User experience in automotive industry: user perspective on functionality and entertainment

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Abstract

The impact of technology is increasing in the automotive industry resulting in user experience to have a significant role in the industry. Previous studies have researched the use of user experience in the automotive industry describing the importance of it. Studies have also described the user experience in connection to in-vehicle functions. Contrariwise, a gap has been identified in relation to the actual use and users’ preferences to these functions. The aim of this study is to analyze the users’ perspective in the automotive industry and how a high level of user experience can be achieved by identifying the preference of the users. This paper aims to identify if functions related to entertainment or functions related to functionality are preferred by the users. It is important to note that the study is not excluding any of the two different type of functions but investigates the preference of the users. Mixed method was used to respond to the research question. Two interviews with experts of the domain of automotive were conducted, where important aspects of the experts’ perspective were covered and was used to develop the survey. In order to achieve a full understanding of the user experience, a survey was sent to identify users’ preferences.

The study proved user experience to be important for the organizations in the automotive industry. Moreover, it discovered a discrepancy between the experts’ perspective and the users’ perceptions. Experts expressed customer satisfactions and fulfillment of their demands to be of the primary aim of organizations in the automotive industry. Contrariwise, users expressed that organizations may consider the preference of the users but only to achieve economic and concurrent benefits. Additionally, users expressed a preference to in-vehicle functions related to functionality. More specifically, in-vehicle functions in relation to safety, connectivity and assistance in driving. As a result, this study suggests for organizations in the automotive industry to include the above functions to their vehicles in order to satisfy the demands of their customers and achieve high level of user experience but not exclude the functions related to entertainment.

Keywords: Automotive, GOMS Analysis, Human-Computer interaction (HCI), In-vehicle technologies, User Acceptance, User Experience (UX)
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<th>Acronym</th>
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<tr>
<td>GOMS</td>
<td>Goals, a set of Operators, a set of Methods and a set of Selections rules</td>
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<td>GPS</td>
<td>Global position system</td>
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<td>HCI</td>
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<td>SPSS</td>
<td>Statistical Package for Social Science</td>
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Table of Contents

Abstract .......................................................................................... i

Table of the acronyms ........................................................................ ii

List figures ....................................................................................... vi

List of tables ..................................................................................... vi

1 Introduction .................................................................................... 1

1.1 Introduction and Research Setting _______________________________ 1

1.2 Purpose Statement and Research Question ___________________________________ 2

1.3 Topic Justification ........................................................................ 3

1.4 Scope and Limitations .................................................................. 3

1.5 Thesis Organization ....................................................................... 3

2. Review of literature ......................................................................... 4

2.1 Human-computer interaction (HCI) ................................................... 4

2.2 Internet of things (IoT) .................................................................. 4

2.3 User interface (UI) and User Experience (UX) Design ......................... 5

2.4 User Experience (UX) methods and theories .................................... 5

2.5 Need for new technologies in automotive industry ............................ 6

2.6 Driving tasks and In-vehicle functions ............................................. 7

2.7 Reflexion of review of literature ..................................................... 7

3. Methodology .................................................................................. 8

3.1 Methodological Tradition ............................................................... 8

3.2 Methodological Approach .............................................................. 8

3.3 Methods for Data Collection ........................................................ 9

3.3.1 Selection of participants .......................................................... 9

3.3.2 Interviews as data collection ..................................................... 9

3.3.3 Survey as data collection ......................................................... 10

3.4 Methods/Techniques for Data Analysis ......................................... 10

3.4.1 Data analysis from interviews .................................................. 11

3.4.2 Data analysis of survey ........................................................... 11

3.5 Reliability, Validity ...................................................................... 12

3.6 Ethical Considerations ................................................................... 12

4. Empirical findings .......................................................................... 13

4.1 Findings from interviews ............................................................... 13

4.1.1 User experience in the automotive industry ................................ 13

4.1.2 Functions developed by the experts ......................................... 14

4.2 Findings from the survey ............................................................... 15

4.2.1 Quantitative data ................................................................. 15

4.2.2 Qualitative data ................................................................. 16
4.2.3 Quantitative analysis of the qualitative data 25
4.3 Data significance 27
4.4 Summary of findings 27
   4.2.1 Summary of findings from the interviews 27
   4.2.2 Summary of findings from the surveys 28
5. Discussion 29
   5.1 Technology in the automotive industry 29
   5.2 Importance of user experience 29
   5.3 Users’ preference 30
   5.4 GOMS analysis and user acceptance testing 30
   5.5 Critical reflection 31
6. Conclusion 32
   6.1 Contributions 32
   6.2 Future Research 32
7. References 34
8. Appendix 39
   Appendix A Missive of survey 39
   Appendix B Survey responses of gender 39
   Appendix C Survey responses of age 39
   Appendix D Survey responses of “Which vehicle are you driving?” 40
   Appendix E Survey responses of choice of scenario one 40
   Appendix F Survey responses of choice of scenario two 41
   Appendix G Survey responses of “Based on your opinion has in-vehicle technologies impacted the automotive industry? if yes how?” 41
   Appendix H Survey responses of “Based on your opinion do organizations in automotive industry take into consideration the preference and opinion of users?” 41
   Appendix I Interview questions 42
   Appendix K Pearson chi-square test 44
List figures
Figure 1 Choice of scenario................................................................. 15
Figure 2 Users perspective of in-vehicle technology impact.............................. 16
Figure 3 Users’ perspective of consideration of users’ preference.......................... 16
Figure 4 Assistance in driving: Functions preferred by the users................................ 26
Figure 5 Connectivity functions preferred by the users........................................... 27

List of tables
Table 1 Functions identified by the experts .................................................... 14
Table 2 Theme table for motivation of choice of scenario one............................. 17
Table 3 Theme table for motivation of choice of scenario one............................. 18
Table 4 Theme table for motivation of choice of scenario two............................. 20
Table 5 Theme table for motivation in-vehicle impact........................................ 22
Table 6 Themes table for consideration of user preferences................................. 24
Table 7 Theme table for functions preferred by the users ..................................... 26
1 Introduction

1.1 Introduction and Research Setting

Technology and innovation can be seen in all our surroundings. Nowadays technology innovations have arisen and been implied in various fields. Automotive is also one of the industries impacted by these evolutions (Yoo, 2010), with multiple technologies gathered together to result to vehicles with the latest innovations (Kaiser et al., 2016; Henfridsson and Lindgren, 2005). The technologies that are embedded in the vehicles have increased dramatically by the digital innovations occurred the past years (Yoo, 2010; King and Lyyninen 2005). The modern vehicles are relying on software exchanges and updates as well as programmable power-train control units to support the functions of the vehicle (Henfridsson, Mathiassen and Svahn, 2014). The technologies used for the in-vehicle functions aim to reduce driver distraction, increase safety and decrease pollution but also to reach the demands from the customers and prominent against concurrent (Pfleging et al, 2012).

During these innovations, Human-computer interaction (HCI) entered the automotive field. HCI is describing the interactions between users and technology as well as computing devices (Ebert et al., 2012). The aim of the HCI is to attain efficient interactions and result in user-friendly systems (Ebert et al., 2012). In the automotive industry vehicles are containing numerous processors and applications that are often depended on inputs and outputs from humans. Therefore, it is critical that Human-computer interaction occur effortlessly (Schidt, Spissel & Kern, 2010). Furthermore, it is important to achieve easy to use HCI and maximized user experience (Pfleging et al, 2012). High user experience is achieved when user satisfaction is attained, and a system fulfils the expectations of the users (Savoy, Guo, & Salvendy, 2009). Hence, organizations in the automotive fields need to be aware of the demands of their customers.

Previous studies have analyzed the importance of user experience in relation to various built-in vehicle technologies. Leshed et al, (2008) have researched the user experience in relation to GPS navigation. The findings of Leshed et al research prove the opportunities of users experience as well as the users’ apprehension of higher security (2008). Another study has evaluated the eco-friendly interfaces and tested its user acceptance. The research showed that existing interfaces to control the behavior and driving were accepted by the users (Meschtscherjakov, 2009). Furthermore, it is proven that assistance in driving functions had a negative impact to the drivers, user experienced failed to be reached because of the control that was implied and the joy of driving was reduced (Eckoldt, 2012). In contrast, when emotional regulation functions were implied to regulate and reduce the danger while driving, it was demonstrated that drivers experienced fewer negative emotions and better driving behavior was achieved (Harris & Nass 2011).

The findings of the studies mentioned above indicate a need for further research of the preference of the users. No innovation and implementation are worth if value is not achieved (McVehiclethly and Wright, 2004) whereas value is achieved by ensuring that the requirements of the customers are accomplished (Bolton and Drew, 1991). In the automotive industry value is achieved by customer satisfaction, maximizing and fulfilling customers’ demands which later may result to increase in sales and positive results for the organization (Ibusuki and
Kaminski, 2004). Consequently, easy-to-use HCI and high level of user experience are of great importance for the organizations in the automotive industry (Pettersson, 2016).

This master thesis aims to analyze the user perspective in relation to the preference of the in-vehicle functions existing today. Due to the latest innovations various technologies have been used in the automotive field to fulfill the demands of the customers. User-friendly HCI and high level of user experience have been stated in previous studies as important aspects to achieve customer satisfaction, but the researches are limited when it comes to the preference of the users. In order to answer the above, firstly a literature review of existing research was conducted to identify automotive user experience (UX) achievements and UX factors in automotive industry. Secondly, interviews were conducted to identify the most important in-vehicle functions used today in the automotive industry, place them into categories and support the definition of the survey. Thereafter, survey was used to receive the opinions of the users which is described in depth in the methodology chapter. It is important to identify the real opinion of the users to achieve a high level of user experience and fulfill the demands of the customers’ so organization in the automotive industry can reach a positive result.

1.2 Purpose Statement and Research Question

As mentioned in previous chapter, studies have defined the importance of User Experience in the automotive industry and the importance of user satisfaction (Savoy, Guo, & Salvendy, 2009; Leshed et al, 2008; Meschtscherjakov, 2009). The findings of the studies indicate a need for further studying to analyze the user perspective in relation to the preference of the in-vehicle functions existing today. This thesis aims to answer to the gap mentioned above and to identify the preference of the users towards functions focusing on functionality or functions focusing on entertainment.

In this paper when the term functionality is used it is related to functions in the vehicles that have a specific use. These functions provide some functionality in connection to for example safety and usability. When referring to functions of entertainment the term hedonic functions is used. Hedonic functions are the functions related to emotional aspects and characterized by the pleasant or unpleasant emotions experienced by the users (Hirschman and Holbrook, 1982). The research question for this study is:

**What are the UX factors preferred by the users? To investigate the importance of functionality over entertainment to users within the automotive industry**

The results of the thesis reflect on functions preferred by the users and how user experience can be achieved in higher level by identifying what is important for the users. The result of this research is of benefit to the organizations in the automotive industry. By proving the preferences of the users, organizations can benefit and focus on fulfilling the demands from their customers which therefore can produce a positive result for them.

To answer the question above an analysis of existing articles was executed in order to identify automotive user experience (UX) achievements and UX factors in automotive industry. Thereafter, interviews with the experts were conducted to identify the most important in-vehicle functions used today in the automotive industry and support in the definition of the survey. Moreover, a survey was created by mean of understanding the actual insights of the customers towards what functions would be preferred.
1.3 Topic Justification

Various studies have occurred regarding technological development in the automotive industry. The focus has been the need of the customers for new technologies and functions in a vehicle that exists today (Pfleging et al., 2012). There are also many studies focusing on how UX is used in the automotive industry describing the term UX automotive and different UX successes and factors. Studies have researched the user experience in connection to functions of the vehicles but have not studied the preference of those by the users (see for instance Leshed et al, 2008; Meschtscherjakov, 2009; Eckoldt, 2012).

As a result, the findings of the studies identified a gap in connection to the actual use and preference of these functions. Studies have investigated the increase in demand from customers for in-vehicle technologies as well as tested the user experience in correlation to different functions. In contrast, the researches today have not answered the question if customers prefer these new technologies due to the increase of safety and usability or because of the fun that in-vehicle functions offer. It is important to identify what users want and reach high user experience which is an important aspect of the evaluation of a product (Korber et al., 2013). For the reasons mentioned above, this study investigated the preference of functions by the users and what is more important to users of automotive industry; functions related to functionality or entertainment.

1.4 Scope and Limitations

The author of this master thesis is located in Paris, France and for that reason the research was be conducted in Paris. The research targets a specific group in order to collect accurate data which can result in specific results just for this group. The target group used for this paper is users holding a driving license and being over 18 years old. Consequently, the result of this paper might not be possible to be used for generalization for different target groups. Contrarily, the result of this research paper may be applied in other countries with similar target groups and cultural backgrounds.

1.5 Thesis Organization

The researched paper is divided into six main chapters. First chapter, introduces the reader to the subject, state the purpose of the study as well as justify the chosen topic. The second chapter includes the literature review of the subject, describing the terms User Experience, UX Design, technologies used in automotive industry and in-vehicle functions as well as a conclusion paragraph of how the above have inspired the thesis research. Chapter three describes the methodology of this study including the methodological approach and data collection. In chapter four, empirical findings of the data collection are presented in combination with the literature review. Lastly, chapter five and six include the discussion of the findings and research conclusion.
2. Review of literature

The aim of this chapter is to provide an overview of the existing literature as well as key concepts and theories that are relevant for this paper. Firstly, an explanation of Human-computer interaction (HCI) is provided and how HCI is used within the field of automotive. Secondly, a brief explanation of Internet of Things (IoT) is described to establish the base to understand in-vehicle technologies. Thereafter, there is a focus on User Interaction (UI), User Experience (UX) Design methods and theories to outline the importance of those in the automotive industry. Moreover, the need for new technologies in the vehicles and various functions that are implemented today is being discussed. The final part of this chapter describes the usage of the previous literature in this research paper.

2.1 Human-computer interaction (HCI)

Human-computer interaction (HCI) is a term describing the key aspect of understanding the interaction of humans with technology and how this interaction can be achieved efficiently (Zhang and Li, 2005). In the automotive field, HCI is referring to the interaction of drivers with new in-vehicle functions that are developed in the vehicles. Nowadays, the driver not only has to perform primary functions like braking and changing gears but also interact with In-Vehicle Information Systems due to the new technologies implemented (Harvey et al., 2011). In-Vehicle Information Systems are based on HCI and integrate most of the new technological functions which are characterized as secondary functions (Harvey et al., 2011). HCI aims to achieve efficient interactions between human and technology therefore, because of new functionalities an easy-to-use HCI needs to be achieved to reach a high level of user experience (Pfleging et al., 2012).

Additionally, it is not sufficient to develop a computer system that is not accepted by the ones who will be using it (McVehiclethy and Wright, 2004). Not only the dimension of usability needs to be considered but also the experience around it (McVehiclethy and Wright, 2004). The emotions have become increasingly important in the product design and during the HCI (Norman, 2004). The dependency and interplay between usability factors and hedonic attributes has arisen making the functionality of a product of same importance as the emotions associated with the use of it (Helander and Khalid, 2006).

Consequently, this study researches an understanding of which factors are preferred by the customers and in this way result to a higher value for the organization in the industry. In the next chapters, some of the evolutions of technology are described to introduce how technology has influenced the automotive industry.

2.2 Internet of things (IoT)

Another evolution of the past years is Internet of Things (IoT). IoT is characterized as technology and information around us as well as network devices that contain connectivity and allow devices and information that interact and exchange data (Jayavardhana et al., 2013). The new in-vehicle technologies developed are also referred in connection to IoT. The difference between the two terms, in-vehicle technologies and IoT, is mostly regarding the functionality. In the automotive industry, in-vehicle technologies focus on security, usability and entertainment while contrary the IoT is used as a wider term that comprises the autonomous vehicles and connected cars (Krasniqi and Hajrizi, 2016). Autonomous vehicles are vehicles
that are driven without the human interaction with functions that achieve autonomy (Fagnat and Kockelman, 2015) and connected cars are the vehicles equipped with Internet allowing sharing various data (Lu et al., 2014).

This paper focuses on the use of in-vehicle functions and not IoT but it is important to mention it in order for the reader to receive a clear view of the field today. Despite the technological evolutions accomplished the past years it is of great importance to understand the value of the users. This part is described in the following chapter.

2.3 User interface (UI) and User Experience (UX) Design

User interface (UI) and User experience (UX) Design are two terms that are used often together but do not have the same meaning. User interface design is related to the graphic design and presentation of a product (Galitz, 2007) while user experience (UX) design is referring to the optimization and user friendliness of the functions of the product (Garett, 2010). For this study UX has been chosen because of its relation to the overall experience between a user and a product and not only the visual part of it.

Pettersson (2016) is emphasizing that due to the competitiveness in the market today it is important to reach a high understanding of the users’ needs. Likewise, there is of great importance to understand all aspects of user experience (Pettersson, 2016), both the usability factors (Hasan and Chandra Gope, 2013) but also the emotional aspects of the user experience (Desmet and Hekkert, 2007). Therefore, it is important not only to understand the usability expected by a consumer but also the hedonic aspects of user experience (Kujala et al, 2011; Hasan and Chandra Gope, 2013). Traditionally in the automotive industry usability has been the most important aspect in the in-vehicle design but because of the high competition in the field to ensure customer fulfillment companies now are being directed towards other trends (Pettersson, 2016). Some UX design factors that customers are expecting from the vehicles are safety, comfort, being social in vehicle, emotion and energy management, freedom, relaxation and novelty (Pettersson, 2016). Thus, the importance of accomplishing functions in relation to usability but also the hedonic functions in a vehicle.

The importance of UX design has been explained and motivated. Additionally, for this study the reader needs to establish a ground foundation on how UX is experienced in the automotive industry and which methods exist to evaluate the above. Those aspects are described below.

2.4 User Experience (UX) methods and theories

User experience is one important aspect in today’s innovations and interactions between humans and technology. UX is referring to the interactions between users and products or services but also the experience the users encounter during the use of those (Roto et al., 2009). The increase of demands from customers and new technologies generated has resulted in tough competition in the automotive industry. For this reason, it is important to reach the customers’ expectations. Researches have shown a connection between user satisfaction and user experience. User experience is of great importance for the evaluation of the final product and is considered today a feasible measurement (Korber et al., 2013). Some examples of UXs factors defined are enjoyment, usability, safety and user acceptance (Roto, 2007). In the automotive industry the primary aim of UX is for the driver to reach the intended destination efficiently. Efficiency has an important aspect in the driving experience as drivers today expect to reach an intended destination quickly but also safely (Bayly, Youth and Regan, 2009).
Additionally, satisfaction and comfort are important factors to enhance the user experience and for the organizations to prominent against their competitors (Walker, 2001).

GOMS Analysis is one method existing to evaluate user experience. GOMS central aspect is to eliminate unnecessary user actions and functions. GOMS analysis is analyzing the goals, operators, methods and selections rules. Goals mean the goals the users need to accomplish, operators are the necessary actions to perform in order to achieve the goals, methods mean the procedure of accomplishing the goal and selection of rules meaning the rules of which method to be used (John and Kieras, 1999). By identifying the above, functions can be evaluated and test if they achieve quality (Resnick et al, 2013). GOMS Analysis is focusing on identifying different methods on accomplishing an action and then by defining rules chose the easiest-to-use with the assistance of the users (John and Kieras, 1999). GOMS Analysis is analyzing the behavior of the users to different goals of functions (Gray, John and Atwood, 1993). There are different variants of GOMS Analysis such as Keystroke-Level Model (KLM) and CMN-GOMS. KLM is estimating the execution time by first listing the sequence of operators and then the total execution time of each. Similarly, CMN-GOMS is predicting the useful characteristics of human interaction with a computer for a task without defining specific assumptions (John and Kieras, 1999).

Another user experience evaluation method is the Edge Case Brainstorming. This method is testing the extreme cases of user experience which other evaluation methods may dismiss. Additionally, it is proven that designs that reach high quality of extreme scenarios can be of the same quality and effectiveness in typical scenarios (Chair et al, 2013). Another important method to test the user experience of a technological function is user acceptance testing (UAT). Dillon and Morris (1996) define user acceptance as the willingness of users to utilize information technology to support tasks. User acceptance testing is establishing if a function of a process is working fully for the users (Davis, Bagozi and Warshaw, 1989). User acceptance has a significant role for the information systems used in any functions. It can increase performance gains if the users chose to use it, hence it is a determining factor for an information system (Dillon and Morris, 1996).

GOMS Analysis is often applied to skilled users it is not seen as suitable for this study as the background of the users is unknown. Thus, this study has used the GOMS Analysis as inspiration and umbrella term to the reflection of the results. Similarly, user acceptance has been used to reflect over the results of the study.

2.5 Need for new technologies in automotive industry

Because of the evolutions in technologies the past years people today demand continuous connection, access to information and autonomy. For this reason, various in-vehicle technologies have been developed in order to fulfill the demand from the users, in this case drivers. Since people spend lots of time in their vehicle everyday there is a high demand for entertainment functions in the vehicles to feel like a room environment in the vehicle (Pfleging et al., 2012).

The way vehicles are designed today has changed and computing capabilities have been integrated into various forms as digital in-vehicle mobile technology, navigation, on-board microprocessors and different entertainment systems (Yoo, 2010). There are several examples as touch-screens providing information to the driver as well as reducing the physical control (Pitts et al., 2014) and head-up displays which are displaying data about speed, temperature
without requiring from the driver to look away from the driver’s line sight (Soro et al. 2014). Next chapter describes in detail a few of these functions.

2.6 Driving tasks and In-vehicle functions

During driving, the driver has to perform various tasks that are identified as primary and secondary tasks (Hedlund et al., 2003). The primary tasks are directly connected to the driving while secondary tasks are performed during the driving but are not related directly to it (Hedlund et al., 2003). Lansdown describes navigating a route, monitoring the environment around the driver and maintaining a safe position as some primary tasks performed by the drivers (2002). Secondary tasks are enhancing the driving experience by providing information for the journey, support the driving with traffic information and entertain with the use of audio and screens (Engstrom et al., 2004).

Different in-vehicle technologies are applied today in the automotive industry. Some of these functions are related to usability and other to entertainment in order to reduce the distraction of the drivers but also reach successful user experience (Schidt, Spiessl & Kern, 2010). Schidt, Spiessl and Kern listed cameras and control units used for parking, fuel consumption processors, radars to detect the distance from other vehicles as functions (2010). Other examples of these functionalities are also dynamics radio volume, auto liftgate, adaptive cruise control, exterior keypad, no gas cap, destination download, airbag call, rear-view sensors and camera and rain sensing wipers (Pfleging et al., 2012).

2.7 Reflexion of review of literature

After the study of the literature existing today within the subject of in-vehicle functions and user experience a gap has identified in relation to the preference of functions for the users. Technologies have had an impact in the automotive industry with the digital innovations changing the functions existing in the modern vehicle today. IoT is one example but since the term is often referred in connection to autonomous vehicles in this paper the focus is in the in-vehicles technologies. In-vehicle technologies are focusing on security, usability and entertainment and these are the terms that this research paper examines in relation to the user experience. As mentioned in this chapter understanding the demands of the users is an important aspect for achieving high user experience for organizations in the automotive industry which may result to high value for the organizations. The findings of the previous studies have identified a need for further research in relation to the preference of the functions.

This master thesis resolves the existing gap by investigating the preference of the users to the in-vehicle functions existing today. User experience is proven having a significant role in the automotive industry. In order to, respond to the research question UX design was used to establish a ground. Additionally, GOMS analysis and Use Acceptance Testing were used to reflect over the evaluation of the results. These methods were used to achieve a scientific study and to proceed with data focusing on the user experience.
3. Methodology

This chapter presents the methodological approach used to justify and answer to the chosen research question. Furthermore, the chosen data collection is described and the methods for the data analysis. Additionally, this chapter presents how reliability and validity were maintained and the ethical considerations for this thesis.

3.1 Methodological Tradition

The aim of this research is to receive an insight of the users’ preferences to functions and establish a ground to understand the users’ perspective. Therefore, the chosen paradigm for this research was interpretivism. Interpretivism is assuming that not only one reality exists but it depends on the understanding of people, their ideology and the meaning that people assign to a phenomenon (Crotty, 1998). Moreover, in information systems interpretivism aims to understand how a system is influenced by a context (Walsham, 1993). As the main goal of this study was to achieve an understanding of which functions are preferred by the users as well as how user experience can be achieved in a high level interpretivism is suitable for this thesis study.

Positivism is the contrary of interpretivism and assumes that only one reality exists independent by the people (Creswell, 2014). Subsequently, positivism tries to predict a phenomenon and therefore is not suitable for this study. Similarly, critical research aims to understand changes by analyzing the social reality (Creswell, 2014). Additionally, action research focuses on understanding and resolving a problem by conducting a practical action to the real world (Creswell, 2014). Hence, critical research and action research were not suitable for this study since the aim of this paper aims to understand user experience and the preference of the users.

Exploratory research is aiming to investigate a problem that is not clearly defined or has not yet been studied (Creswell, 2014). The aim of this paper was to study a problem unexplored today. By analyzing the real preference from the users in the automotive industry new insights are gained and therefore exploratory research is most suitable to this research study. In contrast, descriptive design is used to study a situation, group or individual and observe its behavior (Creswell, 2014). Therefore, descriptive design is not applicable for this research study which aims to examine an unexplored situation. Additionally, because of the reason that explanatory research tests theories and relies on experiments, it is not suitable for this study (Creswell, 2014).

Moreover, this study is a variant of exploratory sequential design science. This form of study is characterized by one type of data being used to provide the basis for the collection of the other main sort of data (Mertens, 2005). This study used interviews to establish a ground for the survey that was developed. More details will be provided in the next chapters.

3.2 Methodological Approach

The approach suggested to the purpose and the research question of this study is mixed method. Mixed method is described as a combination of quantitative and qualitative research methods (Denscombe, 2014; Creswell, 2009). With the use of mixed method a study can achieve in-depth research and obtain stronger findings compared to other methods (Creswell, 2009).
Subsequently, for this study a mixed method has been used. The qualitative research aimed to discover the main functions used in the automotive industry while also receiving the knowledge of the expert of the field. Furthermore, the quantitative research is used to obtain the preference of the users to these functions. The combination of the two research methods and the merge of the results allows to result in scientific findings and identify the preference of the users. A literature review was conducted to analyze previous studies and discover automotive user experience (UX) achievements and UX factors in automotive industry.

Qualitative research can provide an in-depth understanding of phenomena by analyzing the meaning of data collected by participants (Creswell, 2009). Hence, for this study qualitative research method has been used for the data collected by the interviews. Additionally, qualitative research has also been used for the analysis of the open-ended question of the survey.

Creswell (2009) emphasizes that with the use of survey the data collected can provide an insight of trends and opinions of a population. Therefore, for the quantitative research, the data was collected by an open survey in order to identify users’ preferences to the functions. As a result, high level of user experience can be achieved by identifying the preference of the users.

### 3.3 Methods for Data Collection

During the development of the data collection the focus has been to test the user experience according to the preference of the users. Moreover, GOMS Analysis and User Acceptance, reported in previous chapters, were used as inspiration and ground to ensure scientific quality. Mixed method was used to join the data from the analysis of the literature and the data collected from the two interviews and the survey. Firstly, the literature was used to investigate the important aspects of user experience and the in-vehicle functions used today. Thereafter, when a ground was established, the questions for the interviews were developed. The two conducted interviews were used to gain a deeper understanding of the in-vehicle functions.

The data collected from the conducted interviews was used in order to develop the survey and cover the important aspects from the experts’ perspectives. The data collected by from the survey was used to provide a clear understanding of the preference of the users to the functions. By implementing mixed method and merging the data collected from the different methods it was resulted in the identification of preference of the in-vehicle functions. Lastly, to ensure a scientific result in connection to user experience GOMS Analysis and User acceptance testing were used as grounds and inspiration for the data collection. The two UX methods focus on achieving easy-to-use and user accepted functions and therefore are important for this study.

#### 3.3.1 Selection of participants

The aim of the selected participants has differed between the two data collection methods. The participants of the interviews have been selected based on their experience and expertise in the field of automotive to obtain knowledge and support. In contrast, for the participants of the survey the only precondition was to hold a driving license and be older than 18 years old, because of the reason that they are customers in the automotive industry. The two interviews were conducted in Paris, France. Contrarily, the survey was conducted online so that the research participants were not limit in one country.
3.3.2 Interviews as data collection

For the data collection required for this paper two interviews were conducted. To ensure a scientific result in connection to user experience the questions asked during the interviews were inspired by the theories discovered during the study of existing literature. Moreover, two interviews were conducted including two experts in the automotive field to identify the important functions used today and define categories for these functions. One of the experts is acquiring a position of a Leader Engineer for Technical Parts of the vehicles and the second one is acquiring a position of Connective Services Consultant.

The conducted interviews took place in Paris, France 26th of March 2019. The interviews were one-to-one interviews, interviews between one researcher and one interviewee (Denscombe, 2014). Firstly, an introduction occurred by the researcher explaining the aim of the interview. Secondly, questions were asked to the experts regarding their perspective of the technological evolutions and user experience in automotive industry as well as to identify the main in-vehicle functions used today. The data collected from the two interviews was used to formulate the survey and achieve an understanding of the experts’ perspective but was not the main data for this study.

3.3.3 Survey as data collection

A survey was sent and used to achieve an understanding of the users’ viewpoint. Creswell defines two types of survey design, longitudinal which refers to data collections obtained in a longer time and cross-sectional which refers to data collection at one point in time (Creswell, 2012). Because of the limited time of this study, the type of survey design suggested for this study is the cross-sectional survey design. The type of survey used for this research was web-based survey including a combination of scale questions to receive statistical data but also semi-structured, open-ended questions. The choice of open-ended questions was made to ensure that the users can express themselves openly. To achieve designing a good survey it is of great importance to perform a pilot test of the survey by testing the survey in a smaller audience, receiving feedback and correcting if needed (Creswell, 2012). Hence, for this study the survey was firstly presented to the two experts during their interviews.

Two scenarios were defined to place the user in a representative mode to achieve best results. Different questions related to the scenarios were formulated as well as personal questions to understand the profile of the person answering the survey. The first scenario was defined to determine if customers prefer vehicles with in-vehicle technologies related to UX factor of functionality while the second scenario was defined to determine if customers prefer in-vehicle technologies related to UX factors of entertainment. Following the description of the two scenarios the user was given open-ended questions to respond to. The survey was sent by the use of social media to different groups in order to receive participants with differ profiles. The survey was sent between 17th of April and 2nd of May.

3.4 Methods/Techniques for Data Analysis

The data collection conducted in this research paper provided statistical data but also data in text form. Subsequently, different methods were used for the analysis of the data. The quantitative data was analyzed and presented with the use of diagrams while for the qualitative data thematic analysis was used. Additionally, the two UX methods mentioned above, GOMS Analysis and User Acceptance, were used to analyze the results and support the result analysis of the data. The methods of data analysis are described in detail below.
3.4.1 Data analysis from interviews
Creswell describes thematic analysis as a method to present data to reflect the reality and present it effectively (2009). For the analysis of the data collected by the interviews thematic analysis was used. First step was to convert the recorded interviews to written form. Secondly, the data collected was reread in order to familiarize with the data and get a general view of it. Following, an initial coding occurred identifying the meaningful features of the data and resulted to identification of key information. During the analysis of the interviews, the primary functions used in the automotive industry today were identified which were later used in the survey. Only the functions identified by both experts were used in the scenarios.

3.4.2 Data analysis of survey
A typical process for the analysis of the data collected by the survey is 1) identifying the response rate, 2) identifying trends by presenting data in form of statistics, 3) combine questions to develop scales (Creswell, 2012). This process was used for the scale questions of the survey by firstly identifying the response rate. Secondly, the trends and preferences were identified by presenting the statistics and frequency from the data. To represent the frequency of responses of the different questions Pivot tables were used. Pivot tables were used to summarize data and present the results in the form of tables (Power, 2008). Bar charts are the graphs used to represent frequency efficiently (Denscombe, 2014). In order to present the frequencies of the data accurately bar charts were used for the categorical data while for the numerical data histograms were used. The data analysis started by firstly importing it into Excel and was thereafter manually analyzed. At this step duplicates were removed, and syntax changes were made. The changes did not impact the semantics of data but were necessary in order to read the data within the Pivot tables. The last step was to connect the questions and present the results in form of diagrams to represent relations between data.

Following the above-mentioned steps thematic analysis was used in order to interpret the open-ended questions. Thematic analysis is a method to identify themes and patterns in the qualitative data (Clarke and Braun, 2006). Responses from the open-ended questions were processed by firstly creating acquaintance with the data to achieve an understanding and identify patterns. The content of the collected data was then categorized, and codes were identified according to similarities from the open-ended questions. Differently related themes were created for each question from the survey. These themes were a result of the choice of scenario, the participants’ opinion regarding the in-vehicle impact on the automotive industry as well as the consideration of user preference by the organizations in the automotive industry.

Once the data was analyzed and represented in different scales, SPSS (Statistical Package for Social Science) program was used to identify possible correlations and the level of significance between different variables. The variables that were inserted into the SPSS program were scenario choice, gender and age. Pearson Chi-square test was used to measure possible significances between the variables identified by the p-value. If the p-value is below .05 there is a significance while if it appears higher than the given value it suggests there is no significant difference between the values.
3.5 Reliability, Validity

Reliability reflects whether the results of a study are consistent and stable (Babbie, 2010). For this study reliability was achieved through the measure of consistency across time. The surveys were conducted in no time limit for the participants. Additionally, reliability was ensured by checking frequently the responses from the survey to insure no mistakes were made. Furthermore, validity reflects the measurement of real meaning of the findings (Babbie, 2010). Validity on this paper was achieved with the use of mixed method of the data from the qualitative and the quantitative research. In this research paper validity is achieved when the data obtained by the survey is combined with the expertise received by the interview of the two experts. The data was compiled and analyzed together which resulted in findings measuring the variable that they intended.

3.6 Ethical Considerations

An important aspect of the research process was to take ethical principles into consideration. The importance of these becomes central to any research requiring data collection and storage of personal data that reflects any opinions and emotions that participants may have upon the subject. To ensure the above, Creswell (2014) describes that all ethical issues should be discussed in prior and participants should be aware of the purpose of the study.

The participants of this study were informed about the aim of the study as well as that their responses would not be used for purposes beyond the study. This ensured that a freedom of expression was encouraged in the responses received in order to make them trustworthy. All participants were also ensured that their data was handled with safety and care as well as that they were to keep their anonymity. For the interviews the participants were informed about the above by speech face to face while for the surveys the participants reviewed a missive before proceeding to the survey (See Appendix A).
4. Empirical findings

This chapter represents the findings from the data analysis of the survey and the interviews. Firstly, the findings from the interviews with the two experts in the automotive industry are presented defining their opinion regarding the user experience in the automotive industry as well as the main functions used in the vehicles today connected with the new technologies evolved. Secondly, the findings from the survey are presented. The survey was defined with the help of the experts and was later sent to volunteer selection of people with the use of social media. Sixty-one responses were received from the survey but because of one duplicate sixty remained for the analysis.

4.1 Findings from interviews

In the following two chapters the findings discovered by the interviews are presented. First chapter presents findings of the open-ended question following with the second chapter which presents the functions identified by the experts. Expert one is having the role of Leader Engineer for Technical Parts of the vehicles and expert two is a Connective Services Consultant; both experts working in automotive industry. The data collected from the conducted interviews was used to develop the survey and cover the important aspects of the experts’ perspectives but not the main data input for the thesis study.

4.1.1 User experience in the automotive industry

First finding from the interviews is the explanation of how technology has an evolutionary role in the automotive industry. Both of the experts agree that the latest technological evolutions have impacted significantly the automotive industry. The experts express that today’s vehicles are different from the vehicles a few years ago. Vehicles today, according to the experts, are having more functions than before and the focus is not on the driving but on how to make the vehicles more modern and more integrated with technology.

“Technology is today taking over and for this reason the automotive industry must keep up with these evolutions occurring.” (Expert two)

“[…] in the automotive industry the focus is no longer on how to produce vehicles that function to drive but on how to produce vehicles that have these extra functions and on how to include technology in all the functions” (Expert one)

Second finding is related to the consideration of user experience in the automotive industry. When the experts were asked, if according to their expertise and opinion, the automotive industry is aware about the preference of the users the answers were identical. According to the first expert user experience is not a term he has heard before. Later when the term was explained the expert stated:

“Organizations in the automotive industry have the customers as focus. The customer needs to be satisfied and therefore organizations seek to find out what the users want” (Expert one)

Moreover, when the expert two was asked the same question he already knew about the term of user experience and responded similarly with the exert one describing:
“Of course organizations vehicle and are aware of the needs and demands of the drivers today. Customer has been and will be the focus and primary aspect in the automotive industry” (Expert two)

Contrary, both two experts did not know how exactly organizations seek after the preference of the users and how often this investigation occur.

4.1.2 Functions developed by the experts

The experts were asked to define some main functions used today in the vehicles and place them under the categories entertainment and functionality. Table 1 is representing the functions described by the experts, the scenario that they were used as well as the rate of choice from the experts which defines if one function was named only by one expert or from both. The table below represents the functions identified by the experts. The rate of choice from the experts presents if the functions were stated by both experts or not.

Table 1: Functions identified by the experts

<table>
<thead>
<tr>
<th>Functions</th>
<th>Scenario used</th>
<th>Rate of choice from the experts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emergency brake assist role</td>
<td>One</td>
<td>2 of 2</td>
</tr>
<tr>
<td>Software for traffic information</td>
<td>One</td>
<td>2 of 2</td>
</tr>
<tr>
<td>Adaptive cruise</td>
<td>One</td>
<td>2 of 2</td>
</tr>
<tr>
<td>Rear view sensors</td>
<td>One</td>
<td>2 of 2</td>
</tr>
<tr>
<td>Sensors for parking</td>
<td>One</td>
<td>2 of 2</td>
</tr>
<tr>
<td>Control units to measure distance</td>
<td>One</td>
<td>2 of 2</td>
</tr>
<tr>
<td>Stolen vehicle software</td>
<td>One</td>
<td>2 of 2</td>
</tr>
<tr>
<td>Smart home integration</td>
<td>Two</td>
<td>2 of 2</td>
</tr>
<tr>
<td>Heated seats</td>
<td>Two</td>
<td>2 of 2</td>
</tr>
<tr>
<td>Automatic liftgate</td>
<td>Two</td>
<td>2 of 2</td>
</tr>
<tr>
<td>Keyless entry</td>
<td>Two</td>
<td>2 of 2</td>
</tr>
<tr>
<td>Screen on the back seats</td>
<td>Two</td>
<td>2 of 2</td>
</tr>
<tr>
<td>Head up display</td>
<td>Two</td>
<td>2 of 2</td>
</tr>
<tr>
<td>Touch-screens</td>
<td>None</td>
<td>1 of 2</td>
</tr>
<tr>
<td>Fuel consumption processors</td>
<td>None</td>
<td>1 of 2</td>
</tr>
<tr>
<td>Airbag call</td>
<td>None</td>
<td>1 of 2</td>
</tr>
<tr>
<td>Wi-fi hotspots</td>
<td>None</td>
<td>1 of 2</td>
</tr>
<tr>
<td>Heated wipers</td>
<td>None</td>
<td>1 of 2</td>
</tr>
<tr>
<td>Voice recognition</td>
<td>None</td>
<td>1 of 2</td>
</tr>
<tr>
<td>Face recognition</td>
<td>None</td>
<td>1 of 2</td>
</tr>
</tbody>
</table>

Only the functions that were stated by both two experts were used in the survey. These functions are lighted with bold text in the table below. The functions identified as related to entertainment were used on scenario two while the functions related to functionality were used on scenario one.
4.2 Findings from the survey

In the following two chapters the findings discovered by the survey are presented. First chapter presents the quantitative data findings in form of tables and diagrams following with the second chapter which presents the qualitative data represented in the form of themes for each question asked in the survey.

4.2.1 Quantitative data

The response collected from the survey were sixty answers. From the answers there was a 52%, 31 of 60, of females responded and 48%, 29 of 60, of males responded. The variation from the answers of the age was 45%, 27 of 60, were between the age of 18 and 30, 28%, 17 of 60, were between the age of 31 and 43 and lastly 27%, 16 of 60, were of the 44+ age. To present the results of the qualitative data from the survey bar charts have been used. The following figure 2 presents the result from the participants’ choice of the scenario. 80% (48 of 60) of the participants chose scenario one related to functionality while the rest 20% (12 of 60) chose scenario two, related to entertainment. In chapter 4.2.2 the motivation of the answers is presented.

![Figure 1: Choice of scenario](image)

Second figure, 2, is representing the participants response to the question “Based on your opinion has in-vehicle technologies impacted the automotive industry? if yes how?”. 77% (46 of 60) of the participants responded with yes, 13% (8 of 60) responded with no, 8% (5 of 60) responded with do not know and finally 2% (1 of 60) responded with a yes and no. The second part of the question which requested the motivation of answer is presented in chapter 4.2.2.
Following figure 3 represents the participants’ responses to the question “Based on your opinion do organizations in automotive industry take into consideration the preference and opinion of users?”. 66% (39 of 60) of the participants responded with yes, 14% (8 of 60) responded with no and rest 20% with do not know (12 of 60). Additionally, in chapter 4.2.2 the motivation of the answers is presented.

4.2.2 Qualitative data
The qualitative data collected from the survey is presented in the chapters below. Each question of the survey resulted to a theme collection, therefore five theme collections were defined. Table 2 represents the different theme collection of each question.
Firstly, the motivation for the choice of scenario from the participants is represented divided into themes. Secondly described, the results from the data collection regarding the participants’ perceptions in the in-vehicle technologies impact. Following, the data results from the participants regarding the consideration of user preference in the automotive industry.

4.2.2.1 Scenario one
In the choice of scenario 80% of the participants chose the scenario one. Table 3 below represents the motivation of choice of scenario dived into themes as well as the frequency of the themes after the coding was completed.

<table>
<thead>
<tr>
<th>Question</th>
<th>Themes</th>
<th>Sub-themes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motivation of choice of scenario one</td>
<td>Safety</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Assist in driving</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preference</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Luxurious option</td>
<td></td>
</tr>
<tr>
<td>Motivation of choice of scenario two</td>
<td>Entertainment</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Latest technology</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Confidence</td>
<td></td>
</tr>
<tr>
<td>Motivation of in-vehicle impact</td>
<td>New functions because of new technologies</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Autonomous</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Customer need</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Assurance</td>
<td></td>
</tr>
<tr>
<td>Consideration of user’ preference</td>
<td>Economic reasons</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Concurrent relation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preference of customers</td>
<td></td>
</tr>
<tr>
<td>Functions preferred by the users</td>
<td>Assistance in driving</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Self driving</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Driver assistance</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Driving suggestions</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Speed control</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Voice assistance</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Parking assistance</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sensors for traffic</td>
<td></td>
</tr>
<tr>
<td>Connectivity</td>
<td>Face recognition</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mobile control</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Voice recognition</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Screens</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Music plugin</td>
<td></td>
</tr>
<tr>
<td></td>
<td>GPS</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bluetooth connection</td>
<td></td>
</tr>
<tr>
<td>Safety functions</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The themes identified were safety, assist in driving, preference and luxurious option. These themes are relevant to this study because they are arising important aspects of the user’s preference. The following part of this paper is describing the motivation of choice of scenario in depth providing samples of answers received by the survey.

**Theme one – Security**

First theme that was identified in choice of scenario one was security. The participants experienced that scenario one is a better and more suitable choice because of the safety aspects it includes. One participant stated that:

“Safety is important to me.”

Similarly, two other participants agreed and expressed:

“Security and comfort are priority number one for me.”

“Safety is more important than comfortability.”

Additionally, as a result of the functions of the vehicle in scenario one participants experienced that those functions are of greater importance than the ones in scenario two because they offer a more secure environment.

“That vehicle is the safer one to drive, the equipment is meant to make my drive safer and that is far more important to me than screens on the back of the seats.”

Likewise, participants considered the scenario one to be more suitable for them because it increases the security of the driver and the others by supporting in driving and parking.

<table>
<thead>
<tr>
<th>Theme</th>
<th>Frequency of data</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety</td>
<td>24</td>
<td>Safety as a theme is including answers from participants in connection to various aspects of security and safety that motivated them in the choice of scenario.</td>
</tr>
<tr>
<td>Assist in driving</td>
<td>5</td>
<td>Assist in driving as a theme is related to motivation of choice of scenario related to functions for assist in driving and support while driving</td>
</tr>
<tr>
<td>Preference</td>
<td>14</td>
<td>Preference as a theme is including participants' answer related to choose of scenario because of reasons of personal preference</td>
</tr>
<tr>
<td>Luxurious Option</td>
<td>5</td>
<td>Luxurious option is the last identified theme related to opinions for not choosing the scenario two because it seems too luxurious and not in priority</td>
</tr>
</tbody>
</table>
“[..], since I am more interested in security regarding my surroundings, in that way I will be safe as well as my surrounding will be safer from me if I make mistakes while I drive or park.”

**Theme two - Assist in driving**

Second theme that was established was assist in driving. This theme, assist in driving, has an influence on the choice of scenario. The participants of the survey experienced that because of the in-vehicle technologies implemented in the scenario one the vehicle can provide some assistance while driving helping the driver to focus on the driving with no distractions. One of the participants is described:

“I prefer focus technologies that is supporting my driving. When I am in the vehicle I want to focus on my driving and the surrounding environment of the vehicle, not anything else.”

Likewise, using the latest technologies to implement functions that are providing some support while driving in the city or on main roads is preferred by the drivers in comparison to other functions.

“Emergency break, park assist and cameras calculating and altering me to vehicles in my immediate surrounds are especially helpful in city and highway driving. These are most valuable to me than controlling home systems (something easily done by mobile phones too now) and having entertainment. [..]”

Additionally, assist in driving is experienced as an important aspect to the participants and more specifically support in parking is appreciated and preferred by the participants. Two expressions of participants were:

“The functions provided are more useful and practical I like the idea of my vehicle to notify me when I am approaching the other vehicles a bit too much and also to assist in the parking.”

“The functions provided are more useful and practical, assist in driving is really important for me and to receive some help while parking.”

**Theme three – Preference**

Another theme that was identified is Preference. The participants have expressed opinions in choice of scenario one due to various aspects of personal preference without identifying a specific reason for this choice despite than personal impression. Two participants expressed that the functions are more helpful and preferable for them:

“More preferable for me as a driver and owner of the vehicle.”

“The options mentioned in the first scenario are the most important items for me as a driver.”

While similarly, the motivation of choice of scenario one by other participants is due to the fact that they experienced scenario one to be more modern and more interesting for them:

“Alternative one seems more modern and has bigger possibility to offer wishing result.”

“More interesting/ helpful functions.”
Theme three – Luxurious option

Last theme that was identified is Luxurious option in contrast with the previous themes this one is stating the opinion of participants that led them to not choosing scenario two and for that reason chose scenario one. This theme was created because of the aspects defined by the participants in the survey experiencing scenario two to include functions that are not as a personal priority for them. Additionally, considering this choice of functions as a more luxurious option that they were not interested in. Participants expressed the functions of scenario two to be no practical:

“Vehicle in the first scenario is a vehicle that have advanced features as that vehicle about driving safely and comfortably. The second is more fancy feature where i feel it is not practical.”

Furthermore, participants disclosed that the functions presented in scenario one are core functions in the vehicle and for this reason seem important for them while scenario two is including functions of less importance:

“I’d rather choose core functions than extra stuff that in the end sounds quite unnecessary […]”

“There is no need for functions as screen on the back seats of a vehicle and mobile unlock of the vehicle. These are all extras in the vehicle and are not of importance for me.”

4.2.2.2 Scenario two

When asking the participants to choose a scenario 20% of the participants chose the scenario two. Table 4 presents the motivation of choice of scenario dived into themes. Additionally, it provides a description of the themes as well as the frequency of the themes after the coding was completed.

Table 4: Theme table for motivation of choice of scenario two

<table>
<thead>
<tr>
<th>Theme</th>
<th>Frequency of data</th>
<th>Example quotes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entertainment</td>
<td>3</td>
<td>Theme entertainment is related to the choice of scenario two by the participants because of motivation of opinion related to entertainment and fun</td>
</tr>
<tr>
<td>Latest technology</td>
<td>6</td>
<td>Technology as a theme is including answers from the participants in connection to various aspects of new technology</td>
</tr>
<tr>
<td>Confidence</td>
<td>3</td>
<td>Confidence is the last theme identified including participants’ choice of scenario two because of reasons in relation to emotional aspects and confidence</td>
</tr>
</tbody>
</table>
The themes identified were entertainment, latest technology and confidence. Similarly, to previous table these themes are of great importance to the study since they provide an understanding of the users’ preference and motivation of it. Following sections describe into depth the themes of the table above as well as providing examples of participants expressions from the survey.

**Theme one – Entertainment**

First theme that was identified was in relation to entertainment. This theme is including different aspects of fun and entertainment that influenced the participants in choosing scenario two. The participants stated that scenario two is in comparison to scenario one more fun and that the participants as drivers prefer to experience amusement while driving. Some expressions of the participants are:

“I want to have fun in my vehicle”

“Sounds more fun.”

“Scenario two sounds more fun.”

**Theme two – Latest technology**

Second theme identified by the choice of scenario two is the theme of latest technology. The participants of the survey are describing the importance of technology for them. In contrast with scenario one, scenario two is providing according to them new technology and constant connection and is, therefore, a preferable option:

“Overall Connection is important.”

“I love to find all the latest gadgets in the vehicles today.”

Additionally, the participants indicated that the functions described in scenario two are more interesting and of greater value than the ones described in scenario two because of bigger control and use of the latest technologies:

“Being able to control my house’s equipment when I'm not there sounds more interesting and helpful than parking sensors”

**Theme three – Confidence**

Confidence is the last theme that was identified in relation to emotional aspects. The participants motivated their choice of scenario because of reasons related to confidence. The participants expressed confidence in their driving skills and therefore do not need the functions defined in scenario one. Some examples of the expression of the participants are:

“Convenience as well as self-confident in my driving skills.”

“I know how to drive and park, so don't need software to help me, therefore option 1 is not so useful.”

4.2.2.3 In-vehicle technologies impact in the automotive industry

When the participants were asked the question of “Based on your opinion has in-vehicle technologies impacted the automotive industry? if yes how?” Forty-six of sixty (77%) of the participants responded with yes and forty-two gave a motivation for their response. Only the
answers of yes were coded and transformed into themes. Table 5 represents the different themes discovered by the data analysis of the answers to the question above.

<table>
<thead>
<tr>
<th>Theme</th>
<th>Frequency of data</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>New functions because of new technologies</td>
<td>16</td>
<td>This theme is related to answers of the participants in the opinion of the in-vehicle technologies have impacted the automotive industry because of new functions that appear and are implemented</td>
</tr>
<tr>
<td>Autonomous</td>
<td>2</td>
<td>Environment and autonomous vehicles as a theme are including opinions of the participants in relation between in-vehicle technologies impact in automotive industry with environmental impact and autonomous vehicles related</td>
</tr>
<tr>
<td>Customer need</td>
<td>6</td>
<td>Customer need theme is including opinion of participants in the impact of in-vehicle technologies in the automotive industry because of customer needs</td>
</tr>
<tr>
<td>Assurance</td>
<td>13</td>
<td>Assurance theme is including opinion of participants in the impact of in-vehicle technologies in the automotive industry because of security reasons</td>
</tr>
<tr>
<td>Manufacturers</td>
<td>5</td>
<td>This theme is related to answers of the participants in the opinion of the in-vehicle technologies have impacted the automotive industry in connection to manufacturers</td>
</tr>
</tbody>
</table>

The themes that were identified were new functions because of new technologies, autonomous vehicles, customer need, security and manufactures. For the reason that not all the themes are considered valuable for this study only the themes new functions because of new technologies, customer needs and security are described in depth below with examples of the states of the participants.

**Theme one - New functions because of new technologies**
First theme that was identified when asking the participants about their opinion if in-vehicle technologies have impacted the automotive industry was in relation to that new technologies are the reason for creating new functions. The participants expressed that the vehicle of today is not the same as the vehicle a few years ago. According to them, vehicles nowadays are including several functions that may not be directly connected with the driving itself:

“I think that in-vehicle technologies had a huge impact on the automotive industry. Buying and owning a vehicle is no longer about transport alone, it's entertainment, information, navigation, providing safety and making it easier to drive”

“I believe so due to the fact that a vehicle today is not just about driving it but also because all the other functions it has.”
Furthermore, another aspect of the new functions created because of the in-vehicle technological evolutions is the importance of connectivity. Participants described that today there is of great importance to be connected and to assure that connectivity is achieved at all times. Therefore, new functions have been created in cooperation with new technologies:

“[..] they start cooperating with technology companies to deliver integrated solutions and high connectivity.”

“[..] vehicles are autonomous and more connected.”

Another argument for the creation of new functions in the vehicles is because of customer and competitive advantages. Organizations in the automotive industry can gain advantages after implementing these functions both in relation to their competitors:

“Based on how many safety functions as well as cool and functional technologies, the vehicles that has newer and better features will have a competitive advantage. [..] The technologies in the vehicle have become an essential for the customer”.

“Yes for sure. It’s all about digitalisation and competition.”

**Theme two - Customer need**

Second theme is regarding the impact of the in-vehicle technologies because of the need and expectation from the customers. Participants have expressed that nowadays technology is important for the drivers. Additionally, according to the users’ perception an increase of demand from the customers has occurred. Some of the participants stated:

“Because customers will focus more on in-vehicle technology while buying their vehicles, then customer choice will affect manufacturing.”

“[..] nowadays that’s more and more important for consumers it seems.”

Another interesting remark in this theme is the social recognition that a vehicle implemented with the latest in-vehicle technologies provides to its drivers. Participants argued that not only the practical aspect is important for the drivers but also the social recognition they receive owning a vehicle with the latest in-vehicle technologies:

“People look for better in vehicle technology, accompanied by a nice design and safety features.”

“People are more keen to buy premium vehicles in order to fulfill their need of social recognition and security.”

**Theme three – Assurance**

Lastly, for the themes regarding the impact of in-vehicle technologies in the automotive industry the latest described theme is in connection to assurance. Assurance is an important aspect for the participants describing that the latest in-vehicle technologies have impacted the organizations in the automotive industry by providing more security and safety functions.

“[..] by providing some very important safety and nice to have features. Driving in today’s times with PDC, cruise control, keyless starting, Bluetooth, navigational systems, service
reminders, computer based technology. However, only if one can’t afford all the nice-to-haves.”

“Lots of clever solutions, electric driven vehicles, improved comfort and trust in the vehicle to provide safety technology has made driving vehicles almost effortless for drivers [..].”

4.2.2.4 Consideration of user preference in the automotive industry

In the question of “Based on your opinion do organizations in automotive industry take into consideration the preference and opinion of users?” Thirty-nine of sixty (66%) of the participants responded with yes while eighteen of them gave a motivation for their response. Table 6 represents the different themes discovered by the data analysis of the answers to the question above.

Table 6: Themes table for consideration of user preferences

<table>
<thead>
<tr>
<th>Theme</th>
<th>Frequency of data</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economic reasons</td>
<td>5</td>
<td>This theme is related to answers of the participants in the opinion of automotive industry taking into consideration the customer preference because of economic reasons</td>
</tr>
<tr>
<td>Concurrent relation</td>
<td>7</td>
<td>Concurrent relations as a theme are including opinions of the participants of automotive industry taking into consideration the user preference in connection to their concurrent relations</td>
</tr>
<tr>
<td>Preference of customers</td>
<td>6</td>
<td>Preference of customers theme is including opinion of participants that automotive industry is considering the opinion of users to fulfill their needs</td>
</tr>
</tbody>
</table>

The themes that were identified were consideration of users’ preference because of economic reasons, concurrent relation and preference of customers. Below the three themes are described in depth providing example from the participants.

**Theme one – Economic reasons**

First theme is the consideration of preference of the users because of various economic reasons and advantages that organizations in the automotive industry may receive if applying those into their vehicles. Participants are describing the possibility of organizations in the automotive industry to consider and fulfill the requests from their customers but for organization’s benefit. While users’ preferences are applied in the new vehicles the prices are rising and all the extra functions come with an additional extra charge:

“But when choosing a new vehicle it seems the combinations of extras are always designed in such a way that you must choose a set of options included in the package and then pay expensively to add one or two things (like a bull bar, spare tyre).”
“Features get better. But anti highjacking could be automatically installed in all vehicles PRIOR to purchase. This would assist in thefts, but the vehicle industry doesn’t assist as they would sell less vehicles.”

Additionally, participants expressed that with the new functions applied and the new technologies that are added in the vehicles the target group is changing and those impacts are more possibly to be implied in the luxurious vehicles where the target group is wealthier:

“But their sample group of users are selective not accumulative. They take rich users opinion for luxury developments”

Theme two - Concurrent relation
Second theme identified is due to the concurrent advantages that organizations may achieve if they fulfill the users’ preferences. Participants expressed that organizations may apply the demands requested from their users’ but with the only gain to achieve advantages against their concurrent.

“I am not sure about this because I believe the focus is against their concurrent and not users themselves.”

“[..] because the automotive industry struggles and especially german oems see new brands from china as serious competitors. So they have to figure out an unique selling point or make it better than the others.”

Meanwhile, participants believe that organizations are not always taking a step forward daring to create something new except another organization has already tried and has succeed.

“Few makers take chances in creating something different. Only when one company takes a chance and is successful, others follow suit.”

Theme three - Preference of customers
Preference of customers is the last theme identified. This theme is created because of the clear consideration of user’s preference by the organizations in the automotive industry. The participants of the survey expressed that organizations are taking into consideration the demands from the users, drivers, because it is important to offer the functions they want and inquire.

“I would say yes, I think they try to understand what the drivers wants and build functions based on that.”

“I think that organizations in automotive industry take into consideration the preference and opinion of user because all latest vehicles are equipped with things that drivers-consumers want.”

“I think that the automotive industry is the one who creates the preferences so the users feel like those vehicles were created just for them.”

4.2.3 Quantitative analysis of the qualitative data
The chapter presents the response of the participants when asking them “What functions would you like to have in a vehicle?”. The participants of the survey had the option of choosing more
than just one function and could reply in form of text. After the data was manipulated three main themes were identified, assistance in driving, connectivity and safety. In the themes of assistance in driving and connectivity multiple functions were identified which are represented below.

Table 7: Theme table for functions preferred by the users

<table>
<thead>
<tr>
<th>Theme</th>
<th>Sub-themes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assistance in driving</td>
<td>Self driving</td>
</tr>
<tr>
<td></td>
<td>Driver assistance</td>
</tr>
<tr>
<td></td>
<td>Driving suggestions</td>
</tr>
<tr>
<td></td>
<td>Speed control</td>
</tr>
<tr>
<td></td>
<td>Voice assistance</td>
</tr>
<tr>
<td></td>
<td>Parking assistance</td>
</tr>
<tr>
<td></td>
<td>Sensors for traffic</td>
</tr>
<tr>
<td>Connectivity</td>
<td>Face recognition</td>
</tr>
<tr>
<td></td>
<td>Mobile control</td>
</tr>
<tr>
<td></td>
<td>Voice recognition</td>
</tr>
<tr>
<td></td>
<td>Screens</td>
</tr>
<tr>
<td></td>
<td>Music plugin</td>
</tr>
<tr>
<td></td>
<td>GPS</td>
</tr>
<tr>
<td></td>
<td>Bluetooth connection</td>
</tr>
<tr>
<td>Safety functions</td>
<td></td>
</tr>
</tbody>
</table>

First figure 4 represents the assistance in driving category with a total response of 26 of 60 responses. This category is including functions that are supporting the user while driving and can ease the way of driving. These functions are driver assistance with a 4% rate, parking assistance with a 27% response rate, speed control with an 8% rate, driving suggestions with a 4% rate, voice assistance with 8% response rate and sensors for traffic at a 46% response rate.

Figure 4: Assistance in driving: Functions preferred by the users

The figure 5 below represents the category of connectivity with a response rate 24 of 60. This category is including functions in direct relation to connectivity, different technologies that can be used in order for the drivers to remain connected and use while driving. These functions are Bluetooth connection with a response rate of 25%, face recognition with 8% rate, mobile...
control with a 8% rate, music plugin with 21% response rate, screens with 8% rate, voice recognition with 8% response rate and GPS with a 21% rate.

![Figure 5: Connectivity: Functions preferred by the users](image)

Last is the safety category with a total response rate 16 of 60. This category is including functions that are made to provide safety and security to the drivers and vehicle passengers while driving. The participants of the survey were not specific in which type of functions related to security they would like to have in their vehicles while stating that security functions are the ones they prefer in a vehicle.

4.3 Data significance

In the following chapter significance is presented. SPSS program has been used to discover possible significance with the use of Chi-Square also named Pearson Chi-square test ($\chi^2$). In order to use the Chi-square test null hypothesis (Ho) were defined and asymptotic significance was identified. The results from the Chi-Square tests proved that there is no significance between the values that were tested since p value was in all cases bigger than 0.05 (Appendix K). Therefore, this study has not used the result of the Pearson Chi-square test since no significance was detected.

4.4 Summary of findings

This chapter presents the summary of the findings from the interviews and surveys. The data correlation, as described above, does not provide any important value to this study and is not described below. Additionally, GOMS Analysis and User Acceptance Testing is used to reflect over the results and is described in discussion chapter.

4.4.1 Summary of findings from the interviews

The results of the two interviews have proven a technological impact in the automotive industry and an evolution of the functions in the vehicles today. According to the experts, vehicles today
are more modern and more integrated with technology. Another finding from the interviews is the importance of user experience in the field. Both experts agree stating that users are the focus for the organizations in the automotive industry and their needs must be fulfilled. These results were compared to the opinion of the users and are discussed in the discussion chapter.

Furthermore, the answers of the interviews were used to formulate the survey. Only the functions that were stated by both experts were used in the survey. The functions identified as related to entertainment were used on scenario two while the functions related to functionality were used on scenario one. Some of the identified functions were rear view sensors, sensors for parking, control units, and keyless entry.

4.4.2 Summary of findings from the surveys
The results of the survey have demonstrated the users’ opinion for the impact of in-vehicle technologies in the automotive industry. Users described that nowadays there is an impact of the in-vehicle technologies in the automotive industry because of the evolutions of the technology in general and because of the demands from the customers. Additionally, the results of the proved a preference of the users for the scenario one which is related to the functionality. The survey also identified few functions that are preferred by the user’s in relation to assistance in driving, connectivity and safety functions. Lastly, users expressed the possibility of organizations in the automotive industry to consider and fulfill the requests from their customers but for organization’s benefit.
5. Discussion

User experience has been proven to obtain a significant part in the implementation of functions and methods (Pettersson, 2016; Savoy, Guo, & Salvendy, 2009). The research problem of this study was how organizations in the automotive industry can achieve user experience by identifying the preference of the users. The aim of this study was to investigate which UX factors are preferred by the users; functions related to entertainment or functions related to functionality. Previous studies have defined entertainment, and functionality as some of the main UX factors used in the automotive industry (Walker, 2001; Bayly, Young and Regan, 2009). The research question of this study was “What are the UX factors preferred by the users? To investigate the importance of functionality over entertainment to users within the automotive industry”.

5.1 Technology in the automotive industry

Technological evolutions have changed the functions embedded in the vehicles and the demands from the customers have evolved (Yoo, 2010; King and Lyytinen 2005). The technologies used in the vehicles today have increased producing modern vehicles with digital innovations (Henfridsson, Mathiassen and Svahn, 2014; Pfleging et al, 2012). Based on the data collected by the interviews, the experts agree that technological evolutions have had a big impact on the automotive industry changing and developing new functions of the vehicles. Additionally, based on the experts’ perspective the focus of the automotive industry is not on the driving but on how to produce modern vehicles integrated with technology. Likewise, 77% of the users responded to the survey that in-vehicle technologies have impacted and changed the functions in the vehicles. Users perceptions demonstrate that technological evolutions have led to the creation of new functions because of customers demand to have constant connection and include in the vehicles the latest digital innovations. Additionally, based on the users’ responses from the survey, security has increased with the technological impact on the vehicles providing safety features.

5.2 Importance of user experience

As a result of the technological innovation and increase of competitiveness in the automotive industry user experience and satisfaction are important for organizations (Pettersson, 2016; Pfleging et al, 2012). Because of the increase of demands from customers and technological evolutions, it is important for organizations to achieve customers’ expectations and a high level of user experience (Roto et al, 2009; Korber et al., 2013). The opinion of the experts based on the interviews that were conducted prove the importance of user experience. Experts perspective is that the customers’ needs are a primary goal for the organizations in the automotive industry and for this reason they are seeking ways to accomplish the demands of the users. Contrarywise, the opinion of the users is in contrast with the opinion of the experts. While 66% of the users responded in the survey that organizations are taking into consideration the preference of users, the qualitative data presented that the users do not agree that it is for the customers’ benefit. While organizations are supposed to take into consideration the demands of the users to accomplish user satisfaction, organizations are implementing new functions to later raise the prices and focus more on the luxurious target groups. The users expressed that even if organizations take into consideration the preference of the users the aim is to achieve economic and concurrent benefit.
5.3 Users’ preference

Studies have proven the importance of not only functionality but also entertainment in the vehicles. In order to achieve a high level of user experience, it is of great importance to understand both usability and emotional aspects of user experience (Hasan and Chandra Gope, 2013; Kujala et al, 2011). Some of the UX factors that customers expect from the vehicles are safety, comfort, freedom and entertainment (Pettersson, 2016; Desmet and Hekkert, 2007). Based on the data collected from the survey a significant response of 80%, 48 of 60, chose scenario one which is related to functionality. This result from the quantitative data answers to the research question of this study proving that UX factors related to functionality are preferred by the users. Additionally, the analysis of the qualitative data from the survey determined the motivation of users’ preference for scenario one. Based on the users’ perceptions safety is an important aspect and of great importance to have a secure environment while driving. Likewise, users experienced scenario one to offer them assistance in driving as well as provide support assisting the drivers to concentrate on driving with no distractions.

Furthermore, users expressed to experience scenario two as a luxurious option which includes functions that are considered as functions of secondary need. The remaining 20% of the users chose scenario two related to entertainment. Users’ selection of scenario two is due to the new technologies and connectivity functions that are included. Subsequently, Pearson test established no correlation between age or gender and choice of scenario. Therefore, there is no specific relation and no influence between the two values. Additionally, Chi-square tested determined no significance between the values evaluating all null hypothesis as true.

Studies explain the increasing importance of hedonic factors such as entertainment to be of the same value as the functionality of a product (Helander and Khalid, 2006; Norman, 2004). Contrarywise, this thesis paper based on the data collected determines functionality to be the most important aspect for achieving a high level of user experience. Consequently, safety and assistance in driving are the UX factors that are preferred by the users. It is important to state that this research paper aimed to identify the preference of the users, but it is of great importance for organizations to keep a holistic approach and take into consideration both functionality and entertainment in order to accomplish user satisfaction.

5.4 GOMS analysis and user acceptance testing

GOMS Analysis and User Acceptance testing have been used to reflect over the results from the survey. As seen so far user experience is important to accomplish performance gains and benefits. GOMS Analysis evaluates the quality of functions and eliminates the ones that are not preferred by the users (Resnick et al, 2013; Gray, John and Atwood, 1993). The data from the survey proved a significant preference in the functionality functions of scenario one. Additionally, users expressed a preference in safety functions, connectivity and assistance in driving. Therefore, this study is proposing to organizations to concentrate on those functions and conceivably eliminate the functions presented in scenario two.

Another evaluation method of user experience is user acceptance testing. For functions to have a positive result they need to be accepted and considered of value by the users (Dillon and Morris, 1996; Pettersson, 2016). Therefore, for organizations to achieve a high level of user experience the need to increase the inclusion of the users and concentrate on the users’ preference. Additionally, the data collected has proven user preference to functionality
functions and mostly due to aspects related to safety, connectivity, and assistance in driving. With the reflection of user acceptance testing this paper proposes to organizations to concentrate on these functions to receive a positive result and possible advantage against their concurrent. In order to achieve a more complete understanding of the implementation of these theories to the subject a different set of data collection may be used to accomplish higher significance to the results.

Implementation of functions is resulting in a positive outcome when value is reached, and customers’ demands are accomplished (McVehiclethy and Wright, 2004; Bolton and Drew, 1991). It is important to add that additional data could have been revealed by questioning different questions to the participants of the survey. Based on the data collected, this research thesis proposes to organizations in the automotive industry to target UX factors of functionality with a focus on safety and assistance in driving. Users perspective towards these functions is positive and significantly preferred in contrast to the functions related to entertainment. This thesis has determined user preference in relation to functionality nevertheless it is important for the organizations not to exclude the functions in relation to entertainment but use this study to understand the preference of the users without excluding the other functions.

5.5 Critical reflection

This study has included a systematically reading of the previous research studies in order to obtain a good understanding of user experience. Previous studies have described the importance of user experience in automotive industry but not studying the perceptions of the users. The author gained a better understanding of the functions by the conducted interviews and the users’ perceptions after the analysis of the survey. Furthermore, when using the theoretical framework in the reflection of the results the author understood that user experience in automotive industry is complex and requires a holistic view.
6. Conclusion

6.1 Contributions

This research paper aimed to investigate user experience in the automotive industry and identify which UX factors are preferred by users. Therefore, the research questions of this study are “What are the UX factors preferred by the users? To investigate the importance of functionality over entertainment to users within the automotive industry”. Previous studies have explained the importance of user experience in the domain of automotive as well as defining the users to be the actors that determine if functions have a positive value. In order to achieve positive results organizations, need to consider the demands of the users and fulfill them. The analysis of the previous studies indicates a research gap in relation to users’ perception of UX in the automotive industry as well as the actual use and preference of functions and UX factors.

Based on a quantitative and qualitative analysis of expertise in the domain and users’ perspective, it can be concluded that user experience has an important role for the organizations in the automotive industry. Nevertheless, users describe that organizations are considering user experience only for economic and concurrent benefit of the organization. Additionally, the result of the data analysis showed a preference of the users to functionality and UX factors in relation to safety and assistance in driving. The results indicate that UX factors related to functionality are more receptive and accepted by the users.

In conclusion, organizations in the automotive industry need to consider more user experience by obtaining information about users demands and preferences. Additionally, users shall be involved in the process of identifying new features for the vehicles. As result, organizations may include the demands from the users, functions will be valued, and the organization will achieve a positive result. For organizations to achieve a high level of user experience they need to include in the vehicles the UX factors that are preferred by the users. This paper has proved a preference of the users to functionality and more specifically to UX factors of safety and assistance in driving. As GOMS Analysis and User Acceptance testing describe functions need to be preferred by the users to provide a positive result to organizations. Therefore, organizations should prioritize and include UX factors of functionality with a focus on safety and assistance in driving but without excluding the entertainment functions. As a result, users will receive the functions they prefer, high level of user experience will be achieved, and organizations will gain a positive result.

6.2 Future Research

Further aspects need to be studied to achieve a full understanding of the users’ preferences and how to accomplish high level of user experience in the automotive industry. This study has introduced the users’ perspective in relation to user experience and UX factors in the automotive industry.

Firstly, this paper has proven an existing discrepancy between the perspective of the experts and the users’ perspective. Experts express having users’ as a primary focus and as a primary aim their demands to accomplish in the automotive industry. Contrariwise, users’ perception is that organizations in the automotive industry are not aiming at satisfying the demands from the users’ but are only taking actions to gain economic and concurrent benefits. A future study is
suggested to investigate how organizations can act in order to prioritize the users making them feel more important while also gaining economic and concurrent benefits.

This research study has introduced safety and assistance in driving as users’ primary preference and as a secondary option functions related to entertainment. A future study is suggested to discover which exactly functions do users’ prefer which could result in a higher level of user experience once these functions were implemented. The results of this study aim to prove the preference of the users but not exclude the other functions. This study has proven a preference of functionality functions and recommends a prioritization without excluding the functions of entertainment. User experience in the automotive industry is complex and needs further research to achieve a full understanding.
7. References


Krasniqi, X and Hajrizi, E. (2016). ‘Use of IoT technology to drive the automotive industry from connected to full autonomous vehicles’ IFAC 49(29), pp 269-274.


7. Appendix

Appendix A Missive of survey

Appendix B Survey responses of gender

Appendix C Survey responses of age
Appendix D Survey responses of “Which vehicle are you driving?”

Appendix E Survey responses of choice of scenario one
Appendix F Survey responses of choice of scenario two

![Bar chart: Entertainment 25%, Latest Technology 50%, Confidence 25%]

Appendix G Survey responses of “Based on your opinion has in-vehicle technologies impacted the automotive industry? If yes how?”

![Bar chart: New functions 40%, Autonomous 5%, Customer need 10%, Assurance 35%, Manufactures 10%]

Appendix H Survey responses of “Based on your opinion do organizations in automotive industry take into consideration the preference and opinion of users?”

![Bar chart: Concurrent relation 28%, Preference of drivers 33%, Expense raise 39%]
Appendix I Interview questions

1. Tell me a bit about your background
   • What is your current role?

2. Based on your experience how has the technological evolutions impacted the automotive industry?

3. Which are the functions connected to entertainment?

4. Which are the functions connected to functionality?

5. Have you heard about the term user experience?
   • (Yes) is this a term you hear or know if it is used within the organization?
   • (No) explain the term, maybe now that you know the meaning of it, is user experience a focus on your organization?

6. Do you believe the automotive industry is aware of the customer preference to these functions?
   • What kind of factors influence those customer preferences?
   • Do these factors evolve or change?

7. How does your organization investigate the customers preference?
   • How often does this occur?

8. Based on your experience what do you believe is the most wanted function by the customers?

9. How do you reflect over this study? What is your impression?
Appendix G Survey questions

Gender
- Male
- Female
- Other

Age:
- 18-30
- 31-43
- 44+

Which kind of vehicle do you drive
- Cabrio
- Sport vehicle
- Family and 5 doors vehicle
- Four door classic vehicle
- Other

Scenario one
Imagine yourself being in a new modern vehicle with some of the latest technologies. This vehicle is equipped with emergency brake assist role, software to analyze and provide information about the traffic and also adaptive cruise to examine the surrounding environment of the vehicle. It is also equipped with rear view sensors that alert and support the parking as well as cameras and control units that detect the distance of the vehicles around. Lastly the vehicle has integrated stolen vehicle software to detect the vehicle in case of robbery.

Scenario two
Imagine yourself being in a new modern vehicle with some of the latest technologies. This vehicle is equipped with heated smart home integration software that allows you to make in-vehicle commands for home lights and other systems associated with your home. It is also equipped with automatic liftgate detecting you when you are approaching the vehicle and keyless entry while you have the option for heated seats. Lastly the vehicle has screen available on the back seats and a head up display providing information about the speed, temperature and even music playing.

Which scenario would you prefer?

Motivate your answer:

What functions would you like to have in a vehicle?

Based on your opinion has in-vehicle technologies impacted the automotive industry? if yes how?
Based on your opinion do organizations in automotive industry take into consideration the preference and opinion of users?

Appendix K Pearson chi-square test

<table>
<thead>
<tr>
<th>Null hypothesis (H₀)</th>
<th>Relation</th>
<th>Value</th>
<th>df</th>
<th>Asymptotic Significance (2-sided)</th>
</tr>
</thead>
<tbody>
<tr>
<td>There is no significant difference between gender categories and choice of scenario</td>
<td>Gender - choice of scenario</td>
<td>1.298</td>
<td>1</td>
<td>.256</td>
</tr>
<tr>
<td>There is no significant difference between age categories and choice of scenario</td>
<td>Age - choice of scenario</td>
<td>0.266</td>
<td>2</td>
<td>.875</td>
</tr>
<tr>
<td>There is no significant difference between gender categories and in-vehicle impact</td>
<td>Gender - opinion about in-vehicle impact</td>
<td>0.036</td>
<td>2</td>
<td>.837</td>
</tr>
<tr>
<td>There is no significant difference between age categories and in-vehicle impact</td>
<td>Age - opinion about in-vehicle impact</td>
<td>9.060</td>
<td>4</td>
<td>.060</td>
</tr>
<tr>
<td>There is no significant difference between gender categories and opinion about automotive industry and user preference</td>
<td>Gender - automotive industry and user preference</td>
<td>2.075</td>
<td>3</td>
<td>.557</td>
</tr>
<tr>
<td>There is no significant difference between age categories and opinion about automotive industry and user preference</td>
<td>Age - automotive industry and user preference</td>
<td>5.384</td>
<td>6</td>
<td>.496</td>
</tr>
</tbody>
</table>

H₀1: There is no significant difference between gender categories and choice of scenario
Fail to reject. Because of $\chi^2=1.298$, df=1, P=.255 bigger than 0.05

H₀2: There is no significant difference between age categories and choice of scenario
Fail to reject. Because of $\chi^2=0.266$, df=2, P=.875 bigger than 0.05

H₀3: There is no significant difference between gender categories and in-vehicle impact
Fail to reject. Because of $\chi^2=0.0356$, df=2, P=.837 bigger than 0.05

H₀4: There is no significant difference between age categories and in-vehicle impact
Fail to reject. Because of $\chi^2=9.060$, df=4, P=.060 bigger than 0.05

H₀5: There is no significant difference between gender categories and opinion about automotive industry and the preference of users
Fail to reject. Because of $\chi^2=2.075$, df=3, P=.557 bigger than 0.05

H₀6: There is no significant difference between age categories and opinion about automotive industry and the preference of users
Fail to reject. Because of $\chi^2=5.384$, df=6, P=.496 bigger than 0.05