass etc., fifth one is a network infrastructure, last one is a marker. And software divided into three. These are an app or program running locally, web services, and a content serves (Kipper, 2013)

Mohamed El-Zayat (2012) made schematization of augmented reality components from real environment to virtual environment. It consists of three parts which are a real scene, a web server, and an AR scene.

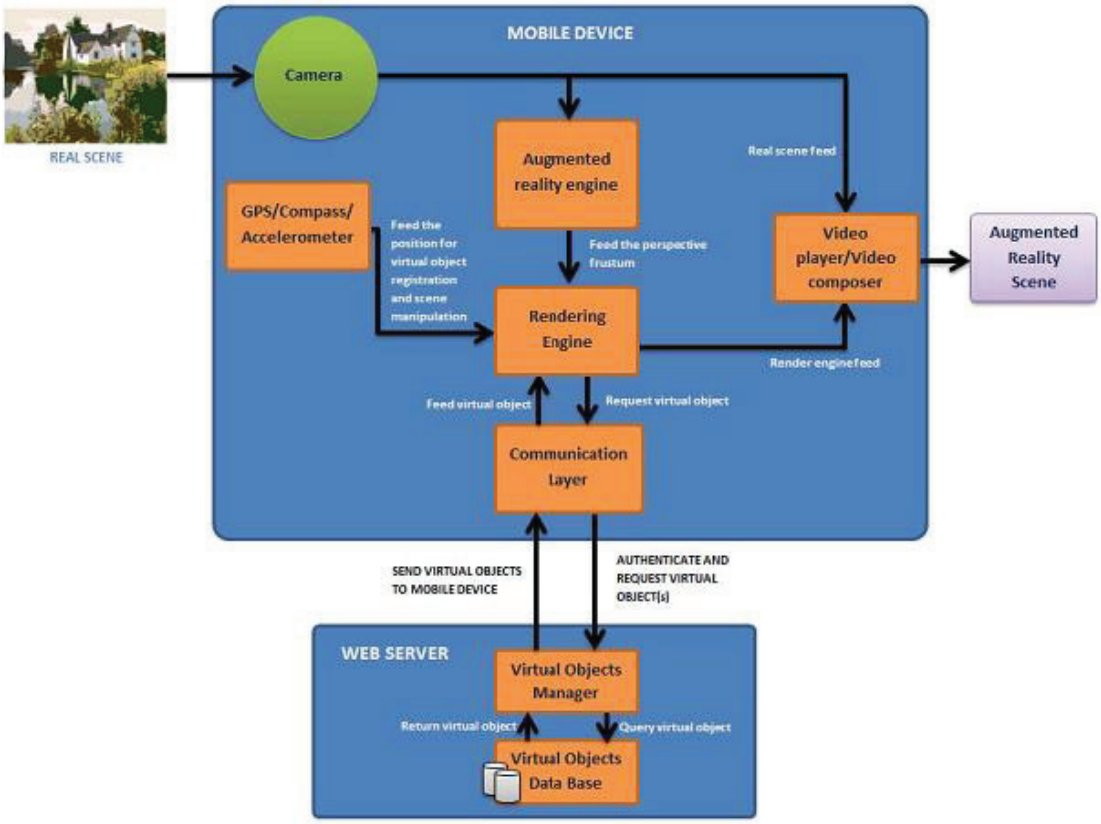

Figure 2.4. Components of Augmented Reality (El-Zayat, 2012)

Visual content for augmented reality applications can be categorized into three base types. These are 3D objects, 2D images, and animations (Craig, 2013).

2.3.4. Key Features of Augmented Reality

According to Yu et al. (2016), MAR systems have many key technologies. But the most important ones are; first one is tracking and registration technology because MAR needs highly accurate position to align, register. Second one is using technology about object detection and recognition. With this technology, exploring the scene and finding the target can be done. Third one is calibration. The benefit of calibration is restoring objects which are in the real world with using image pixels on cameras. Forth one is model rendering. The importance of this technology is, getting geometrical models in the real world. The last key technology is display and interaction.

2.3.5. Augmented Reality Application Area

Nowadays, there are many areas where AR is used and it seems that new areas will be added to these areas. One of the biggest factors for the increase of the areas is usage of mobile devices, such as mobile phone, tablet, in daily life.

According to researches, the number of AR users is expected to reach 1 billion in 2020 and the combination of AR and VR market size is expected to reach US $ 215 billion in 2021. Furthermore, AR and VR games are expected to reach 216 million .Figure 2.5. shows market predictions (newgenapps, 2018).

Figure 2.5. Market Predictions of AR (newgenapps.com, 2018)

2.3.5.1. Entertainment:

According to Perkins Coie survey 2018, individuals, who completed the questionnaire came from various sectors, selected entertainment area is the most prominent area among augmented reality applications. Gaming area follows the entertainment with 18% of the votes.

Figure 2.6 and Figure 2.7 are examples of augmented reality application in entertainment area. First one is InkHunter AR. With this app, user can try virtual tattoos. The greatest benefit is the ability to make a pretesting of the tattoo that will be permanent in the body. Second one is an example from the movie industry, Iron Man 3. In the movie, Tony Stark, which is the main character, wears a personal helmet. The helmet shows important information like ambient condition, health situation etc. to the character.

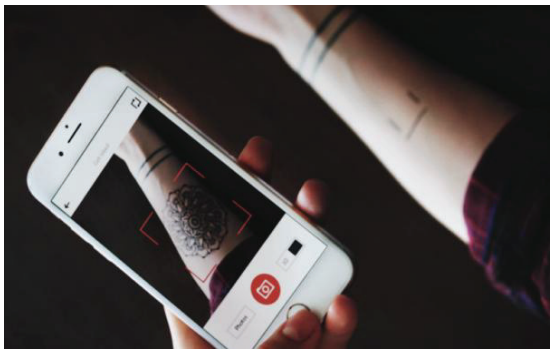

Figure 2.6. Interface image of the InkHunter App (gadgette.com, 2016)

Figure 2.7. Iron Man 3 Movie (indiatoday.in, 2016)

2.3.5.2 Gaming:

Considering the myriad potential augmented reality and virtual reality applications, the current market segment with the highest potential and enthusiasts is game (Aukstakalnis, 2016).

Augmented reality is overtly the next step in the development and will most probably service as the primary yielding market segment of the AR industry in the

coming years . Even though still very young from the point of launch and development into the marketplace. Because of the possibility of a completely new gaming experiences class ,this specific paradigm holds remarkable potential (Aukstakalnis, 2016).

Figure 2.8 and Figure 2.9 are examples of augmented reality application in game area. First one is Pokemon GO, which is downloaded 650 million times until June 2017, presents location-based MAR game experience (Chatzopoulos et al., 2017). With this application, players can find their Pokemon characters and can train them while doing this MAR app using geographical data. Moreover, players close their hands for making "Pokemon eggs" and walk a bit because of hatching. Thereby, unlike other video games, Pokemon GO needs to get out of the closed areas and walk around to make progress in the game (Watanabe, 2017).Second one is AR Dragon. This app is a kind of pet simulator. Players can feed, train and play with the dragon. The game starts from the infancy of the dragon and continues with its growth.

Figure 2.8. An image from Pokemon GO (graphicartsmag.com, 2016)

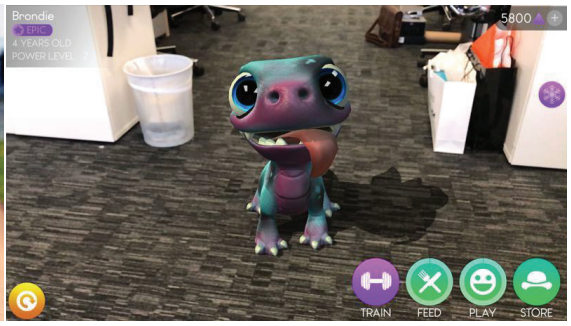

Figure 2.9. An image from AR Dragon App (macworld.co.uk, 2018)

2.3.5.3. Education

With the AR applications, students learn the information about their course in a more fun and clear way. Research also emphasizes that this way is more memorable. Through the educational applications, students see the 3D virtual image of the subject in

the real world. For example, medical students can use medical application when studying on anatomy subject so that they can use their time more efficiently and may be they have not a change to find a cadaver easily but with the applications they have a change to examine organs in 3D. Or archeology students can absorb historical ruins more impressive.

Figure 2.10 and Figure 2.11 are examples of augmented reality application in education area. First one is Augment, which has a wide application area, for the archaeology of the Lincoln Home National Historic Site. Moreover with that application 3D historical model, geographic information, archival documents, photographs can appear when the screen is held toward the template/ paper (Shin, 2016). Second one is AR solar system magic book. The aim of that application is to teaches knowledge in a fun way.

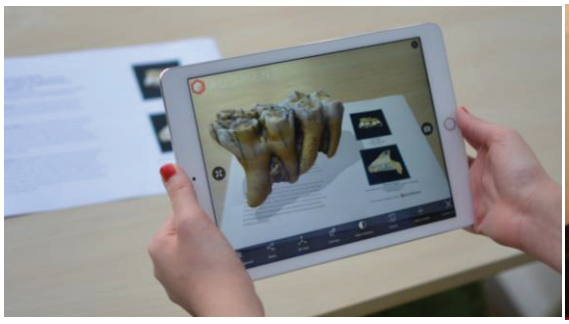

Figure 2.10. Interface image of the Augment App (augment.com, 2016)

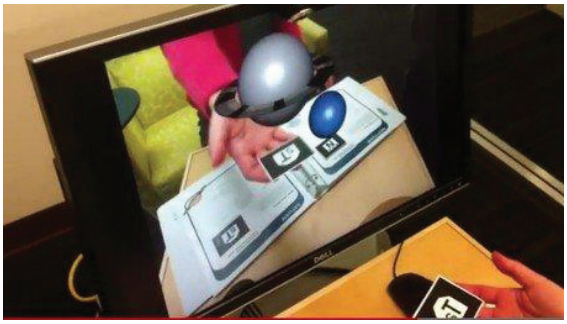

Figure 2.11. Interface image of the AR Solar System Book (scoop.it, 2013)

2.3.5.4 Marketing and Advertising

Nowadays, augmented reality applications are seen as more available area for brands. For example, BMW and Mini, Nissan, Toyota used augmented reality in magazine ads. And they publish 3D models of cars with AR application. The AR is not used only in printed form but also in cinema and television industry. Transformers, Iron Man, and Star Trek are some example of the film industry (Kipper et al, 2013).

Figure 2.12 and Figure 2.13 are examples of augmented reality application in advertising area. First one is Unbelievable campaign which is an AR campaign of Pepsi Max. The campaign works with see-through display system and it was made in London. The concept of campaign is to take attention of waiting passengers at the bus stop with different contents like a huge robot crashing, meteor drop to a bus stop, and an alien invasion etc. Furthermore, PepsiCo won the a lot of awards with the campaign. Second one is a marketing augmented reality application of Audi. The name of application is Audi Quattro Coaster AR. To start using the application, a mobile device needs to see the television screen when the ad is appeared. So that Audi quattro rushes out of the TV screen and goes on a trip in the user's living space. Moreover, four different quattro coaster models in a miniature and real size can be explored and they can take a test drive in four different seasons on their own route.

Figure 2.12. An image from Pepsi Max campaign (littledotstudios.com, 2015)

Figure 2.13. An image from Audi campaign (dijitalajanslar.com, 2018)

2.3.5.5. Tourism

In order to attain wider audiences, tourist organizations should create attractive multimedia content which attracts tourists. Thus, new systems are needed to promote these innovative applications and provide added-value content (Fritz et al,2005).

Figure 2.14 and Figure 2.15 are examples of augmented reality application in advertising area. First one is an augmented reality application for American Museum of

Natural History which is the largest natural history museum in the world. When ruins, that are in the museum, are detected by the application, users can learn extra knowledge about the ruins and they can also see animated version of the ruins with their videos. Additionally, users can test their knowledge about the ruins and can purchase their tickets with online. Second one is a mobile augmented reality application of The Franklin Institute. The application is done only for Terracotta Warrior exhibition. And it was displayed for a limited time. When the application scanned items with visitor's smartphone, the items are visualized with rich AR content. So they learned a lot of knowledge about riveting history behind the gorgeous clay soldiers. Lastly, MAR application powerd by Wikitude AR SDK.

Figure 2.14. Image of the AMNH App (youtube.com, 2013)

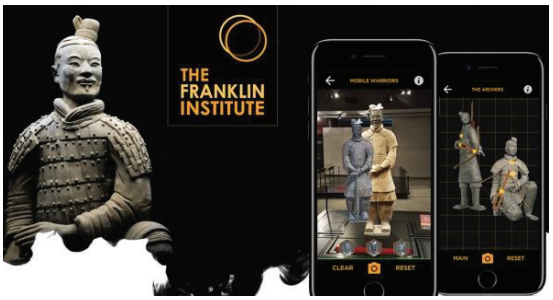

Figure 2.15. Image of Terracotta Warrior App (wikitude.com, 2018)

2.3.5.6 Navigation

With the advent of the Android system, smartphones are quickly improving and access to the internet is getting easier on the phones, the user can easily access the location information anywhere and anytime (Chung et al, 2016). And this leads to increased use of navigation systems.

According to Chung et al, the navigation system comprise of the following components;

1. The location data (by the location service provider)

2. Sensor data (several sensors inside the device)
3. The filter part (it filters out errors in sensor and location data)
4. The output processor (compares the resolution and movement of the device for the user to display the data obtained on the screen)

Figure 2.16 and Figure 2.17 are examples of augmented reality application in navigation area. First one is Sygic GPS Navigation that is the world's most downloaded GPS navigation application. The Sygic works with users smartphone's camera and GPS. It is available both Android and IOS users and it can be used without an internet connection. Second one is ARCity which enables users to access information and content for traveling and navigating around cities. And users are interacted with the world through the application. Furthermore, it is a part of the Blippar Group.

Figure 2.16. Interface image of the Sygic Navigation (sygic.com, 2016)

Figure 2.17. Interface image of the ARCity App (drivenxdesign.com, 2018)

2.3.5.7. Browser

There are several benefits of using augmented reality browsers. Firstly, building content is easy because of little or no programming information needed. Secondly, generally contents encounter to people, who are interested in AR. Thirdly, Android and Iphone would worked the same content. And lastly, usage of mobile device are increased and this makes browsers more discoverable (Madden, 2011).

There are various AR browsers that allow users navigation between different points of interest with GPS, camera tracking techniques. Best-selling AR browsers , at

the moment usable have been organized by supplier, URL, platform promoted and head office of respective AR browser organizations (Khan A. et al., 2015).

Figure 2.18 and Figure 2.19 are examples of augmented reality application in browser area. First one is Wikitude. The browser is the first AR browser released in 2008. And it won the award for being easiest browser to create content in 2010 (Madden, 2011). Second one is Layar. With the browser, user can receive information on local restaurants or apartments. When the user activates camera of smartphone, the content layer are superimposed over the screen. As the camera is pan, different icons come to exist. Furtermore, it is a part of the Blippar Group.

Figure 2.18. Interface image of the Wikitude (geeky-gadgets.com, 2011)

Figure 2.19. Interface image of the Layar (fastcompany.com, 2010)

2.3.5.8. Medicine

Augmented reality would be used by doctors as a visualization and educational aid for surgery. Probably, doctors can collect patient's 3D datasets in real time, using non-invasive sensors such as MRI (magnetic resonance imaging), CT (computed tomography scans), and ultrasound imaging. After collecting, they can render and combine in real time with a real patient's view (Azuma, 1997).

Augmented reality in medical education has the potential to present a safe, suitable and cost-effective training environment in which completely real world

educational tasks can be implemented. In such controlled environments, students can make mistakes without any negative results (Kamphuis et al, 2014).

Figure 2.20 illustrate medical application process. They include three part which are a real word image, an AR system, and a virtual world model. In the real world part, camera was captured the environment or place where the object was placed. In the second part, user combines virtual object and real world. And in the virtual world, where 3D objects are compressed.

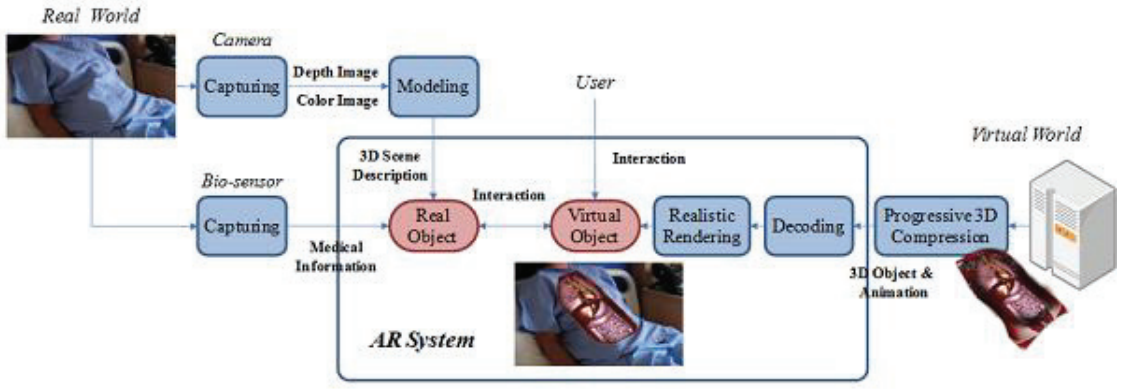

Figure 2.20. Overall Process of Medical Augmented Reality System (Arol, 2014)

Figure 2.21 and Figure 2.22 are examples of augmented reality application in medicine area. First one is HoloAnatomy with Microsoft's HoloLens. The product allows user to examining the human body's organ at user's own pace and from any perspective. But it is available only for Microsoft user. HoloAnotomy won the awards, which is Jackson Hole Wildlife Film Festival Science Media, on 2016. Second one is Kapanu application. It can be used by dentist or dental companies. With the application, patients can choose the teeth structure which they want to see in their teeth. Moreover, Kapanu interoperates with a detachable scanner.

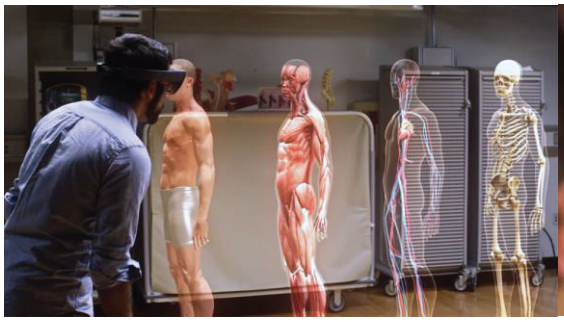

Figure 2.21. Microsoft HoloAnotomy user (youtube.com, 2015)

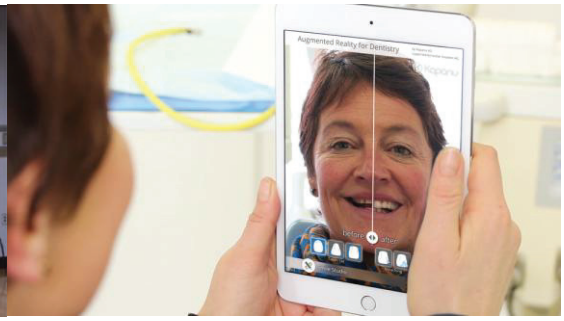

Figure 2.22. Interface image of the Kapanu App (kapanu.com, 2018)

Eight augmented reality application areas, which are described above, are listed in the Table 2.1. according to their features, description of potential implementations etc..

Table 2.1. Summary of augmented reality application area

Area	**Features, description of potential implementations etc**
Entertainment	The most promoted area
Gaming	The highest potential and enthusiasts area
Education	Funny, memorable, and clear learning way
Marketing & Advertising	More available area for brands to reach their customer mass
Tourism	Become more attractive place for visitors
Navigation	Interacted with the world though MAR applications
Browser	Easy building content and encountering to people
Medicine	A safe, suitable, and cost-effective training environment

Figure 2.23. Poster of Sensorama (reddit.com, 2015)

Figure 2.24. The Sword of Damocles (assemblrworld.com, 2018)

2.3.6. Timeline of Augmented Reality

1962- Sensoroma, which is a motorcycle simulator, was designed by Morton Heilig

1968- The first Augmented Reality system called The Sword of Damocles is invented by Ivan Sutherland.

1974- The videoplace is created by Myron Krueger.

1980- Steve Mann invented EyeTap which is the first wearable computer.

1982- Augmented reality was seen for on TV first time by Dan Reitan

1992- With coining the term of "AR" is credited by Tom Caudell and David Mizell

1996- Navi Cam which is an AR prototype is developed by Jun Rekimoto

1997- The defacto definition for ARA is provided by Ronal Azuma.

1999- Total Immersion, that is AR solutions provider, is created and entered the market first time

- The ARTollKit to open source community is offered to market by Hirokazu Kato.

- A wearable augmented reality system is developed by Hollerer, Feiner, and Pavlik

- An AR dashboard is utilized by Nasa for navgating the X-38

Figure 2.25. MARA of Nokia (techblog.gr, 2007)

Figure 2.26. Interface image of the ARKit (netsolutions.com, 2018)

2000- Quake, that is game, is created by Bruce Thoms et al created.

- BARS (Battlefield Augmented Reality System) is created by Simon Julier et al..

2001- An mobile augmented reality system is created by Reitmayr and Schmalstieg

- Archeoguide, that is an AR system for tourism and education, is created by Vlahakis et al

- RWWW (Rel World Wide Web) is created by Kooper and Maclntyre are creaters of the first AR Browser

2004- the first mobile application system for tracking 3D markers is presented by Mathias Möhring

2006- MARA is initiated by Nokia

2008- Wikitude, which is browser for AR, is launched by Mobilizy

- Commercial usage of AR is started AR

2009- Layar (Augmented reality browser) is launched by SPRXmobile

- FLARToolKit is created

2012- Google Glass develops to mix reviews.

2016- Pokemon Go is presented

2017- ARKit is presented by Apple

- Google presents ARCore.

2.4. Mobile Augmented Reality

The first example of mobile augmented reality can definitely related to the improvement of wearable augmented reality. When physical devices and screens are transformed and miniature, the theme of mobile augmented reality evolved towards the term of "mobile device", also known as AR on a mobile device (Arth et al., 2015). Besides that, after 2010 mobile augmented reality apps started to be used, however they were not common among people with a remarkable exception. In the 6 July 2016, everything has changed with the emergence of the application which is Pokemon GO. It continues to be a global and social phenomenon (Aluri, 2017).

In the beginning of MAR, it requires special hardware and software systems, in recent years experiences of augmented reality on mobile and hand-held devices have been largely introduced. One of the reasons is the occurrence of smart phones which combine fast CPUs with displays, cameras, graphic acceleration, compass, GPS sensors, and gyroscopes. So that, people have a strong AR hardware platform under their hands (Azuma et al., 2011).

According to Chatzopoulos et al., mobile augmented reality was arrived that;

1. Real images and virtual images are combined in a real world
2. User should interact in real time
3. Real and virtual models are recorded and aligned with one another
4. The image, which is augmented, is run and/or displayed on any mobile devices

Generally components of a mobile augmented reality are included in the device. Besides that, user needs a cloud server system to store the virtual models (Chatzopoulos et al., 2017) . According to Chatzopoulos et al. (2017), The presentation of main components of MAR systems is shown in Figure 2.27.

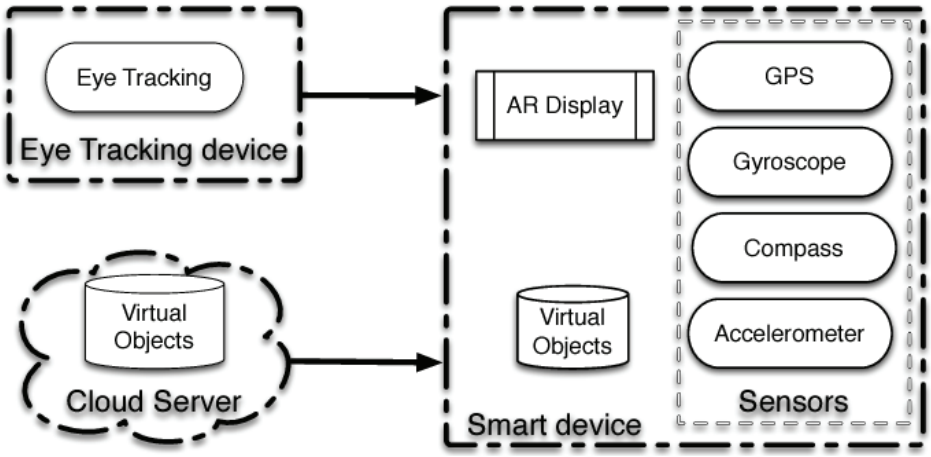

Figure 2.27. Basic components of MAR systems (Chatzopoulos et al, 2017)

2.5. Augment Application

Augment is one of the mobile augmented reality application which enables users visualize 3D models in real world. With that application, users can see models with their original dimensions and they can try models where they want to see. And also users can add their 3D models but that process need some professionalism like to know three-dimensional modeling. On the other hand Augment can works with QR codes and markerless . Both methods have different advantage that explained in the following section. Lastly, Augment App can be available free of charge on App Store (IOS) and Google Play (Android).

With Augment app;

1. 3D models can be viewed in augmented reality
2. Different colors and textures of 3D models can be tried
3. 3D models can be compared

Figure 2.28. The logo of the Augment (augment.com, 2019)

CHAPTER 3

FRAMEWORK

3.1. MAR Usage Factors Taxonomy

Before proposing the model and the hypothesis, mobile augmented reality usage factor taxonomy was created by using the variables collected from literature review and semi-structured interview. Table 3.1. shows the proposed taxonomy.

In Table 3.1., letters near the variables were written to indicate source of the variable. Letter "L" refers to literature review, letter "I" represents interview, and letter "S" refers to expert focus study. On the other hand, if two letters were written like (L) (I), its meaning is the variable was taken in both source.

MAR usage factor taxonomy was divided into six categories, as follows "user health", "social factors", "user characteristics", "facilitating conditions", "application features", and "intermediary". Application characteristics also contain four more sub-categories, such as "design", "hardware", "general", and "software". All of these categories include specific variables.

Nearly 160 publications were read and analyzed for collecting constructs. Table 3.2. listed some of these constructs and related publications. For example, Eye health construct is about possibility of eye damage when using MAR applications. Enjoyment is about having fun when using it and use for entertainment. Personalization is about editing application in user own request. Cost construct is about estimating a price for an application. User interface is about interaction between application and user. Usefulness is about the user's benefit of the application.

Table 3.1. Taxonomy of MAR usage factor

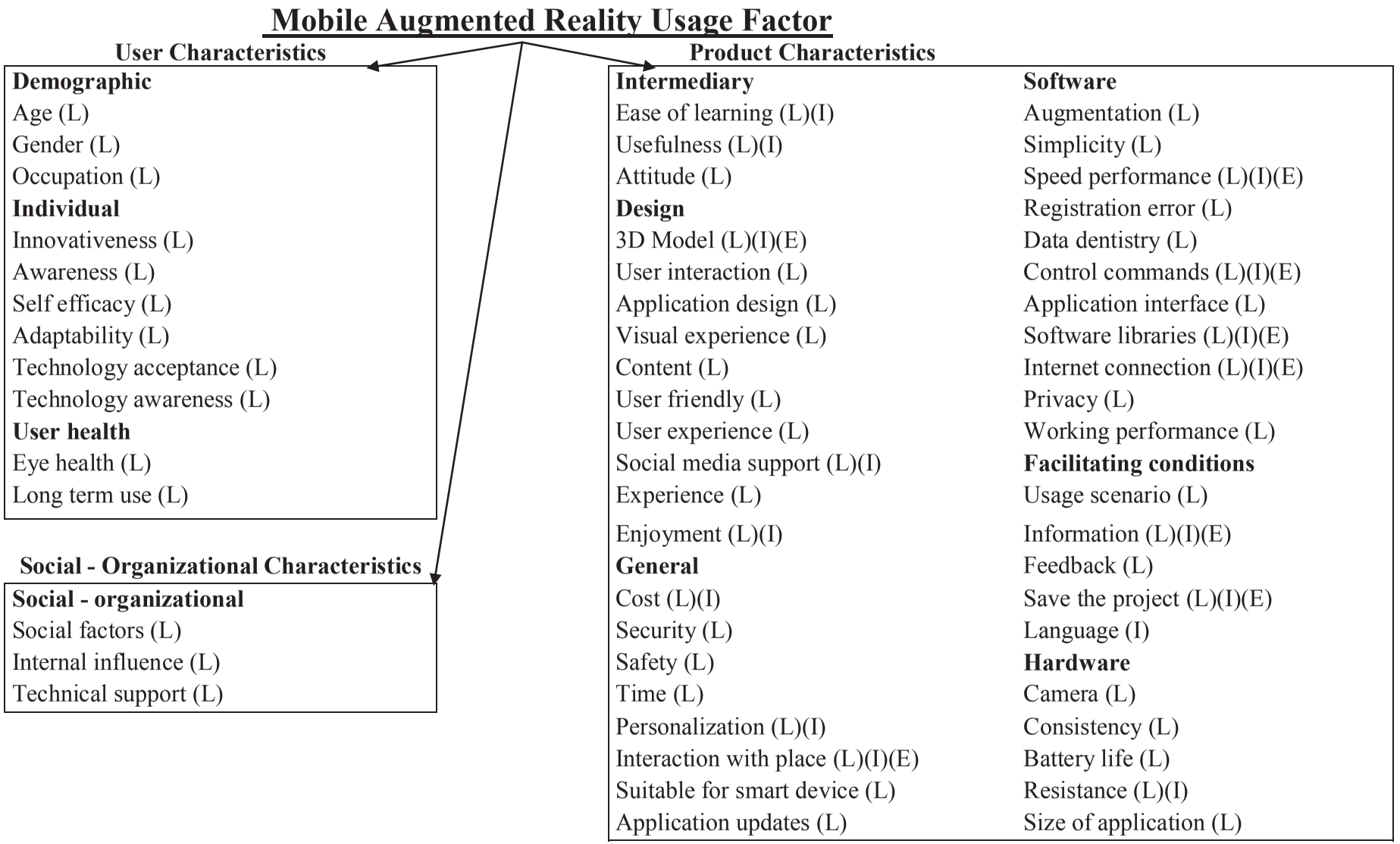

Table 3.2. Constructs and related publications

Construct	Publications
Social acceptance	Azuma R. Et al., 2001; Sudarshan S., 2018
Eye Health	Due B. L., 2014; Azuma R. Et al.,2001
Enjoyment	Aluri A., 2017; Chehimi F. Et al., 2014; Topal B., 2015; Kılıç T., 2016
Personalization	Chatzopoulos D. Et al., 2017; Dieck M. C. Et al., 2016; Aluri A. 2017
Technical support	Arbelaez-Estrada J. Et al., 2013; Kılıç T., 2016; Dieck M. C. Et al., 2016; Aluri A.,2017;
Hardware limitation	Due B. L., 2014; Cooper D., 2011; Kılıç T., 2016; Arbelaez-Estrada J. Et al., 2013; Guimaraes M. Et al., 2014
Speed performance	Dieck M. C. Et al., 2016
Visual quality of 3D model	Wang X., 2009; Kılıç T., 2016
Privacy	Chatzopoulos D. Et al., 2017; Dieck M. C. Et al., 2016; Rauschnabel P. A. Et al., 2016; Sudarshan S., 2018; Chehimi F. Et al., 2014; Muensterer O. J. Et al., 2014
Security	Cooper D., 2011; Chatzopoulos D. Et al., 2017; Dieck M. C. Et al., 2016; Chehimi F. Et al., 2014; Due B. L., 2014
Cost	Cooper D., 2011; Şahin D. 2015; Kamphuis C. Et al., 2014; Arbelaez-Estrada J. Et al., 2013;
Learning	Shaljari B., 2018; Chehimi F. Et al., 2014; Dieck M. C. Et al., 2016
Ease of use	Topal B., 2015; Arol K., 2014; Halıcı S. M., 2016; Cooper D., 2011; Bilic F., 2015; Kılıç T., 2016; Rauschnabel P. A. Et al., 2016; Azuma R. Et al., 2001
User interface	Chatzopoulos D. Et al., 2017; Dieck M. C. Et al., 2016
Attitude	Bilici F., 2015
Usefulness	Olsson T. Et al., 2012; Topal B., 2015; Bilici F., 2015; Dieck M.C. Et al., 2016; Kamphuis C. Et al., 2014; Aluri A., 2017

3.2. Research Framework and Hypothesis

In the study, two research models are proposed. These models are based on the literature review, the taxonomy, and interviews. The first model aimed to examine

MAR application design parameters and the other one's aim is about a user intention of a MAR application.

3.2.1. User Intention of MAR Application

Fig 3.1. illustrates frameworks of mobile augmented reality application affecting factors. Based on the framework, determinants of intention are attitude, usefulness, ease of use, content of application for giving valuable information, project saving, and social media support.

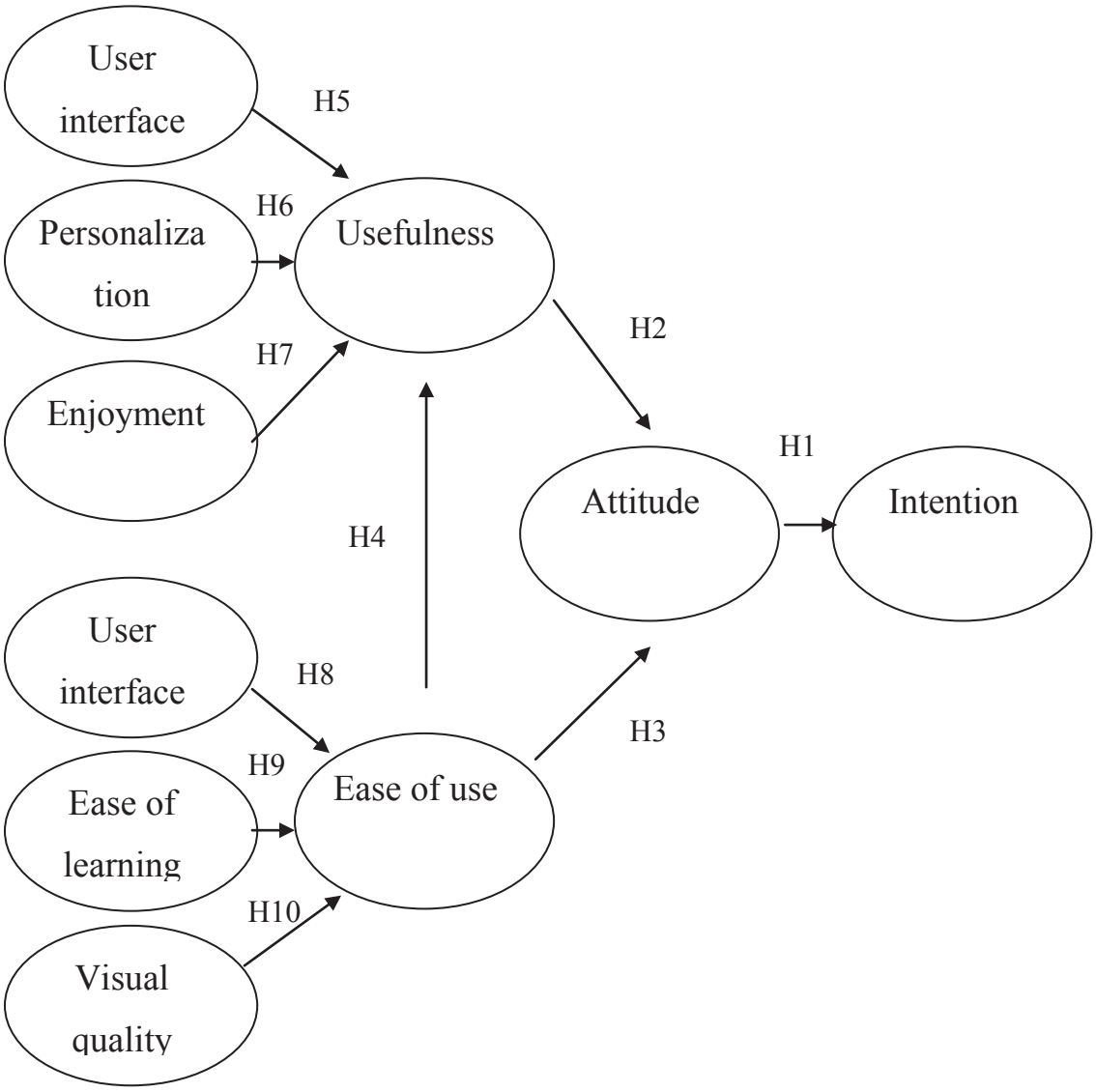

Figure 3.1. Framework of MAR application affecting factors

H1: Attitude significantly and positively affects user intention.

H2: Usefulness significantly and positively affects attitude.

H3: Ease of Use significantly and positively affects attitude.

H4: Ease of Use significantly and positively affects usefulness.

H5: User Interface significantly and positively affects usefulness.

H6: Personalization significantly and positively affects usefulness.

H7: Enjoyment significantly and positively affects usefulness.

H8: User Interface significantly and positively affects ease of use.

H9: Ease of Learning significantly and positively affects ease of use.

H10: Visual Quality significantly and positively affects ease of use.

Table 3.3. Predictive factors of MAR application intention framework

Hypothesis	**Dependent Variable**	**Independent Variable**	**Relationship**
H1	Intention	Attitude	Positive
H2	Attitude	Usefulness	Positive
H3	Attitude	Ease of Use	Positive
H4	Usefulness	Ease of Use	Positive
H5	Usefulness	User Interface	Positive
H6	Usefulness	Personalization	Positive
H7	Usefulness	Enjoyment	Positive
H8	Ease of Use	User Interface	Positive
H9	Ease of Use	Ease of Learning	Positive
H10	Ease of Use	Visual Quality	Positive

Table 3.3. summarizes the user intention of a MAR application. Predictive factors of intention are attitude, usefulness, ease of use, user interface, personalization, enjoyment, ease of learning, and visual quality.

CHAPTER 4

METHODOLOGY

The thesis study started in December 2017 with research of virtual reality and augmented reality publications, records and observations. At the end of the two years of research, close to 160 works were reviewed and two different observations were obtained. The first one is done with virtual reality glasses and the second observation is done many applications and has been tried in different areas such as browsers, marketing and tourism applications etc. Through the research augmented reality was selected as the main subject. According to the selected subject, a lot of MAR applications were investigated and Augment was selected because the application can be reached easily in commonly used operating systems and it has a wide range of 3D models.

Table 4.1. The relationship among the research studies

Study	**Duration**	**Description**
Preliminary Studies	24 months	Topic of study were decided and 160 literature were reviewed
Interview- Part 1	1 week	Interview- part 1 was applied to 4 technology savvy persons with different character. No questions asked.
Interview-Part 2	1 week	Interview- part 2 was applied to 4 participants which have different demographic profile and questions are about demographic information, AR and Augment.
Interview-Part 3	1 week	Interview- part 3 was applied to 4 participants, and 4 questions were asked them. In this part, the application was described with the video.
Construct Analysis	3 weeks	19 out of 139 variables selected and 3 demographic variables were added.

(cont. on next page)

Table 4.1. The relationship among the research studies (cont.)

Quantitative Experimental Study	1 months	The experimental study was conducted to 146 participants. Firstly they watched 2 videos and than 47 question were asked.

As shown in Table 4.1., the study began with the selected topic discussion. Firstly, three ideas were discussed which are virtual reality, mobile augmented reality applications, and smart glasses. After that, the literature review was conducted and nearly 160 works were reviewed. Towards the end of the literature survey, many AR applications were tried , lastly Augment, a MAR application, was chosen. After this decision, the first part of interview was done with four people in which only their experience was evaluated. Then, the second and third parts of interview were done for grasping the topic with eight people. In the second part, four persons from different demographic profiles were selected. After analyzing the second part, the third one was conducted with four people. The main difference between the last two parts of the interview is expression of application. In the second part of the interview, participants learned to use the application with the interviewer, whereas in the third part, they learned to use the application with the videos. Lastly, the quantitative experimental study was conducted with 146 people.

4.1. Interview- First Part

In the first part of the interview, four technology savvy people were selected. Their behavior, usage style of the MAR application, faced problems while using were observed and their thoughts about the MAR application were listed. In this part, no questions were asked to them. The interview took nearly half an hour and notes were taken.

Table 4.2. The structure of interview- first part

Town	Gender	Number	Average Age
İzmir	Woman	1	29
İzmir	Man	2	25
Aydın	Man	1	50

4.2. Interview- Second Part

Before starting the interview, all features of the application are learned. Different devices such as tablet, smart phone with Android , and IOS operating system were tested and IOS was experienced as the best operating system for the application. After that, the questions were prepared. Included questions are divided in three, which are demographic information, about the AR and Augment. The Questions were asked to all participants, who had different demographic profiles. The diversity of participants revealed different variables.

After the third question, Augment was described by using in IOS operating system and then the participants tried to use the application themselves. When they were trying, observations were made in order to analyze behaviors.

Table 4.3. The questions of interview- second part

Question No	Questions of Interview-2
1.	Gender, Age, Education, Occupation, Technology curiosity
2.	Do you used smart phone?
3.	Do you know anything knowledge about augmented reality? If yes, did you use any application?
4.	Do you have any expectations about AR?
5.	Do you think that you can use it in work?
6.	What do you think about usage of application?
7.	Which features of the application attracted your attention?
8.	Are there any features that you want to add the application?

(cont. on next page)

Table 4.3. The questions of interview- second part (cont.)

9.	Do you advice the application to your friends?
10.	Did you encounter any problem?
11.	Do you think to use the application later?
12.	Have you changed your thoughts after using the application?

Table 4.4. The structure of interview- second part

Town	Gender	Number	Average Age
Aydın	Man	1	31
Aydın	Woman	3	43

4.3. Interview- Third Part

According to the first questionnaire, the number of questions were reduced to four. One of them is about AR and other ones are about the application. And several videos, which were uploaded by Augment, were watched and reduced to three. They were shared with the first participant group. Later, one of them was selected. In there, the application was described with the video.

Table 4.5. The questions of interview- third part

Question No	Questions of Interview-3
1.	Gender Age Education Occupation Technology curiosity
2.	Do you know anything knowledge about augmented reality? If yes, did you use any application?
3.	What do you think about usage of application?
4.	Are there any features that you want to add the application?

Table 4.6. The structure of interview - third part

Town	Gender	Number	Average Age
Aydın	Man	2	42
Aydın	Woman	2	41

After the third part, ideas of doing the interview with the video was accepted because of good feedbacks and being understandable. Hence the interview was decided to conduct web-based so that the interview can be reached more and different (characters, demographic profile etc.) participants. Moreover, the answers of three interviews had been analyzed and some variables were detected.

4.4. Construct Analysis

For doing the quantitative experimental interview, 129 variables had been collected from literature and 10 variables had been collected from the interviews. Starting from the most mentioned variables, all of them had been examined and 19 of these constructs and plus 3 demographic variables were selected.

Table 4.7. Selected constructs

Innovativeness	Speed performance	Ease of use
Social influence	Visual quality	User interface
Eye Health	Ad convenience	Usefulness
Enjoyment	Privacy	Attitude
Personalization	Security	Intention
Technical support	Cost	
Hardware	Ease of learning	

4.5. Quantitative Experimental Study

The aim of the quantitative experimental study is to examine the factors that influence usage of mobile augmented reality application. The study consists of four parts. The first part contains information about study and related videos, the second part contains demographic profile questions, the third part contains five points Likert-scale questions, and the last part contains short answer questions. Moreover, Google Forms was used for collecting data.

According to the selected construct, interview questions were prepared and demographic questions are added to them. After that, questions were send four participant for checking them and some changes were made in line with their opinions. Lastly, videos, which are selected in previous interviews, were reviewed again and two of them selected for to inform participants about the application. They are about how to use the application and what can be done with the application. Selected videos are;

1. Augment - 3D Augmented Reality
   https://www.youtube.com/watch?v=IsVz5K15uNU
2. Augment- Online Products Sales
   https://www.youtube.com/watch?v=Lgqgz59NMQA

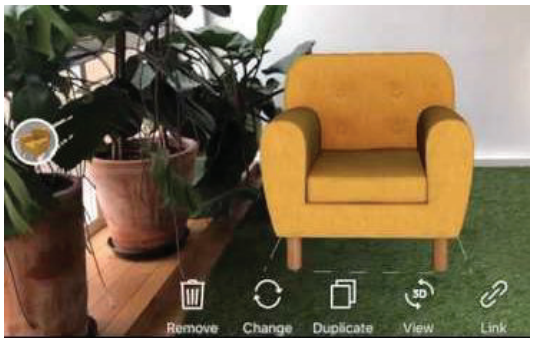

Figure 4.1. Screenshot of the Augment- 3D Augmented Reality (youtube.com, 2019)

Figure 4.2. Screenshot of the Augment- 3D Augmented Reality (youtube.com, 2016)

The second part of the study contains questions on collecting demographic information of the participants. Table 4.8. shows demographic constructs, question items, and question options.

Table 4.8. Questions about the demographic structure

Variable	Question	Options
Age	Choose your age	24 and below, 25-34, 35-44, 45 and above
Gender	Choose your gender	woman, man
Occupation	Write your occupation	.....

The third part of the study contains items for interview. Table 4.9. shows constructs of the interview and question items. Questions of this part were five points Likert-scale questions. The form of questions like that; 1-Strongly agree, 2- Agree, 3-No opinion, 4-Disagree, 5-Strongly disagree. The participants complete questions by choosing options which are matched with their character.

Table 4.9. The quantitative experimental study constructs and items

Constructs	Items
Innovativeness	I am usually cautious about adopting new ideas
Innovativeness	I am interested in new technologies
Social influence	It is important to use the MAR app by your friends
Social influence	The positive recommendations of people who follow the current technology are important
Health	Using MAR for a long time can damage my eye
Enjoyment	MAR app should be fun to use
Personalization	MAR app can be personalized
Technical support	Created things, while using MAR, should be shared on social media
Technical support	Technical support should be when using MAR
Technical support	It should be the section where the negative views about the MAR app can be evaluated
Hardware	MAR app should be able to work on devices which are low technical equipment
Speed performance	The speed of MAR app should not be low speed

(cont. on next page)

Table 4.9. The quantitative experimental study constructs and items (cont.)

Visual quality	The image of the products in the MAG app should be high quality
Ad convenience	There is no harm in using MAR app for advertising purposes
Privacy	Personal information should be kept confidential when using the MAR app
Security	Information should be kept in a secure environment when using the MAR app
Cost	I can pay a fee for MAR app
Ease of learning	It should be easy to learn to use MAR app
Ease of use	No difficulty in using the MAR app
Ease of use	Product placement should be easy when using MAR app
Ease of use	MAR app can be used without the help of another
User interface	MAR app should be able to interact with sound
User interface	The product can be found in a simple way with MAR app
User interface	In MAR app control commands can be easily used (rotation, magnification etc.)
User interface	MAR app should be user friendly
User interface	In the MAR app, the use of symbols should be more than text (should be understood by signs/icons instead of text)
User interface	MAR application's interface design should be useful
Usefulness	With MAR app, a product in real world can be removed and a virtual product can be replaced
Usefulness	Must be able to shop at MAR app
Usefulness	MAR app should be used in different devices (tablet, pc, phone, etc.)
Usefulness	The details of the product should be shown in the MAR app (such as interface design when electronic devices are switched on)
Usefulness	MAR app shortens the time to obtain ideas about the product
Usefulness	In the MAR app, the products should be classified according to their categories (for easier access to the desired product)
Usefulness	In the MAR app product range should be a wide
Usefulness	With the MAR app, information about the product such as size, color and pattern should be reached.
Usefulness	What to do in MAR app should be saved
Attitude	I would like to use MAR app
Attitude	MAR app should be used also by my friends
Intention	I plan to use MAR app soon

Table 4.10. The quantitative experimental study constructs and items 2 (comment questions')

Constructs	Items
K words	Which of the following words represent the MAR app (select 4 5 words)
Animal	If you were designing a logo for this app, which animal would you prefer to use as a representative?
Car	According to you, which car brand or model is similar to this app?
Improvement	What would you recommend for a MAR app to be more useful?
Comment	Is there something you want to add?

Table 4.11. List of Kansei words

Kansaei words	
Attractive	Cazip
Different	Değişik
Impressive	Etkileyici
Advanced	Gelişmiş
Fast	Hızlı
Bright	Parlak
Amazing	Şaşırtıcı
Constructive	Yapıcı
Creative	Yaratıcı
Clever	Zeki

CHAPTER 5

FINDINGS

5.1. Findings of Interview- First Part

The study was done with 4 participant. Three of them were male and one of them was female. Table 5.1. lists the profile of participants. Moreover, The record of the study only was written.

Table 5.1. Participants profile of interview- first part

Participant	Age	Town	Gender	Education	Profession	Date
1	29	İzmir	Woman	Graduate student	Engineer	February'19
2	29	İzmir	Man	Graduate student	Industrial design	February'19
3	22	İzmir	Man	University	Student	February'19
4	50	Aydın	Man	High School	Optician	February'19

According to participants, the application is attractive and functional. It can be used many commercial and noncommercial sectors but the application should be improved. Because they faced some problems when using. Trying two 3D models same time is the most encountered problem. In soft light, the application can not recognize the environment, control commands are not familiar are the other encountered problems. The participant, which was a student, said he can use the application when presenting his project in the university.

5.2. Findings of Interview- Second Part

This study was conducted with 4 participant. Only one of them was male. Furthermore, the interview's type was semi-structured in depth and it was conducted face to face. Table 5.2. shows the participants' profile.

Table 5.2. Participants profile of interview- second step

Participant	Age	Town	Gender	Education	Profession	Date
1	28	Aydın	Woman	University	Optician	March'19
2	31	Aydın	Man	University	Optician	March'19
3	45	Aydın	Woman	High School	Entrepreneur	March'19
4	56	Aydın	Woman	Academy	Nurse	March'19

Analysis of study are as follows;

1. Answers of interviewees were only written word by word on the digital platform.
2. Eight constructs were reached from interviewees answers. Constructs of questionnaires are combined with other constructs

Table 5.3. Collecting constructs from study

Constructs	Number	Constructs	Number
Time	3	Speed performance	2
Enjoyment	3	Render	2
Interaction	2	Language	1
Content	2	Functionality	1

Table5.3. includes eight constructs which are occurred after the interview. Two constructs took same and top score. These are time and enjoyment. According to participants, they think time is the most valuable thing in today's world. So they want to get things what they need as soon as possible and the application is one of the solution

because user can decided easily when they see the product/model with 3D view and real size, texture etc.

The second construct is enjoyment. Users want to use application for fun. For example the most of them try models in the entertainment part. Playing game, visualizing the product when scanned by the application are the basic examples of this construct.

Interaction, Content, Speed performance, and Render/ 3D model are one of the application characteristics. Each of them were stated by two participants. They said the application should be able to detect the area in which the 3D model is shown. Furthermore, the application's speed should be faster. And the content of application should be high quality because user want to learn valuable information when using applications.

One of the participant said that she do not know the application's language so that she couldn't use the application efficiently.

In brief, interviewees found the application useful and it was attracted their attention but some improvements should be done.

5.3. Findings of Interview- Third Part

This study was conducted with four participants. Two of them was male and other two was female. All of them live in Aydın. And average age of participants is 42. Furthermore, the interview's type was semi-structured in depth and it was conducted face to face but audio and video recording not taken in this part. Table5.4. lists of the participants' profile.

Table 5.4. Participants profile of interview- third part

Participant	Age	Town	Gender	Education	Profession	Date
1	27	Aydın	Man	University	Optician	March'19
2	22	Aydın	Woman	High School	Salesman	March'19
3	61	Aydın	Woman	Primary School	Housewife	March'19
4	58	Aydın	Man	University	Optician	March'19

Analysis of study are as follows;

1- Answers of interviewees were only written word by word on the digital platform.

2- Six constructs were reached from interviewees answer

3- Constructs of questionnaires are added to other constructs

Table 5.5. Collecting constructs from study

Constructs	Number	Constructs	Number
Ease of use	4	Library	2
Command	3	Sound	1
Enjoyment	2	Model adding	1

Table 5.5. includes six constructs which are identified during the interview. Ease of Use received the highest rate. All Interviewees agree that the application should be used easily. The application meets this expectation by interviewees.

Other high rate construct is about command implementation. Participants claim that if standard commands (zoom, rotate etc.) is used by the application, it's easier to learn how to use the application.

Enjoyment is also important value for the participants. For example, one participant said that he want to add virtual characters to the real view when taking picture.

Two of the participants agree that library of the application should be wide range. They do not want to download a lot of application for different features.

Adding a sound to models is requested by an interviewee. Specially, moving 3D models can perform with a sound.

In brief, interviewees liked the application and it attracted their attention but the application should be improved with some details.

5.4. Finding of Quantitative Experimental Study

5.4.1. Results of Frequency Analysis

In the study, there were three demographic questions which age, gender, and occupation. The question about age was regrouped into four options. These are 24 or below, 25-34, 34-44, and 45 or above. The gender question was regrouped into two options which are woman and man. Additionally, an answer of occupation question was written in the empty section.

146 individuals were joined to the interview, all participants responded five points Likert-scale questions but last five questions, which are short answers, were not answered by all of them. The frequency analysis was done on the demographic construct and Table 5.6. shows the results of these constructs.

According to the results, 69% of respondents were female and 31% of respondents were male, at that rate female participants were more than male participants. Furthermore, 44 % of participants were between the ages of 25-34. Most of the participants were working (70%), 15% of them were a student and the rest were retired, house wife or unemployed (15%).

Table 5.6. Demographic profile of interviewees

Variable		Frequency (n)	Percentage (%)
Gender			
	Female	102	69,9
	Male	44	30,1
Age			
	24 and below	49	33,6
	25-34	65	44,5
	35-44	14	9,6
	45 and above	18	12,3
Profession			
	Student	22	15
	Employed	102	70
	In pension and unemployed	22	15

5.4.2. Results of ANOVA

ANOVA has been conducted on age from demographic information. Participants were grouped into four categories, which are 24 and below, 25-34, 34-45, 45 and above. Table 5.7. shows the results of ANOVA for age construct. The results shows that compared to aged users, participants in the age of 25-34 stated that they was usually cautious about adopting new ideas on the other hand age of 45 and above stated opposite. Moreover, using MAR applications for a long time can damage my eye and the speed of MAR applications should be fast speed when using MAR applications were important for age of 24 and below. Besides, usefulness variables, which are classification of models according to categories, showing model details and information like size, color and pattern, are important for age of 25-34. Useful interface design of MAR applications are important for age of 24 and below. And also it is important for them to have a technical support. As in the innovativeness1 construct, participants aged 25-34 are most interested in new technologies.

Table 5.7. Age based ANOVA results

Construct	F	Sig.	24 and below (n=49)	25-34 (n=65)	34-45 (n=14)	45 and above (n=18)	Total (n= 146)
Innovativeness1	4,840	0,003	2,55	3,26	2,79	2,28	2,86
Health	4,427	0,005	3,55	2,97	2,64	2,61	3,09
Speed_performance	3,085	0,029	4,65	4,43	3,71	4,28	4,42
Usefulness6	2,622	0,053	4,63	4,72	4,21	4,22	4,58
Usefulness4	2,535	0,059	4,59	4,66	4,29	4,11	4,53
Usefulness8	2,083	0,105	4,59	4,69	4,07	4,39	4,56
User_interface6	2,050	0,110	4,55	4,40	4,14	3,94	4,37
Innovativeness2	1,955	0,123	4,08	4,15	3,64	3,61	4,01
Technical_Support2	1,705	0,169	4,59	4,49	3,93	4,33	4,45

5.4.3. Results of Descriptive Statistics

Table 5.8. lists the number of respondents, constructs, questions, and mean. The descriptive statistics results find out that their information should be kept in a secure place is an important factor when using MAR applications. And also they wanted to kept their personal information confidential. Furthermore, most of the participants stated that a MAR application should be easy to learn and it has a high 3D model quality. That is to say, users want to see visual products or objects clearly and apprehensible way. Beside ease of learning, a MAR application should be ease of use.

Table 5.9. shows distribution of Kansei words. The results of 43 question " Which of the following words represent the MAR app (select 4-5 words) " shows that creative (69%), advanced (62%), and impressive (55%) words were represented the MAR applications by most of the participants

Table 5.8. Descriptive statistics (Shorted by Mean)

Construct	Questions	Mean
Security	Information should be kept in a secure environment when using the MAR app	4,740
Privacy	Personal information should be kept confidential when using the MAR app	4,658
EoL	It should be easy to learn to use MAR app	4,603
Visual_quality	The image of the products in the MAG app should be high quality	4,603
EoU1	No difficulty in using the MAR app	4,596
Usefulness6	In the MAR app, the products should be classified according to their categories (for easier access to the desired product)	4,582
Usefulness7	In the MAR app product range should be a wide	4,562
Usefulness8	With the MAR app, information about the product such as size, color and pattern should be reached.	4,562
User_interface2	The product can be found in a simple way with MAR app	4,541
Usefulness4	The details of the product should be shown in the MAR app (such as interface design when electronic devices are switched on)	4,534
Usefulness9	What to do in MAR app should be saved	4,534
User_interface3	In MAR app control commands can be easily used (rotation, magnification etc.)	4,514
Usefulness3	MAR app should be used in different devices (tablet, pc, phone, etc.)	4,500

Table 5.9. Distribution of Kansei words

Construct	Mean
Creative	0,685
Advanced	0,615
Impressive	0,552
Different	0,483
Attractive	0,371
clever	0,343
Fast	0,336
Constructive	0,259
Amazing	0,182
Bright	0,091

5.4.4. Results of Correlation Analyses

Correlation analysis was made to examine the relationship among constructs. Table 5.11. shows the correlation results of intermediary variables which are ease of use, usefulness, attitude, and intention. Full list of the correlation analysis can be reached in Appendix E. According to Table 5.10., strongest relationship exists between ease of use and usefulness (0,932). Additionally, intention and attitude has strong correlation (0,646).

Table 5.10. Result of correlation analyses

	EoU	**Usefulness**	**Attitude**	**Intention**
EoU	1	, 932**	, 508**	, 214**
Usefulness	, 932**	1	, 583**	, 310**
Attitude	, 508**	, 583**	1	,646**
Intention	, 214**	, 310**	, 646**	1

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

5.4.5. Results of Reliability Analyses

Reliability analysis is done for testing the reliability of the measurement instrument. Some constructs include more than one question like usefulness, user interface, attitude, technical support, ease of use, innovativeness, and social influence. The internal consistency of the constructs is controlled with Cronbach's Alpha coefficient. Threshold value of the reliability statistics was chosen as 0.6 . Table 5.11. summarizes the reliability analysis results and most of the alpha value are above the threshold value.

Table 5.11. Reliability Analyses

Construct	No of items	Cronbach's Alpha	If Deleted	
Privacy, Security	2	0,916		
Usefulness	9	0,911	0,914	Usefulness1
Attitude	2	0,904		
User interface	6	0,829	0,846	User_interface6
Hardware, Speed performance, Visual quality	3	0,784	0,807	Hardware
EoU	3	0,774	0.744	EoU3
Technical support	3	0,760	0,768	Technical_Support1

5.4.6. Results of Regression Analyses

Regression analysis was conducted to understand relationships between constructs in the taxonomy of MAR application usage factor. Regression model were presented in SPSS Statistics 25 software. Table 5.13. summarizes the results of analysis.

Table 5.12. Results of regression analyses

Dependent Variable	Independent Variables	B	Std. Error	Beta	t	Sig.
Intention	(Constant)	0,175	0,335		0,523	0,602
	Attitude	0,806	0,079	0,646	10,153	0,000
Attitude	(Constant)	0,618	0,410		1,506	0,134
	Usefulness	0,795	0,092	0,583	8,615	0,000
Usefulness	(Constant)	0,002	0,016		0,151	0,880
	User_interface	0,792	0,010	0,794	78,087	0,000
	Personalization	0,072	0,004	0,098	18,053	0,000
	Enjoyment	0,047	0,004	0,062	11,675	0,000
	EoU	0,092	0,009	0,097	10,429	0,000
EoU	(Constant)	-0,014	0,119		-0,116	0,908
	User_interface	0,530	0,058	0,503	9,165	0,000
	EoL	0,342	0,041	0,383	8,349	0,000
	Visual_Quality	0,115	0,034	0,135	3,416	0,001

Based on the regression results, Fig. 5.1. illustrates the framework of MAR application affecting factors.

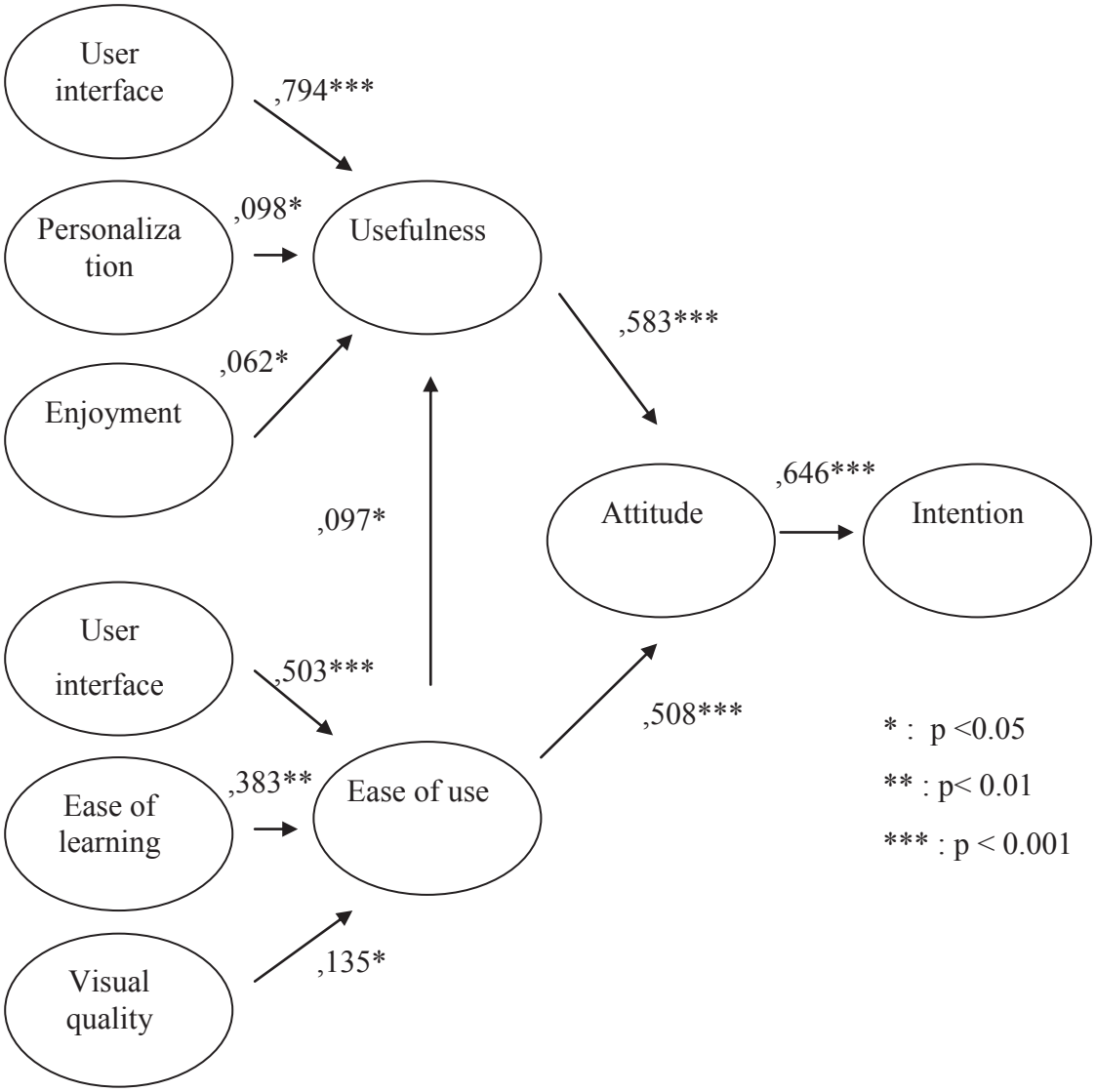

Figure 5.1. The results of framework of MAR application affecting factors

The results indicate that attitude is directly has an effect with users' intention toward the MAR applications with a coefficient of 0,646.

Attitude is directly impressed by usefulness and ease of use with the coefficients ,583 and ,508, respectively. Furthermore, ease of use is a considerable extent correlated with usefulness.

The model reveals that; user interface (b= 0,794), personalization (b= ,098), and enjoyment (b= ,062) are direct determinants of usefulness.

Additionally, the effect of user interface, ease of learning, and visual quality on ease of use are sustained with 0,503, 0,383, and 0,135 beta coefficients.

In reference to results of regression analysis, ten hypotheses are accepted. Table 5.13. shows proposed hypotheses and their results.

Table 5.13. Results of Analysis

Hypothesis	**Dependent Variable**	**Independent Variable**	**Supported**
H1	Intention	Attitude	Supported
H2	Attitude	Usefulness	Supported
H3	Attitude	Ease of Use	Supported
H4	Usefulness	Ease of Use	Supported
H5	Usefulness	User Interface	Supported
H6	Usefulness	Personalization	Supported
H7	Usefulness	Enjoyment	Supported
H8	Ease of Use	User Interface	Supported
H9	Ease of Use	Ease of Learning	Supported
H10	Ease of Use	Visual Quality	Supported

5.4.7. Results of Cluster Analyses

Cluster analysis was conducted in order to indentify market segments of the mobile augmented reality applications. SPSS Statistics 25 is used to group the participants in different segments whose members show similar behavioral in some sense. More than one cluster analysis containing two, three, and four clusters was applied based on the participants' preferences and constructs studied in the regression.

There are two cluster typologies with cluster analyses;

Cluster-Typology 1;

As shown in Table 5.14., 3 groups were constructed from the data. Names of these groups are "willing", "cautious", and "curious". Respectively, groups have 91, 4, and 51 members.

Table 5.14. Cluster Typology 1

Construct	**Willing 91**	**Cautious 4**	**Curious 51**
Innovativeness1	3,00	5,00	3,00
Innovativeness2	4,00	2,00	4,00
Social_influence	4,10	1,38	3,36
Health	3,00	2,00	3,00
Enjoyment	5,00	1,00	4,00
Personalization	5,00	1,00	4,00
Technical_Support1	5,00	1,00	3,00
Hardware	5,00	1,00	4,00
Speed_performance	5,00	1,00	4,00
Visual_Quality	5,00	1,00	4,00

Cluster-1: Willing: Innovativeness1, enjoyment, personalization, technical support 1, hardware, speed performance, and visual quality constructs show that it has high value. This means that the willing group want to enjoy when using a MAR application and they want to personalize their application. On the other hand they have relatively low value on the health construct. This situation explain that they don't care much about their health.

Cluster-2: Cautious: The major difference of this group is having the highest value of Innovaiveness1 construct. Additionally, the average age of this group has the highest value when compared others. For this group, it does not matter if people around them use or recommend MAR applications.

Cluster-3: Curious: Security is the single construct that has the highest value for this group. In other words, they want to keep their personal information

confidential. In addition, innovativeness2, health, and cost are the other highest constructs when comparing with other groups.

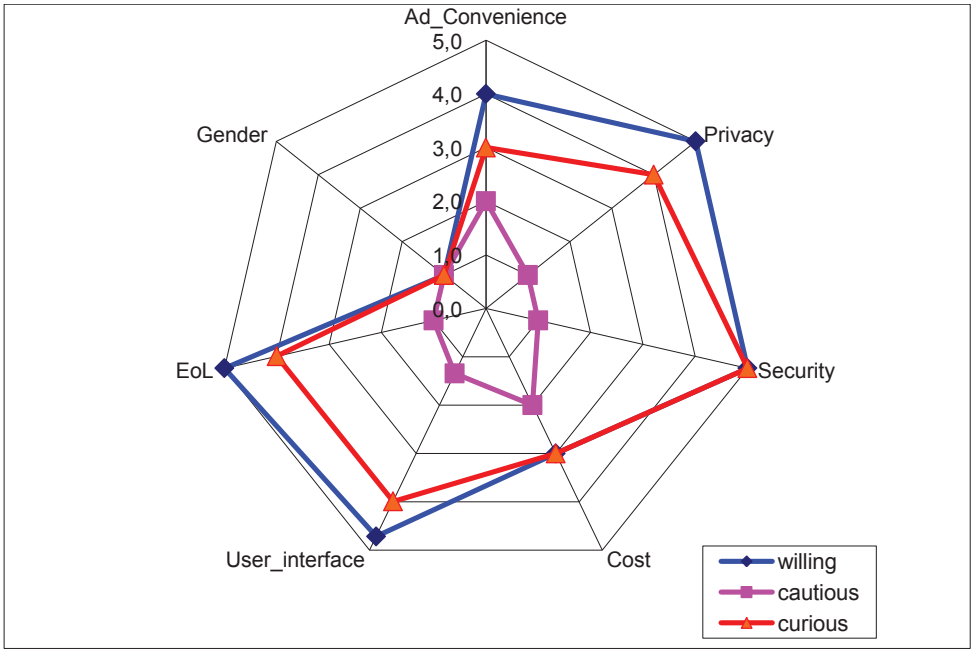

Figure 5.2. Cluster Typology 1.

Cluster-Typology 2;

As shown Table 5.15., four groups were constructed from the data. Names of these groups are "cautious", "cost sensitive", "unwary", and "controlling". Respectively, groups have 4, 52, 74, and 16 members.

Table 5.15. Cluster Typology 2

Construct	**Cautious**	**Cost sensitive**	**Unwary**	**Controlling**
	4	52	74	16
Innovativeness1	5,00	3,00	2,00	3,00
Innovativeness2	2,00	4,00	4,00	4,00
Social_influence	1,38	3,54	4,19	3,19
Health	2,00	3,00	3,00	3,00
Enjoyment	1,00	4,00	5,00	4,00
Personalization	1,00	4,00	5,00	4,00

(cont. on next page)

Table 5.15. Cluster Typology 2 (cont.)

Technical_Support1	1,00	4,00	5,00	4,00
Hardware	1,00	4,00	5,00	3,00
Speed_performance	1,00	5,00	5,00	3,00
Visual_Quality	1,00	5,00	5,00	3,00

Cluster-1: Cautious: Only innovativeness1 construct was taken a high value in this group. And age has higher value than other groups. According to this group, technical aspects, like hardware and the speed performance of application, do not matter for them.

Cluster-2: Cost sensitive: Cost and ad convenience construct show that, it has low value. So that they do not want to pay money for MAR applications and also they do not want see an advertisement when using applications. On the other hand, the ease of learning construct has high value so they do not want to need an extra effort. Moreover, they think MAR applications should be fast and 3D models should be high quality.

Cluster-3: Unwary: This group has the highest values on almost every constructs. User interface and social influence are the highest construct when comparing with other groups. In other words, they are affected by ideas of people who around them. Furthermore, they like to share on social media what they create on MAR applications. On the contrary, innovativeness1 construct has the lowest value. This means that they are not cautious in adopting new ideas.

Cluster-4: Controlling: This group has average values. But yet cost and innovativeness2 constructs have the highest value. They say that they can pay money for the MAR applications and they are tech enthusiasts. Compared to the other groups, this one does not have any lowest constructs. But in itself, innovativeness1, hardware, speed performance, visual quality, and ad convenience constructs have the lowest value.

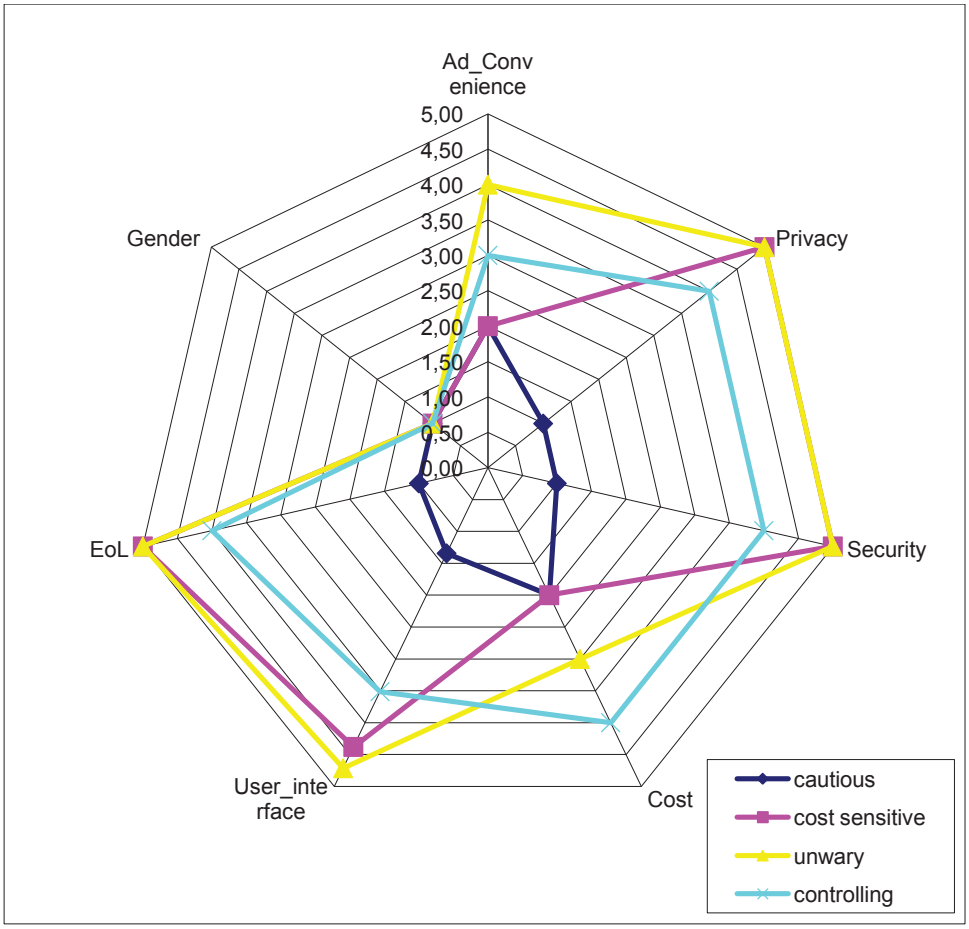

Figure 5.3. Cluster Typology 2

CHAPTER 6

CONCLUSION

Mobile augmented reality has evolved even more rapidly in recent years with technological developments. Foremost among these are, smart devices since they allow users to connect to the internet wherever they want, they are portable devices that can be used everywhere, and they have geo-location awareness etc.. According to the literature, the current technology of MAR applications is at a beginning stage. This study investigated the factors affecting users of MAR applications. This question led to the creation of design inputs. Throughout the study, both qualitative and quantitative research were performed.

6.1. Implications

The research study's target group is application developers and, designers, especially UI and UX designers. However it also may give valuable information for mobile augmented reality researchers. In this research, priorities of usage factors have been investigated. Firstly, interviews consisting of 3 parts, were done. With the information obtained from them, the quantitative experimental study was conducted. The method of this study was an internet-based survey. In the end, a lot of analyses were done. These are; ANOVA, descriptive analysis, frequency analysis, correlation analysis, reliability analysis, regression and cluster analysis.

According to the results of descriptive analysis, security is the most important factor for MAR application users. This means that users wants to be sure the information is kept in a safe environment. The second one is privacy and it is similar to the first factor. So developers/designers should solve questions, which are on people's mind, about security and privacy. The third one is ease of learning.

3D models of the application are one of the main usage factor for MAR applications. It should be a high quality. This allows the user to understand the 3D

model better. Moreover, the propensity to use is increases when the MAR application is easy to use, and separation of 3D models by category is important to find the search model easily.

22 constructs were investigated in the descriptive analyses. The first six of them had been placed and (sorted by mean) explained above.

Like a previous study (Davis, 1989) the results showed that compared with ease of use, usefulness had a considerably higher correlation with attitude. Additionally, ease of use significantly affects the usefulness found in this research and previous ones (Davis, 1989; Dishaw et al., 1999; Mathieson et al., 2001).

Parallel to a previous research findings (Khan et al.,2015; Chehimi et al., 2014; Dieck et al., 2016) security and privacy were found important determinants of attitude toward the mobile augmented reality application usage. Moreover, other research (Wang, 2007; Azuma et al., 2001) were found that 3D models (their quality, wide database range) are another significant determinant.

In brief, a lot of constructs, which are influencing the usage of mobile augmented reality application, were examined. In addition to this, the relationship between the constructs were searched. According to the study, it is understood that a lot of mobile augmented reality applications should be designed for daily use.

6.2. Limitations

One limitation of this study is relative to sample size, which are 146. Even though the number of participants is sufficient to make an analyses, it would be better to increase the participant size to generalize the findings of study.

Another limitation was that the mobile augmented reality applications was not known by most people. So early stages of the study have passed difficult than expected because it was hard to find people who knew the augmented reality application.

The experiment was conducted in Turkey, therefore it would not be right to generalize the findings for people live in other countries. Cultural differences should be considered when examining the research results.

6.3. Further Works

Although two hundred twenty three constructs were derived from the literature review, qualitative and quantitative research, only several of them can be used in the MAR application usage factor framework. So that, extracted constructs or new constructs from the literature can be added to the proposed taxonomy.

Additionally, the study can be done with specific groups, such as a specific age range or specific professional groups. Thus, the study cannot be general as the study done and can get a definite conclusion for specific groups.

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APPENDIX A

INTERVIEW - FIRST PART

A.1. Interview - First Part -Participant Comment

Participant 1

Cinsiyet: Kadın

Eğitim: Yüksek Lisans (Endüstriyel Tasarım)

Meslek: Mühendis

Kullanılan İşletim Sistemi: IOS

Uygulama Hakkındaki Düşünceleri: Uygulamanın ara yüzünü rahat kullanamadığını özellikle ikili model kullanımlarında modelin ikincisini rahat kullanamadığını belirtti. Bunun sebebinin de modelin perspektifi oturtamadığı için olduğunu düşünüyor yani model havada yüzüyor gibi oldu diye belirtiyor. Ayrıca tanımlanan parmak hareketlerinin alışık olduğu gibi olmadığını (zoom komutu için) belirtiyor.

Participant 2

Cinsiyet: Erkek

Eğitim: Yüksek Lisans (Endüstriyel Tasarım)

Meslek: Endüstriyel Tasarımcı

Kullanılan İşletim Sistemi: Android

Uygulama Hakkındaki Düşünceleri: Kullanıcı ilk deneyimini loş ışıkta kullandığı için modellerin kontrolünde(modelin zemine oturması, döndürme komutunun rahat kullanılmaması) zorlandığını belirtti. Programın pazarlama sektöründe özellikle küçük ve orta ölçekli işletmeler için kullanılmasının başarılı olacağını belirtti.İkinci kullanışında ışıklı bir ortamda kullandığında programı daha rahat kullandığını belirtti.

Participant 3

Cinsiyet: Erkek

Eğitim: Lisans (Mimarlık)

Meslek: Öğrenci

Kullanılan İşletim Sistemi: IOS

Uygulama Hakkındaki Düşünceleri: Uygulama kullanıcının dikkatini çekti. Sadece iki model kullanırken ikisini yönetmekte zorlandı. Ama proje anlatımlarını yaparken uygulamanın derslerde çok faydalı olacağını belirtti. Benzer uygulamaları final projelerini anlatırken kullandıklarını ve daha verimli olduğunu belirtti.

Participant 4

Cinsiyet: Erkek

Eğitim: Lise

Meslek: Esnaf

Kullanılan İşletim Sistemi: IOS

Uygulama Hakkındaki Düşünceleri: Uygulamayı daha çok eğlence amaçlı kullanmayı tercih etti. Hareketli modeller dikkatini çekti ve hareketli modellerin fotoğraf kaydetmek gibi video olarak da kaydedilmesinin olması gerektiğini belirtti. Diğer kullanıcılar gibi iki modeli kullanmak istediğinde sıkıntı yaşadı.

APPENDIX B

INTERVIEW - SECOND PART

B.1. Interview- Second Part Questions- (English)

1. Gender
   Age
   Education
   Occupation
   Technology curiosity
2. Do you used smart phone?
3. Do you know anything knowledge about augmented reality? If yes, did you use any application?
4. Do you have any expectations about AR?
5. Do you think that you can use it in work?
6. What do you think about usage of application?
7. Which features of the application attracted your attention?
8. Are there any features that you want to add the application?
9. Do you advice the application to your friends?
10. Did you encounter any problem?
11. Do you think to use the application later?
12. Have you changed your thoughts after using the application?

B.2. Interview- Second Part Questions (Turkish)

1. Cinsiyet:
   Yaş:
   Eğitim:
   Meslek:
   Teknoloji merakı:
2. Akıllı telefon kullanıyor musunuz?
3. Arttırılmış gerçeklik hakkında bilginiz var mı? Varsa AR'ı kullandığınız uygulamalar var mı?
4. AR dan bir beklentiniz var mı? Sizce hangi alanlarda faydalı olur?
5. Mesleğiniz de kullanabileceğinizi düşünüyor musunuz?
6. Uygulamayı nasıl buldunuz? (kullanım kolaylığı, fayda sağlaması vb.)
7. Uygulamayı kullanırken dikkatinizi çeken özellikler neler?
8. Kullandığınız uygulamaya eklemek istediğiniz başka özellikler var mı?
9. Uygulamayı kullanmaları için çevrenizdeki kişilere tavsiye eder misiniz?
10. Kullanırken herhangi bir problem yaşadınız mı?
11. Uygulamayı daha sonra tekrar kullanmak ister misiniz?
12. Uygulamayı kullandıktan sonra AR hakkındaki düşünceleriniz değişti mi?

APPENDIX C

INTERVIEW - THIRD PART

C.1. Interview Questions- Third Part (English)

1. Gender
   Age
   Education
   Occupation
   Technology curiosity
2. Do you know anything knowledge about augmented reality? If yes, did you use any application?
3. What do you think about usage of application?
4. Are there any features that you want to add the application?

C.2. Interview Questions- Third Part (Turkish)

1. Cinsiyet:
   Yaş:
   Eğitim:
   Meslek:
   Teknoloji merakı:
2. Arttırılmış gerçeklik hakkında bilginiz var mı? Varsa AR'ı kullandığınız uygulamalar var mı?
3. Uygulamayı nasıl buldunuz? (kullanım kolaylığı, fayda sağlaması vb.)
4. Kullandığınız uygulamaya eklemek istediğiniz başka özellikler var mı?

APPENDIX D

QUANTITATIVE EXPERIMENTAL STUDY

D.1. Quantitative Experimental Study Questions (English)

1. Age
2. Gender
3. Occupation
4. I am usually cautious about adopting new ideas
5. I am interested in new technologies
6. It is important to use the MAR app by your friends
7. The positive recommendations of people who follow the current technology are important
8. Using MAR for a long time can damage my eye
9. MAR app can be used without the help of another
10. MAR app should be used in different devices (tablet, pc, phone, etc.)
11. In MAR app control commands can be easily used (rotation, magnification etc.)
12. Must be able to shop at MAR app
13. MAR app should be user friendly
14. It should be easy to learn to use MAR app
15. No difficulty in using the MAR app
16. Product placement should be easy when using MAR app
17. MAR app shortens the time to obtain ideas about the product
18. In the MAR app, the products should be classified according to their categories (for easier access to the desired product)
19. In the MAR app product range should be a wide
20. With the MAR app, information about the product such as size, color and pattern should be reached.
21. The details of the product should be shown in the MAR app (such as interface design when electronic devices are switched on)
22. The product can be found in a simple way with MAR app
23. With MAR app, a product in real world can be removed and a virtual product can be replaced
24. MAR app should be able to interact with sound
25. In the MAR app, the use of symbols should be more than text (should be understood by signs/icons instead of text)
26. MAR application's interface design should be useful
27. MAR app should be fun to use
28. MAR app can be personalized
29. What to do in MAR app should be saved
30. Created things, while using MAR, should be shared on social media
31. It should be the section where the negative views about the MAR app can be evaluated
32. MAR app should be able to work on devices which are low technical equipment
33. The speed of MAR app should not be low speed

34. Technical support should be when using MAR
35. The image of the products in the MAG app should be high quality
36. There is no harm in using MAR app for advertising purposes
37. Personal information should be kept confidential when using the MAR app
38. Information should be kept in a secure environment when using the MAR app
39. I can pay a fee for MAR app
40. I would like to use MAR app
41. MAR app should be used also by my friends
42. I plan to use MAR app soon
43. Which of the following words represent the MAR app (select 4-5 words)
44. If you were designing a logo for this app, which animal would you prefer to use as a representative?
45. According to you, which car brand or model is similar to this app?
46. What would you recommend for a MAR app to be more useful?

D.2. Quantitative Experimental Study Questions (Turkish)

1. Yaşınız
2. Cinsiyetiniz
3. Meslek
4. Yeni fikirleri benimseme konusunda genellikle temkinli davranırım
5. Yeni teknolojilere meraklıyım
6. MAG uygulamasının çevremdekiler tarafından kullanılması önemlidir
7. MAG hakkında teknolojiyi takip eden kişilerin olumlu tavsiyeleri önemlidir
8. MAG uygulamasını uzun süre kullanmak gözüme zarar verebilir
9. MAG uygulaması başkasının yardımı olmadan kullanabilmeli
10. MAG uygulaması farklı cihazlarda kullanılabilmeli (tablet, pc, telefon vb.)
11. MAG uygulamasında düzenleme komutları kolaylıkla kullanılabilmeli (döndürme, büyütme vb.)
12. MAG uygulamasında alış veriş de yapılabilmeli
13. MAG uygulaması kullanıcıyı yönlendiren, yardım eden "kullanıcı dostu" olmalı
14. MAG uygulamasını kullanmayı öğrenmek kolay olmalı
15. MAG uygulamasını kullanılırken zorluk yaşanmamalı
16. MAG uygulaması kullanılırken ürün yerleştirme işlemi kolay yapılabilmeli
17. MAG uygulaması ürünün hakkkında fikir edinme sürecini kısaltmalı
18. MAG uygulamasında ürünler kategorilerine göre sınıflandırılmalı (aranılan ürüne daha kolay ulaşılması için)
19. MAG uygulamasında ürün çeşitleri çok olmalı
20. MAG uygulamasıyla ürün hakkında boyut, renk, desen gibi bilgilere ulaşılabilmeli
21. MAG uygulamasında ürünün detayları gösterilmeli (elektronik cihazlar açıldığında arayüz tasarımı gibi)
22. MAG uygulamasıyla denenmek istenen ürün basit bir şekilde bulunabilmeli
23. MAG uygulaması ile gerçek ortamdaki ürünü kaldırıp yerine sanal bir ürün koyabilmeli

24. MAG uygulaması sesle etkileşime geçebilmeli
25. MAG uygulamasında sembol kullanımı yazıdan daha fazla olmalı (yazı okumak yerine işaretlerle anlaşılmalı)
26. MAG uygulamasının bilgisayar etkileşimini yazılım ile sağlayan "arayüz tasarımı" kullanışlı olmalı
27. MAG uygulamasının kullanımı eğlenceli olmalı
28. MAG uygulaması kişiselleştirilebilmeli
29. MAG uygulamasında yapılanlar kaydedilebilinmeli
30. MAG kullanırken oluşturturulanlar sosyal medyada paylaşılabilmeli
31. MAG uygulaması hakkındaki olumsuz görüşlerin değerlendirilebileceği bölüm olmalı
32. MAG uygulaması teknik donanımları düşük olan cihazlarda da çalışabilmeli
33. MAG uygulamasının hızı düşük olmamalı
34. MAG uygulamasını kullanırken teknik destek olmalı
35. MAG kullanımındaki ürünlerin görüntü kalitelisi yüksek olmalı
36. MAG uygulamasının reklam amaçlı kullanılmasında sakınca yoktur
37. MAG uygulamasını kullanırken kişisel bilgilerim gizli tutulmalı
38. MAG uygulamasını kullanırken bilgilerim güvenli ortamda saklanmalı
39. MAG uygulaması için belli bir ücret ödeyebilirim
40. MAG uygulamasını kullanmak isterim
41. MAG uygulamasını çevremdekilerin de kullanmasını isterim
42. MAG uygulamasını yakın zamanda kullanmayı planlıyorum
43. Aşağıdaki kelimelerden hangileri sizce MAG uygulamasını temsil ediyor? (4-5 kelime seçiniz)
44. Eğer bu uygulama için bir logo yapıyor olsaydınız hangi hayvanı temsili olarak kullanmayı tercih ederdiniz?
45. Bu uygulamayı, hangi araba marka-model ile benzer yakın bulursunuz?
46. MAG uygulamasının daha kullanışlı olması için ne önerirsiniz?

APPENDIX E

RESULTS OF ANALYSES

E.1. Findings f Analyses

Table.E.1. Descriptive Statistics (shorted by mean)

Descriptive Statistics

	N	Mean	Std. Deviation	Min	Max	Question
Security	146	**4,740**	0,77	1	5	Information should be kept in a secure environment when using the MAR app
Privacy	146	**4,658**	0,89	1	5	Personal information should be kept confidential when using the MAR app
EoL	146	**4,603**	0,85	1	5	It should be easy to learn to use MAR app
Render	146	**4,603**	0,89	1	5	The image of the products in the MAG app should be high quality
EoU1	146	**4,596**	0,90	1	5	No difficulty in using the MAR app
Context	146	**4,582**	0,86	1	5	In the MAR app, the products should be classified according to their categories (for easier access to the desired product)
Content1	146	**4,562**	0,86	1	5	In the MAR app product range should be a wide
Content	146	**4,562**	0,83	1	5	Content
Content2	146	**4,562**	0,91	1	5	With the MAR app, information about the product such as size, color and pattern should be reached.
User_experience	146	**4,541**	0,89	1	5	The product can be found in a simple way with MAR app
Functionality	146	**4,534**	0,85	1	5	The details of the product should be shown in the MAR app (such as interface design when electronic devices are switched on)
Personal_data	146	**4,534**	0,95	1	5	What to do in MAR app should be saved
User_friendly2	146	**4,514**	0,90	1	5	In MAR app control commands can be easily used (rotation, magnification etc.)
User_friendly1	146	**4,500**	0,92	1	5	MAR app should be used in different devices (tablet, pc, phone, etc.)
Technical_S	146	**4,452**	1,01	1	5	Technical support should be when

upport						using MAR
Enjoyment	146	**4,432**	0,94	1	5	MAR app should be fun to use
Speed_performance	146	**4,418**	1,06	1	5	The speed of MAR app should not be low speed
Personalization	146	**4,411**	0,97	1	5	MAR app can be personalized
EoU	146	**4,411**	0,88	1	5	Ease of Use
User_friendly4	146	**4,404**	0,99	1	5	MAR app should be user friendly
Feedback	146	**4,384**	0,99	1	5	It should be the section where the negative views about the MAR app can be evaluated
User_friendly	146	**4,377**	0,80	1	5	User_friendly
User_interface2	146	**4,370**	0,97	1	5	MAR application's interface design should be useful
Usability	146	**4,315**	1,02	1	5	MAR app can be used without the help of another
Usefulness	146	**4,267**	0,98	1	5	MAR app shortens the time to obtain ideas about the product
EoU2	146	**4,226**	1,07	1	5	Product placement should be easy when using MAR app
Interaction1	146	**4,178**	1,14	1	5	With MAR app, a product in real world can be removed and a virtual product can be replaced
Interaction	146	**4,151**	0,93	1	5	Interaction
Hardware	146	**4,151**	1,10	1	5	MAR app should be able to work on devices which are low technical equipment
Social_media_support	146	**4,151**	1,13	1	5	Created things, while using MAR, should be shared on social media
Attitude1	146	**4,123**	1,00	1	5	I would like to use MAR app
Interaction2	146	**4,123**	1,10	1	5	MAR app should be able to interact with sound
Attitude	146	**4,106**	0,97	1	5	Attitude
Internal_influence	146	**4,103**	1,03	1	5	The positive recommendations of people who follow the current technology are important
Attitude2	146	**4,089**	1,04	1	5	MAR app should be used also by my friends
User_friendly3	146	**4,089**	1,08	1	5	Must be able to shop at MAR app
User_interface	146	**4,075**	0,97	1	5	User_interface
User_characteristic	146	**4,014**	1,05	1	5	I am interested in new technologies
User_interface1	146	**3,781**	1,26	1	5	In the MAR app, the use of symbols should be more than text (should be understood by signs/icons instead of

						text)
Intention	146	**3,486**	1,22	1	5	I plan to use MAR app soon
Effeciency_of_use	146	**3,479**	1,37	1	5	There is no harm in using MAR app for advertising purposes
Social_norm	146	**3,438**	1,20	1	5	It is important to use the MAR app by your friends
Innovativeness	146	**3,144**	1,26	1	5	I am usually cautious about adopting new ideas
Health	146	**3,089**	1,21	1	5	Using MAR for a long time can damage my eye
Cost	146	**2,767**	1,38	1	5	I can pay a fee for MAR app
Age	146	**2,007**	0,96	1	4	Age
Gender	146	**1,301**	0,46	1	2	Gender
Yaratici	143	**0,685**	0,47	0	1	Creative
Gelismis	143	**0,615**	0,49	0	1	Advanced
Etkileyici	143	**0,552**	0,50	0	1	Impressive
Degisik	143	**0,483**	0,50	0	1	Different
Cazip	143	**0,371**	0,48	0	1	Attractive
Zeki	143	**0,343**	0,48	0	1	clever
Hizli	143	**0,336**	0,47	0	1	Fast
Yapici	143	**0,259**	0,44	0	1	Constructive
Sasirtici	143	**0,182**	0,39	0	1	Amazing
Parlak	143	**0,091**	0,29	0	1	Bright

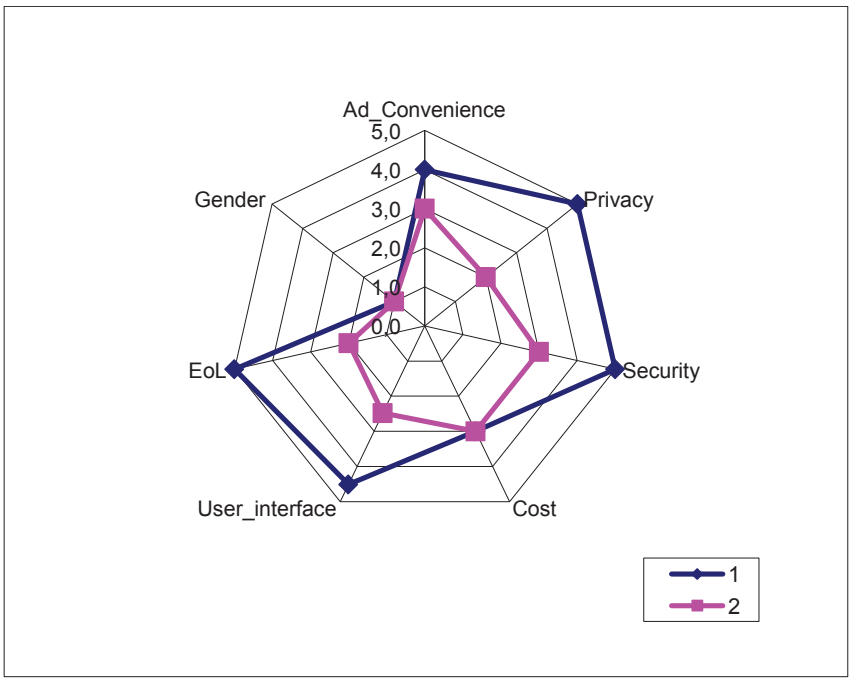

Figure.E.1. Cluster Analysis 1a

Table.E.2. Cluster Analysis 1a

	1	2
Innovativeness1	3,00	**4,00**
Innovativeness2	**4,00**	3,00
Social_influence	**3,88**	2,25
Health	**3,00**	2,00
Enjoyment	**5,00**	2,00
Personalization	**5,00**	2,00
Technical_Support1	**4,00**	2,00
Hardware	**4,00**	3,00
Speed_performance	**5,00**	2,00
Visual_Quality	**5,00**	2,00
Ad_Convenience	**4,00**	3,00
Privacy	**5,00**	2,00
Security	**5,00**	3,00
Cost	**3,00**	**3,00**
User_interface	**4,51**	2,48
EoL	**5,00**	2,00
Gender	**1,00**	**1,00**
Age	2,00	**3,00**

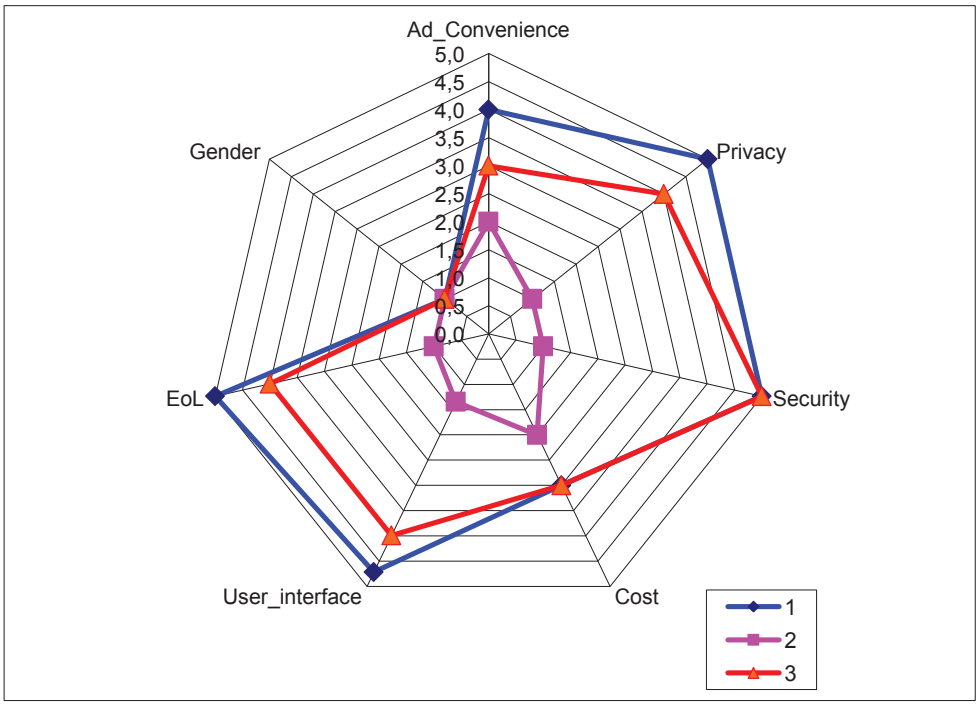

Figure.E.2. Cluster Analysis 1b

Table.E.3. Cluster Analysis 1b

	1	2	3
	91	*4*	*51*
Innovativeness1	3,00	**5,00**	3,00
Innovativeness2	**4,00**	2,00	**4,00**
Social_influence	**4,10**	1,38	3,36
Health	**3,00**	2,00	**3,00**
Enjoyment	**5,00**	1,00	4,00
Personalization	**5,00**	1,00	4,00
Technical_Support1	**5,00**	1,00	3,00
Hardware	**5,00**	1,00	4,00
Speed_performance	**5,00**	1,00	4,00
Visual_Quality	**5,00**	1,00	4,00
Ad_Convenience	**4,00**	2,00	3,00
Privacy	**5,00**	1,00	4,00
Security	**5,00**	1,00	**5,00**
Cost	**3,00**	2,00	**3,00**
User_interface	**4,72**	1,34	3,99
EoL	**5,00**	1,00	4,00
Gender	**1,00**	**1,00**	**1,00**
Age	2,00	**3,00**	2,00

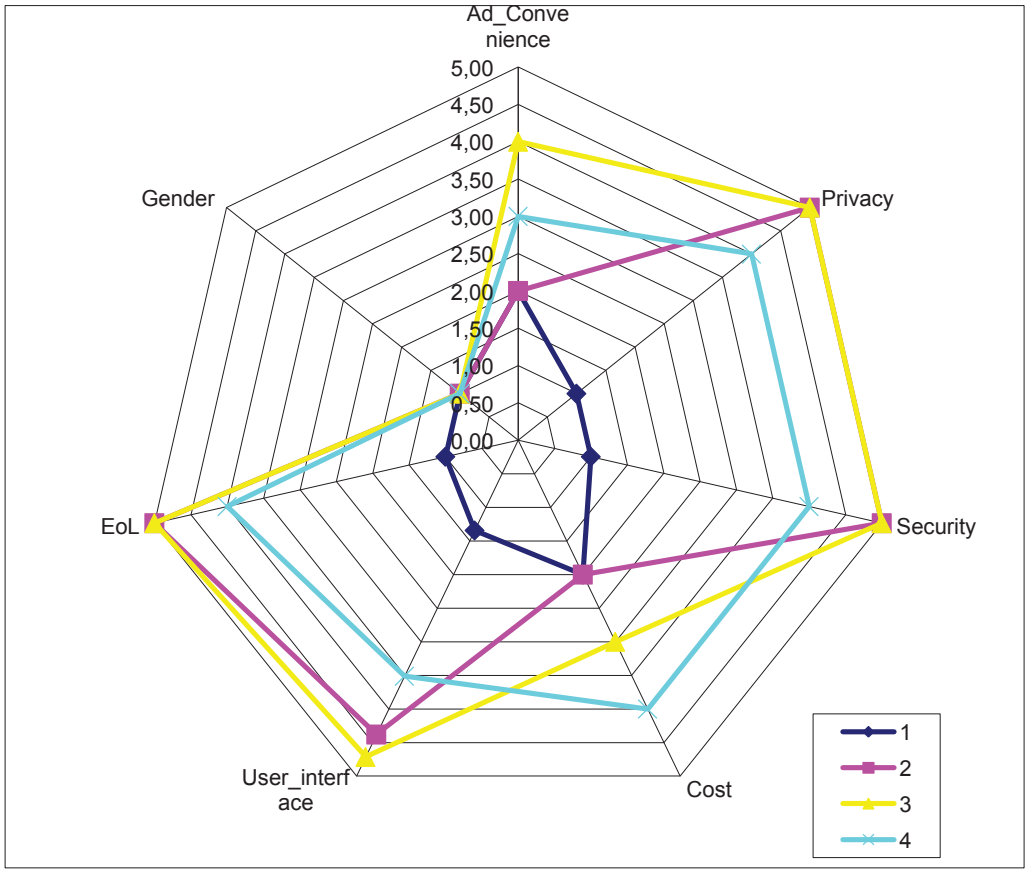

Figure.E.3 Cluster Analysis 1c

Table.E.4. Cluster Analysis 1c

	1	2	3	4
n=	*4*	*52*	*74*	*16*
Innovativeness1	**5,00**	3,00	2,00	3,00
Innovativeness2	2,00	**4,00**	**4,00**	**4,00**
Social_influence	1,38	3,54	**4,19**	3,19
Health	2,00	**3,00**	**3,00**	**3,00**
Enjoyment	1,00	4,00	**5,00**	4,00
Personalization	1,00	4,00	**5,00**	4,00
Technical_Support1	1,00	4,00	**5,00**	4,00
Hardware	1,00	4,00	**5,00**	3,00
Speed_performance	1,00	**5,00**	**5,00**	3,00
Visual_Quality	1,00	**5,00**	**5,00**	3,00
Ad_Convenience	2,00	2,00	**4,00**	3,00
Privacy	1,00	**5,00**	**5,00**	4,00
Security	1,00	**5,00**	**5,00**	4,00
Cost	2,00	2,00	3,00	**4,00**
User_interface	1,34	4,38	**4,71**	3,51
EoL	1,00	**5,00**	**5,00**	4,00
Gender	**1,00**	**1,00**	**1,00**	**1,00**
Age	**3,00**	2,00	2,00	2,00

Table.E.5. Regression Model Summary

Dependent Variable	Independent Variables	B	Std. Error	Beta	t	Sig.
Intention	(Constant)	0,175	0,335		0,523	0,602
	Attitude	0,806	0,079	0,646	10,153	0,000
Intention	(Constant)	0,175	0,335		0,523	0,602
	Attitude	0,806	0,079	0,646	10,153	0,000
Intention	(Constant)	0,855	0,461		1,854	0,066
	Attitude	0,904	0,091	0,724	9,925	0,000
	EoU	-0,246	0,116	-0,155	-2,117	0,036
Intention	(Constant)	0,175	0,335		0,523	0,602
	Attitude	0,806	0,079	0,646	10,153	0,000
	(Constant)	-0,104	0,320		-0,324	0,747
	Attitude	0,707	0,078	0,566	9,097	0,000
	Cost	0,248	0,055	0,282	4,528	0,000
Intention	(Constant)	0,090	0,333		0,269	0,788
	Attitude	0,822	0,079	0,659	10,414	0,000
	(Constant)	-0,150	0,318		-0,471	0,639
	Attitude	0,718	0,078	0,576	9,192	0,000
	Cost	0,242	0,056	0,273	4,357	0,000

(Constant)	-0,177	0,313		-0,566	0,572
Attitude	0,694	0,077	0,557	8,975	0,000
Cost	0,242	0,055	0,273	4,435	0,000
Hizli	0,375	0,151	0,146	2,474	0,015

Table.E.6. Regression Model Summary 2

Dependent Variable	Independent Variables	B	Std. Error	Beta	t	Sig.
Attitude	(Constant)	0,618	0,410		1,506	0,134
	Usefulness	0,795	0,092	0,583	8,615	0,000
Attitude	(Constant)	1,653	0,263		6,294	0,000
	Social_influence	0,650	0,068	0,629	9,608	0,000
	(Constant)	1,016	0,281		3,620	0,000
	Social_influence	0,526	0,068	0,509	7,674	0,000
	Technical_Support1	0,266	0,057	0,309	4,665	0,000
	(Constant)	0,866	0,281		3,078	0,003
	Social_influence	0,495	0,068	0,479	7,258	0,000
	Technical_Support1	0,256	0,056	0,297	4,555	0,000
	Cost	0,112	0,044	0,157	2,554	0,012
	(Constant)	0,356	0,331		1,077	0,283
	Social_influence	0,414	0,073	0,401	5,698	0,000
	Technical_Support1	0,175	0,062	0,204	2,823	0,005
	Cost	0,135	0,044	0,190	3,105	0,002
	Visual_Quality	0,235	0,085	0,214	2,772	0,006
Attitude	(Constant)	1,653	0,263		6,294	0,000
	Social_influence	0,650	0,068	0,629	9,608	0,000
	(Constant)	1,016	0,281		3,620	0,000
	Social_influence	0,526	0,068	0,509	7,674	0,000
	Technical_Support1	0,266	0,057	0,309	4,665	0,000
	(Constant)	0,866	0,281		3,078	0,003
	Social_influence	0,495	0,068	0,479	7,258	0,000
	Technical_Support1	0,256	0,056	0,297	4,555	0,000
	Cost	0,112	0,044	0,157	2,554	0,012
	(Constant)	0,356	0,331		1,077	0,283
	Social_influence	0,414	0,073	0,401	5,698	0,000
	Technical_Support1	0,175	0,062	0,204	2,823	0,005
	Cost	0,135	0,044	0,190	3,105	0,002
	Visual_Quality	0,235	0,085	0,214	2,772	0,006
Attitude	(Constant)	1,629	0,260		6,255	0,000
	Social_influence	0,657	0,067	0,633	9,801	0,000
	(Constant)	0,987	0,277		3,569	0,000
	Social_influence	0,528	0,068	0,508	7,775	0,000

Technical_Support1	0,272	0,056	0,315	4,816	0,000
(Constant)	0,835	0,279		2,989	0,003
Social_influence	0,502	0,068	0,483	7,417	0,000
Technical_Support1	0,264	0,056	0,305	4,740	0,000
Cost	0,103	0,043	0,146	2,422	0,017
(Constant)	0,322	0,327		0,985	0,327
Social_influence	0,419	0,072	0,404	5,814	0,000
Technical_Support1	0,181	0,062	0,210	2,940	0,004
Cost	0,128	0,043	0,181	3,013	0,003
Visual_Quality	0,238	0,084	0,218	2,840	0,005

Table.E.7. Regression Model Summary 3

Dependent Variable	Independent Variables	B	Std. Error	Beta	t	Sig.
Usefulness	(Constant)	0,057	0,042		1,366	0,174
	User_interface	0,991	0,009	0,994	105,559	0,000
	(Constant)	0,026	0,026		0,963	0,337
	User_interface	0,910	0,008	0,912	111,484	0,000
	Personalization	0,088	0,006	0,120	14,648	0,000
	(Constant)	0,007	0,022		0,293	0,770
	User_interface	0,888	0,007	0,890	120,446	0,000
	Personalization	0,069	0,006	0,094	12,337	0,000
	Enjoyment	0,045	0,006	0,060	7,932	0,000
	(Constant)	-0,002	0,021		-0,093	0,926
	User_interface	0,859	0,010	0,861	83,213	0,000
	Personalization	0,065	0,005	0,088	11,969	0,000
	Enjoyment	0,050	0,006	0,065	8,906	0,000
	EoL	0,029	0,008	0,034	3,815	0,000
	(Constant)	-0,006	0,021		-0,276	0,783
	User_interface	0,848	0,011	0,850	77,644	0,000
	Personalization	0,065	0,005	0,088	12,128	0,000
	Enjoyment	0,046	0,006	0,060	8,101	0,000
	EoL	0,028	0,007	0,033	3,732	0,000
	Visual_Quality	0,016	0,006	0,020	2,559	0,012
Usefulness	(Constant)	0,057	0,042		1,366	0,174
	User_interface	0,991	0,009	0,994	105,559	0,000
	(Constant)	0,026	0,026		0,963	0,337
	User_interface	0,910	0,008	0,912	111,484	0,000
	Personalization	0,088	0,006	0,120	14,648	0,000
	(Constant)	0,007	0,022		0,293	0,770
	User_interface	0,888	0,007	0,890	120,446	0,000

	Personalization	0,069	0,006	0,094	12,337	0,000
	Enjoyment	0,045	0,006	0,060	7,932	0,000
	(Constant)	-0,002	0,018		-0,138	0,891
	User_interface	0,797	0,011	0,798	69,668	0,000
	Personalization	0,069	0,004	0,094	15,559	0,000
	Enjoyment	0,047	0,005	0,062	10,416	0,000
	EoU	0,090	0,010	0,097	9,238	0,000
	(Constant)	-0,006	0,017		-0,330	0,742
	User_interface	0,790	0,012	0,792	67,441	0,000
	Personalization	0,069	0,004	0,094	15,861	0,000
	Enjoyment	0,047	0,004	0,061	10,391	0,000
	EoU	0,094	0,010	0,101	9,591	0,000
	Ad_Convenience	0,005	0,002	0,009	2,159	0,033
	(Constant)	-0,004	0,017		-0,216	0,830
	User_interface	0,794	0,012	0,796	67,669	0,000
	Personalization	0,069	0,004	0,094	16,038	0,000
	Enjoyment	0,047	0,004	0,062	10,664	0,000
	EoU	0,095	0,010	0,102	9,791	0,000
	Ad_Convenience	0,005	0,002	0,010	2,360	0,020
	Social_influence	-0,008	0,004	-0,010	-2,056	0,042
Usefulness	(Constant)	0,061	0,042		1,443	0,151
	User_interface	0,991	0,009	0,994	104,413	0,000
	(Constant)	0,038	0,025		1,535	0,127
	User_interface	0,902	0,008	0,905	115,856	0,000
	Personalization	0,093	0,006	0,127	16,319	0,000
	(Constant)	0,017	0,021		0,807	0,421
	User_interface	0,883	0,007	0,885	128,418	0,000
	Personalization	0,074	0,005	0,101	13,958	0,000
	Enjoyment	0,043	0,005	0,057	8,110	0,000
	(Constant)	0,002	0,016		0,151	0,880
	User_interface	0,792	0,010	0,794	78,087	0,000
	Personalization	0,072	0,004	0,098	18,053	0,000
	Enjoyment	0,047	0,004	0,062	11,675	0,000
	EoU	0,092	0,009	0,097	10,429	0,000
	(Constant)	0,002	0,015		0,156	0,876
	User_interface	0,790	0,010	0,792	79,029	0,000
	Personalization	0,072	0,004	0,098	18,332	0,000
	Enjoyment	0,043	0,004	0,056	10,095	0,000
	EoU	0,091	0,009	0,097	10,553	0,000
	Technical_Support1	0,007	0,003	0,011	2,448	0,016
Usefulness	(Constant)	0,061	0,042		1,443	0,151
	User_interface	0,991	0,009	0,994	104,413	0,000

	(Constant)	0,038	0,025		1,535	0,127
	User_interface	0,902	0,008	0,905	115,856	0,000
	Personalization	0,093	0,006	0,127	16,319	0,000
	(Constant)	0,017	0,021		0,807	0,421
	User_interface	0,883	0,007	0,885	128,418	0,000
	Personalization	0,074	0,005	0,101	13,958	0,000
	Enjoyment	0,043	0,005	0,057	8,110	0,000
	(Constant)	0,002	0,016		0,151	0,880
	User_interface	0,792	0,010	0,794	78,087	0,000
	Personalization	0,072	0,004	0,098	18,053	0,000
	Enjoyment	0,047	0,004	0,062	11,675	0,000
	EoU	0,092	0,009	0,097	10,429	0,000
	(Constant)	0,002	0,015		0,156	0,876
	User_interface	0,790	0,010	0,792	79,029	0,000
	Personalization	0,072	0,004	0,098	18,332	0,000
	Enjoyment	0,043	0,004	0,056	10,095	0,000
	EoU	0,091	0,009	0,097	10,553	0,000
	Technical_Support1	0,007	0,003	0,011	2,448	0,016
Usefulness	(Constant)	0,057	0,042		1,366	0,174
	User_interface	0,991	0,009	0,994	105,559	0,000
	(Constant)	0,026	0,026		0,963	0,337
	User_interface	0,910	0,008	0,912	111,484	0,000
	Personalization	0,088	0,006	0,120	14,648	0,000
	(Constant)	0,007	0,022		0,293	0,770
	User_interface	0,888	0,007	0,890	120,446	0,000
	Personalization	0,069	0,006	0,094	12,337	0,000
	Enjoyment	0,045	0,006	0,060	7,932	0,000
	(Constant)	-0,002	0,018		-0,138	0,891
	User_interface	0,797	0,011	0,798	69,668	0,000
	Personalization	0,069	0,004	0,094	15,559	0,000
	Enjoyment	0,047	0,005	0,062	10,416	0,000
	EoU	0,090	0,010	0,097	9,238	0,000
	(Constant)	-0,006	0,017		-0,330	0,742
	User_interface	0,790	0,012	0,792	67,441	0,000
	Personalization	0,069	0,004	0,094	15,861	0,000
	Enjoyment	0,047	0,004	0,061	10,391	0,000
	EoU	0,094	0,010	0,101	9,591	0,000
	Ad_Convenience	0,005	0,002	0,009	2,159	0,033
	(Constant)	-0,004	0,017		-0,216	0,830
	User_interface	0,794	0,012	0,796	67,669	0,000
	Personalization	0,069	0,004	0,094	16,038	0,000
	Enjoyment	0,047	0,004	0,062	10,664	0,000
	EoU	0,095	0,010	0,102	9,791	0,000

Ad_Convenience	0,005	0,002	0,010	2,360	0,020
Social_influence	-0,008	0,004	-0,010	-2,056	0,042
(Constant)	-0,020	0,019		-1,053	0,294
User_interface	0,794	0,012	0,795	68,360	0,000
Personalization	0,069	0,004	0,093	15,985	0,000
Enjoyment	0,048	0,004	0,063	10,882	0,000
EoU	0,096	0,010	0,103	9,993	0,000
Ad_Convenience	0,005	0,002	0,010	2,343	0,021
Social_influence	-0,008	0,004	-0,011	-2,220	0,028
Gender	0,012	0,006	0,008	1,990	0,049

Table.E.8. Regression Model Summary 4

Dependent Variable	Independent Variables	B	Std. Error	Beta	t	Sig.
EoU	(Constant)	0,088	0,149		0,588	0,558
	User_interface	0,988	0,034	0,926	29,367	0,000
	(Constant)	-0,004	0,123		-0,035	0,972
	User_interface	0,634	0,051	0,594	12,531	0,000
	EoL	0,356	0,043	0,396	8,351	0,000
	(Constant)	-0,053	0,119		-0,443	0,658
	User_interface	0,519	0,058	0,487	8,965	0,000
	EoL	0,353	0,041	0,392	8,621	0,000
	Visual_Quality	0,123	0,034	0,143	3,639	0,000
	(Constant)	0,027	0,119		0,230	0,818
	User_interface	0,562	0,058	0,527	9,660	0,000
	EoL	0,341	0,040	0,379	8,515	0,000
	Visual_Quality	0,102	0,034	0,118	3,023	0,003
	Cost	-0,041	0,014	-0,075	-2,977	0,003
EoU	(Constant)	0,138	0,148		0,933	0,353
	User_interface	0,977	0,033	0,927	29,356	0,000
	(Constant)	0,037	0,123		0,297	0,767
	User_interface	0,639	0,050	0,606	12,739	0,000
	EoL	0,343	0,042	0,384	8,074	0,000
	(Constant)	-0,014	0,119		-0,116	0,908
	User_interface	0,530	0,058	0,503	9,165	0,000
	EoL	0,342	0,041	0,383	8,349	0,000
	Visual_Quality	0,115	0,034	0,135	3,416	0,001
	(Constant)	0,054	0,119		0,451	0,653

	User_interface	0,568	0,058	0,539	9,745	0,000
	EoL	0,333	0,040	0,373	8,277	0,000
	Visual_Quality	0,097	0,034	0,114	2,879	0,005
	Cost	-0,038	0,014	-0,069	-2,705	0,008
EoU	(Constant)	0,138	0,148		0,933	0,353
	User_interface	0,977	0,033	0,927	29,356	0,000
	(Constant)	0,037	0,123		0,297	0,767
	User_interface	0,639	0,050	0,606	12,739	0,000
	EoL	0,343	0,042	0,384	8,074	0,000
	(Constant)	-0,014	0,119		-0,116	0,908
	User_interface	0,530	0,058	0,503	9,165	0,000
	EoL	0,342	0,041	0,383	8,349	0,000
	Visual_Quality	0,115	0,034	0,135	3,416	0,001
	(Constant)	0,054	0,119		0,451	0,653
	User_interface	0,568	0,058	0,539	9,745	0,000
	EoL	0,333	0,040	0,373	8,277	0,000
	Visual_Quality	0,097	0,034	0,114	2,879	0,005
	Cost	-0,038	0,014	-0,069	-2,705	0,008
EoU	(Constant)	0,088	0,149		0,588	0,558
	User_interface	0,988	0,034	0,926	29,367	0,000
	(Constant)	-0,004	0,123		-0,035	0,972
	User_interface	0,634	0,051	0,594	12,531	0,000
	EoL	0,356	0,043	0,396	8,351	0,000
	(Constant)	-0,053	0,119		-0,443	0,658
	User_interface	0,519	0,058	0,487	8,965	0,000
	EoL	0,353	0,041	0,392	8,621	0,000
	Visual_Quality	0,123	0,034	0,143	3,639	0,000
	(Constant)	0,027	0,119		0,230	0,818
	User_interface	0,562	0,058	0,527	9,660	0,000
	EoL	0,341	0,040	0,379	8,515	0,000
	Visual_Quality	0,102	0,034	0,118	3,023	0,003
	Cost	-0,041	0,014	-0,075	-2,977	0,003

Table.E.9. Correlations Analysis

Correlations

		Intention	EoU	User_interface	Attitude	Innovativeness	Social_influence	Technical_support	Usefulness
Intention	Pearson Correlation	1	,214**	,310**	,646**	0,088	,479**	,303**	,310**
	Sig. (2-tailed)		0,010	0,000	0,000	0,293	0,000	0,000	0,000
	N	146	146	146	146	146	146	146	146
EoU	Pearson Correlation	,214**	1	,926**	,508**	0,023	,557**	,768**	,932**
	Sig. (2-tailed)	0,010		0,000	0,000	0,785	0,000	0,000	0,000
	N	146	146	146	146	146	146	146	146
User_interface	Pearson Correlation	,310**	,926**	1	,576**	0,018	,592**	,835**	,994**
	Sig. (2-tailed)	0,000	0,000		0,000	0,826	0,000	0,000	0,000
	N	146	146	146	146	146	146	146	146
Attitude	Pearson Correlation	,646**	,508**	,576**	1	0,090	,633**	,539**	,583**
	Sig. (2-tailed)	0,000	0,000	0,000		0,278	0,000	0,000	0,000
	N	146	146	146	146	146	146	146	146
Innovativeness	Pearson Correlation	0,088	0,023	0,018	0,090	1	,188*	-0,017	0,005
	Sig. (2-tailed)	0,293	0,785	0,826	0,278		0,023	0,834	0,949
	N	146	146	146	146	146	146	146	146
Social_influence	Pearson Correlation	,479**	,557**	,592**	,633**	,188*	1	,506**	,590**
	Sig. (2-tailed)	0,000	0,000	0,000	0,000	0,023		0,000	0,000
	N	146	146	146	146	146	146	146	146
Technical_support	Pearson Correlation	,303**	,768**	,835**	,539**	-0,017	,506**	1	,847**
	Sig. (2-tailed)	0,000	0,000	0,000	0,000	0,834	0,000		0,000
	N	146	146	146	146	146	146	146	146

Usefulness	Pearson Correlation	,310**	,932**	,994**	,583**	0,005	,590**	,847**	1
	Sig. (2-tailed)	0,000	0,000	0,000	0,000	0,949	0,000	0,000	
	N	146	146	146	146	146	146	146	146

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).