ASSESSMENT OF INSIDE EARS (CIC) HEARING AIDS DEVICE, MAJOR ISSUES AND SOLUTIONS

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ABSTRACT

ASSESSMENT OF INSIDE EARS (CIC) HEARING AIDS DEVICE, MAJOR ISSUES AND SOLUTIONS

Hearing aids come from the widest medical sector that involves many other sectors that they work in collaborations with. A hearing aid demand work in many aspects starting from auditory, psychologic ergonomic and technologic etc. pushing forward the product to reply user's personal needs. Through the evolution of the hearing aids, the design tends to be miniaturized in response to the psychology or the comfort side of patients and the market respond positively. Minimizing items would be great in several respects but would also higher risk to be lost.

As long as the hearing aid's industries looking forward to improving and idealizing the product there will be a long journey in the future to match technologies and innovative design to come over those issues, there will be a lot to criticize and work on.

This study started with a literature survey in order to construct a clear idea about the item and their impact on the user with or without it and collect any potential technologies for better user experience. Later qualitative studies, an interview in depth and satisfaction survey, in which Interview in depth was done with some audiometrist collecting their preview from their patients.

The Interviews where recorded. Then comes the satisfaction survey destinated to the users of hearing aids. In the satisfaction survey, we took into consideration if the user has tried both behind the ear and completely inside the ear to see if there is any remarkable preference or rejection between both items.

To sum up, this study case is to collect any failure or issues that might face the hearing aids users in aim to put the light on some potential solution to enhance the experience of the users. So do to marketing demand to the miniature of hearing aids caused by the stigmatization of users, factors and facts like battery life, technologies, invisibility or secrecy of hearing aids and fear of losing it should be considered to enhance and improve the experience of hearing aids users.

ÖZET

İÇ KULAK (CIC) İŞİTME CİHAZLARININ DEĞERLENDİRİLMESİ, MAJÖR PROBLEMLER VE ÇÖZÜMLERİ

İşitme cihazları, işbirliği içinde çalıştıkları diğer birçok sektörü içeren en geniş tıbbi sektörden gelmektedir. Bir işitme cihazı, işitsel, psikolojik ergonomik ve teknolojik vb. yönlerden başlayarak, kullanıcının kişisel gereksinimlerine cevap vermek için ürünü ileriye taşıyan birçok yönden çalışma gerektirir. İşitme cihazlarının evrimi boyunca, tasarım, hastaların psikolojisine veya rahat tarafına cevap olarak minyatürleştirme eğilimindedir ve piyasada olumlu tepki görmektedir. Maddeleri küçültmek birçok bakımdan çok faydalı olduğu gibi, fakat aynı zamanda kaybolma riski de artar.

İşitme cihazını, ürünü geliştirmek ve idealize etmek isteyen endüstriler, gelecekte bu konuların üstesinden gelmek için teknolojileri ve yenilikçi tasarımları eşleştirmek için uzun bir yolculuk olacaktır, eleştirilecek ve üzerinde çalışılacak çok şey ortaya çıkacaktır.

Bu çalışma, eşyaların ve onunla veya onsuz kullanıcı üzerindeki etkileri hakkında net bir fikir oluşturmak ve daha iyi kullanıcı deneyimi için potansiyel teknolojiler toplamak amacıyla yapılan bir literatür taramasıyla başladı. Daha sonra nitel çalışmalar, derinlemesine görüşme ve memnuniyet anketleriyle desteklenmiştir. Bu nedenle, kullanıcıların taleplerinin damgalanmasından kaynaklanan işitme cihazlarının minyatürüne pazarlama talebinde bulunmak, pil ömrü, teknolojiler, işitme cihazlarının görünmezliği veya gizliliği ile kaybetme korkusu gibi faktörler ve gerçekler işitme cihazı kullanıcılarının deneyimini arttırmak ve iyileştirmek için dikkate alınmalıdır.

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CHAPTER 1

INTRODUCTION

The human body has always limits, some they born with good physic genetic some they have born with worst. However, ability, capacity and competence can be earned by learning things. But no human being also has the same physique conditions to absorb and learn. The major factors to learn things is by our senses sight, hearing, smell, taste and touch. If any of these senses are rectified the person will struggle to learn and adapt to the society and live by then stress, anxiety and feel unsecure, their family too would also be affected and feel worried and emotional all time.

A handicap or disabled doesn't mean at all incompetence many examples of disabled are geniuses or writers or Scientifics or talented pianist; we can name Professor Stephen Hawking, theoretical physicist, has been living with the debilitating ALS disease for decades, struggling with intensifying disability and discomfort despite the fact that his theory of exploding black holes was based on both relativity theory and quantum mechanics. He also worked with space-time singularities and won lot of prices and being an excellent member of society. In other domain there is also blind writers who inspired millions of his readers like Taha Hussein or a blind pianist that has fans all over the world that they would travel miles to attend his concert like Steve Wonder all those examples shows how human being can be awesome despite the disability.

Each Obstruction that human being struggle with, handicaps try to retrieve that damage or the lack he or she has during their daily life with adapting themselves in the society and by trying to perform like normal people, allows them to enhance their other sense capacity and make them talented and efficient like normal people would be.

However, a handicap to perform like normal people has never been easy without devices that are designed to improve their performance. A person who lost the ability to walk were never been able to move properly or faster without wheeling chair or crutches same things for other disabilities.

1.1. Definition of the Problem

Hearing loss disabled themselves can be productive and normal thanks to the hearing aids. Many studies showed the positive impact the hearing aids helping them to perform properly and interact better with the society and especially when they early implant to recover the loss of hearing that might prevent faster learn and collecting information.

However, with the marketing strategy of miniaturizing the hearing aids hearing aids due to the social stigmatization and the preference of users to smaller devices, hearing aids tend to be more lost by users affecting their psychologies, their performance and interaction with the society.

1.2. Aim of This Study

The aim of this study is to assist about the small hearing hearing aids like CIC (complete in canal) and put in contrast with the bigger ones like BTE (Behind the ear) and examine the parametres that affect users in positive and negative terms.

In addition, the order of importance is essential have been taken in consideration to treat this vital product for users that suffers hearing loss and put light on most critical ones.

The purpose of this study is to understand user's psychologies understand their needs investigate the construct that producers in the field should focus in.

1.3. Reasearch Question

Many questions were asked throught this study like follow:

- Which constructs and parameters are the most significant for users and expert that provides services to users?
- What are the cons and the pros of each hearing aids?
- According to which pros and cons users choose their devices?

- What should designer and expert in the field work on to improve in the hearing aid and to enhance their daily experience with the hearing aids?

1.4. Methodology of the Study

The research, three research methods will be used. First one is a semi-structured in-depth interview. The second one is expert focus work and the last one is the experimental study. We have interviewed with 8 experts and 5 users; worked with 6 persons in the expert focus work and done a hard copy questionnaire with 61users and web-based questionnaire with 49 users.

Table 1.1. Numbers and type of participants of the research.

Method	Number of participant	Type of participent
Interview 1	8	Expert (audiologists and pronunciation instructors)
Interview 2	5	Hearing aids users
Expert focus	6	Expert (only audiologists)
Quantitative Analysis-1	61	Hearing aids users
Quantitative Analysis-2	49	Hearing aids users

1.5. Structure of Study

The first chapter, (Introduction), the aim and the structure of the study are mentioned. In Chapter Two, (Literature Review), a summary of literature between 1980 and 2017 about the research's topic is written. In Chapter three (Adoption of theory) Theory of Reasoned Action (TRA), Theory of Planned Behavior (TPB) Technology Acceptance Model (TAM) and model 2 (TAM 2) were mentioned. In Chapter Four, (Framework), taxonomy and hypotheses about the research results are presented. In Chapter Five, (Methodology) the process which we trace is stated. In Chapter Six, (Findings) discovery is showed. In Chapter Seven, (Conclusion) meanings of our discovery are explained.

CHAPTER 2

LITERATURE SURVEY

The hearing loss has been known from long time ago from the very first person that cup their hand behind their ear. From then human attempts to improve the hearing loss and find ways and solution to improve their hearing deficiency.

Luckily hearing aids passed through long journey of improvement and innovation starting from primitive items as the ear trumpet from animal's horns coming up nowadays with miniature technological items plugged into the canal of the ears providing users a better sound quality and enhancement. So through the history records hearing aid has evolved a lot of changing in shape and technologies in term of advancement and development.

The developpement of hearing aids can be devided in two part, the acoustic era and the electronic era.

2.1. The Acoustic Era

In the early time starting from the 13th century those who suffered from the hearing loss were using concaves coming out from animal's horns (Packer 2016). Athanasius Kircher described that by the 18th century the human invented his first modern ear trumpet inspired from the primitive items that were used previously (Figure 2.1). The ear trumpet was designed like funnel which wasn't amplifying or enhancing any sound however it was working by collecting sound into the tight funnel.

The conversion of the sound signals because different diameter between the entrance and the exit of the trumpet relatively make a boost of the acoustic flow through the ear.

Figure 2.1. Ear trumpet

2.2. The Electronic Era

2.2.1. Hearing Aid Made of Carbon

The invention of electricity as carbon transmitter by Blake and Hughes in 1878 allowed Alexander Graham to develop the first telephone from which telephone was transformed to hearing aids or "deaf aid" when some people whom struggling with hearing realized they hear better through phone comparing to face to face conversation (Mills 2011).

The first hearing aid was invented in 1898 by Miller Reeve Hutchinson in the USA using carbon transmitter to make a mobile amplifier and it was officially in the market in 1902 (Mills 2011). From the other continent in Vienna in 1900 another hearing aids with different system has being made Frederick Alt, working at Adam Politzer's. It consists of a simple circuit: a battery, a smaller carbon transmitter, and one or two earphone receiver as shown in Figure 2.2.

Figure 2.2. Frederick Alt's Micro-Telephone (1900).

2.2.2. The Vacuum Tube

By 1920 Earl Hanson developed the first hearing instrument using vacuum tube and by 1921 it was produced by Western Electric Company and was distributed in the market (Mudry, Dodelé, and Otology 2000). This hearing aid system worked way better

than the carbon system, it raised the sound level to 70dB, and however it was remarkably heavier than the one composed of carbon.

The technological improvement continued its progress which by 1936 the evolution of decreasing the size of the battery by changing the zinc batteries with mercury, which from then wearable hearing aids was introduced to the marquet.

2.2.3. The Transistor Technology

By the mid-20th centuries the hearing aids goes to be smaller when Bell Telephone Laboratories come up with perfected transistor. The transistor was able to controls the electricity and the movement of the electrons which make it a switch that can stop and control the volume the flow, all these specificities make it suitable for many settings.

The transistor start replacing the vacuum tube quickly due to their inferior performance comparing to the new transistor technology and because they took of the surrounded vacuum tube they manage to reduce the volume and the weight of the hearing aids from 550g to 5g (Goldenberg 1996).

Figure 2.3. 1st Behind Ear Aid.

As result then hearing aids wasn't only able to be smaller but they managed to make it wearable behind the ear as shown in Figure 2.3, and inside the ear as shown in Figure 2.4 (Mudry, Dodelé, and Otology 2000).

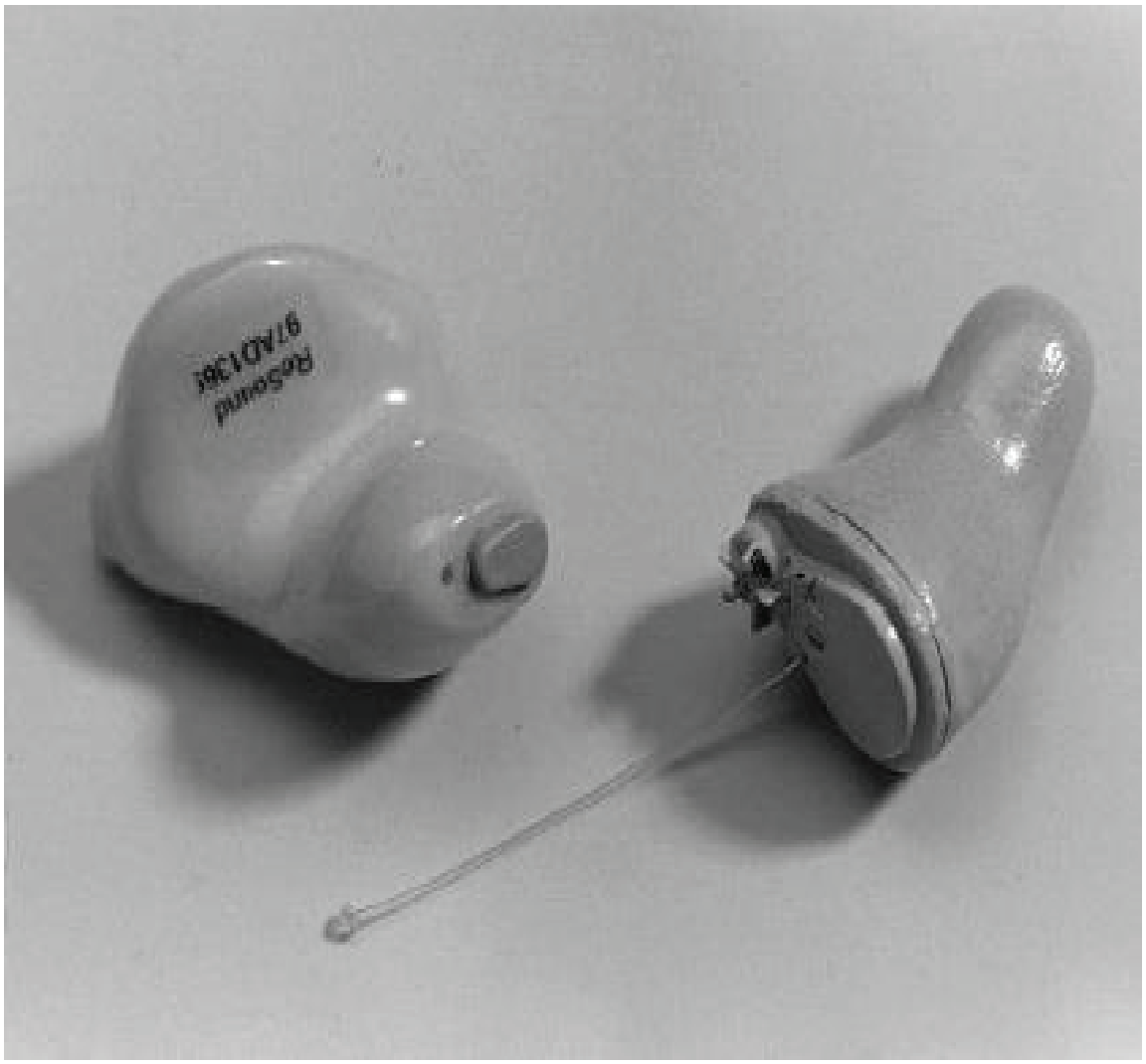

Figure 2.4. 1st Inside Ear Aid.

2.2.4. The late 20th Century: From Analogue to Digital

With the introduction of the compact in 1979 the digitalization of sound took the hearing aid industry a big step further. Processing with analogue system result with some distortion while with digital coding it is possible to simplify the signal to keep it intact at each stage. From then it allows the protection of the input signal independently of the applied process (Laurent 1997).

In 1996 Widex Senseo introduced the first fully digital hearing aids and it was successfully commercialized. (History of the technological development of air conduction hearing aids). With digital hearing aids many possibilities for signal processing are possible, like spectral and temporal analysis of signal, selective

amplification, reduction of the background noise and regulations for the dynamic range and feedback suppression (Mudry, Dodelé, and Otology 2000).

2.2.5. 21st Century: High Tech and New Horizons

The hearing aid development keep its progress where hearing aids are easily programmable suiting the costumers needs allowing users to customize it the way it find the right tune for them. Nowadays users can be guided and fine-tuned be audiometrist and professional that they customize it according the loss gape needed (Packer 2016).

With the global technology development hearing aids can be connected to each other electronic devices, digital technology is the same now as laptops, TV, smartphones, so every recent features are almost adapted the digital hearing aid like Bluetooth connection, Telecoil, FM connectivity.

So from acoustic era to the present hearing aid passed by a fully eventful journey keep improving and races to be in the front line by evolving the technology advances for a better product the response the need of customer.

2.3. Hearing Aid User's Psychology and Complexity

A hearing aids users especially children tend to have more sensitive and fragile psychology due their hearing loss that lack their interaction with others comparing to their sane peers. Literature studies mentioned hearing impaired tend to experience more difficulties in social life and more emotional complication than the normal one. All that difficulties are reasons of anxiety disorder that has a significant impact into their lifestyle quality and their professional functioning bringing out an economic load to the society (Theunissen et al. 2012).

Roughly only 17% to 24% of all children sane and impaired too are previewed by pediatric anxiety disorder. Although anxiety is widespread, the disorder is poorly recognized in clinical process and is therefore commonly under-treated, specifically in children (Chavira *et al.* 2004, Kroenke et al. 2007, Munk-Jorgensen et al. 2006).

However, across the severity range, parents reported an impact of the child's HI on family health (including stress), time spent with the child, child behavior, and independence (Moeller and hearing 2007).

A study of Heffernan *et al.* revealed that most the individuals that participated in their study, reported a negative emotional representation of their hearing loss. These emotions are noted as disbelief, anger, and fear.

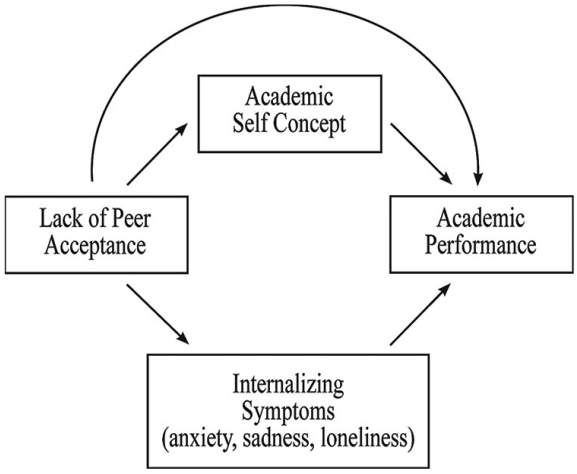

Figure 2.5. Model of factors influencing the relationship between peer acceptance and academic performance (adapted from Flook, Repetti & Ullman, 2005).

A study done by Cappelli *et. al* examinated 23 children with H.I who had the same grade and gender to test their peers aceptance, Findings showed that significantly more children with HI (30%) compared to peers with NH (5%) were rejected by their peers (Cappelli 1995).

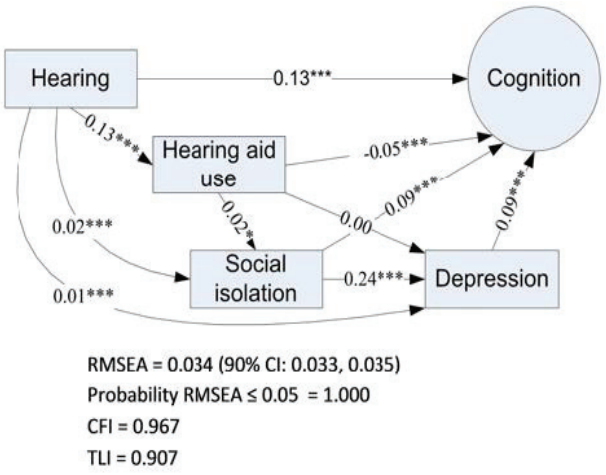

Figure 2.6. Structural equation models of standardized path coefficients between hearing, cognition, hearing aid use, social isolation and depression.

Another study by Piers Dawes *et al*. revealed that social isolation is significantly related to the poor hearing associated with higher frequency of depression, however it says that the depression and social depression are related to poorer cognition and that hearing aids use have no relation with depression (Figure 2.6) (Dawes et al. 2015).

2.4. Comparison Between Hearing Implanted and Normal Children

Roughly only 17 % to 24 % of all children sane and impaired too are previewed by pediatric anxiety disorder (Kroes et al. 2001). Although anxiety is widespread, the disorder is poorly recognized in clinical process and is therefore commonly under-treated, specifically in children.

Many studies worked on the anxiety of children hearing aid users compared to those whom are normal, three studies declare that hearing implanted children tend to have greater rate of anxiety comparing the normal children declared by themselves 9,10, or their parents 11, while 2 studies shows that there is no remarkable difference in their rate of anxiety (Remine, Brown, and psychiatry 2010).

A study done by Theunissen *et al*. about the anxiety in children hearing aids comparing to the normal one outcome that the hearing aided got higher level of anxiety comparing to the no hearing loss (Figure 2.7) (Theunissen et al. 2012).

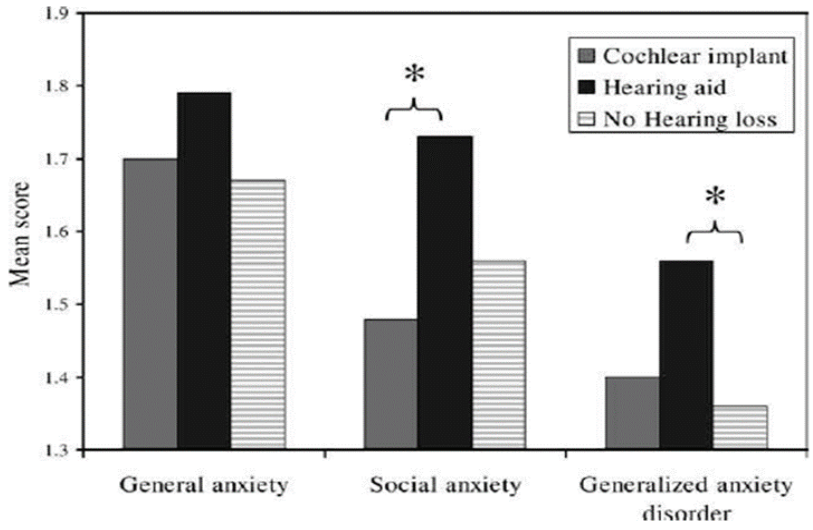

Figure 2.7. The outcomes where differences were found for social anxiety and generalized anxiety.

Their study demonstrates that in the comparison hearing aided children they tend to have higher social anxiety issues than the normal children. Moreover, they collected more statement from hearing aids parents declaring their children suffer also from global anxiety disorder.

However, Theunissen et.al., says in their studies that as long as children with hearing loss implant hearing aids earlier as much they reduce the risk having possible negative effect of hearing loss mainly anxiety disorders symptoms. Sooner you implant hearing aids the more you benefit from the contribution of the hearing aid and replace the loss they have.

2.5. Hearing Aids Benefits, Types and Preferences

2.5.1. The Welfare of Hearing Aids

Hearing aids are a vital item that treats the hearing loss, a system that is designed from an artistic and scientific perspective at the same time. It's a technology that hand over the user the item that compensate the hearing loss damage. Choosing and fitting hearing aids is about achieving the sane balance between repairing the hearing loss and satisfy the user's personal desires.

Any potential users have to be mindful of what he or she can benefit from sound that will be amplified from the hearing aids, making sure also to make his expectation realistic and modest.

Weinstein stated that one of the reason that put elderly people vulnerable to hearing loss would be the shortage of routine screening that with a delay of previewing the hearing loss it might complicate and deepen. So as soon as they preview their hearing loss they would they would save themselves from losing more by using hearing aids in early stage(Weinstein and Bernstein 2017).

Possibly that the most important think to learn is to get used to the device and coexist and live along with, because all that experience that users will have is something new and outlandish. So there will be new communication or interaction between the mind and the new sounds that users start to hear (Banerjee, Garstecki, and Surgery 2003).

2.5.2. Main Type of Hearing Aids and Technologies

2.5.2.1. Types

There are four basic hearing aid styles that varies in size, shape, options and features, power capacity and the easiness of its use as shown in Figure 2.8 (Banerjee, Garstecki, and Surgery 2003).

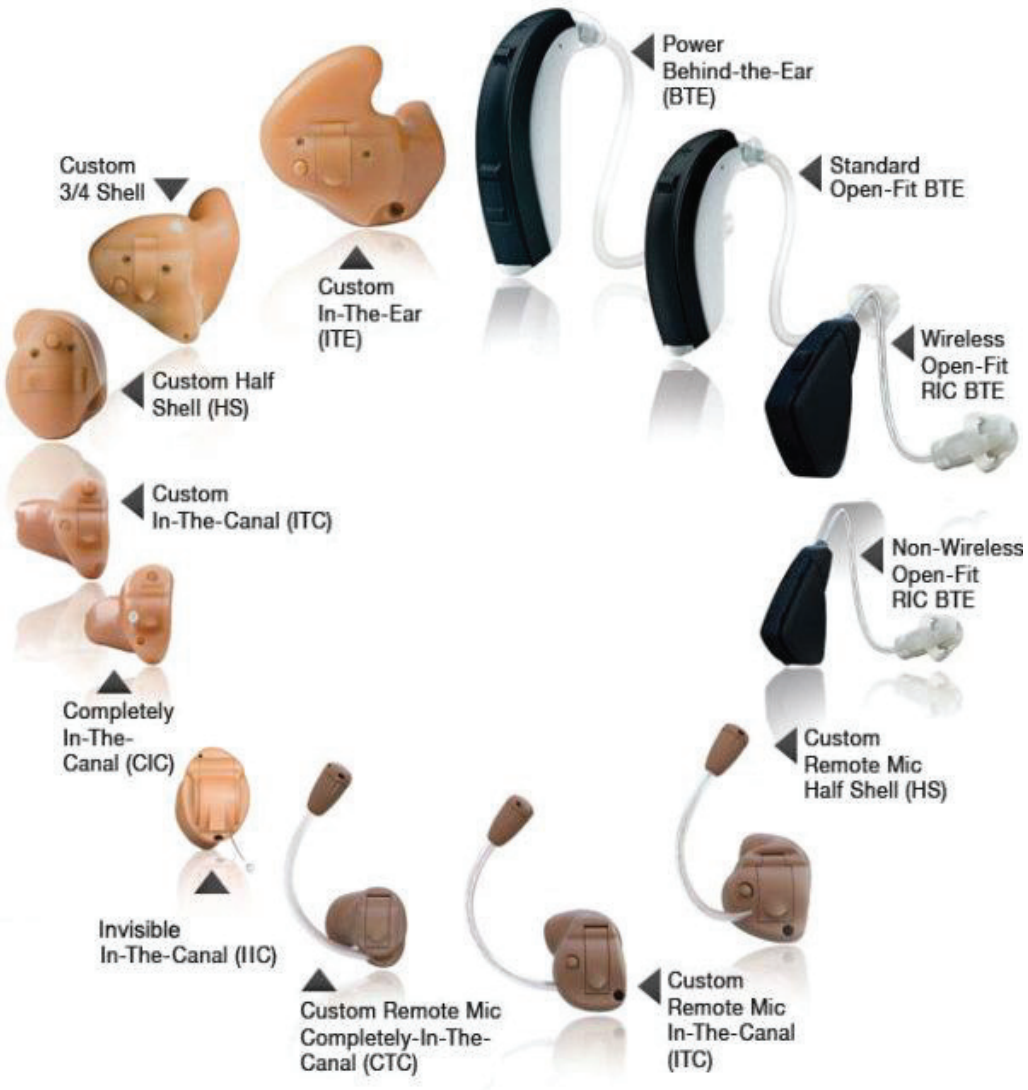

Figure 2.8. Range Type of Hearing Aids.

A behind-the-ear (BTE) hearing aid: it has a shape of shrimp that droop on the back of the ear from which the amplified sound is transmitted to the ear canal through a

tube and earmold. The BTE hearing aids are the most convenient for any intensity of hearing loss. Moreover, because the ears shape and the canal shape of the children grows too fast it is the best option if not the only option that would be advised due the low cost changing the earmold instead of changing the whole hearing aid like CIC and ITC.

In-the ear hearing aids essentially are appropriate for the all the degree of hearing losses, which perform like BTE but instead of hanging behind the ear it fills all of the concha or almost depending on the side of the ear. So the ITE relatively might be discreet.

In-the-canal (ITC) aids are a smaller version of the ITE hearing aids which instead of filling the whole concha it fills a small part of the cavum concha. They are somehow unobtrusive but still visible. Advised for users with mild to moderate hearing lost.

Completely-in-the-canal (CIC) aids which are the smallest version that do not occupy any of the concha and basically it is invisible for normal viewer. It is limited the involvement and many features due to miniature size of the item. Nonetheless, because CIC aids doesn't occupy the concha it allows the users to benefit of the natural acoustic properties of the pinna in contrast with the other models. CIC hearing aids are suitable only for those with a mild to moderate hearing loss.

2.5.2.2. Technologies

To classify the technologies of the hearing aids there is 2 main aspects:

- Analog versus digitals
- Programmability

Analog signal processing: it is more batteries efficient than the digital once due to its use of simple noise reduction strategies.

Digital signal processing: this one is non batteries efficient due to the energy consumed providing better quality sound comparing to the analogue processing. The digital signal processing has a multiple program for different listening situations, advanced noise reduction strategies, and electronic reduction of acoustic feedback.

Programmability: in term of programmability of hearing aid there is to type the first one is the non-programmable one which parameters and features should be made correctly according to the user, because once it's done you can't change parameters that might suit better the user. In the other hand the programmable one benefit of a parameters

flexibility tuned via computer interface which provide a better customization of the parameters according to the users' needs (Banerjee, Garstecki, and Surgery 2003).

2.5.3. Hearing Aids Preferences

A variety of hearing aids in term of design and performance can confuse users to choose the ideal items that fit him or her needs and desires. However, Kochkin mentioned that The Behind-the-ear BTE showed before the years of 2000 selling rates under 20% and seemed that interest of the costumer decreased by rejecting it as design to choose (Figure 2.9) (Kochkin 2011).

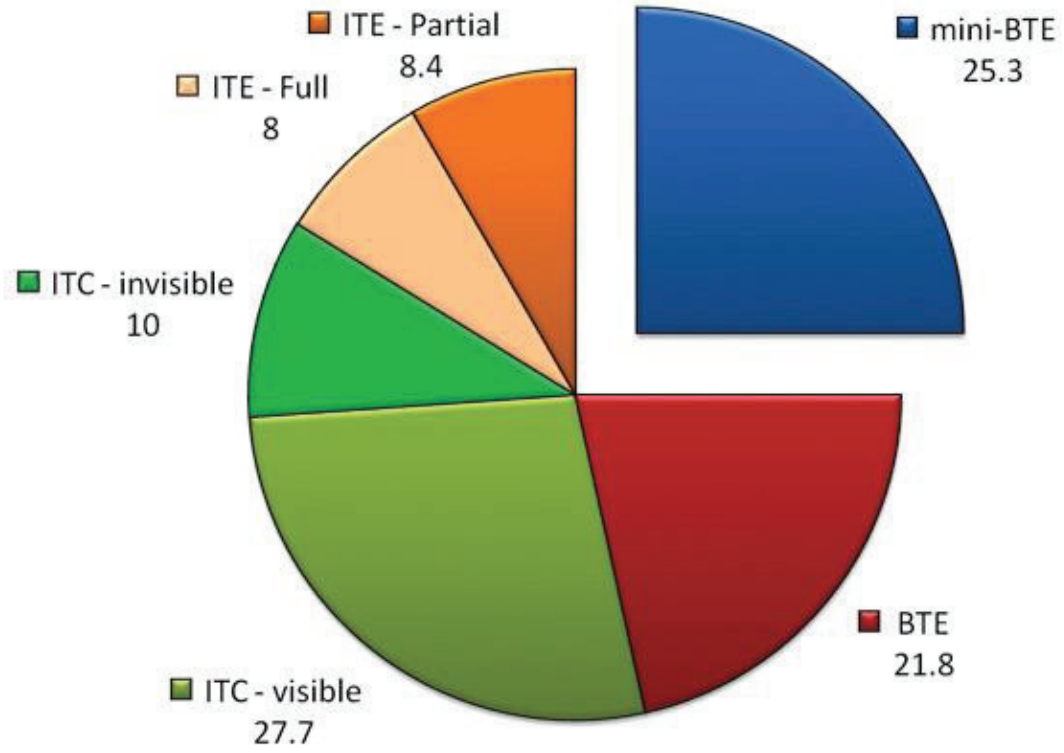

Figure 2.9. Hearing aid style mix (%) for the period 2005-2008.

Later with the launch of the open-fit hearing aids and receiver in canal (RIC) hearing aid which are a refined smaller version of BTE, got back to the market and shows 63% of all hearing aid sales (Kirkwood 2009). Outcomes and numbers that can shows that users tend to prefer what is minimized or they tend to choose new concepts as shown in figure 2.10.

Figure 2.10. Some Sketch of the Mini-Behind The Ear Hearing BTE Aids.

During the history of hearing aids evolution, miniaturization has been the force behind hearing aid design. But the question that arises is the objective of miniaturization in the best ergonomic possible does interest the typical end user?

Weinstein claimed that to put the subject about the complexity of the issues related to the hearing aids experience - for all different type of hearing aids – drive us to think about what is the best or ideal type to use or which is the perfect program parameters to provide the best experience, but the solution may lie in The story of Malcolm Gladwell's wisdom about revolutionized the tomato sauce industry saying that “There is no perfect tomato sauce, but rather a perfectible selection of sauces”. That lead us to determine that it is not about finding the perfect recipe of the hearing aid to provide the better experience, but it’s about the optimization of variety hearing aids to fit the user’s subjective preferences (Weinstein and Bernstein 2017).

2.6. Radio Frequency Identification

Nowadays items we buy get more numerous and tend to be more expensive by the time and the economic crises we live with. All these conditions make items that people own, more valuable and count on them in many activities like studying, traveling,

camping etc. However, there is some items that is vital for some and cannot be replaced and living without cause them panic and maybe depressions.

The loss of hearing aid would be a critical situation for their owners however some technologies worked perfectly for finding lost items, some they are still presented as patents.

(RFID) the abbreviation of Radio-Frequency Identification is one perfect solution for finding loosing items that interesting due to the very low energy that consume. It is a wireless sensor technology. It is based on the detection of the electromagnetic signals (McCarthy et al. 2002).

A regular RFID system consist of three elements:

- An antenna or coil
- Receiver (with decoder)
- Transponder (RF tag)

All these three elements are electronically set up with unique data as shown in figure 2.11.

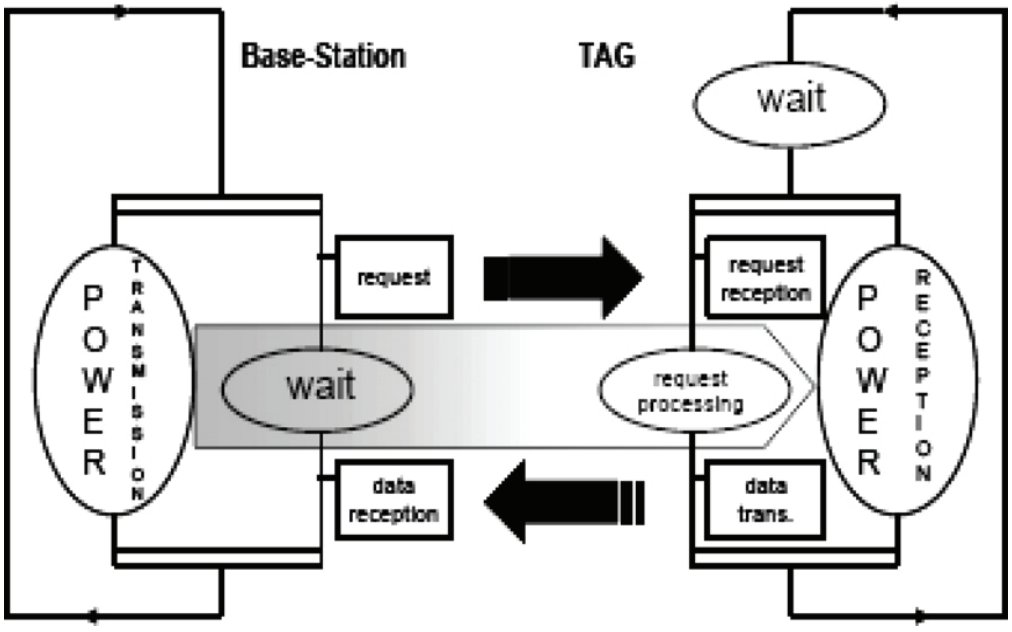

Figure 2.11. A Typical RFID system (Domdouzis, Kumar, and Anumba 2007).

As an epitome, in daily life, RFID can be applied to personal belongings especially for elders and people with disabilities to prevent lose their items such as eyeglasses, artificial teeth replacements, drugs, hearing aids, etc. RFID provides to person an easy way in order to find their personal belongins between 10 meter, 3 meter, and 1 meter (Figure 2.12) (Velhal et al. 2007).

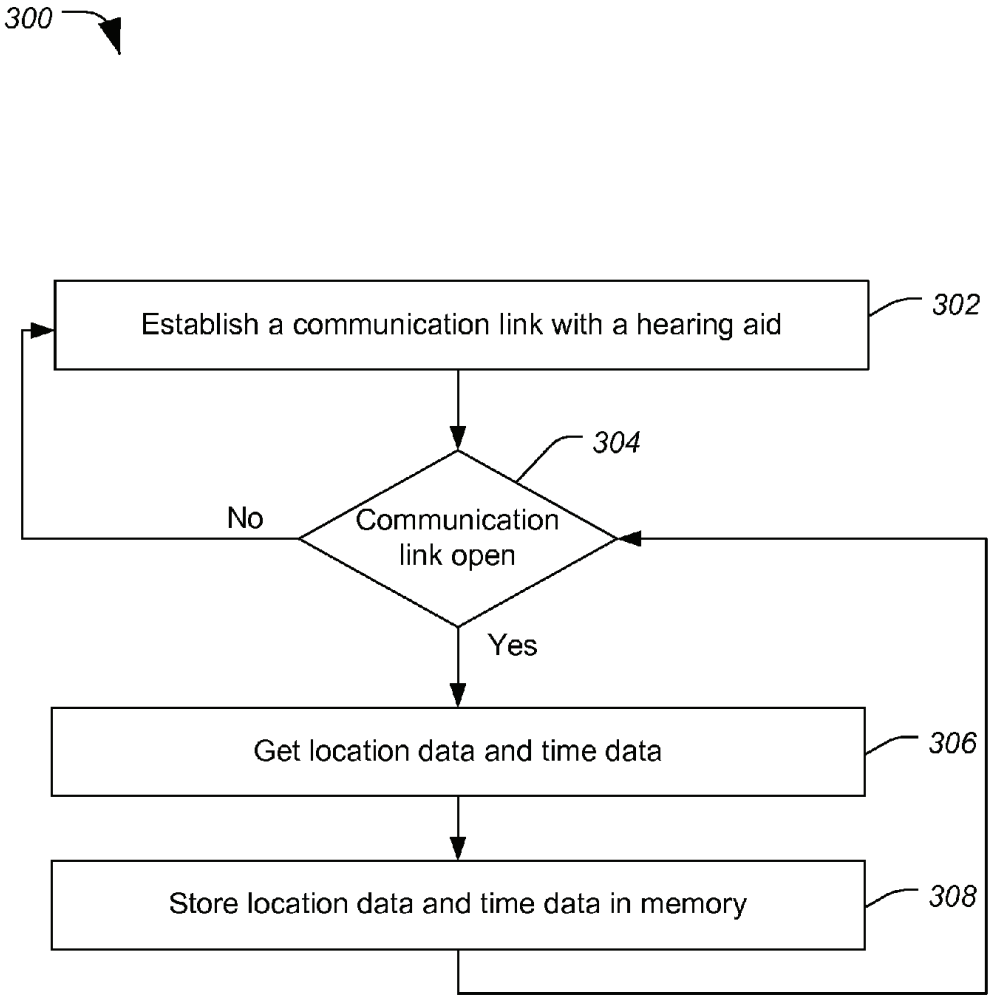

Figure 2.12. A flow diagram of an embodiment of a method of storing last known location and time data of a hearing aid.

CHAPTER 3

ADOPTION THEORIES

For familiar adoption theories are below.

3.1. Theory of Reasoned Action (TRA)

During the past decades, many theoretical models were developed by researchers to explain the human behaviors in the adoption process (Topacan 2009). Theory of Reasoned Action (TRA), shown in Figure 3.1, (Fishbein and Ajzen 1980)which has been used to predict wide range of behaviors is one of the well known models. Fishbein and Ajzen used two main constructs, namely attitude toward behavior and subjective norm, to predict the behaviors (Fishbein and Ajzen 1975). Attitude defined as “the person’s beliefs that the behavior leads to certain outcomes and his/her evaluations of these outcomes”. Beliefs that a person builds up over his lifetime influence attitude. An attitude, then, is a person's belief about whether the outcome of his action will be positive or negative. If the person has positive beliefs about the outcome of his behavior then he is said to have a positive attitude about the behavior, or vice-versa. Subjective norms defined as “the person’s beliefs that specific individuals or groups think he/she should or should not perform the behavior and his/her motivation to comply with the specific referents”. Subjective Norms are perceptions about how family and friends will perceive the outcome of the behavior (Fishbein and Ajzen 1980).

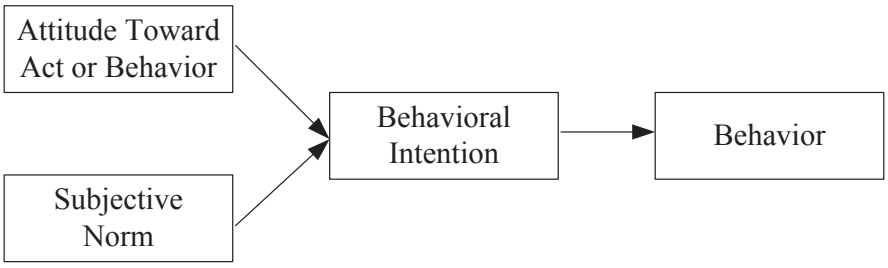

Figure 3.1. Theory of reasoned action.

3.2. Theory of Planned Behavior (TPB)

Theory of Planned Behavior (TPB) is the successor of the TRA. Fig. 12 illustrates the model (Ajzen 1991). Ajzen developed it by adding perceived behavioral control, defined as "the perceived ease or difficulty of performing the behavior", to the TRA. These are the beliefs that may assist, or may obstruct the performance of the behavior (Figure 3.2).

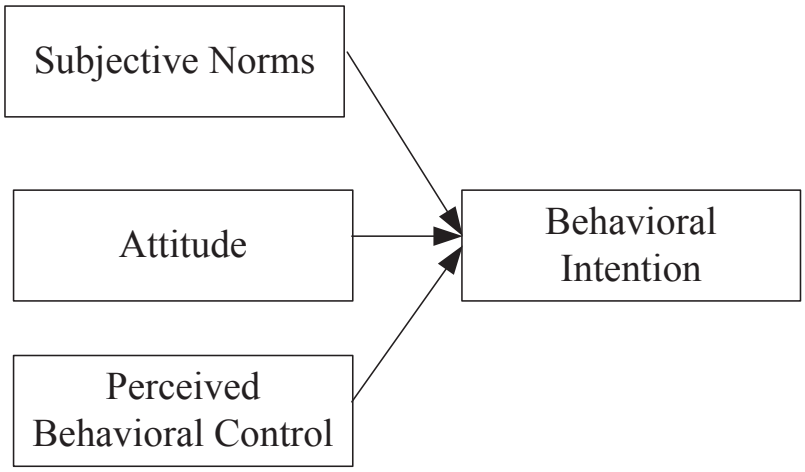

Figure 3.2. Theory of Planned Behavior.

3.3. Technology Acceptance Model (TAM)

Following the Theory of Reasoned Action (TRA) model, many researchers attempted to expand it by adding new constructs or by applying it in different contexts. Technology Acceptance Model (TAM) (Venkatesh and Davis 2000b) was applied in the IS context to predict technology acceptance.

According to Davis, users' intention toward system use is significantly correlated with both of perceived usefulness, defined as "the degree to which a person believes that using a particular system would enhance his or her job performance" and perceived ease of use, defined as "the degree to which a person believes that using a particular system would be free of effort". Figure 3.3 shows technology acceptance model.

Although TPB is a general model of human behavior, TAM focuses on specific behavior to predict information technology acceptance (Topacan 2009).

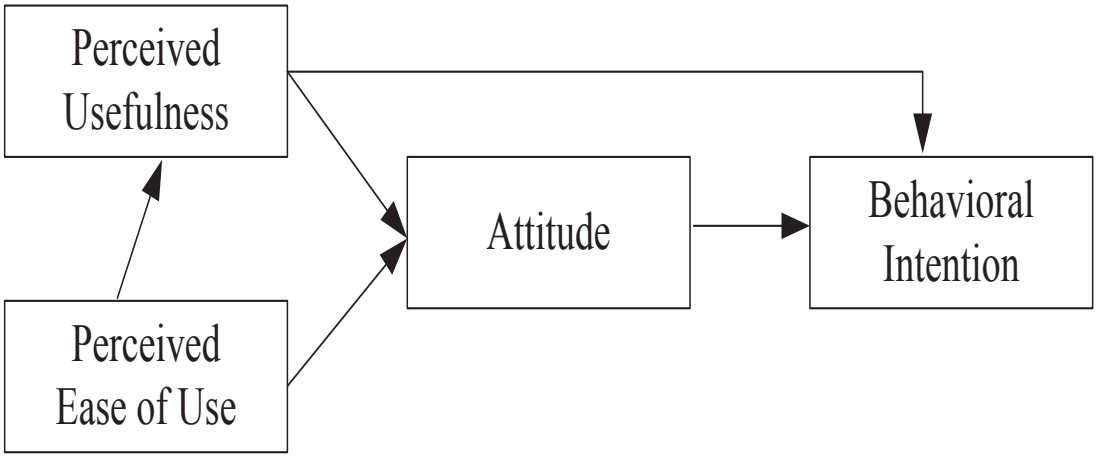

Figure 3.3. Technology Acceptance Model.

3.4. Technology Acceptance Model 2 (TAM2)

Venkatesh and Davis concluded that TAM explains 40% of usage intention and behavior (Venkatesh and Davis 2000b). They extended the model (TAM) by including additional key determinants namely social influence processes (subjective norm, voluntariness, and image) and cognitive instrumental processes (job relevance, output quality, and result demonstrability) to the base constructs of TAM. Definitions of these variables are as follows;

Subjective Norms – "person's perception that most people who are important to him think he should or should not perform the behavior in question" (Fishbein & Ajzen, 1975).

Voluntariness – "the extent to which potential adopters perceive the adoption decision to be non-mandatory" (Moore and Benbasat 1991).

Image – "the degree to which use of an innovation is perceived to enhance one's image or status in one's social system" (Moore and Benbasat 1991).

Job Relevance – "an individual's perception regarding the degree to which the target system is applicable to his or her job" (Venkatesh and Davis 2000b).

Output Quality – "how well the system performs tasks" (Venkatesh & Davis, 2000). Result Demonstrability – "tangibility of the results of using the innovation" (Moore and Benbasat 1991).

Venkatesh & Davis (2000) found that all of these variables significantly influence user acceptance of information technology and proposed Technology Acceptance Model 2 (TAM2) as shown in Figure 3.5.

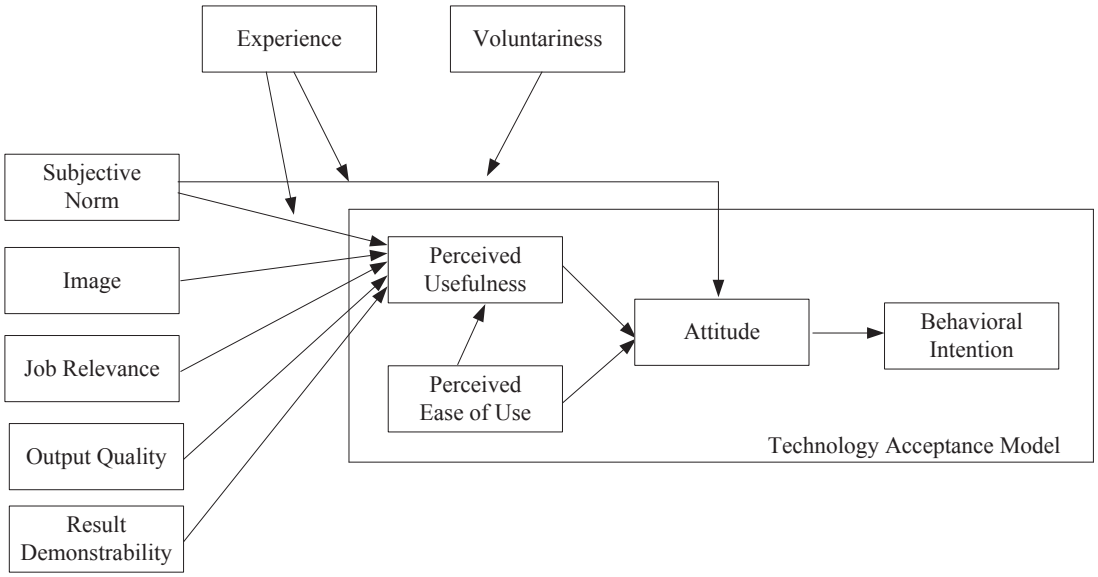

Figure 3.5. Technology Acceptance Model 2.

CHAPTER 4

FRAMEWORK

4.1. Hearing Aids Adoption Taxonomy

Before proposing the models and the hypothesis, hearing aids health adoption taxonomy was created by using the variables collected from literature survey, qualitative studies, and expert focus group study.

The proposed taxonomy is presented in Table 4.1. In Table 4.1 letters shown near the variables indicates source of the variable. Letter "L" represents literature survey, letter "I" refers to interview, and letter "E" denotes expert focus groups. For instance-, (L) (E) means that the variable was mentioned in both of literature survey and expert focus group. Smart glasses health adoption taxonomy was divided into six categories, as follows "user health", "product characteristics", "user characteristics", "facilitating conditions", "social-organizational", "medical functions", and "intermediary". Product characteristics also contain four more sub-categories, like "hardware", "software", "mechanical", and "general". All of these categories include specific variables.

Table 4.1. Taxonomy of hearing aids adoption.

Individual (user characteristic)	**Social Stigmatisation**	**Demographic (User characteristic)**	**Services**
•Awareness (L) •Anxiety (L) •Losing item (L) •Complexity (L) •Fear (L) •Depression (L) •Intent (L)	•Social factors (L) •Stigma (L) •Psychology (L) •Interaction (L)	•Age (I) •Gender (I) •Income (I) •New user (I) •Experienced users (I)	•Audiologist (L) (I) (E) •Warranty (L) •Technical service (L) (I) (E) •Healthcare (L) •Cost (L) (I) (E) •(Device) Type (L) (I) (E)
General (Product characteristic)	**Hardware**	**Intermidiary**	**User's health**
•Brand (L) (E) •Weight (L) (I) (E) •Design (L) (E) •Visibility (L) (I) (E) •Safety (L) (I) •Wireless (L) (I) (E) •RFID (L) •Resistance (L) (I) •Color (L) •Size (L)	•Sound Quality (L) (E) •Battery life (L) (I) (E) •Mold (L) (E)	•Ease of use (L) (I) (E) •Usefulness (L) (I) (E)	•Ears health (I) (E) •Hearing (L) (I) (E)

Table 4.2. Literature list of taxonomy.

Variables	Authors
Appearance	Albert Mudry *et. al.* ,2000
Design	Chavira *et. al.*, 2004
Weight, Size	Goldenberg *et. al.*, 1996
Depression	Kirkwood *et. al.*, 2009
Awareness	Kochkin *et. al.* l, 2010
Battery life	Kochkin *et. al.*, 2011
Audiologist	Kochkin *et. al.*, 2012
Fear	Kroenke *et. al.*, 2007
Complexity	Kroes *et. al.*, 2001
Sound quality	Laurent, S *et. al.*, 1997
RFID	McCarthy *et. al.*, 2002
Losing Item	McCarthy *et. al.*, 2011
Stigmatization	Moeller *et. al.*, 2007
Depression,	Munk *et. al.*, 2006
Technology	Packer, Lisa, 2016
Psychology	Remine *et. al.*, 2010
Anxiety	Theunissen, S *et. al.*, 2012
RFID	Velhal *et. al.*, 2007
Healthcare	Weinstein *et. al.*, 2017

4.2. Research Framework and Hypothesis

In this study two research model were developed, basing on literature review, taxonomy and interviews. First one aimed to understand the psychologies of different age group of children users and older group of users. Analysing also the different type of hearing aids and its developpement through history. The second one aimed to come up with the user intention of the hearing aids apropos daily use experience.

4.2.1. User Intention of Hearing Aids

Figure 4.1 shows all style hearing aids adoption framework in daily experience if there is any difference between CIC and BTE then it would be mentioned. Respecting the framework, determinants of intention are attitude, usefulness, ease of use, battery life, wireless, volume control, size, weigh connectivity, ears health, weight, resistance, technology, easy insertion / take out, cleaning. These significant constructs were chosen by 6 audiometric in an expert focus group work.

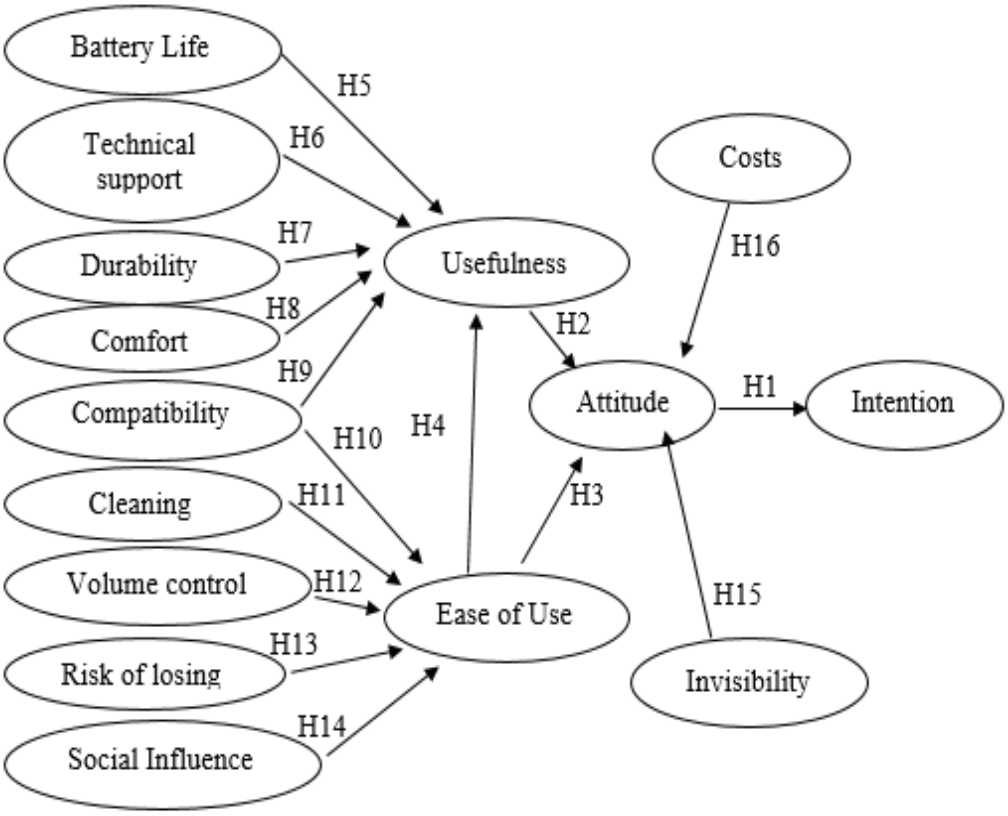

Figure 4.1. Hearing aids adoption framework.

Fishbein and Ajzen (1975) defined attitude as "the individual's positive or negative feelings about performing a behavior". To use the system or object attitude has a strong effect on the user's willingness to use the program (Ajzen 1991, Bruner II and Kumar 2005, Dishaw and Strong 1999).

H1: Attitude significantly and positively affects user intention.

Usefulness is one of the main constructs of TAM which is a key theoretical model for the theory of technology adoption, and has been defined as "the degree to which a person believes that using a particular system would enhance his or her job performance"

(Davis 1989). It was found in the Davis (1989) research that Usefulness has a major impact on behavioral intent. Many other researchers tested and supported this finding in various contexts and situations (Venkatesh and Davis 2000a, Yu, Li, and Gagnon 2009, Karahanna, Straub, and Chervany 1999).

H2: Usefulness significantly and positively affects attitude.

Ease of use is another main construct of TAM (Davis 1989). In the TAM model, both of usefulness and behavioral intention are affected by ease of use. Although there is a general belief that ease of use is critical in predicting the adoption of technology, Some researchers have not established a strong correlation between ease of use and usefulness (Liu & Ma, 2005); and ease of use behavioral and intention (Liu and Ma 2005);(Hung and Chang 2005)

H3: Ease of Use significantly and positively affects attitude.

H4: Ease of Use significantly and positively affects usefulness.

When it comes to battery life hearing aids as much as battery last more as much the user get satisfied. However, as the size of the hearing aid varies from style to another the size of the battery varies and that affect its life duration for that CIC rated with lower battery life when BTE devices yeilded hight satisfaction rate (Wong, Hickson, and McPherson 2003).

H5: Battery life significantly and positively affects usefulness.

Users face different problems when using a product or service. Such problems need to be addressed in order to improve the quality of the service. Technical support means how to help a client solve their experienced issue. Kim & Chang (2007) found that support for users has a significant impact on the usefulness and ease of use of health information. Moreover, it enhances user satisfaction (Kim and Chang 2007).

H6: Technical support significantly and positively affects usefulness.

For hearing aids users durability and comfort/fit was important critics that Kochkin has mentioned in his study that over than 82% of the participent were satisfied with the comfort of their hearing aids andover 61% where satisfied in term of durability (Kochkin 1997).

H7: Durability significantly and positively affects usefulness.

H8: Comfort significantly and positively affects usefulness.

Rogers found in his research that an innovative model has some key features that decide the adoption rate and trend (M Rogers 1983). Compatibility is, according to him, one of these features and he described compatibility as “the degree to which an innovation

is perceived as being consistent with the existing values, needs, and past experiences of potential adopters". The more user-friendly an invention is, the faster the acceptance process will take place. Aubert and Hamel concluded that compatibility has indirect positive effect on adoption process. Therefore, compatibility is a significant source for perceived utility (Aubert and Hamel 2001).

H9: Compatibility significantly and positively affects usefulness.

H10: Compatibility significantly and positively affects ease of use.

Lena *et. al*. mentioned in its study that a minority of users complained about cleaning difficulties and volume adjustability (Wong, Hickson, and McPherson 2003). Over 61% of participent mentioned their satisfaction of their frequency of cleaning, while for users that complained about Volume control adjustment there where only 4.9% (Kochkin 2000).

H11: Cleaning significantly and positively affects ease of use.

H12: Volume control significantly and positively affects ease of use.

H13: Risk of losing significantly and negatively affects ease of use.

TRA, which for most adoption theories was a key theoretical model, contains variable social influence in its subjective standard constract, defined as "the person's perception that most people who are important to him think he should or should not perform the behavior in question" (Fishbein and Ajzen 1975). In both TRA (Fishbein and Ajzen 1975) and TPB (Ajzen 1991) a clear determinant of behavioral control were found. In addition, Venkatesh and Davis found that subjective expectations directly affect behavioral intention and usefulness (Venkatesh and Davis 2000a).

H14: Social influence significantly and positively affects ease of use.

The rate satisfaction varies from the style of hearing aids CIC and ITC collected higher rates of satisfaction in term of visibility, comfort with loud sound (Wong, Hickson, and McPherson 2003). For an over satisfaction rated from 0% to 10% invisible ITC earned higher rates than ITC, ITE or BTE that are more visible.

H15: Invibility significantly and positively affects attitude.

Perceived financial cost is described as "the degree to which a person believes it will cost money to use a service" (Luarn and Lin 2005). In previous studies, financial resources, namely costs, were found to be a significant antecedent for the behavioral purpose of using a product (Mathieson, Peacock, and Chin 2001, Tung, Chang, and Chou 2008).

H16: Cost significantly and negatively affects attitude.

Tablo 4.3. Determinant of hearing aids intention.

Hypothesis	Dependent Variable	Independent variable	Relationship
1	Intention	Attitude	Positive
2	Attitude	Usefulness	Positive
3	Attitude	Ease of use	Positive
4	Usefulness	Ease of use	Positive
5	Usefulness	Battery life	Negative
6	Usefulness	Technical support	Positive
7	Usefulness	Durability	Positive
8	Usefulness	Comfort	Positive
9	Usefulness	Compatibility	Positive
10	Ease of use	Compatibility	Positive
11	Ease of use	Cleaning	Positive
12	Ease of use	Volume Controle	Positive
13	Ease of use	Risk of losing	Negative
14	Ease of use	Social influence	Positive
15	Attitude	İnvisibility	Positive
16	Attitude	Costs	Negative

CHAPTER 5

METHODOLOGY

This study started in september 2018 by reviewing about hearing aid related literature in many aspects; reviewing topics about psycholgies of users, about technologies might be involved in the field of work and collecting a baguage of knowledge and better undestanding of the item and. After that a qualitative and quantitive interviews have been done to come up with with spot of flows to focus on.

Table 5.1. Summery of reaserch studies.

Study	Dates	Notes
Literature reviews	2018 -2019	How many articles,book,journals
Interview 1 (medical staff)	January 2019/ May 2019	8 health staff, composed of 6 audiologists and 2 prononciantion instroctors. Average of 20 minutes each
Interview 2 (users)	April 2019 /May 2019	5 users composerd of 2 inside hearing aids users and 3 behind ears users. Average of 20 minutes each
Expert focus group	January2019/ May 2019	6 health staff composed of 6 audiologists worked on selecting the 15 most relevant construct from 57 candidates variables
Quantitative Analysis-1	April 2019/ May 2019	61 active Hearing aid users responded. Hard copy questionnaire
Quantitative Analysis-2	August 2019/ October 2019	49 active Hearing aid users respondedThe web-based questionnaire, contains 5 questions to collect demographic information of the participants,1 question of specifying the type of hearing aid and 31 questions of five-point Likert-scale questions

The Table 5.1 shows the brief of the journey and the prosses of developping this study. The study began with a brainstorming stage to come up with the topic to work on. Just as the topic being validated the literature review started and come out with outputs that being used for the interviews and the coming stages of studies. Later a semi-

structured interview has been started to carry out. In first step we started with 8 professional as audiologist, then with 61 users and we revised the interview and did it again with 46 users.

Qualitative and quantitive research method was applied in order to a better understanding of the topic and collect useful information, first from profesionals like audiometrists to get their perspective of view toward users, and later to go deeper in the topic doing interviews with users them selves.

5.1. In-Depth Interview

Table 5.2. Sample of questionaire concerning interview with profesional about hearing aids and their users.

1- I would like to know your age and your occupation.
2- For how long do you work in this post (position)?
3- What is your mission and service you provide your costumer?
4- How do you see the intervention and the contribution of the hearing aids on your patients?
5- What are the things that patients complain about hearing aids?
6- For those who use the invisible hearing aids (CIC models and similar) what are their complaints?
7- Did you get any suggestion from patients to improve the hearing aid they use?

Some of the interview were voice recorded after taking a permission from the audiometrist or prononciation specialist. There were 8 in total 4 in Turkey and 4 in Tunisia.

The proposed interviews were aimed to:

From Profesional:

- Know from profesional perspective if hearing aids satisfy completely their costumers or not, and collect their costumer's complaint to study on it.

- Understand seperately different of style of hearing aids and know their cons and pros.

- Get their own opinion about hearing aids should be choosen how it sould work for users.

- To know if according costumers' complaints if any suggestions or demands for improving hearing aids in specific features, or possible added features.

Table 5.3. Sample of questionaire concerning interview with users about their experience with their hearing aids

1-How old are you? How long do use H.A?
2-How do you qualify the value/quality of the item?
3-What do you think about the comfort and the fitness of the item in your ear?
4-What is you rank for reliability of the item?
5-How do you note its secrecy?
6-Is it easy to clean?
7-How is the battery life?
8-How is the expense while using it?
9-How do qualify the ease of adjusting the volume?
10-Would you recommend it to a friend?
11-Would you purchase it again?

From hearing aids users

- Collect information about user's daily experiences in order to put the light on cons.

- With the variety of style of hearing aids collecting users experinces depending on their hearing aids style, seeing their preference and their reasons.

- Understand their psychologies, their fears, and their needs in order to understand users and arise alternative exsistant or possible invented solutions.

These in-depth interview studies were aimed to tight the topic and assemble significant constructs to structure the research work. After an in-depth interview, the experimental focus group study has been launched. The description of the process is placed under the methedology 5.2 (Expert Focus).

5.2. The Expert Focus

From literature reviews and interviews 57 construct were extracted and an expert focus group were attented to narrow down the number of construct. The participants were composed of 6 audiologists which they were asked to choose the 15 most considerably construct out of 57 related to the preferences and facts that affect users to use the hearing aids.

Table 5.4. Table of constructs studied in the expert focus group.

Gender	ExternalInfluence	Device type
Age	Comfort	Experience
Education	Durability	Fear of damage
Expertise	Costs	Stigmatisation
Expertise_Other	Ease of use	Invisibility
Fear_Loss	Usefulness	Social influence
BatteryLife	Attitude	New users
Weight	Intention	Experienced users
Wireless Connectivity	SystemSpeed	RFID
Adjustability	View_Screen	Shape
Ear Health	Resolution_Screen	Ear
HandsFree	GestureControl	Self_efficacy
VoiceControl	Innovativeness	Comment
TechnicalSupport	Satisfaction	Type of device
Privacy	Warranty	Understanding
Compatability	Self esteem	Psychology
Internal Influence	Complexity	İsolation
Quality of sound	Brand	Noise
Mold	Design	Developpement
Anxiety	Technologies	Handicap

5.3. Experimental Studies

5.3.1. Quantitative Analysis-1

The aim of this experimental study is to explore users's thoughts about their hearing aids they use. A hard sheet copy survey was distributed in the hospital of Dokuw eylul hospital in Izmir/Turkey and in Charle Nicole Hospital in Tunis/Tunisia. 61 users in total participated to reply this survey, 52 users from Turkey and 9 users from Tunisia.

The survey was composed of 2 demografic questions, 10 of 5-likely-scale questionnaires to explore the users thought about his device and the 4 of 4-likely-scalequestions toillustrate there fear of losing their device, then finally one last question to see if the users if they would avice anyone who think to purchase same device. Table 5.5 and 5.6 shows that.

Table 5.5. Behind ear implanted participants experience questionnaire.

Age : Gender : M / F

A. **What is your type of hearing aid? in-ear / behind-ear**

	Totally unsatisfied	unsatisfied	neutal	satisfied	Very satisfied
1.Quality / Price ratio					
2. Easy battery replacement					
3. Battery life					
4.Costs					
5.Durability					
6.Ears health					
7.Ease of cleaning					
8.Ease of volume adjustment					
9.Overall use					
10. Appearance of the device from outside					

Table 5.6. Distribution of worries among behind ear implanted participants.

	hiç bir zaman	nadiren	her zaman	çoğu zaman
11. Are you afraid of losing your device?				
12. How often do you lose the device?				
13. Cihazınızı kullanmayı unutuyor musunuz ?				
14. Do you forget to use your device?				
15. Do you advise your friend suffering hearing loss to buy a hearing aid?				
a. Certainly do not recommend b. Do not recommend c. Neutral d. Recommend e. Highly recommend				

5.3.2. Quantitative Analysis-2

The purpose of the experimental study is to discover the cons and the pros that users declare about the hearing aids. To collect data from respondents, a web-based data collection system was developed from questionnaire for Descriptive analysis, T-Test and regression analysis.

The regression questionnaire form of this study was designed to test the hypotheses of hearing aid intention framework. It contains 5 questions to collect demographic information of the participants,1 question of specifiying the type of hearing aid and 31 questions of five-point Likert-scale questions to assess the participant's attitude to hearing aids.

Analysis including Descriptive T-test, correlation was applied in the experimental study. Findings and results of these analysis will be explained in Findings section.

Table 5.5. Sample of questionaire concerning interview with users about their daily experince and opinions about hearing aids.

1st 5 questions: Gender, Age, Education, Profession, Income	
Type of device	6- What type of hearing aids do you use? Inside or behind ears
Experience	7- How many years do you use it?
Fear_Loss	8- Do you scare losing you hearing aids
BatteryLife	9- Does the the battery life of your hearing aid matter for you?
BatteryLife	10- Is it good for you to charge your hearing aids with wireless charger
Weight	11- Is the weignt of your hearing aids important?
Compatability	12- It is important to connect your hearing instruments to the phone and other smart devices?
Volume adjustment	13- Does the volume controle adjustment easy to use?
Ear health	14- Do you think that hearing aid will harm your ear?
Hand free	15- Hand free feature is it benificial?
Satisfaction	16- Does the volume control makes the device convenient?
Technical support	17- It is important to get technical support when needed?
Privecy1	18- Does people around makes you uncomfortanble when they looks at your ears?
Privecy2	19- Is it better when the device is not visible in the ear
Compatability2	20- Do you think that making hearing aid is compatible with other devices will make life easier?
InternalInfluence	21- Do you consider the advice of your freind or family?
ExternalInfluence	22- Does ads or audiometrist views and opinon ifluences you?
Comfort	23- Do you think it is comfortable to use?
Durability 1_ORG	24- Does your device breaks down frequently?
Durability 2	25- Do you think your device is durable?
Costs 1	26- Does the batteries of the device create a financial charge?
Costs 2	27- When a part of your device fail is it an unexpected cost?
Ease of use 1	28- Is it difficut to use?
EoU2_ORG	29- Is it because it's small that you find a difficulties to use?
EoU3	30- Is it easy to clean?
Usefulness 1	31- Do you think it's easier to adjust the volume via smartphone application
Usefulness 2	32- Do you think the quality of your hearing is improved
Usefulness 3	33- Do you believe it can be benificial?
Attitude 1	34- Do you advice any one with hearing loss to use the device?
Attitude 2	35- these type of items interests me
Intention	36- Are you planing to by one soon?
Comment	37- What kind of changes and improvements do you recommend regarding hearing aids?

CHAPTER 6

FINDINGS

6.1. Findings of Expert Interviews

6 individuals were participated in this study 4 of them were female and the rest were male. Table 6.1 shows the profile of participents.

Table 6.1. Participants profile of qualitative research.

Participant	Gender	Age	Profession	Experience	Duration
1	Male	25	Audiologist	5-10 years	30 min
2	Female	26	Audiologist	5-10 years	30 min
3	Male	24	Audiologist	0-5 years	15 min
4	Female	28	Audiologist	0-5 yeras	15 min
5	Female	48	Prononciation Instructor	30+ years	20 min
6	Female	62	Pronunciation Instructor	20-30 years	20 min
7	Female	44	Audiologist	20-30 years	30 min
8	Female	46	Audiologist	10-20 years	30 min

The following steps were carried out in the analysis phase of the qualitative research.

1. The audio recordings of interviews are deciphered and written by sentence in a file document.

2. These transcripts have been used in the chapter framework.

3. Many constructions have been made from these interviews. Table 6.2.

4. Some constracts were added to the other constracts that would be taken out from hearing aid literature.

Table 6.2. Selection frequencies of the constructs select them from highest to lowest.

Construct	Frequencies of construct
Invisible	5
Battery	5
Type of device	5
Stigmatization	4
Compatibility	4
Size	4
Sound quality	4
Wireless	4
Durability	4
Weight	3
Technical support	3
Costs	3
Losing risk	3
warranty	3
Technologies	2

In this interview study participent were from the profesional field of hearing aids service as audiometrist and pronunciation instructor. In this interview we focused on the daily experience that their users (hearing paired) face and extract basically the pros and cons. However, there were limitation of time and availability and they were too busy and they had a lot of patients to look for.

Table 6.2 shows the frequencies of the chosen constructs. The most popular structures are invisible and stigmatization. The structure invisible and stigmatisation are well related, as the society make users feels stigmatisated they do ask for ivisible devices to feel comfortable in the society. However, to make it invisible it cross also with the size and structure to provide invisibility of the item. They noted that their users who changed from using from behind ear hearing aids to inside ear declared that they are more confident in the society comparing to their previous period when they were using behind ear hearing aids.

Battery also was mentioned as one of the most popular structures too, they said that not few of their costumers complained how their battery doesn't last as long as they want. However, they mentioned that inside ear hearing aids users are less satisfied then those who use behind ear aids.

Type of device was cited as features that play roles of making costumers choose their devices. The type of devices is specified by the shape of the heaing aids, if it is

behind the ear or inside the ear. For one of those type have variety of shapes according to their sizes.

Sound quality was mentionned as cricical stucture. Audiometrist mentionned that the quality of sound can make a difference enhacing the hear loss. They specified that throught the hearing aids develepement they realised that from the analog hearing aid to the digital hearing aids a huge difference was accured. Setting up the device to user's needs were much easier and more precise. They said that producers in any case if new technology was applied to the device, they always tried to exctract the last drop from its juice to enhace the quality of hearing aids. Like wireless feature werent only used to connect to other devices, they manage to make left and right hearing aids sharing signal together to prevent a 360-degree sound.

In addition, they also mentionned that wireless connection provided users many amenities like being able to reply to their phone call without holding the phone into the ear, as it is a bleutooth earphone.

In the same topic related to wireless connectivity, comptability with other devices like phone, smart tv took the hearing aids to next level and make it a fun device. However, to get these features in the hearing aids it difficult for the costumers to offord it, as one side of hearing aids could cost more than 1000 € and not less.

It was mentioned that when it comes to purshase a new hearing aids costumers asks also if the device is solide or fragile to know how they have to use their new device and what is its limits.

Audiologist whom works in sales centers cited that one of the things that makes the costumer buy faster or prefer to buy from specific center or brand instead of other is their warranty details, if they offer longer warranty or advantageous package costumers goes for the better offer.

Technical support was mentioned as improrttant critics for users but it was said that hearing aids technical services improved a lot and number repair specialists raised, and their experienced raised too, and spare part are available as the hearing aids market grows which make repairing a device failure easy to fix it.

Audiologist declare that as long as the request of users for smaller and more invisible devices are in raise as they see their costumers loosing or damaging their devices accidentally.

A list of commun way that patients have lost or damage their hearing aids:

- It was flushed down the toilet.

- It was left in the pocket of the pant and later it was the washed in the washing manching.
- When swimming, showering or bathing with them by accident, it was damaged.
- Fallen out of the ear and have been stepped on it.
- Was chewed by baby or a dog.

Water resistance hearing devices exist in the market but audiometrist mentioned that their aim goal is to provide their patients the best sound enhancement more than making it more waterproof. As it is said that waterproof hearing aids has its limitation and by abusing using the device under water condition the device fail and costumer become unsatisfied from the devices.

To sum up expert that hearing aids improved through its history and technology, and that the request and the need of costumer also has a hand onthese improvment, especially minimasing the size and the weight of the device to respond to the request of the costumer. However, minimazing these devices created other issues like the higher risk of losing or damaging the device.

6.2. Findings of User Interviews

5 individuals were participated in this study 3 of them were males 2 of them were female. These induviduals are an active hearing aid users, 3 of them uses behind hearing aid and of 2 of themuses inside hearing aids. Table 6.3 shows.

Table 6.3. Participants profile of qualitative research.

Participant	Gender	Age	Hearing type	Town/Country	Duration
1	Male	28	Behind Ears	Alsancak/Turkey	15 min
2	Female	36	Behind Ears	Alsancak/Turkey	15 min
3	Male	29	Inside Ears	Tunis/Tunisia	30 min
4	Male	33	Inside Ears	Zaghouan/Tunisia	30 min
5	Female	71	Behind Ears	Karsiyaka/Turkey	30 min

6.3. Selection of Factors by Experts

To define the most convenient construtcs a selection of factors was attended with 6 audiologists, 4 of them were female, and 2 were male. Average age of the participants is 20-40. These are mentioned below at Table 6.4.

Table 6.4. Participants profile of expert focus.

Profession	Gender	Experience	Average age
Audiologist	Male	5-10 years	20-30
Audiologist	Female	5-10 years	20-30
Audiologist	Male	0-5 years	20-30
Audiologist	Female	0-5 yeras	20-30
Audiologist	Female	20-30 years	30-40
Audiologist	Female	10-20 years	30-40

An expert focus group were attented to narrow down the number of construct. The participants were asked to choose the 15 most considerably construct out of 57.

Table 6.5. Selection frequencies of the constructs.

Construct	#	Construct	#	Construct	#
Gender	-	ExternalInfluence	-	Anxciety	-
Age	-	Comfort	3	Experience	-
Education	-	Durability	2	Fear of damage	2
Expertise	-	Costs	3	Stigmatisation	2
Expertise_Other	-	Ease of use	3	Invisibility	3
Fear_Loss	4	Usefulness	4	Social influence	3
BatteryLife	3	Attitude	-	New users	-
Weight	2	Intention	-	Experienced users	-
Wireless Connectivity	3	SystemSpeed	-	RFID	2
Adjustability	3	View_Screen	-	Shape	2
Ear Health	2	Resolution_Screen	-	Ear	1
HandsFree	3	GestureControl	1	Self_efficacy	-
VoiceControl	3	Innovativeness	3	Comment	-
TechnicalSupport	2	Satisfaction	3	Type of device	3
Privacy	3	Warranty	3	Understanding	-
Compatability	3	Self esteem	-	Psychology	2
Internal Influence	-	Complexity	-	İsolation	-
Quality of sound	4	Brand	2	Noise	2
Mold	-	Design	3	Developpement	-
Anxiety	2	Technologies	4	Handicap	-

6.3. Findings of Experimental Studies

6.3.1. Quantitive Analysis 1

The total number of participant, each scales collected responses and the highest collected number percentage were summarized. The questionnaire qualitative analysis was devided according to the type of hearing aids.

- **For behind the ears (BTE)**

Table 6.6. Behind ear implanted participants experience of quantitative anlysis.

	Totally dissatis-fied	Dissatis-fied	Neut-ral	Satisfied	Totally satisfied	Total participant
Volume adjustment	0	0	2	3	35	40
Battery life	0	3	2	13	25	40
Easy battery replacement	0	1	3	13	23	40
Overall uses	0	0	2	38	0	40
Resistance	0	0	3	37	0	40
Expenses	0	0	7	32	25	40
Quality / Price ratio	0	0	3	23	14	40
Cleaning easiness	0	6	25	9	0	40
Appearance	18	13	4	2	3	40

Table 6.7. Distribution of worries among Behind ear implanted participants.

	Never	Rarely	Many times	Every times	Total participant
Are you afraid of losing your device?	0	16	19	5	40
How often do you lose the device?	10	26	4	0	40
How often does your device fail?	8	31	1	0	40
Do you forget to use your device?	33	7	0	0	40

Table 6.8. Behind ear implanted participant's advice for purshasing Hearing aids.

	Strongly not recommend	Not recommend	Neutral	Advice	Strongly advice	Total participant
Do you advise hearing loss person to buy it?	0	0	3	35	2	40

- **For Inside the Ears (ITE)**

Table 6.9. Inside ear implanted Participants experience of qualitative anlysis.

	Very dissatisfied	Dissatisfied	Neutral	Satisfied	Totally satisfied	Total participant
Quality / Price ratio	0	0	0	3	18	21
Appearance	0	0	0	4	17	21
Expenses	0	0	1	20	0	21
Resistance	0	0	3	18	0	21
Battery life	0	3	6	12	0	21
Easy battery replacement	0	0	4	11	8	21
Volume adjustment	0	0	2	10	9	21
Overall uses	0	0	0	21	0	21
Cleaning easiness	0	0	10	9	2	21

Table.6.10. Distribution of worries among inside ear implanted participants.

	Never	Rarely	Many times	Every times	Total
Are you afraid of losing your device?	0	1	6	14	21
How often do you lose the device?	2	11	8	0	21
Do you forget to use your device?	9	12	0	0	21
How often does your device fail?	14	7	0	0	21

Table 6.11. Inside ear implanted participant's opinion of used Hearing aids.

	Strongly not recommend	Not recommend	Neutral	Advice	Strongly advice	Total
Do you advise hearing loss person to buy it?	0	0	0	4	17	21

In comparisation between BTE and ITE users replies a selection of the highest variable in each question to put in contrast the difference of satisfaction between both devices user.

From the most satisfied variable to the most dissatisfied variable according to:

1. BTE users:

- **Totally satisfied:** Volume adjustment by 87.5%, Battery life by 62.5%, Easy battery replacement by 57.5%

- **Satisfied:** Overall uses 95%, Resistance 92.5%,
  Expenses 80%,
  Quality / Price ratio by 57.5%.
- **Neutral:** Cleaning easiness 62.5%
- **Totally dissatisfied**: Apprearance 45%
- **Fear of losing the device**: 47.5% (many time)
- **Risk of losing**: 65% (Rarely)
- **Advice for purchase the Hearing aid**: 87.5% (Advice)

2. ITE users:

- **Totally satisfied:** Quality / Price ratio 85.71%, Appearance 80.95%
- **Satidfied**: Expenses 95.23%, Resistance 85.71%, Battery life 57,14%, Easy battery replacement 52.38%, Volume adjustment 47,61%, Overall uses 100%
- **Neutral:** Cleaning easiness 47.61%
- **Fear of losing the device:** 66.66% (Every times)
- **Risk of losing:** 38% (Many times)
- **Advice for purchase the Hearing aid:** 80.95% (Strongly advice)

According to participant's responses ITE seems to be more preferred and more satisfying overall even if the battery life is less efficient than BTE batteries. However, the satisfaction attitude of costumers seems coming from the invisibility of the device in the ear.

From the other hand, BTE users look to be more satisfying in term of duriness of the battery and the ease of use due to handy size. ITE the look that they don't have that privilege.

The ITE users didn't complain negatively about the device while BTE the most negative variable was about the appearance of the item. However, both BTE and ITE mentioned their neutral opinion about the device cleaning.

The BTE tend to be less worried about loosing their hearing aids while it is clear according that ITE worries more. This could be explained bythe miniature size of ITE and the higher risk of loosing.

Both Hearing aids users seems to be satisfied and benefits from the device that's why both advice users advice anyone with hearing loss to use the device. The only small difference that ITE tend to advice more about purchasing their type of hearing aid explaining that ITE might satisfy more the users.

6.3.2. Quantitive Analysis 2

The number of respondents, mean, standard deviation, variance, minimum and maximum construct values are summarized in Table 6.12.

Table 6.12. Descriptive statistics (sorted by mean).

Variable	Rev	Question	Mean
Usefulness3		I do believe that it will be beneficial	**4,69**
Technical Support		It is important to get support when needed	**4,67**
Usefulness		Usefulness	**4,65**
Battery2		It would be nice to charge the batteries with the wireless charger	**4,65**
Attitude1		I recommend the use	**4,65**
Usefulness2		I think the quality of hearing is improved	**4,61**
Weight		The weight of the devices is important	**4,59**
Battery1		Battery life of hearing aids is important	**4,55**
Privacy		Privacy	**4,53**
Privacy1		I feel uncomfortable when people around me look at my ear.	**4,53**
Privacy2		I feel comfortable when the device is not visible in my ear	**4,53**
Cost2		When Part of the device breaks down it is unexpected expenses	**4,49**
Fearless		I'm afraid of losing the device	**4,47**
Cost		Cost	**4,46**

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Table 6.12 (cont.)

Attitude2		If any part of the device breaks down it is unexpected expenses	**4,29**
Voice Control		Volume control makes the device convenient	**4,27**
External Influence		I get influenced by ads or the views of experts in this business	**4,14**
Compatibility		I think it will make my life easier when my hearing aid is compatible with other devices	**4,04**
Usefulness1		I can easily adjust the volume via smartphone application	**4**
Wireless Connectivity		It is important to connect hearing aids to the phone and other smart devices	**3,96**
Internal Influence		I consider my friends' advice	**3,94**
Hands-free		Hands Free feature is useful	**3,88**
Intention		I plan to buy it soon	**3,55**
Ear Health		I don't think the hearing aid will harm the ear	**3,41**
Durability2		I think my device is durable	**3,35**
Durability		Durability	**3,27**
Adjustability		The Volume is easy to adjust	**3,2**
Comfort		I think it is comfortable to use	**3,18**
Durability1	R	0	**3,18**
EoU3		It Easy to clean	**3,16**
EoU2	R	0	**2,82**
EoU1		It is not difficult to use	**2,765**

6.3.1. Results of Descriptive T-Test Analysis

Participant were grouped into 2 groups titled ITE (Inside The Ear) and BTE (Behind the ear). The table 6.13 shows the results of variation for device type construct.

It can be seen that ITE users tend to fear more losing there devices while BTE users are more relaxed. Another significant result shows that privacy matter more for ITE then BTE and they tend to not caring also for the costs as much BTE users cares.

From the other hand because BTE batteries last more we can explain the higher result of BTE user comparing ITE users. Also BTE from the results we can see higher score of Ease of use due to its bigger size comparing to ITE.

BTE hearing aid tend to be more influenced by experts than ITE users means they follow more the advice of their audiologist and doctors.

Durability request are higher for ITE user declaring theirs worries about durability of their devices while BTE users look less worried.

Ease of use 2 linked to the easiness of using device is case it's to small appear difficult to them while ITE users look like they are used to and they don't see much difficulties in using small item.

The Higher rate of intention variable shows that users they more likely to purchase ITE than BTE explaining their preference to smaller and invisible devices.

Table 6.13. Descriptive T-Test Analyses (Devise Type by mean difference).

DeviceType **Variable**	**SMALL Mean**	**BIG Mean**	**Mean difference**	Sig. (2-tailed)	t
EoU2	2.25	3.09	-0.84	0.004	-3.00
ExternalInfluence	3.88	4.27	-0.39	0.195	-1.32
Cost2	4.25	4.61	-0.36	0.086	-1.75
Cost	4.25	4.56	-0.31	0.151	-1.46
Cost1	4.25	4.52	-0.27	0.291	-1.07
VoiceControl	4.13	4.33	-0.20	0.372	-0.90
Battery1	4.44	4.61	-0.17	0.459	-0.75
Battery2	4.56	4.70	-0.14	0.465	-0.74
Usefulness1	3.94	4.03	-0.09	0.759	-0.31
Usefulness3	4.69	4.70	-0.01	0.955	-0.06
HandsFree	3.88	3.88	0.00	0.989	-0.01

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Table 6.13 (cont.)

TechnicalSupport	4.69	4.67	0.02	0.896	0.13
Compatability	4.06	4.03	0.03	0.909	0.12
Privacy1	4.56	4.52	0.04	0.822	0.23
Weight	4.62	4.58	0.04	0.782	0.28
Usefulness	4.69	4.64	0.05	0.737	0.34
Adjustability	3.25	3.18	0.07	0.835	0.21
EoU1	2.81	2.73	0.08	0.781	0.28
Durability1	3.25	3.15	0.10	0.698	0.39
Usefulness2	4.69	4.58	0.11	0.497	0.68
Fear_Loss	4.56	4.42	0.14	0.633	0.48
EarHealth	3.50	3.36	0.14	0.683	0.41
Privacy	4.63	4.48	0.14	0.441	0.78
Durability	3.41	3.20	0.21	0.370	0.91
Attitude1	4.81	4.58	0.23	0.129	1.55
Privacy2	4.69	4.45	0.24	0.218	1.25
WirelessConnectivity	4.13	3.88	0.25	0.475	0.72
InternalInfluence	4.13	3.85	0.28	0.383	0.88
Durability2	3.56	3.24	0.32	0.201	1.30
Attitude2	4.50	4.18	0.32	0.218	1.25
Intention	3.81	3.42	0.39	0.310	1.03
EoU3	3.44	3.03	0.41	0.246	1.17
Comfort	3.50	3.03	0.47	0.175	1.38

According to **EoU2 variables** BTE (Behind The Ear) users expect to find small H.A moderately difficult to use in the beginning by a mean of 3.09 out of 5 while ITE (Inside The Ear) users doesn't find it that difficult with a mean of 2.25 out 5. With the sig. value of 0.004 between these two devices it may explain that when users use small hearing aids they adapt to it and find it easier with time especially.

According to **external influence variables** BTE and ITE users tend to consider the advice of their doctors and experts and get influenced by advertisement about the hearing aids devices. However, BTE mean are slightly higher from those of ITE users

which can explain that they might be influenced from experts and advertisement that ITE users.

The **cost variable** shows that BTE users cares about expenses more than ITE and it seems critic fact for choosing devices with less expenses during their utilization. From other hand ITE looks less worried about expenses that can explain that they are accepting paying more expenses for getting smaller device.

A voice control is a feature that is the most preferable both hearing aids users with a mean difference of 0.20 in accordance with **Voice Control Variable**. The related variable explains that it would make their hearing aids easier to use and make it more practical for their daily life.

Battery life of hearing aids is critical detail for both users as reported by **Battery 1** variable which shows that as long it last as long it satisfies them. Also **Battery 2** variable shows that if battery could be charged with wireless charger it might improve their daily experience with their hearing aids.

The mean difference between battery 1 and 2 in raw are 0.17 and 0.14 shows there is no significant difference between both users' responses.

Usefulness 1 variable shows that using hearing aids through smart phones application to adjust volume would make it easier for them than using it traditionally from the device directly. BTE means is slightly higher than ITE mean but nothings significant can be explained that most ITE users use smart phone application to adjust volume while BTE users they do adjust manually through the device itself from which the demand of this feature is bit higher than ITE users.

Usefulness 3 Variable indicate almost the same mean for both type of users with a mean difference of 0.01. Both type of users believe that Hearing aids is beneficial for them which explain that no matter is the type of the hearing aids they are seeing benefits from there devices.

Hand Free Variable reveals the same mean of 3.88 out of 5 for both type users demonstrating that users think positively hand free would be very useful features for their daily usage of hearing aids.

Technical Support Variable indicate that is an important service for ITE and BTE users with 4.69 and 4.67 in accordance explaining it is a critical service for users to have when using hearing aids device.

Both type users of hearing aid think that compatibility of hearing aids with other devices like smart phone, smart television or multimedia of cars would facilitate their

daily life experience conforming to **Compatibility Variables**. Only 0.03 mean difference is indicated between ITE and BTE devices illustrating the agreement of both users about compatibility feature.

In accordance with **Privacy 1 Variable** with a total mean of 4.53 out of 5, both type of hearing aids users highly feels uncomfortable when people around figure out that they use hearing aids by staring to their ears. Which also the slightly higher mean of the ITE comparing to BTE mean explain that ITE cares more about their privacy and the invisibility of their device.

As stated in the **Weight Variable** as light as the device is as better it is, from which also the upper hand ITE mean comparing to BTE mean explain the reason of ITE users purchases of the smaller and the lighter device as ITE hearing aids is known for.

Adjustability Variable shows that ITE users finds that it is easy for them to adjust volume in contrast with BTE users, because the only way that ITE users do to adjust the volume is through smartphone application which is easier than the traditional way that BTE users do which is through the device itself.

EoU1 Variable shows that both Hearing aids users doesn't find their hearing device very easy to use but moderate easy with mean of 2.81 for ITE and 2.71 for BTE out of 5.

Hearing aids users declare that their devices tend to be fragile and need quite attention by experiencing moderate frequent fail during their uses in accordance to the Durability 1 Variable.

Usefulness 2 variable shows that both hearing aid users find their devices helping them with better hearing. However, the difference mean between both scales of mean is 0.11 is not so significant but both being scaled above 4.5 out of 5 illustrate that hearing aids are effective in proving users better hearing.

In accordance with **Fear of loss variable** both hearing aids users remarkably tend to fear losing their item with total mean of 4.47 out of 5. Furthermore BTE users mean variable manifest with marginally higher mean comparing to BTE mean of 4.56 out of 5 which can explain that ITE have higher risk to be lost due to its minimalist size makes their users worries more.

Hearing implanted users according to **Ear Health variable** don't look worrying if hearing aids would harm their ears in which also ITE users are likely to be more relaxed about it. Hearing implanted they look trusting the medical industry for providing them a safe product.

Both of hearing aids users ITE and BTE agreed about advice anyone with hearing loss to purchase hearing aids in which also ITE mean showed a slightly higher positivity about using hearing aids explaining possibility of higher satisfaction comparing to BTE users in agreement with **attitude variable**.

In consonance with **Privacy 2 variable** both hearing aids users agreed that as long as their hearing aid doesn't appear in their ear as long they feel comfortable with that, which also explain higher mean of ITE user comparing to BTE mean.

Wireless connectivity variable reveals that any pairement of hearing aid devices with any smart device is important, providing them better daily experience with this feature. Variable also shows that ITE mean is slightly higher than BTE means elucidate that ITE users might be more interested about wireless technologies.

ITE users looks that they could be more influenced from their friends and take consideration of their advices than BTE users in consonance with **internal influence variable**. Which also can in negative way let say advice about visibility it could be related then with their fragility to stigmatization and caring about people opinions.

Hearing aids users think that their devices are solid and durable as stated in **Durability 2 variable** in which also it shows that ITE think more positively about the solidity of their devices comparing to BTE. The reason may have justified that ITE device being implanted inside the ear far from any outside hits against BTE which droop on the back of the ear more exposed to any outside hit.

ITE users are more open up to their devices than BTE users in accordance with the **Attitude 2 variable** with means out of 5 of 4.50 and 4.18 relatively. That might justify also their higher overall satisfaction with their device and finding interesting to use.

Conforming to **Intention variable** ITE mean shows higher variable of 3.81 in contrast with BTE mean of 3.42 out of 5. This can explain ITE users tend to be more interested to purchase for the reason that feed their needs.

For device cleaning ITE device looks easier than BTE according to **EoU3 variable** which could be explained that smaller size and less component might be the reason of being easier to clean. On the point that BTE is bigger and composed of 3 components as the core device, the tube and the mold inside the ear.

According to comfort variable Hearing aids depict their device as moderate comfortable device with total mean of 3.18 out of 5. Additionally, it shows also that ITE is comfier than BTE with mean difference of 0.47. The minimalism of the ITE device can be the reason of providing an extra comfort of use.

6.3.2. Results of Correlation Analysis

Correlation analysis was conducted to show the relationship between constructs. Table 6.14 summarizes the correlation results of intermediary variables. Full list of the analysis was attached in Appendix.

Table 6.14. Correlation Results.

Variable		EoU1	EoU2	EoU3	Usefulness	Attitude	Intention
EoU1	P.C	1.00	0.00	0.29	-0.01	0.16	-0.01
	Sig. (2-tailed)	0.000	0.976	0.040	0.962	0.271	0.964
EoU2	P.C	0.00	1.00	-0.16	0.12	-0.01	-0.20
	Sig. (2-tailed)	0.976	0.000	0.283	0.401	0.948	0.161
EoU3	P.C	0.29	-0.16	1.00	0.07	0.26	0.08
	Sig. (2-tailed)	0.040	0.283	0.000	0.653	0.068	0.575
Usefulness	P.C	-0.01	0.12	0.07	1.00	0.63	-0.09
	Sig. (2-tailed)	0.962	0.401	0.653	0.000	0.000	0.540
Usefulness1	P.C	0.00	-0.17	0.28	-0.02	0.18	0.29
	Sig. (2-tailed)	1.000	0.239	0.052	0.883	0.229	0.042
Usefulness2	P.C	-0.03	0.06	0.18	0.91	0.64	-0.08
	Sig. (2-tailed)	0.860	0.685	0.230	0.000	0.000	0.587
Usefulness3	P.C	0.01	0.16	-0.05	0.91	0.50	-0.08
	Sig. (2-tailed)	0.932	0.265	0.725	0.000	0.000	0.568
Attitude	P.C	0.16	-0.01	0.26	0.63	1.00	0.24
	Sig. (2-tailed)	0.271	0.948	0.068	0.000	0.000	0.092
Attitude1	P.C	0.07	0.14	0.09	0.79	0.78	0.10
	Sig. (2-tailed)	0.659	0.351	0.563	0.000	0.000	0.518
Attitude2	P.C	0.19	-0.11	0.32	0.35	0.89	0.29
	Sig. (2-tailed)	0.201	0.450	0.026	0.015	0.000	0.048
Intention	P.C	-0.01	-0.20	0.08	-0.09	0.24	1.00
	Sig. (2-tailed)	0.964	0.161	0.575	0.540	0.092	0.000

P.C: Person Correlation

CHAPTER 7

CONCLUSION

Hearing aids is a wearable devices with a long history of development and changes. It clear according to the literatures and survey that the most the trend of this device is being minimalizing replying the request of the market and its patients. However, when hearing aids goes smaller users tend to live undesirable experience like losing or damaging it due to its minimized size. During the study, both qualitative and qualitative studies have been applied in order to construct hearing aids adoption taxonomy.

7.1. The Implication

This research may put the light on the cons of the most desirable hearing aids device in the aim of improving its efficiency and the users daily experience avoiding any undesirable experience. To come up with such information and solutions. Firstly, in-depth interviews and expert focus group works were conducted. After that, the experimental study has been done by an internet-based survey. In the end, many analyses were performed. There are descriptive T-Test, descriptive summary and correlation.

According to descriptive analysis, hearing aids producers should take considerably more attention to reduce the risk of losing their devices by including technologies as standard and not an option. As mentioned in the literature part the RFID has been applied as a patent in hearing aid in the aim to find it when it is lost should be more officialised and standardized.

Moreover, in argument with information collected from the interviews done and the group focused group worked on, Inside hearing aid seems that its battery last less as far as it goes smaller which is inconvenient to users especially when his battery if dead and he is out of spare batteries. So rechargeable battery might be a solution as nowadays power-banks, chargers exists almost everywhere and used frequently in the daily life.

Surveys and collected data showed that users has always a preference to choose the smaller device to feel normal and not been stigmatized by the society. Last but not the least, making the device trackable and easy to find will not be simple feature, it would give users more confidence and less worry about unwanted accident.

7.2. Limitations of the Study

One limitation in this study is linked to the size sample, 49 is the number of the participant which is few but considerable. However, improving the respondent size in order to generalize findings.

This study field of work is sensitive and limited than others in term of target work. Being a research limited on people who suffer hearing loss is not evident to find them easily. Workforce support would be beneficial for these studies expending the size of the sample not limiting only in Turkey and Tunisia. Consideration should be given also to cultural differences when evaluating the findings of the study.

7.3. Further Work

Although fifty seven construct were derived from derived from the literature survey, qualitative and quantitative studies, only some of them were used in the hearing aids assessment. Therefore, extracted constructs or new constructs from the literature can be added to the proposed taxonomy and validity test can be carried out.

In addition, the study can be conducted in different cultures to reduce the effects mono cultural study, thus generalizing the results of the study in a larger population.

REFERENCES

Ajzen, Icek. 1991. "The theory of planned behavior." *Organizational behavior and human decision processes* 50 (2):179-211.

Aubert, Benoit A, and Geneviève Hamel. 2001. "Adoption of smart cards in the medical sector:: the Canadian experience." *Social Science & Medicine* 53 (7):879-894.

Banerjee, Shilpi, Dean C %J Operative Techniques in Otolaryngology-Head Garstecki, and Neck Surgery. 2003. "Brief update on hearing aids." 14 (4):268-271.

Bruner II, Gordon C, and Anand Kumar. 2005. "Explaining consumer acceptance of handheld Internet devices." *Journal of business research* 58 (5):553-558.

Cappelli, Mario %J Volta Review. 1995. "Social development of children with hearing impairments who are integrated into general education classrooms." 97 (3):197-208.

Chavira, D. A., M. B. Stein, K. Bailey, and M. T. Stein. 2004. "Child anxiety in primary care: prevalent but untreated." *Depress Anxiety* 20 (4):155-64. doi: 10.1002/da.20039.

Davis, Fred D. 1989. "Perceived usefulness, perceived ease of use, and user acceptance of information technology." *MIS quarterly*:319-340.

Dawes, Piers, Richard Emsley, Karen J Cruickshanks, David R Moore, Heather Fortnum, Mark Edmondson-Jones, Abby McCormack, and Kevin J %J PloS one Munro. 2015. "Hearing loss and cognition: the role of hearing AIDS, social isolation and depression." 10 (3):e0119616.

Dishaw, Mark T, and Diane M Strong. 1999. "Extending the technology acceptance model with task–technology fit constructs." *Information & management* 36 (1):9-21.

Fishbein, M, and I Ajzen. 1975. Belief, attitude, intention and behavior: An introduction to theory and research. Reading, MA: Addison-Wesley Publishing Company.

Fishbein, M, and I Ajzen. 1980. Understanding Attitudes and Social Behavior. Prentice Hall, Englewood Cliffs, NJ.

Goldenberg, Robert A. 1996. *Hearing aids: a manual for clinicians*: Lippincott Williams & Wilkins.

Hung, Shin-Yuan, and Chia-Ming Chang. 2005. "User acceptance of WAP services: test of competing theories." *Computer Standards & Interfaces* 27 (4):359-370.

Karahanna, Elena, Detmar W Straub, and Norman L Chervany. 1999. "Information technology adoption across time: a cross-sectional comparison of pre-adoption and post-adoption beliefs." *MIS quarterly*:183-213.

Kim, Dohoon, and Hyejung Chang. 2007. "Key functional characteristics in designing and operating health information websites for user satisfaction: An application of the extended technology acceptance model." *International journal of medical informatics* 76 (11-12):790-800.

Kirkwood, David H %J The Hearing Journal. 2009. "Resilient hearing aid industry records rising sales despite a troubled economy." 62 (12):11-14.

Kochkin, Sergei. 1997. "Subjective measures of satisfaction and benefit: Establishing norms." Seminars in Hearing.

Kochkin, Sergei. 2000. "MarkeTrak V:"Why my hearing aids are in the drawer" The consumers' perspective." *The Hearing Journal* 53 (2):34-36.

Kochkin, Sergei %J The Hearing Journal. 2011. "MarkeTrak VIII Mini-BTEs tap new market, users more satisfied." 64 (3):17-18.

Kroenke, K., R. L. Spitzer, J. B. Williams, P. O. Monahan, and B. Lowe. 2007. "Anxiety disorders in primary care: prevalence, impairment, comorbidity, and detection." *Ann Intern Med* 146 (5):317-25.

Kroes, Marielle, Ariane C Kalff, Alfons GH Kessels, Jean Steyaert, Frans JM Feron, Astrid JWGM Van Someren, Petra PM Hurks, Jos GM Hendriksen, Thea MCB Van Zeben, Nico %J Journal of the American Academy of Child Rozendaal, and Adolescent Psychiatry. 2001. "Child psychiatric diagnoses in a population of Dutch schoolchildren aged 6 to 8 years." 40 (12):1401-1409.

Laurent, S. 1997. "La technique nume´ rique: principes fondateurs. Les Cahiers de l'audition 1997;10:6–15."

Liu, Liping, and Qingxiong Ma. 2005. "The impact of service level on the acceptance of application service oriented medical records." *Information & Management* 42 (8):1121-1135.

Luarn, Pin, and Hsin-Hui Lin. 2005. "Toward an understanding of the behavioral intention to use mobile banking." *Computers in human behavior* 21 (6):873-891.

M Rogers, Everett. 1983. Diffusion of innovations. The free press.

Mathieson, Kieran, Eileen Peacock, and Wynne W Chin. 2001. "Extending the technology acceptance model: the influence of perceived user resources." *ACM SIGMIS Database: the DATABASE for Advances in Information Systems* 32 (3):86-112.

McCarthy, Joseph F, David H Nguyen, Al Mamunur Rashid, and Suzanne %J ACM SIGGROUP Bulletin Soroczak. 2002. "Proactive displays & the experience UbiComp project." 23 (3):38-41.

Mills, Mara %J IEEE Annals of the History of Computing. 2011. "Hearing aids and the history of electronics miniaturization." 33 (2):24-45.

Moeller, Mary Pat %J Ear, and hearing. 2007. "Current state of knowledge: psychosocial development in children with hearing impairment." 28 (6):729-739.

Moore, Gary C, and Izak %J Information systems research Benbasat. 1991. "Development of an instrument to measure the perceptions of adopting an information technology innovation." 2 (3):192-222.

Mudry, Albert, Léon %J The Journal of Laryngology Dodelé, and Otology. 2000. "History of the technological development of air conduction hearing aids." 114 (6):418-423.

Munk-Jorgensen, P., C. Allgulander, A. A. Dahl, L. Foldager, M. Holm, I. Rasmussen, A. Virta, M. T. Huuhtanen, and H. U. Wittchen. 2006. "Prevalence of generalized anxiety disorder in general practice in Denmark, Finland, Norway, and Sweden." *Psychiatr Serv* 57 (12):1738-44. doi: 10.1176/ps.2006.57.12.1738.

Packer, Lisa. 2016. "Hearing aid history: From ear trumpets to digital technology." *https://www.healthyhearing.com/report/47717-Digital-hearing-aid-history* Healthy Hearings.

Remine, Maria D, P Margaret %J Australian Brown, and New Zealand journal of psychiatry. 2010. "Comparison of the prevalence of mental health problems in deaf and hearing children and adolescents in Australia." 44 (4):351-357.

Theunissen, S. C., C. Rieffe, M. Kouwenberg, L. De Raeve, W. Soede, J. J. Briaire, and J. H. Frijns. 2012. "Anxiety in children with hearing aids or cochlear implants compared to normally hearing controls." *Laryngoscope* 122 (3):654-9. doi: 10.1002/lary.22502.

Topacan, U %J Unpublished master's thesis, Bogazici University, Istanbul, Turkey. 2009. "Exploring the adoption of technology assisted services in the healthcare industry."

Tung, Feng-Cheng, Su-Chao Chang, and Chi-Min Chou. 2008. "An extension of trust and TAM model with IDT in the adoption of the electronic logistics information system in HIS in the medical industry." *International journal of medical informatics* 77 (5):324-335.

Velhal, Ravindra V, Jeetendra G Deshmukh, Nikhil M Deshpande, R Harold Crawford, and John D Fowler. 2007. Proximity management system and method using radio-frequency identification tags. Google Patents.

Venkatesh, Viswanath, and Fred D Davis. 2000a. "A theoretical extension of the technology acceptance model: Four longitudinal field studies." *Management science* 46 (2):186-204.

Venkatesh, Viswanath, and Fred D %J Management science Davis. 2000b. "A theoretical extension of the technology acceptance model: Four longitudinal field studies." 46 (2):186-204.

Weinstein, Barbara, and Michael J %J The Hearing Journal Bernstein. 2017. "Revising the Hearing Health Care Delivery System." 70 (5):10-12.

Wong, Lena LN, Louise Hickson, and Bradley McPherson. 2003. "Hearing aid satisfaction: what does research from the past 20 years say?" *Trends in Amplification* 7 (4):117-161.

Yu, Ping, Haocheng Li, and Marie-Pierre Gagnon. 2009. "Health IT acceptance factors in long-term care facilities: a cross-sectional survey." *International journal of medical informatics* 78 (4):219-229.

APPENDIX A

INTERVIEW WITH EXPERT

Merhabalar, yüksek lisans tezim olan işitme cihazları üzerine çalışmaktayım. Mümkünse bu konuda sizle bir röportaj yapmak, birkaç soru sormak ve izniniz olursa ses kaydı almak istiyorum.

Öncelikle yaşınızı ve işinizi öğrenebilir miyim?

24 ve 26 yasindayiz ve mesleğimiz odiometrist.

Bu işte ne kadar süredir çalışmaktasınız?

Eylem : 6 sene

Bulut : 3 sene

İşitme cihazlarının hastalarınızın üzerindeki etkilerini ve katkılarını nasıl görüyorsunuz?

Hastanın amacı duymaksa rahat bir şekilde duymasını sağlayabiliyoruz ama hastanın istekleri değiştikçe cihaz açısından beklentileri biraz farklı oluyor. Bunlar nasıl oluyor? Ses netliği, ses doğallığı bir de cihazın özellikleri. Bazı hastalar cihaz kullanırken telefonla konuşmak istiyor. Bazı cihazlarımızda bu özellik var ama bazılarında telefona bağlanma özelliği yok, ister istemez kulağının üstüne götürmek zorunda kalıyor, onun da acıları farklı oluyor ve hasta bunu sorguluyor. Hastanın beklentileri farklılaştıkça cihazdan beklentileri de farklılaşıyor. İşitme cihazının temel amacı insanın duymasını sağlamaktır. Amacını tam olarak gerçekleştirmektedir. Bazı hastalar dışardaki gürültüleri bizim kadar duymuyor, cihazı taktıktan sonra bu gürültüleri duymak istemeyip işitme cihazından uzaklaşan hastalar da var. Bu düşünce çok yanlış. Uzun süre bir işitme kaybından sonra hastalar bazı sesleri unutuyor, cihaz kullanıp dışarı çıkıldığında çevredeki seslerin (araba sesi gibi) neye ait oldugunu anlayamıyorlar, sesin nerden geldiği bulmaya çalışıyorlar, cihazdan geldiğini düşünüyorlar, yani işitme cihazının sürekli kullanımı önemli.

Hastaların işitme cihazlarıyla ilgili şikayetleri nelerdir?

Genelde yaşlı hastalarda, genel şikayet bakımı konusundadır, en fazla şikayette pil ömrüdür. Gençlerde de teknolojik açıdan şikayet geliyor.

Görünmez işitme cihazlarını kullanıcılarının (CIC modelleri ve benzerleri) şikayetleri nelerdir?

CIC modellerin bakımı zor, sadece filtre değiştirebiliyoruz. Çabuk arızalanabiliyor. Kaybolma riski daha fazla.

Kullandıkları işitme cihazının geliştirilmesi için hastalardan herhangi bir öneri aldınız mı?

Daha çok kişisel istekler. Suya dayanıklı olması isteniyor özellikle. Ancak işitme cihazının asıl amacı duyurmaktır.

Gelen bir diğer öneri de, kulak içi cihazlarda silikon bir parça ile kaydırmaz özelliği olması.

APPENDIX B

USERS INTERVIEWS

Original turkish reply:

1- Kaç yaşındasınız? Ne kadar süredir işitme cihazı kullanıyorsunuz?

28 yaşındayım. 23 senedir kullaniyorum.

2- Cihazın kalitesini nasıl değerlendirirsiniz?

Klasik cihazların orta kalitede oldugunu düşünüyorum, duyabilmemi sağlıyorlar.

3- Cihazın kulağınızdaki rahatlığı ve kulağa uyumluluğu hakkında ne düşünüyorsunuz?

Kulak arkası cihaz kullanıyorum, cihazın kulağa uyumluluğu iyi ancak biraz büyük olduğu için kullanımda zorluk yaratabiliyor.

4- Cihazın güvenilirliğini nasıl puanlarsınız?

Maliyete göre kullandığım cihaz orta seviye güvenilirlikte ama işitmeye yetiyor.

5- Cihazın görünmezliğini nasıl puanlarsınız?

Cihazın görünmez olması toplum içide kullanımda yararlı bir özellik. İnsanların beni kusurlu görmesi hoşuma gitmiyor.

6-Cihazı temizlemek kolay mıdır?

Cihaz temizliği benim için kolaydır.

7- Cihazın pil ömrü nasıldır?

Cihazın pil ömrü orta seviye.

8- Cihazın masrafları nelerdir?

Cihazın en masraflı parçası bozulmadığı sürece pilleri.

9- Cihazın ses ayarlama kolaylığı nasıldır?

Ses ayarlaması yapmak kolay, sorun yaşamıyorum.

10- Cihazın kullanımını arkadaşlarınıza önerir misiniz?

Cihazın kullanımını işitme kaybı yaşayan herkese öneririm, hayat kalitesini arttırıyor.

11- cihazı tekrar satın alır mısınız?

Kulak içi cihaz almayı planlıyorum, görünür olması beni rahatsız ediyor.

Original frensh reply:

• Quel âge avez-vous? Combien de temps utiliser appareil auditive?

J'ai 30 ans. J'utilisé mes appareils depuis que j'avais 4 ans.

• Comment qualifiez-vous le rapport qualité / prix de l'appareil?

Je pense que rapport qualité/prix assez juste mais il sera toujours mieux améliorer l'appareils avec des technologie plus récente.

• Comment qualifiez-vous la facilité de changer de batterie?

Je pense qu'avec le temps l'utilisateur s'habitue et apprend a changer les piles plus facilement.

• Que pensez-vous du confort et de la forme physique de l'article dans votre oreille?

Au debut on sent que c'est un corp intrus

• comment classer du 1(très mauvais) to 5(très bien) pour la fiabilité de l'article?

Je pense que je vais dis 4 comme etant bien car une amélioration de lappareil sera toujours demandé par le consommateur.

• Comment évaluez-vous son invisibilité dans l'oreils?

Je trouve que mon type d'appareil (CIC) est bien invisible et je suis satisfait a propos ça.

• Est-ce facile à nettoyer?

Je trouve qu'il y'a pas trop pour nettoyer. Juste il faut pas laisser l'appareil pour aussi longue durée sans la netoyer sinon les filtre vont boucher. Ou bien changer le filtre quand ça bouche.

• Comment est la vie de la batterie?

Avant j'ai utilisé les appareils qui se posent derriere l4oreil est je peux dire qu'ils sont plus avantageux question durée de la vie de batterie. Mais pour avoir un appareil invisible j'accepte d'avoir une batterie qui dure moinque mon appareil precedent.

• Comment est la dépense lors de l'utilisation?

Generalement il y'a seulement les depenses des piles. Par moi je consomme 4 piles par appareil

• Comment qualifier la facilité de réglage du volume?

Generalement je change pas le reglage je le met au niveau 2 qui me va bien.

• Le recommanderiez-vous à un ami (quelqu'un qui souffre de sourdité)?

Certainement ça va amiliorer la qualité du vie pour toute personne qui souffre du sourdité.

• Voulez-vous l'acheter à nouveau?

Si il'y aura des nouvelles technologies ajoutées j'acheterai du nouveau.

APPENDIX C

HARD COPY OF USERS SURVEY (FRENCH VERSION)

Questionnaire de satisfaction comparant les prothèses auditives derierre oreille et intra-auriculaire

YAS : 22 sexe : H / F

	İntra	externe
A. Quel appareille auditive vous utilisez ?		x

	Tres insatisfait	Insatisfait	indécis	Satisfait	Insatisait
1. Ratio avantages / satisfaction				x	
2. Facilité remplacement pile				x	
3. Durée de vie de batterie					x
4.Frais d'utilisation				x	
5.Durabilité				x	
6.Securité			x		
7.Facilité de netoillage			x		
8.facilité de reglage volume					x
9.Usage general				x	
10.l'apparence exterieure de l'appareille	x				

	Jamais	Rarement	Souvent	Toujours
11. Est ce que vous craignez de perdre votre appareille?		x		
12. Combien de fois vous perdez votre appareil?	x			
13. Est ce que vous oubliez d'utilisez votre appareil?	x			
14. Combien de fois votre appareil s'abime?		x		

	certainement Recommende pas	Recommande pas	indécis	Recommande	Recommande certainement
15. Recommandez-vous l'achat de l'appareil auditif à vos amis / connaissances (perte auditive)?				x	

APPENDIX D

HARD COPY OF USERS SURVEY (TURKISH VERSION)

Kulak arkası ve kulak içi işitme cihazlarını karşılaştıran memnuniyet anketi

YAS : 32 CINSIYET : E / K

	kulak içi	kulak arkasi
A. İşitme cihazı türünüz nedir ?		x

	Hiç memnun değilim	Memnun değilim	Kararsızım	Memnunum	Çok Memnunum
1.Fayda /memnuniyet oranı					x
2.Pil değiştirme kolaylığı					x
3.Pil dayanma süresi					x
4.kullanım sırasındaki masraflar					x
5.Dayanaklığı				x	
6.Güvenliği				x	
7.Temizleme rahatlığı			x		
8.Ses düzeyi ayarlama kolaylığı					x
9.Genel Olarak kullanmaktan				x	
10.Cıhazı dışarıdan görünme durumu	x				

	Hiç bir zaman	Nadiren	Çoğu zaman	Her zaman
11. Cihazınızın kaybetmekten korkuyor musun ?			x	
12. Cihazı kaybetme sıklığınız nedir ?	x			
13. Cihazınızı kullanmayı unutuyor musunuz ?	x			
14. Cihazınızı ne sıklıkla bozulur ?		x		

	Kesinlikle önermen	Önermen	Kararsızım	Öneririm	Kesinlikle öneririm
15. Arkadaşınıza / tanıdıklarınıza (işitme kayıplı) işitme cihazı almasını öneriyor musunuz ?				x	

APPENDIX E

GRAPHIC RESULTS OF THE WEB-BASED SURVEY

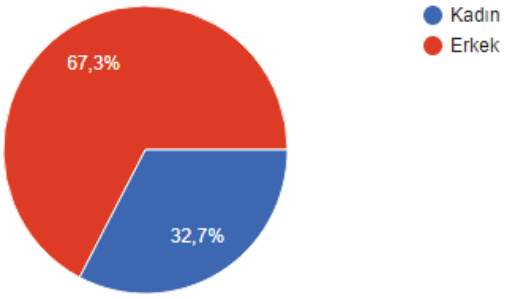
Kulak arkası ve kulak içi işitme cihazlarını memnuniyet anketi

49 yanıt

Section sans titre

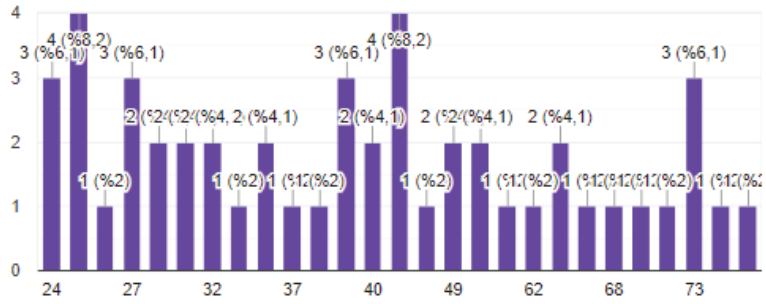
1- Cinsiyetiniz

49 yanıt



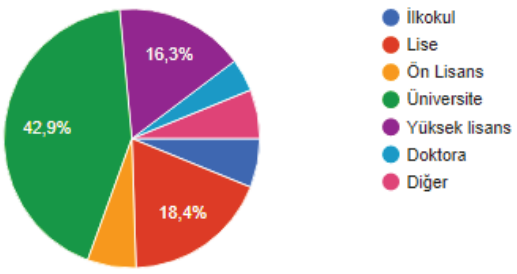
2- Yaşınız

49 yanıt



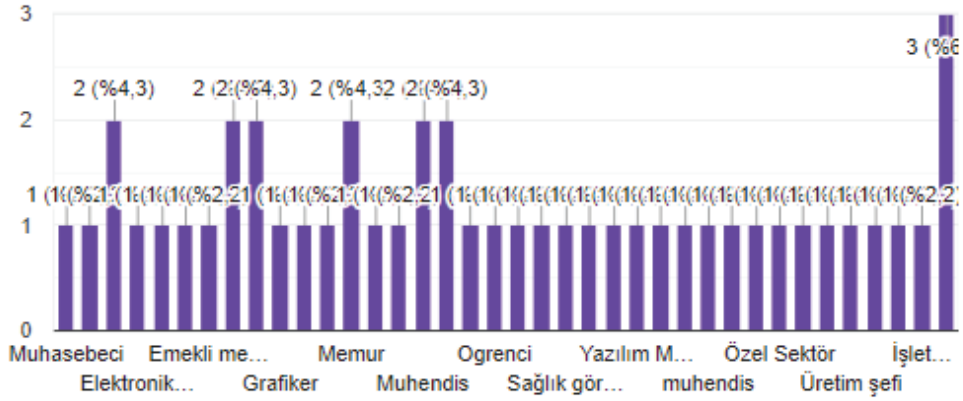
3- Eğitim Seviyeniz

49 yanıt



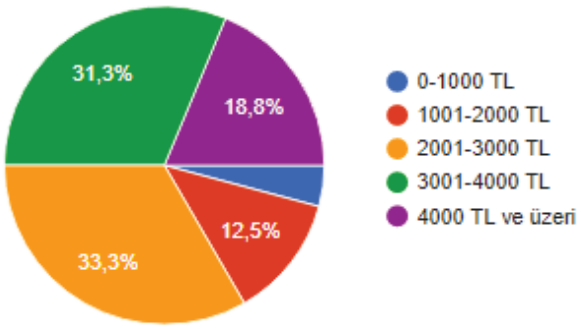
4- Mesleğiniz

46 yanıt



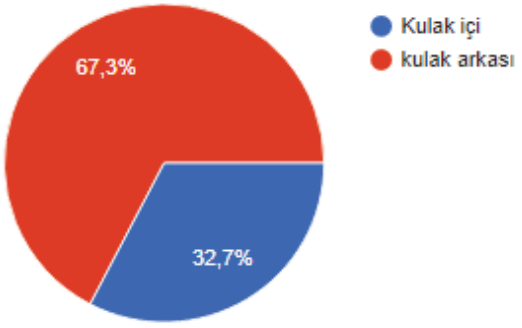
5- Aylık net geliriniz

48 yanıt



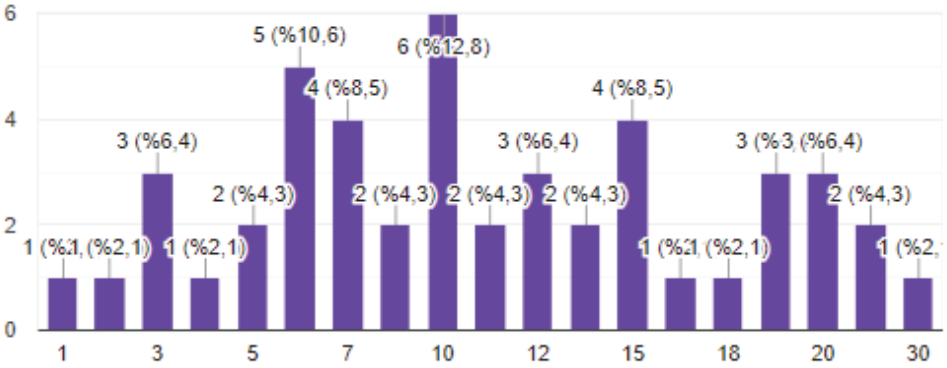
6- Hangi tür işitme cihazı kullanıyorsunuz

49 yanıt



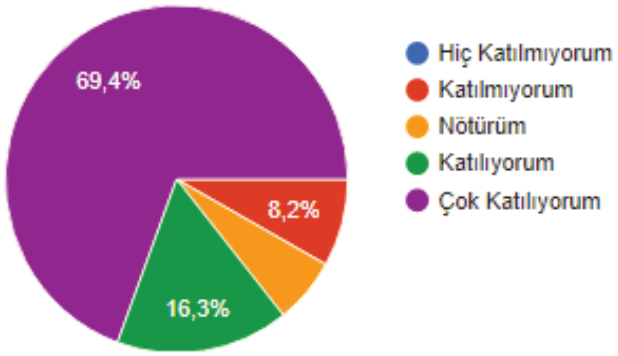
7-Kaç yıldır

47 yanıt



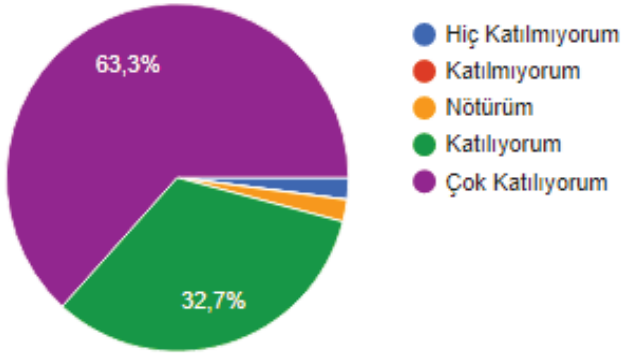
8- Cihazı kaybetmekten korkuyorum

49 yanıt



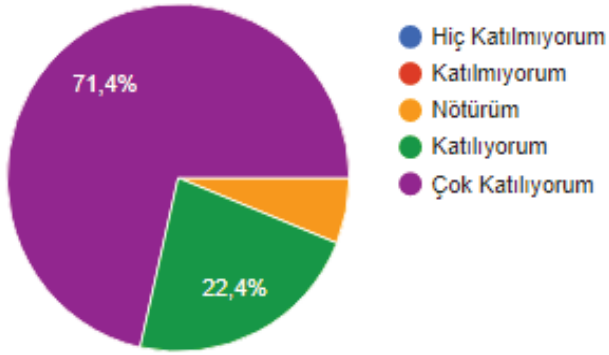
9- İşitme cihazlarının pil ömrü önemlidir

49 yanıt



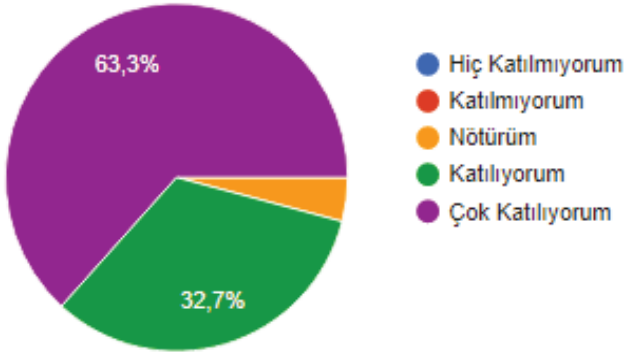
10- Kablosuz sarj aleti ile pilleri şarj edebilmesi güzel olur

49 yanıt



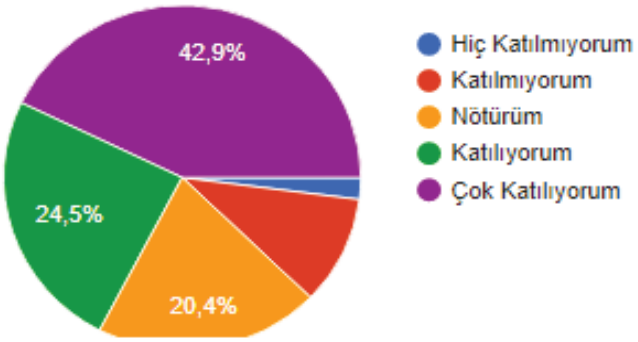
11- Cihazların ağırlığı önemlidir

49 yanıt



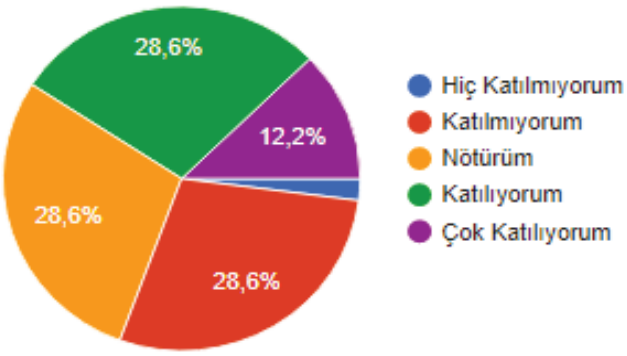
12- İşitme cihazlarınızı telefona ve diğer akıllı cihazlar bağlamak önemlidir

49 yanıt



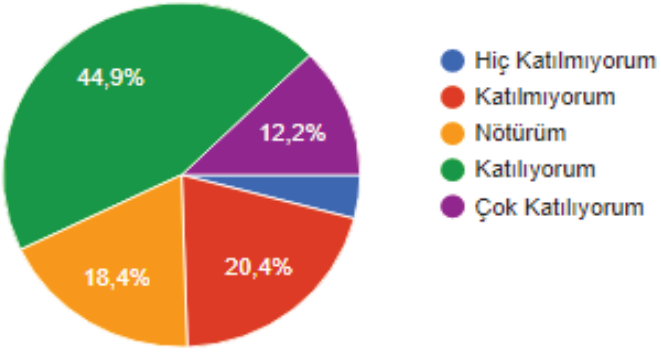
13- Ses düzeyi ayarlamak kolaydır

49 yanıt



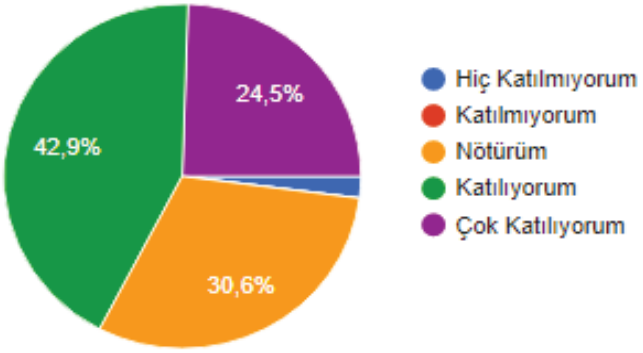
14- İşitme cihazının kulağa zarar vereceğini düşünmüyorum

49 yanıt



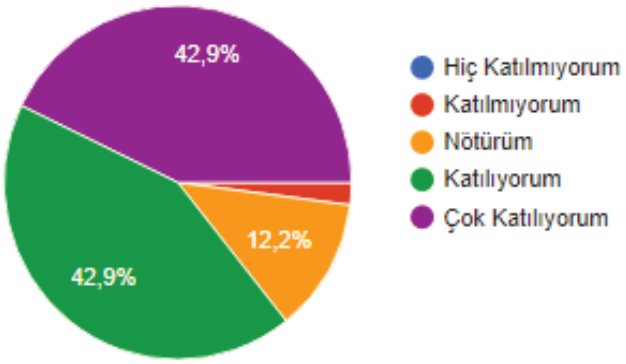
15- Hands Free/El serbest özelliği yararlıdır

49 yanıt



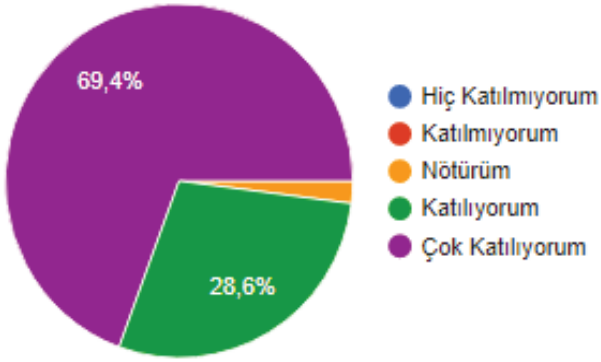
16- Ses kontrol özelliği cihazı kullanışlı hale getirir

49 yanıt



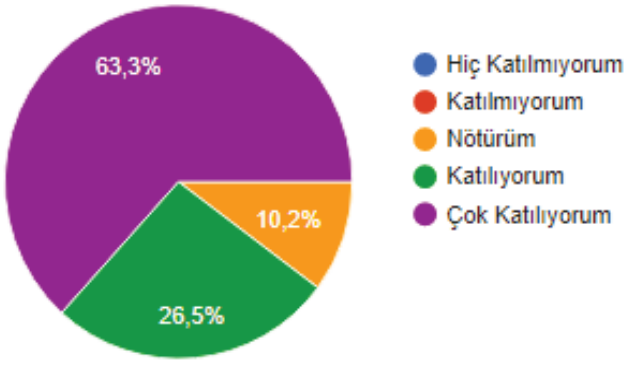
17- Gerektiğinde destek alabilmek önemlidir

49 yanıt



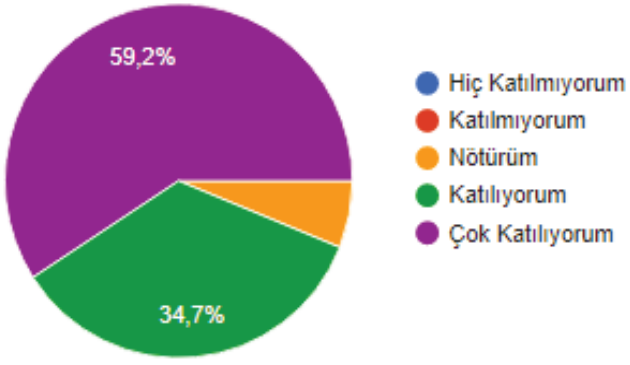
18- Etrafımdaki insanlar kulağıma uzun uzun bakınca rahatsız oluyorum.

49 yanıt



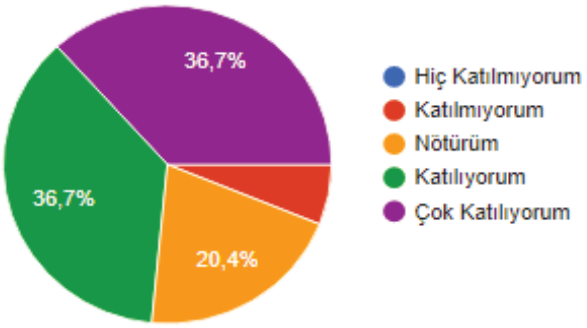
19- Cihaz kulağımda görünmeyince rahat hissediyorum

49 yanıt



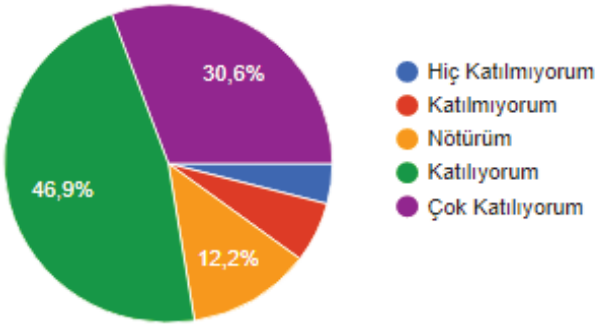
20- İşitme cihazım diğer cihazlarla uyumlu olunca hayatımı kolaylaştıracağını düşünüyorum

49 yanıt



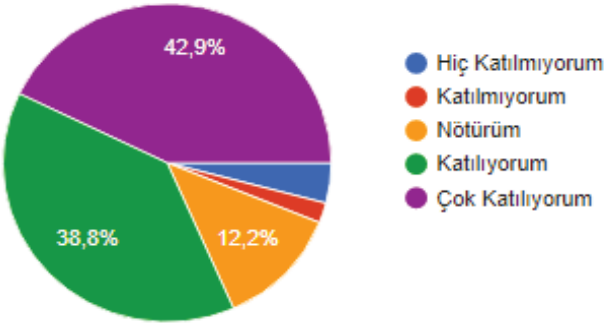
21- Arkadaşlarımın tavsiyelerini dikkate alırım

49 yanıt



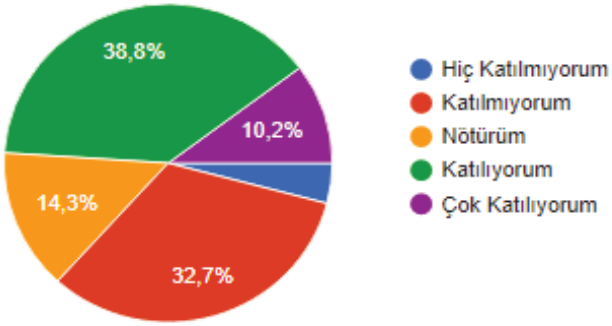
22- Reklamlar veya bu işin uzmanlarının görüşlerinden etkilenirim

49 yanıt



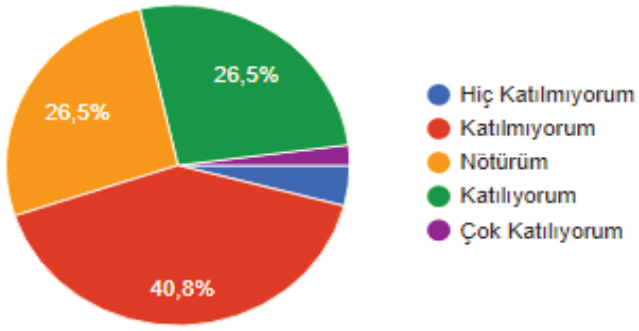
23- Kullanımının rahat olduğunu düşünüyorum

49 yanıt



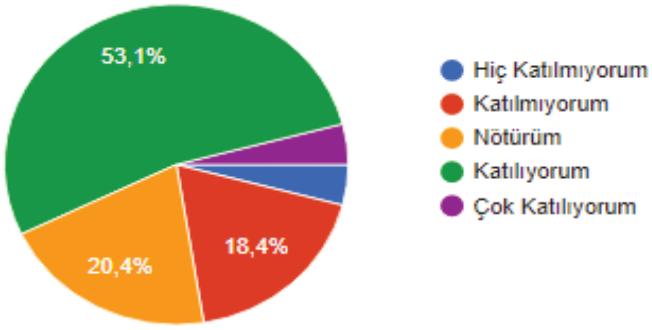
24- Cihaz sık sık bozuluyor

49 yanıt



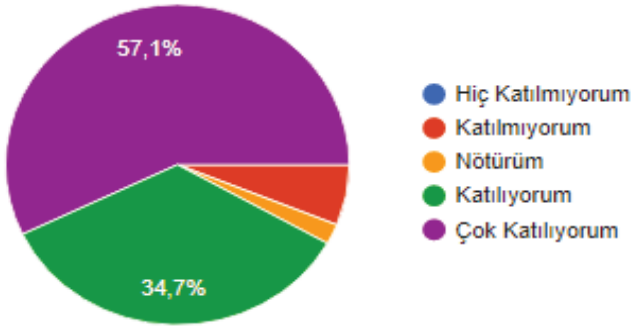
25- Cihazım bence dayanıklıdır

49 yanıt



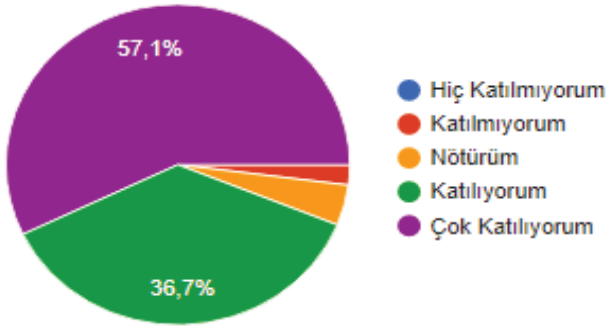
26- Cihazın pilleri mali bir yük oluşturuyor

49 yanıt



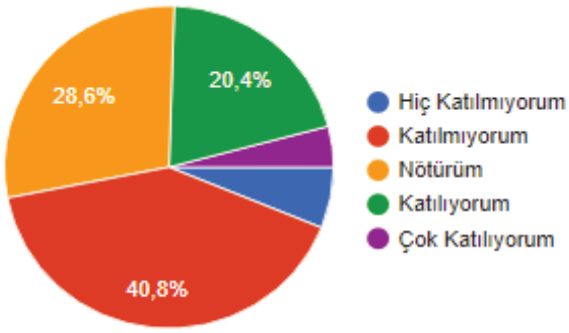
27- Cihazın bir parçası bozulur ve beklemeyen masrafları oluşabilir

49 yanıt



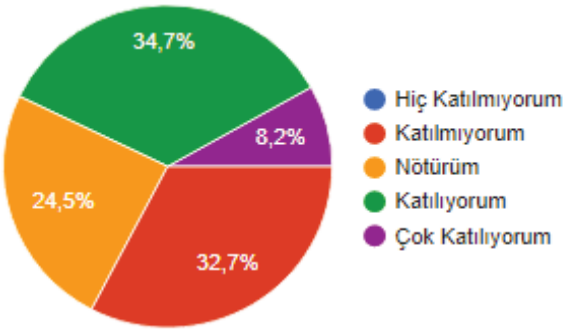
28- Kullanım zorluğu söz konusu değil

49 yanıt



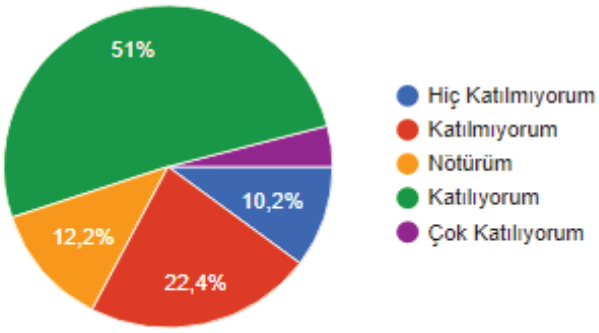
29- Biraz küçük olduğu için ilk seferde zorlanırım

49 yanıt



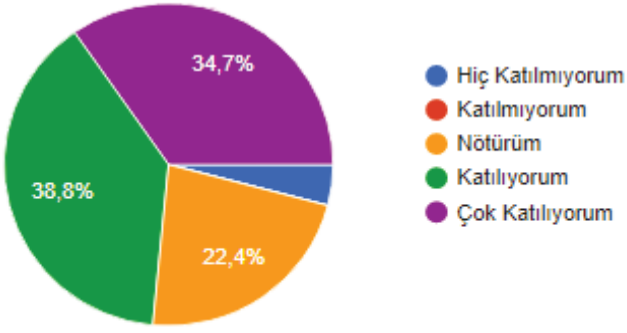
30- Cihazın temizliği kolaydır

49 yanıt



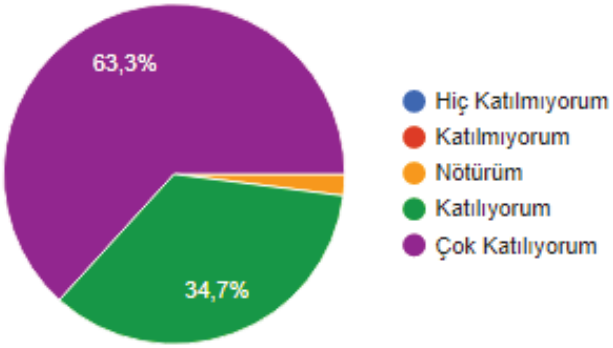
31- Akıllı telefon uygulaması üzerinden ses ayarlaması yaparak çok daha kolay kullanırım

49 yanıt



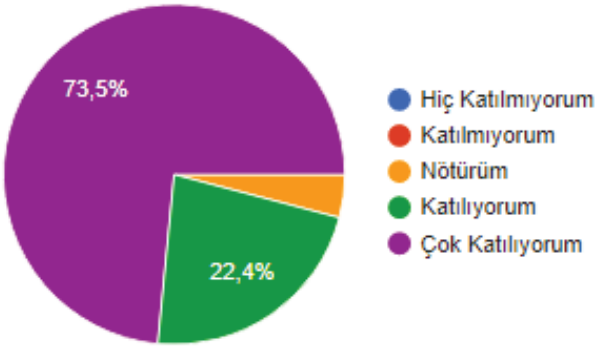
32- İşitme kalitesinin arttığını düşünüyorum

49 yanıt



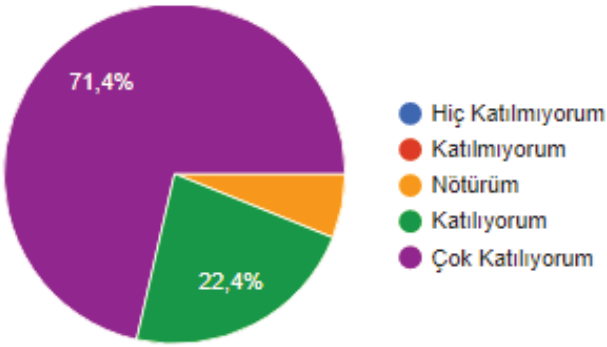
33- Yararlı olabileceğine inanıyorum

49 yanıt



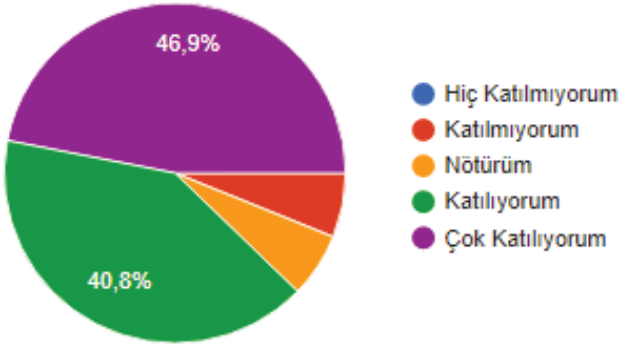
34- Kullanılmasını tavsiye ederim

49 yanıt



35- Bu tür cihazları kullanmaya sıcak bakarım

49 yanıt



APENDIX F

DESCRIPTIVE ANALYSIS

			DeviceType	Total							
				N	Mean	Median	Minimum	Maximum	Std. Deviation	Variance	Skewness	Kurtosis
Variance	Skewness	Kurtosis										
0,90	-0,23	-0,91	Attitude2	49	**4,29**	4	2	5	0,84	0,71	-1,25	1,33
0,46	-1,15	0,11	TechnicalSupport	49	**4,67**	5	3	5	0,52	0,27	-1,23	0,51
0,82	-0,63	-0,53	Usefulness1	49	**4,00**	4	1	5	0,98	0,96	-1,11	1,69
0,24	-1,21	0,88	Battery2	49	**4,65**	5	3	5	0,60	0,36	-1,55	1,44
1,31	-0,60	-0,92	Attitude1	49	**4,65**	5	3	5	0,60	0,36	-1,55	1,44
1,28	-0,11	-1,18	Usefulness3	49	**4,69**	5	3	5	0,55	0,30	-1,63	1,87
0,36	-1,55	1,44	Weight	49	**4,59**	5	3	5	0,57	0,33	-1,06	0,20
0,27	-1,23	0,51	Battery1	49	**4,55**	5	1	5	0,74	0,54	-2,62	10,16
0,38	-0,96	-0,04	Privacy1	49	**4,53**	5	3	5	0,68	0,46	-1,15	0,11
0,46	-1,41	2,43	Privacy2	49	**4,53**	5	3	5	0,62	0,38	-0,96	-0,04
0,88	-1,73	1,87	Compatability	49	**4,04**	4	2	5	0,91	0,83	-0,60	-0,50
0,74	-0,59	1,02	Cost	49	**4,46**	5	2	5	0,71	0,50	-1,29	1,66
0,30	-1,63	1,87	Fear_Loss	49	**4,47**	5	2	5	0,94	0,88	-1,73	1,87
1,25	-0,76	-0,42	Privacy	49	**4,53**	5	3	5	0,59	0,35	-0,92	-0,15
1,06	-1,19	1,34	Durability	49	**3,27**	3,5	1	5	0,91	0,82	-0,63	-0,53
0,99	-0,15	-1,20	Intention	49	**3,55**	4	1	5	1,24	1,54	-0,50	-0,61
0,35	-0,92	-0,15	VoiceControl	49	**4,27**	4	2	5	0,76	0,57	-0,79	0,24
0,71	-1,25	1,33	Comfort	49	**3,18**	3	1	5	1,13	1,28	-0,11	-1,18
0,50	-1,29	1,66	InternalInfluence	49	**3,94**	4	1	5	1,03	1,06	-1,19	1,34
1,12	0,12	-0,94	Usefulness2	49	**4,61**	5	3	5	0,53	0,28	-0,90	-0,32
0,36	-1,55	1,44	WirelessConnectivit	49	**3,96**	4	1	5	1,12	1,25	-0,76	-0,42
0,67	-1,68	2,76	ExternalInfluence	49	**4,14**	4	1	5	1,00	1,00	-1,47	2,42
0,54	-2,62	10,16	HandsFree	49	**3,88**	4	1	5	0,86	0,74	-0,59	1,02
0,98	0,39	-0,50	Usefulness	49	**4,65**	5	3	5	0,49	0,24	-1,21	0,88
0,33	-1,06	0,20	EarHealth	49	**3,41**	4	1	5	1,08	1,16	-0,48	-0,61
0,96	-1,11	1,69	Cost2	49	**4,49**	5	2	5	0,68	0,46	-1,41	2,43
1,00	-1,47	2,42	Durability2	49	**3,35**	4	1	5	0,97	0,94	-0,76	-0,25
0,28	-0,90	-0,32	Adjustability	49	**3,20**	3	1	5	1,06	1,12	0,12	-0,94
0,57	-0,79	0,24	Durability1	49	**3,18**	3	1	5	0,95	0,90	-0,23	-0,91
0,83	-0,60	-0,50	Cost1	49	**4,43**	5	2	5	0,82	0,67	-1,68	2,76
0,94	-0,76	-0,25	EoU3	49	**3,16**	4	1	5	1,14	1,31	-0,60	-0,92
1,16	-0,48	-0,61	EoU2	49	**2,82**	3	1	4	0,99	0,99	-0,15	-1,20
1,54	-0,50	-0,61	EoU1	49	**2,76**	3	1	5	0,99	0,98	0,39	-0,50
			Attitude	49	**4,47**	4,5	3	5	0,61	0,37	-0,82	-0,41
0,37	-0,82	-0,41										

DeviceType sorted by Mean

Category	Variable	Rev	Question (Turkish)	N	Mean	Median	Minimum	Maximum	d. Deviation		Variance	Skewness	Kurtosis
Intermediary perception	Usefulness3		Yararlı olabileceğine inanıyorum	49	**4,69**	3	1	5	0,95	I do believe that it will be benificial	0,90	-0,23	-0,91
Service	TechnicalSupport		Gerektiğinde destek alabilmek önemlidir	49	**4,67**	5	3	5	0,68	It is important to get support when needed	0,46	-1,15	0,11
Intermediary perception	Usefulness			49	**4,65**	3,5	1	5	0,91	Usefulness	0,82	-0,63	-0,53
Product Feature	Battery2		Kablosuz sarj aleti ile pilleri şarj edebilmesi güzel olur	49	**4,65**	5	3	5	0,49	It would be nice to charge the batteries with the wireless charger	0,24	-1,21	0,88
Intermediary perception	Attitude1		Kullanılmasını tavsiye ederim	49	**4,65**	4	1	5	1,14	I recommend the use	1,31	-0,60	-0,92
Intermediary perception	Usefulness2		İşitme kalitesinin arttığını düşünüyorum	49	**4,61**	3	1	5	1,13	I think the quality of hearing is improved	1,28	-0,11	-1,18
Product Feature	Weight		Cihazların ağırlığı önemlidir	49	**4,59**	5	3	5	0,60	The weight of the devices is important	0,36	-1,55	1,44
Product Feature	Battery1		İşitme cihazlarının pil ömrü önemlidir	49	**4,55**	5	3	5	0,52	Battery life of hearing aids is important	0,27	-1,23	0,51
Product Feature	Privacy			49	**4,53**	5	3	5	0,62	Privacy	0,38	-0,96	-0,04
Product Feature	Privacy1		Etrafımdaki insanlar kulağıma uzun uzun bakınca rahatsız oluyorum.	49	**4,53**	5	2	5	0,68	I feel uncomfortable when people around me look at my ear.	0,46	-1,41	2,43
Product Feature	Privacy2		Cihaz kulağımda görünmeyince rahat hissediyorum	49	**4,53**	5	2	5	0,94	I feel comfortable when the device is not visible in my ear	0,88	-1,73	1,87
Product Feature	Cost2		Cihazın bir parçası bozulur ve beklemeyen masrafları oluşabilir	49	**4,49**	4	1	5	0,86	When Part of the device breaks down it is unexpected expenses	0,74	-0,59	1,02
Intermediary perception	Fear_Loss		Cihazı kaybetmekten korkuyorum	49	**4,47**	5	3	5	0,55	I'm afraid of losing the device	0,30	-1,63	1,87
Product Feature	Cost			49	**4,46**	4	1	5	1,12	Cost	1,25	-0,76	-0,42
Product Feature	Cost1		Cihazın pilleri mali bir yük oluşturuyor	49	**4,43**	4	1	5	1,03	The batteries of the device are an expected expenses	1,06	-1,19	1,34
Intermediary perception	Attitude2		Bu tür cihazları kullanmaya sıcak bakarım	49	**4,29**	3	1	4	0,99	If any part of the device breaks down it is unexpected expenses	0,99	-0,15	-1,20
Product Feature	VoiceControl		Ses kontrol özelliği cihazı kullanışlı hale getirir	49	**4,27**	5	3	5	0,59	Volume control makes the device convenient	0,35	-0,92	-0,15
Social	ExternalInfluence		Reklamlar veya bu işin uzmanlarının görüşlerinden etkilenirim	49	**4,14**	4	2	5	0,84	I get influenced by ads or the views of experts in this business	0,71	-1,25	1,33
Product Feature	Compatability		İşitme cihazım diğer cihazlarla uyumlu olunca hayatımı kolaylaştıracağını düşünüyorum	49	**4,04**	5	2	5	0,71	I think it will make my life easier when my hearing aid is compatible with other devices	0,50	-1,29	1,66
Intermediary perception	Usefulness1		Akıllı telefon uygulaması üzerinden ses ayarlaması yaparak çok daha kolay kullanırım	49	**4,00**	3	1	5	1,06	I can easily adjust the volume via smartphone application	1,12	0,12	-0,94
Product Feature	WirelessConnectivity		İşitme cihazlarınızı telefona ve diğer akıllı cihazlara bağlamak önemlidir	49	**3,96**	5	3	5	0,60	It is important to connect hearing aids to the phone and other smart devices	0,36	-1,55	1,44
Social	InternalInfluence		Arkadaşlarımın tavsiyelerini dikkate alırım	49	**3,94**	5	2	5	0,82	I consider my friends' advice	0,67	-1,68	2,76
Product Feature	HandsFree		Hands Free/El serbest özelliği yararlıdır	49	**3,88**	5	1	5	0,74	Hands Free feature is useful	0,54	-2,62	10,16
Intermediary perception	Intention		Yakın zamanda satın almayı planlıyorum	49	**3,55**	3	1	5	0,99	I plan to buy it soon	0,98	0,39	-0,50
Individual	EarHealth		İşitme cihazının kulağa zarar vereceğini düşünmüyorum	49	**3,41**	5	3	5	0,57	I don't think the hearing aid will harm the ear	0,33	-1,06	0,20
Product Feature	Durability2		Cihazım bence dayanıklıdır	49	**3,35**	4	1	5	0,98	I think my device is durable	0,96	-1,11	1,69
Product Feature	Durability			49	**3,27**	4	1	5	1,00	Durability	1,00	-1,47	2,42
Product Feature	Adjustability		Ses düzeyi ayarlamak kolaydır	49	**3,20**	5	3	5	0,53	The Volume is easy to adjust	0,28	-0,90	-0,32
Intermediary perception	Comfort		Kullanımının rahat olduğunu düşünüyorum	49	**3,18**	4	2	5	0,76	I think it is comfortable to use	0,57	-0,79	0,24
0	Durability1	R	Cihaz sık sık bozuluyor	49	**3,18**	4	2	5	0,91	0	0,83	-0,60	-0,50
Intermediary perception	EoU3		Cihazın temizliği kolaydır	49	**3,16**	4	1	5	0,97	It Easy to clean	0,94	-0,76	-0,25
0	EoU2	R	Biraz küçük olduğu için ilk seferde zorlanırım	49	**2,82**	4	1	5	1,08	0	1,16	-0,48	-0,61
Intermediary perception	EoU1		Kullanım zorluğu söz konusu değil	49	**2,76**	4	1	5	1,24	It isnot difficult to use	1,54	-0,50	-0,61

DeviceType Total

	N	Mean	Median	Minimum	Maximum	Std. Deviation	Variance	Skewness	Kurtosis
Attitude2	49	**4,29**	4	2	5	0,84	0,71	-1,25	1,33
TechnicalSupport	49	**4,67**	5	3	5	0,52	0,27	-1,23	0,51
Usefulness1	49	**4,00**	4	1	5	0,98	0,96	-1,11	1,69
Battery2	49	**4,65**	5	3	5	0,60	0,36	-1,55	1,44
Attitude1	49	**4,65**	5	3	5	0,60	0,36	-1,55	1,44
Usefulness3	49	**4,69**	5	3	5	0,55	0,30	-1,63	1,87
Weight	49	**4,59**	5	3	5	0,57	0,33	-1,06	0,20
Battery1	49	**4,55**	5	1	5	0,74	0,54	-2,62	10,16
Privacy1	49	**4,53**	5	3	5	0,68	0,46	-1,15	0,11
Privacy2	49	**4,53**	5	3	5	0,62	0,38	-0,96	-0,04
Compatability	49	**4,04**	4	2	5	0,91	0,83	-0,60	-0,50
Cost	49	**4,46**	5	2	5	0,71	0,50	-1,29	1,66
Fear_Loss	49	**4,47**	5	2	5	0,94	0,88	-1,73	1,87
Privacy	49	**4,53**	5	3	5	0,59	0,35	-0,92	-0,15
Durability	49	**3,27**	3,5	1	5	0,91	0,82	-0,63	-0,53
Intention	49	**3,55**	4	1	5	1,24	1,54	-0,50	-0,61
VoiceControl	49	**4,27**	4	2	5	0,76	0,57	-0,79	0,24
Comfort	49	**3,18**	3	1	5	1,13	1,28	-0,11	-1,18
InternalInfluence	49	**3,94**	4	1	5	1,03	1,06	-1,19	1,34
Usefulness2	49	**4,61**	5	3	5	0,53	0,28	-0,90	-0,32
WirelessConnectivit	49	**3,96**	4	1	5	1,12	1,25	-0,76	-0,42
ExternalInfluence	49	**4,14**	4	1	5	1,00	1,00	-1,47	2,42
HandsFree	49	**3,88**	4	1	5	0,86	0,74	-0,59	1,02
Usefulness	49	**4,65**	5	3	5	0,49	0,24	-1,21	0,88
EarHealth	49	**3,41**	4	1	5	1,08	1,16	-0,48	-0,61
Cost2	49	**4,49**	5	2	5	0,68	0,46	-1,41	2,43
Durability2	49	**3,35**	4	1	5	0,97	0,94	-0,76	-0,25
Adjustability	49	**3,20**	3	1	5	1,06	1,12	0,12	-0,94
Durability1	49	**3,18**	3	1	5	0,95	0,90	-0,23	-0,91
Cost1	49	**4,43**	5	2	5	0,82	0,67	-1,68	2,76
EoU3	49	**3,16**	4	1	5	1,14	1,31	-0,60	-0,92
EoU2	49	**2,82**	3	1	4	0,99	0,99	-0,15	-1,20
EoU1	49	**2,76**	3	1	5	0,99	0,98	0,39	-0,50
Attitude	49	**4,47**	4,5	3	5	0,61	0,37	-0,82	-0,41

APPENDIX G

CORRELATION ANALYSIS

Correlations	0,05	15/10/2019								
		EoU1	**EoU2**	**EoU3**	**Usefulness**	**Attitude**	**Intention**	**all-4**	**all-4**	Rev
Gender	Pearson Correlation	-0,04	0,05	-0,21	0,17	0,00	-0,36		VR AI	-
	Sig. (2-tailed)	0,781	0,749	0,153	0,231	0,996	0,011	VR AI	VR AI	
Age	Pearson Correlation	0,07	0,43	-0,22	0,32	0,09	-0,26		VR AI	
	Sig. (2-tailed)	0,640	0,002	0,122	0,025	0,525	0,068	VR AI	VR AI	
Education	Pearson Correlation	0,00	0,03	0,23	-0,10	-0,08	-0,17		FA UX	
	Sig. (2-tailed)	0,984	0,822	0,120	0,483	0,608	0,247	FA UX	FA UX	
DeviceType	Pearson Correlation	-0,04	0,40	-0,17	-0,05	-0,22	-0,15		VR AI	
	Sig. (2-tailed)	0,781	0,004	0,246	0,737	0,135	0,310	VR AI	VR AI	
DeviceYear	Pearson	-0,26	-0,15	-0,22	-0,29	-0,34	0,08		VR AI	

	Correlation								
	Sig. (2-tailed)	0,081	0,315	0,137	0,045	0,019	0,588	VR AI	VR AI
Fear_Loss	Pearson Correlation	0,22	-0,11	-0,21	0,34	0,12	-0,26		VR AI
	Sig. (2-tailed)	0,136	0,465	0,149	0,018	0,422	0,069	VR AI	VR AI
Battery1	Pearson Correlation	0,08	0,03	-0,21	0,54	0,20	-0,20		VR AI
	Sig. (2-tailed)	0,611	0,852	0,152	0,000	0,166	0,164	VR AI	VR AI
Battery2	Pearson Correlation	0,10	-0,04	0,02	0,19	0,14	-0,02		FA UX
	Sig. (2-tailed)	0,494	0,788	0,872	0,204	0,329	0,904	FA UX	FA UX
Weight	Pearson Correlation	-0,03	-0,10	-0,21	0,45	0,29	0,00		VR AI
	Sig. (2-tailed)	0,822	0,505	0,140	0,001	0,042	0,997	VR AI	VR AI
WirelessConnectivity	Pearson Correlation	0,05	-0,38	0,33	-0,06	0,18	0,26		VR AI
	Sig. (2-tailed)	0,747	0,007	0,020	0,661	0,210	0,075	VR AI	VR AI
Adjustability	Pearson Correlation	0,05	-0,12	0,40	-0,08	0,25	0,53		VR AI

	Sig. (2-tailed)	0,740	0,404	0,004	0,579	0,080	0,000	VR AI	VR AI
EarHealth	Pearson Correlation	-0,10	0,07	0,06	0,14	0,13	-0,02		FA UX
	Sig. (2-tailed)	0,496	0,626	0,667	0,355	0,370	0,914	FA UX	FA UX
HandsFree	Pearson Correlation	0,26	-0,17	0,23	0,07	0,25	0,24		FA UX
	Sig. (2-tailed)	0,073	0,232	0,106	0,632	0,080	0,096	FA UX	FA UX
VoiceControl	Pearson Correlation	-0,02	-0,07	0,07	0,36	0,29	0,09		VR AI
	Sig. (2-tailed)	0,877	0,621	0,636	0,010	0,043	0,562	VR AI	VR AI
TechnicalSupport	Pearson Correlation	-0,04	-0,17	-0,08	0,61	0,30	-0,20		VR AI
	Sig. (2-tailed)	0,798	0,257	0,564	0,000	0,036	0,166	VR AI	VR AI
Privacy	Pearson Correlation	-0,15	-0,40	0,01	0,27	0,19	0,06		VR AI
	Sig. (2-tailed)	0,312	0,004	0,957	0,060	0,187	0,673	VR AI	VR AI
Privacy1	Pearson Correlation	-0,14	-0,38	-0,01	0,16	0,04	0,02		VR AI

	Sig. (2-tailed)	0,326	0,008	0,964	0,281	0,784	0,910	VR AI	VR AI	
Privacy2	Pearson Correlation	-0,12	-0,35	0,02	0,35	0,32	0,10		VR AI	
	Sig. (2-tailed)	0,396	0,014	0,879	0,015	0,024	0,494	VR AI	VR AI	
Compatability	Pearson Correlation	0,22	-0,36	0,19	0,01	0,04	0,22		VR AI	
	Sig. (2-tailed)	0,131	0,011	0,183	0,951	0,785	0,131	VR AI	VR AI	
InternalInfluence	Pearson Correlation	-0,04	-0,42	0,13	0,02	-0,09	0,22		VR AI	
	Sig. (2-tailed)	0,809	0,003	0,363	0,897	0,555	0,124	VR AI	VR AI	#N/A
ExternalInfluence	Pearson Correlation	0,08	0,03	-0,04	0,42	0,25	-0,25		VR AI	
	Sig. (2-tailed)	0,594	0,854	0,790	0,003	0,086	0,084	VR AI	VR AI	
Comfort	Pearson Correlation	0,36	-0,17	0,17	-0,30	0,18	0,46		VR AI	
	Sig. (2-tailed)	0,012	0,233	0,243	0,039	0,228	0,001	VR AI	VR AI	
Durability	Pearson Correlation	0,41	-0,19	0,26	-0,08	0,22	0,29		VR AI	

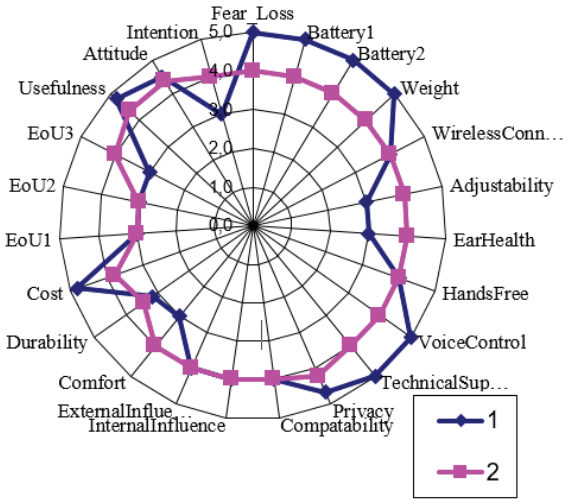
	Sig. (2-tailed)	0,003	0,197	0,073	0,579	0,124	0,041	VR AI	VR AI	
Durability1_ ORG	Pearson Correlation	-0,36	0,18	-0,16	0,06	-0,19	-0,21		FA UX	
	Sig. (2-tailed)	0,011	0,205	0,261	0,675	0,190	0,143	FA UX	FA UX	
Durability2	Pearson Correlation	0,42	-0,17	0,32	-0,09	0,23	0,34		VR AI	
	Sig. (2-tailed)	0,003	0,242	0,023	0,530	0,111	0,017	VR AI	VR AI	
Cost	Pearson Correlation	0,15	-0,01	-0,15	0,48	0,26	-0,21		VR AI	
	Sig. (2-tailed)	0,306	0,941	0,315	0,000	0,066	0,145	VR AI	VR AI	
Cost1	Pearson Correlation	0,16	-0,08	-0,12	0,33	0,13	-0,26		VR AI	
	Sig. (2-tailed)	0,277	0,581	0,407	0,022	0,366	0,073	VR AI	VR AI	
Cost2	Pearson Correlation	0,12	0,07	-0,16	0,61	0,39	-0,13		VR AI	
	Sig. (2-tailed)	0,412	0,612	0,277	0,000	0,006	0,378	VR AI	VR AI	
Variable		**EoU1**	**EoU2**	**EoU3**	**Usefulness**	**Attitude**	**Intention**	**all-4**	**all-4**	**Rev**
EoU1	Pearson Correlation	1,00	0,00	0,29	-0,01	0,16	-0,01		VR AI	

	Sig. (2-tailed)	0,000	0,976	0,040	0,962	0,271	0,964	VR AI	VR AI
EoU2	Pearson Correlation	0,00	1,000	-0,166	0,12	-0,01	-0,20		VR AI
	Sig. (2-tailed)	0,976	0,000	0,283	0,401	0,948	0,161	VR AI	VR AI
EoU3	Pearson Correlation	0,29	-0,166	1,000	0,07	0,26	0,08		VR AI
	Sig. (2-tailed)	0,040	0,283	0,000	0,653	0,068	0,575	VR AI	VR AI
Usefulness	Pearson Correlation	-0,01	0,12	0,07	1,00	0,63	-0,09		VR AI
	Sig. (2-tailed)	0,962	0,401	0,653	0,000	0,000	0,540	VR AI	VR AI
Usefulness1	Pearson Correlation	0,00	-0,17	0,28	-0,02	0,18	0,29		VR AI
	Sig. (2-tailed)	1,000	0,239	0,052	0,883	0,229	0,042	VR AI	VR AI
Usefulness2	Pearson Correlation	-0,03	0,06	0,18	0,91	0,64	-0,08		VR AI
	Sig. (2-tailed)	0,860	0,685	0,230	0,000	0,000	0,587	VR AI	VR AI
Usefulness3	Pearson Correlation	0,01	0,16	-0,05	0,91	0,50	-0,08		VR AI

	Sig. (2-tailed)	0,932	0,265	0,725	0,000	0,000	0,568	VR AI	VR AI
Attitude	Pearson Correlation	0,16	-0,01	0,26	0,63	1,00	0,24		VR AI
	Sig. (2-tailed)	0,271	0,948	0,068	0,000	0,000	0,092	VR AI	VR AI
Attitude1	Pearson Correlation	0,07	0,14	0,09	0,79	0,78	0,10		VR AI
	Sig. (2-tailed)	0,659	0,351	0,563	0,000	0,000	0,518	VR AI	VR AI
Attitude2	Pearson Correlation	0,19	-0,11	0,32	0,35	0,89	0,29		VR AI
	Sig. (2-tailed)	0,201	0,450	0,026	0,015	0,000	0,048	VR AI	VR AI
Intention	Pearson Correlation	-0,01	-0,20	0,08	-0,09	0,24	1,00		VR AI
	Sig. (2-tailed)	0,964	0,161	0,575	0,540	0,092	0,000	VR AI	VR AI

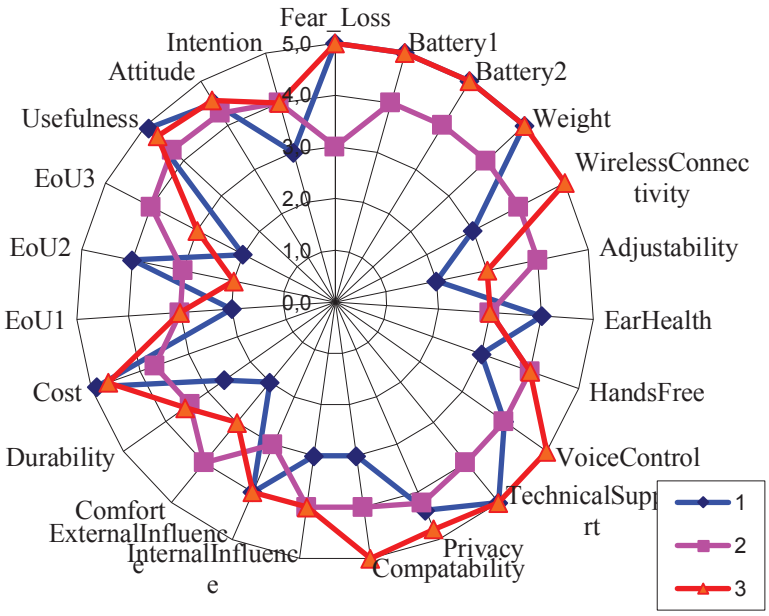
APPENDIX H

CLUSTER ANALYSIS



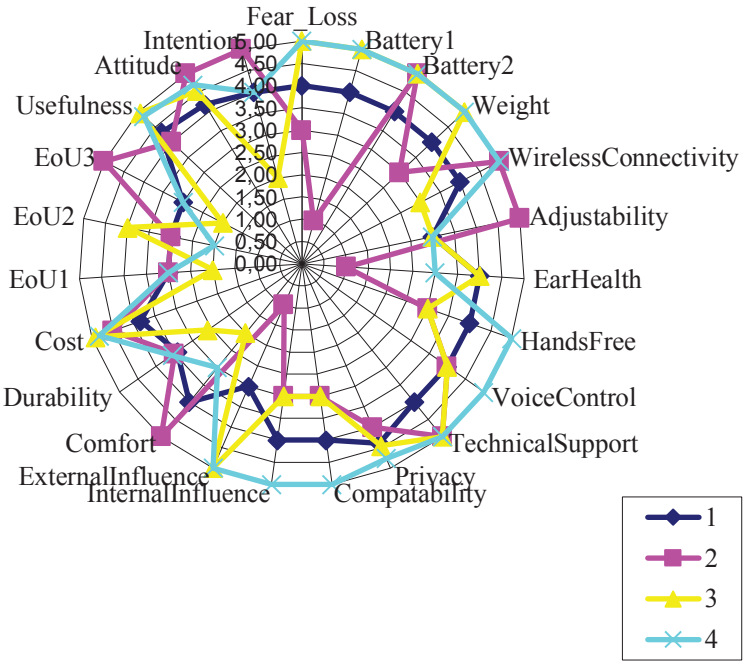
Final Cluster Centers

	Cluster	
	1	2
n=	*32*	*17*
Fear_Loss	**5,00**	4,00
Battery1	**5,00**	4,00
Battery2	**5,00**	4,00
Weight	**5,00**	4,00
WirelessConnectivity	**4,00**	**4,00**
Adjustability	3,00	**4,00**
EarHealth	3,00	**4,00**
HandsFree	**4,00**	**4,00**
VoiceControl	**5,00**	4,00
TechnicalSupport	**5,00**	4,00
Privacy	**4,69**	4,24
Compatability	**4,00**	**4,00**
InternalInfluence	**4,00**	**4,00**
ExternalInfluence	**4,00**	**4,00**
Comfort	3,00	**4,00**
Durability	3,17	**3,44**
Cost	**4,81**	3,79
EoU1	**3,00**	**3,00**
EoU2	**3,00**	**3,00**
EoU3	3,00	**4,00**
Usefulness	**4,81**	4,35
Attitude	**4,52**	4,38
Intention	3,00	**4,00**



Final Cluster Centers

	Cluster		
	1	2	3
n=	13	13	23
Fear_Loss	5,00	3,00	5,00
Battery1	5,00	4,00	5,00
Battery2	5,00	4,00	5,00
Weight	5,00	4,00	5,00
WirelessConnectivity	3,00	4,00	5,00
Adjustability	2,00	4,00	3,00
EarHealth	4,00	3,00	3,00
HandsFree	3,00	4,00	4,00
VoiceControl	4,00	4,00	5,00
TechnicalSupport	5,00	4,00	5,00
Privacy	4,38	4,23	4,78
Compatability	3,00	4,00	5,00
InternalInfluence	3,00	4,00	4,00
ExternalInfluence	4,00	3,00	4,00
Comfort	2,00	4,00	3,00
Durability	2,62	3,42	3,54
Cost	4,88	3,69	4,65
EoU1	2,00	3,00	3,00
EoU2	4,00	3,00	2,00
EoU3	2,00	4,00	3,00
Usefulness	4,92	4,31	4,70
Attitude	4,50	4,27	4,57
Intention	3,00	4,00	4,00



Final Cluster Centers

n=301

	Cluster			
	1	**2**	**3**	**4**
n=	*19*	*1*	*12*	*17*
HandsFree	4,00	3,00	3,00	**5,00**
VoiceControl	4,00	4,00	4,00	**5,00**
TechnicalSupport	4,00	**5,00**	**5,00**	**5,00**
Privacy	4,39	4,00	4,46	**4,76**
Compatability	4,00	3,00	3,00	**5,00**
InternalInfluence	4,00	3,00	3,00	**5,00**
ExternalInfluence	3,00	1,00	**5,00**	**5,00**
Comfort	4,00	**5,00**	2,00	3,00
Durability	3,42	3,50	2,58	**3,56**
Cost	3,84	4,50	**4,92**	4,82
EoU1	**3,00**	**3,00**	2,00	**3,00**
EoU2	3,00	3,00	**4,00**	2,00
EoU3	3,00	**5,00**	2,00	3,00
Usefulness	4,32	4,00	**4,96**	4,85
Attitude	4,18	**5,00**	4,54	4,71
Intention	4,00	**5,00**	2,00	4,00