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TESIS
QUE PARA OPTAR POR EL GRADO DE:
MAESTRO EN INGENIERÍA

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III. Resumen

El presente trabajo de investigación es sobre el diseño de una nueva experiencia de movilidad (transporte). Este proceso fue desarrollado por un grupo multinacional de estudiantes de la Universidad de Stanford y de la Universidad Nacional Autónoma de México para satisfacer las necesidades de un socio industrial, Ford Motor Company. Fue liderado por un equipo docente internacional de ambas universidades según la metodología ME310. Este documento describe el proceso de diseño realizado por el equipo de diseño, así como sus resultados y, finalmente, una conclusión sobre el desarrollo completo del proyecto.

El proyecto de diseño se centró en una nueva experiencia de transporte centrada en la mejora de la salud y el bienestar del usuario a través de la estimulación de los sentidos, por lo que la experiencia del usuario (UX) y la interacción hombre-máquina (HMI) se convirtieron en componentes importantes de la investigación.

La primera parte del proceso de diseño estuvo orientada a la definición del usuario principal teniendo en cuenta la descripción de diferentes personas, por ejemplo, emprendedores, niños, personas mayores, entre otros, para elegir a la pareja de niños y padres que se mueven juntos en un Coche como principal usuario de la nueva experiencia de movilidad.

Luego, el equipo de diseño definió las principales áreas de oportunidad y los beneficios potenciales de una nueva experiencia a través de un proceso de experimentación constante con personas reales y prototipos rápidos, para determinar el mayor impacto en la salud y el bienestar. Esos prototipos llevaron al equipo a desarrollar una ventana interactiva que puede mostrar información sobre el vidrio mientras mantiene su transparencia, para que los niños se entretengan en el auto mientras interactúan con los alrededores dentro de la ciudad o en la carretera. Un prototipo funcional final fue desarrollado y mostrado en un evento público llamado "EXPE" en la Universidad de Stanford, donde fue probado por más de 80 personas.

1. Abstract

The current research work is about the design of a new mobility (transportation) experience. This process was developed by a multinational group of students from both, Stanford University and the National Autonomous University of Mexico in order to fulfill the needs of an industrial partner, Ford Motor Company. It was led by an international teaching team from both universities according to the ME310 methodology. This document describes the design process that was performed by the design team, as well as its outcomes and finally a conclusion on the entire development of the project.

The design project was focused on a new transportation experience concentrated on the improvement of the health and wellness of the user through the stimulation of senses, thus, user experience (UX) and human machine interaction (HMI) became important components of the research.

The first part of the design process was oriented to the definition of the main user taking into account the description of different personas, for example entrepreneurs, children, elder people, among other, in order to choose the couple children and parents moving together in a car as the main user of the new mobility experience.

Then, the design team defined the main opportunity areas and potential benefits of a new experience through a process of constant experimentation with real people and rapid prototypes, in order to determine the highest impact in health and wellness. Those prototypes led the team to develop an interactive window that is able to show information on the glass while keeping its transparency, for children to be entertained in the car while they are interacting with the surroundings inside the city or on the road. A final functional prototype was developed and showed in a public event called “EXPE” at Stanford University, where it was tested by more than 80 people.

2. Introduction

The accelerated growth of population and urbanization around the world means that people are spending more time than ever stuck in traffic. For Ford Motor Company this challenge also represents an opportunity: “Can we use this time to improve the health and well-being of passengers?”

This challenge was presented to a team of graduate students at Stanford University and the National Autonomous University of Mexico (UNAM). This team of students, developed through a period of 8 months, a concept proposal, along with a testable and functional prototype, through processes based on design thinking followed at both universities.

Through the multiple activities and development of the project over time, and as a product of the constant learnings, our team chose to focus on people who commute by car and, after conducting need-finding and market studies, we identified a particular population that could benefit from new technology: parents and their young children.

This document presents the work done during this period, from all the activities performed during the design process, to the learnings and findings from these activities. It is shown here the complete evolution of the project

since its beginning; when the project possibilities were almost infinite, until the convergence that gave as a result the final concept and prototypes.

This project represented a significant collaboration between different disciplines, universities, countries and cultures, therefore, this document, aside from the design learnings, also reflects many personal learnings product of this intense collaboration (Charleston, León, Lumbreras, Palacios, Pineda, Chao, Gu, & Xu, 2017)

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3. Objective

This project aims to create a testable prototype of a new product that can improve user's health and wellness through a new mobility experience in Mexico City's context.

4. Scope

This document presents the work done during an 8-months period, from all the activities performed during the design process, to the learnings and findings from these activities. It is shown here the complete evolution of the project since its beginning; when the project possibilities were almost infinite, until the convergence that gave as a result the final concept and prototypes.

5. Background

5.1 – The design team

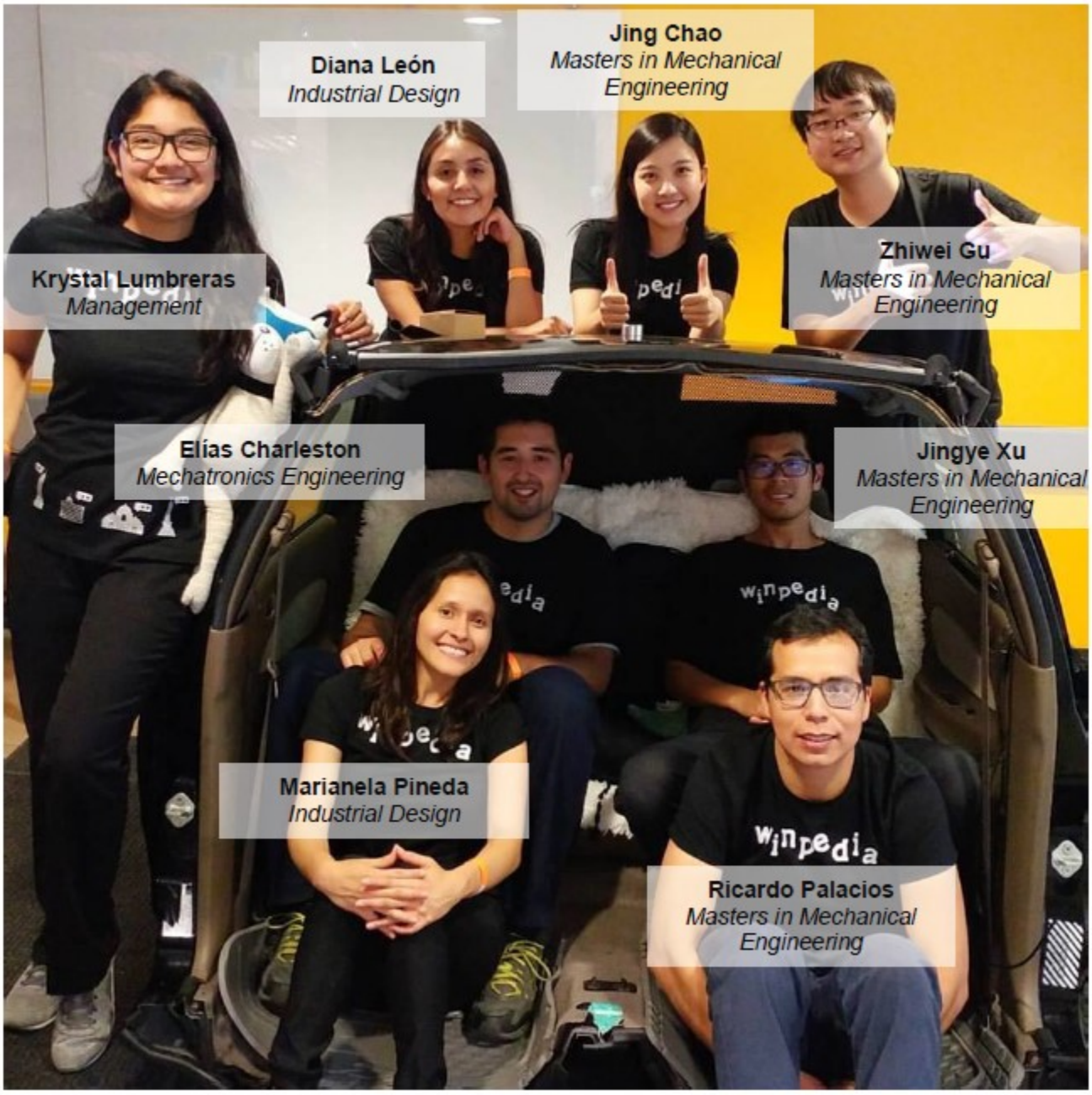

Fig. 5-1 The design team (Charleston et al. 2017)

As part of the ME310 design methodology the team was integrated by students from different academic disciplines and contexts, as it can be seen from figure 5-1. Online communications were very important in order to keep the team as a whole, sharing information and decisions (Charleston et al. 2017).

5.2 – Participants

Ford Motor Company

It was the sponsor of the project, (Charleston et al. 2017) since there is a great interest from this company in the innovation. The company defined the project leaders within Ford. Among these leaders' responsibilities were: follow the process development through constant meetings with the students' team, represent the company's expectations of results and assist the team in whatever the needs were. The corporate partner for this project is the Research & Design Team within the Interaction & Ergonomics division of Ford Motor Company in Mexico. Ford Mexico has a large presence in the country with 8800 employees and 14% of North American production coming from there as of 2015 (Isidore, 2016). These numbers are expected to grow significantly with investments amounting to $1.6 billion and plan to grow car production by 53% in 2019. (Rogers, 2016).

The company's team was integrated by:

Benjamín Dueñas – HMI interaction designer

Michael Thomas – UX Vision Lead

Jennifer Brace – UX Supervise

UNAM (CDMIT and CIDI)

From UNAM side, there were two participant parts: The Mechanical Design and Technological Innovation Center (CDMIT), part of the Engineering School, and the Industrial Design Research Center (CIDI), part of the School of Architecture. Professors from both schools develop, every year and in collaboration with real companies, multidisciplinary innovation projects. Through their participation, they transmitted the team their great experience, knowledge and constant opinions, which were fundamental for the successful 10onclusion n.

Dr. Marcelo López Parra

Dr. Vicente Borja Ramírez

Dr. Alejandro Ramírez Reivich

D.I. Yesica Escalera Matamoros

Arq. Arturo Treviño Morales

Stanford University

From Stanford University side, there are also projects developed every year innovation projects with different companies and global teams. The professors from Stanford University also participated actively in the project with their previous experience, knowledge and, through the ME310 course, they defined the main objectives and scopes for a successful conclusion.

Dr. Larry Leifer

Dr. George Toye

Dr. Mark Cutkosky

Other participants

As mentioned before, through the first stage of the project, the team at Stanford University was changed constantly for the students to know all the projects, therefore, below is shown a recognition of those participants:

Stanford Team 1

Marissa Cucinotta
Nasreddine El-Dehaibi
Chen Zhong

Stanford Team 2

Annabel Imbrie-Moore
Alex Gruebele
Jingqi Xu

Stanford Team 3

Alison Bick
Marissa Cucinotta
Roy Pan

Stanford Teaching Assistants

Danee Kenyon
Sam Frishman
Oliver Boeckle

5.3 – Ford's requirements for the project

As stated by Edgar Nuñez and Michael Thomas from Ford Mexico, in the document "Proposal for a joined project between Ford Motor Company, Stanford University, and National Autonomous University of Mexico" the objective of this project is:
"Generate testable proposals of HMI provocations (prototypes) that enable a hypothesis of the Health and Wellness Experience by Region, this includes (Charleston et al. 2017):

-Build ready to test health and wellness proposals (2020 implementation timeframe)
-Possible provocations include:
    -Digital designs focused on the current systems (sync, clusters, head-up displays)
    -Wearables
    -Mobile
    -Hardware
    -IoT
    -Web
    -New business model

-Interior design explorations
-Etc…

• Exploring an expanded view of the senses to identify HMI – UX levers of unexpectedly or provoked magical experiences”

6. Methodology

6.1 – First cycle

6.1.1 Definition of the challenge statement

The team proceeded to redefine the milestones and objectives stated by Ford Motor Company in order to integrate them in a challenge statement. The resultant statement has 4 main concepts that need to be explored by the team as the main research lines of the project. Figure 6-1 shows in a graphic way those concepts (Charleston et al. 2017):

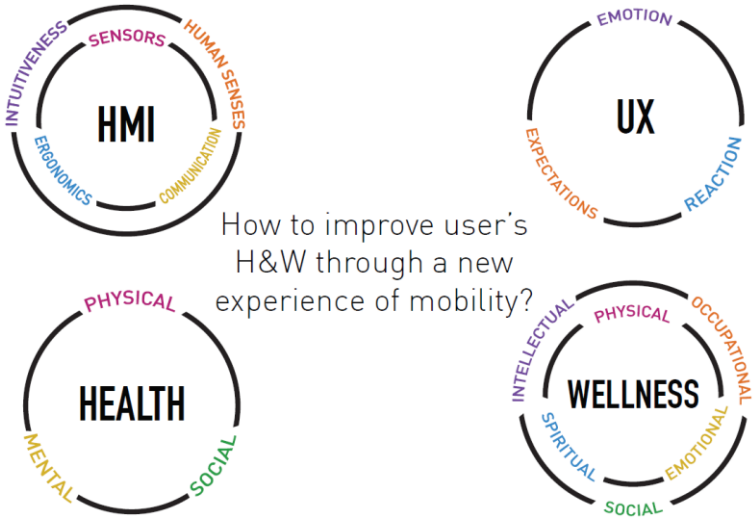

Fig. 6-1 Challenge statement (Charleston et al. 2017)

6.1.2 Concept definition

User experience (UX)

Based on the ISO Standard FDIS 9241-210:2009, Ergonomics of human system interaction, user experience is defined as “a person’s perceptions and responses that result from the use or anticipated use of a product, system or service.” (Kraft, 2013). But not being in complete accordance with it, Christian Kraft creates his own definition and describes user experience as “the feelings that the user gets when using a product. Using feelings as a comparison model allows us to understand that the user experience can be anything from hate to love. From anger to happiness. From indifference to passion. From expectance to nostalgia. From pride to humiliation” (Kraft, 2013).

An important point is that even for the same product, reactions and emotions could be different for different people. Also, the same person could react differently to the same situation in different times. Negative

experiences must be considered. A single bad experience requires perhaps many good experiences for the user to be happy (Charleston et al. 2017).

UX is about expectations, a successful product must not only fulfill user's expectations but exceed them and "for sustainable brands, you actually want the customers to have high expectations. High expectations basically mean that you can charge more for your products". (Kraft, 2013)

Redefinition:

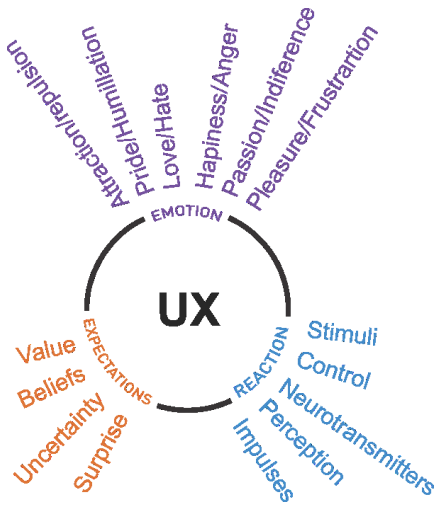

Fig. 6-2 concept redefinition: UX. (Charleston et al. 2017)

Using the information above stated a visual map for UX was created, and a new short definition is provided (Charleston et al. 2017):

User Experience is the set of emotions and reactions provoked while using a product. To be qualified as a "good" experience it must be "better than expected"

Human machine interaction (HMI)

HMI is the study of how people interact with machines and to what extent machines are or are not developed for successful interaction with human beings. It is also referred as Human Computer Interaction (HCI).

According to Körber et al. (Körber, Eichinger, Bengler, & Olaverri-Monreal, 2013), two qualities lead people's perception of product interaction: pragmatic and hedonic. Pragmatic interaction qualities are related to product's function and work-oriented while hedonic interaction qualities are oriented to psychological human needs; For instance, a user can have hedonic and pragmatic goals to be fulfilled by a product. For Hassenzahl et al. (Hassenzahl, Diefenbach, & Göritz, 2010) there are three hierarchical stages of goals, those are on first place goals that "motivate action and provide it with meaning", or "be-goals". On second place there are goals that are related to a specific result of a process or "do-goals". Finally, the lowest stage and third one is that of "motor-goals", which are related to process execution. Be-goals are hedonic while do-goals and motor-goals are pragmatic (Charleston et al. 2017).

For Hassenzahl et al. (2010) there are 7 main needs to be fulfilled "in the context of experiences with technology". These are: competence, relatedness, popularity, stimulation, meaning, security and autonomy.

Fig. 6-3 concept redefinition: HMI (Charleston et al. 2017)

HMI is the way in which people introduces an input to a machine in order to achieve either a pragmatic or hedonic goal fulfilling a psychological need (Charleston et al. 2017).

Health

According to the World Health Organization (WHO), Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity. (World Health Organization, 1948)

Machteld Huber and colleagues proposed renovating that definition, for the reason that chronic illnesses have been increasing throughout the years, so a complete wellbeing would be almost impossible. They proposed changing the emphasis towards the ability to adapt and self-manage in the face of social, physical, and emotional challenges (Huber, 2011)

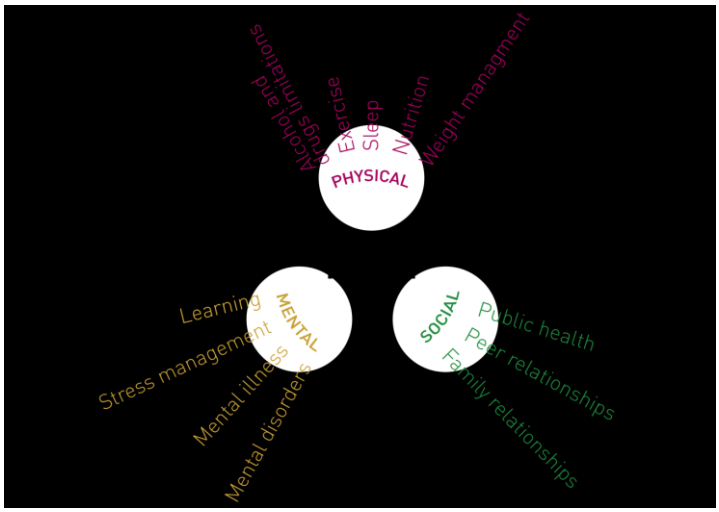

Fig. 6-4 concept redefinition: Health (Charleston et al. 2017)

For the team to have a better understanding of each of these main challenges, their main attributes and possible paths to follow were defined:

Physical health

Deals with the body's ability to function, and it's conformed by many components including exercise, nutrition, sleep, alcohol and drugs consumption, and weight management (Charleston et al. 2017)

Exercise consists in working the muscles to obtain more energy, maintain weight, increase confidence & self-esteem, and helps battling chronic diseases. Besides exercise, proper meals are important to maintain a balance between what we eat and the way our body uses it for energy and growth. (Nutter, 2003)

The human body also requires rest to maintain a healthy condition; it is appropriated that the average adult get at least between 7 to 9 hours of sleep daily for a proper rest (Hirshkowitz, et al., 2014)

Mental health

Relates to the way we think, feel and cope with daily life; it encompasses learning, stress management and mental illnesses or disorders. (Nutter, 2003)

Talking about learning involves the development of skills, behaviors and knowledge, which it is known to increase a person's self-confidence, awareness, coping skills, and self-perception.

Another important aspect of mental health, is knowing how to cope with stress, with the way our bodies and minds deal with life changes, so it prevents us from suffering from anxiety or depression.

Stress and personal problems in school, work, family, or any other situation can be a factor to develop mental illnesses, like depression, so it of most importance to try to maintain stable relationships.

Social health

It concerns the way we react with people within our environment. This includes public health, family relationships, and peer relationships (Nutter, 2003).

With public health we referred as everything including disease prevention and promoting health through means of good decision making, since keeping everyone safe and healthy benefits not only each person but also the community as a whole.

Humans are social beings since they are born, and the main contact they know is the family, hence the importance of maintaining a healthy family relationship, one that is supportive, loving, responsible, and balanced, promoting a safe and enjoyable environment.

Then, there are the relationships each person creates and develop by their own, their friends, strong and supportive friendships that increase happiness and self-esteem.

The team developed a short definition for health:

Heath is the state where an individual is able to function properly according to their specific conditions, under the physical, emotional and social schemes.

Wellness

The National Wellness Institute (NWI) refers to Wellness as a multidimensional and holistic process through which people become aware of, and make choices towards a more successful existence. (National Wellness Institute, s.f.)

Dr. Bill Hettler (1976) developed an interdependent model, which encompasses 6 dimensions: occupational, physical, social, intellectual, spiritual and emotional.

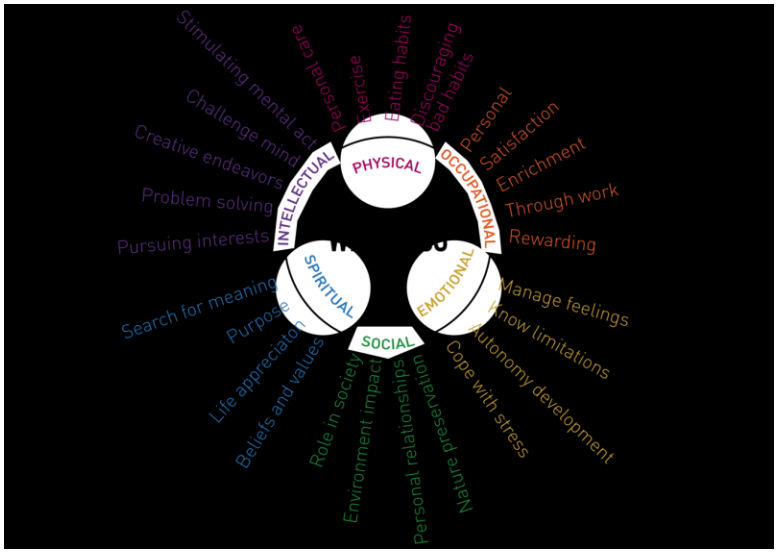

Fig 6-5 Redefinition of the concept of wellness (Charleston et al. 2017)

Occupational

Revolves around the satisfaction one gets in work related events, such as improving skills, learning or teaching someone, or any action that recognizes personal satisfaction that will be personally meaningful and rewarding.

Physical

Entails personal responsibility for the condition and care of one's body. Encouraging physical exercise, good eating habits or monitoring of own vitals, while discouraging substances that affect them like tobacco, alcohol or drugs.

Social

Enhances personal relationships and preservation of nature, basically realizing that you form part of an environment and community, and, as a matter of fact, you must contribute to preserve it.

Intellectual

Consists on finding ways to challenge their minds, while being creative, solving problems, learning or improving a skill, basically anything that stimulate the mind.

Spiritual

This one goes more on a subjective level, recognizing and discovering personal beliefs and values, trying to find the sole purpose of existence and re-connecting with one's self.

Emotional

Being able to manage one's feelings and related behaviors including the realistic assessment of one's limitations, development of autonomy, and ability to cope effectively with stress.

With all these inputs, we can see there are many factors that intervene in a person's wellbeing. The question remains in finding new solutions and implementation on how to improve it. Research in human health keeps developing constantly, overcoming a variety of changes and different perspectives, what has led to current views recognizing human's health and wellness as dynamic beings, whose state of health can change from day to day or even from hour to hour; leaders in the health field suggest thinking of each person in a graduated scale of wellness, ranging from extreme dire illness through the absolute absence of discernible disease to a state of optimal functioning in every aspect of one's life. (Lewis, s.f.)

A short definition for wellness was also developed (Charleston et al. 2017):

Wellness is the state where an individual reaches a balance between their body, mind and spirit's wellbeing that leads towards the individual's full potential.

6.2 – Benchmarking: health and wellness in the automotive context

As a first approach the team did a quick research about trends and technologies being adopted/developed by other automotive companies all around the world on the field of Health and wellness (Charleston et al. 2017).

6.2.1 - Toyota's smart insect prototype

Fully electric car, with Microsoft's Kinect motion detection. When the user gets inside the car, motion sensors recognize the owner of the car analyzing body shape and face, as well as driver's behaviors and movements to make predictions of what the user will do or need, to determine certain actions, like opening the door.

The car also features a home energy management system, which allows the user to control certain car functions, like locking the door, via user's smartphones through an app. (Silbert, 2012)

6.2.2 - Smart Steering Wheel – Nissan drowsiness-detecting

A great amount of car accidents had been related due to fatigue or drowsiness, or for some reason stopped being alert to their driving. This was the premise that the German engineering form Hoffman and Krippner used for developing a "fatigue-sensing steering wheel add-on" that tracks the driver's grip. The device basically analyzes the pressure of the driver grip on the wheel, to compare and establish a typical driving pattern for the user, so when it detects an anomaly in it, alert the driver and pull over.

A thin strip of sensors conforms the device, and then it is put inside the rim of an existing steering wheel, where it's going to detect pressure that will generate the short circuits that will send the signals to the microprocessor. (Coxworth, 2015)

6.2.3 - Jaguar's mind sense

Featuring NASA technology to read and analyze driver's brain waves. An interesting characteristic is that it doesn't require any equipment for the user, the sensors are embedded in the steering wheel to pick up the brainwaves.

Then it analyzes those brainwaves, without the user perception or consciousness of it, to determine if the user is being properly focus, or daydreaming, tires or confused. If not, the brake pedal will vibrate to alert the user and keep them focused (VWArticles, 2015)

6.2.4 - Health-monitoring Kia Cub Concept

The most relevant feature of this concept is a sensor strip integrated into the steering wheel, which monitors the driver's biorhythms. Which Kia considers could adjust settings inside the car, such as providing a more comfortable interior environment if the users drivers heart rate were elevated due to stress (Pinter, 2013)

6.2.5 - Lexus RC F 'heartbeat car'

Conceptual Project led by Lexus Australia and creative agency M&C Saatchi that aim to strength the connection between the driver and the car. They call it "the vehicle with a heartbeat".

The car exterior panels are covered in electroluminescent paint that glows in accordance to the driver's heartbeat monitored by the car, so it can display if the driver is relaxed or agitated through a real-time animation sequence (Hutchings, 2015).

6.2.6 - Faurecia's Active Wellness driver seat

Active WellnessTM 2.0 is Faurecia's smart seat, with embedded sensors in and around them to collect and analyze biological data and vitals, to remember and compare driver's behaviors and preferences, to provide the most comfortable experience for them, being that is going to be personalized to their physical conditions, time of day and travelling or weather conditions.

It can also detect when the driver is feeling motion sickness, stress, discomfort, drowsiness, and it gathers data that translates to personalized therapies or actions for the user, such as seat position, massage, seat ventilation, environment audio and light (Faurecia, 2016)

6.3 – Knowing the user

6.3.1 - Context of Mexico City

The context is inseparable from individuals, it determines not only social relations, traditions and culture but also the characteristics and needs of each target group. From this point of view, contexts are not to be understood as definitely given, but are built dynamically, mutually, with the participation of various factors interacting together.

A first step is to identify and analyze the variables that configure the context, we must consider and keep in mind all those elements with basic influence in the design and implementation of the project, ignoring them would undoubtedly deteriorate the internal coherence of problem identification and negatively influence its applicability and validity (Charleston et al. 2017).

The nature of each of the variables and the interactions between them will indicate to what extent our purposes are affordable.

Health Context

Obesity

Every year, the increase in the pace of life of Mexicans, coupled with a high rate of addiction to nutrition, has fueled an endless struggle against obesity that has claimed the lives of thousands of people.

Obesity, unhealthy eating habits and lack of exercise cause 32% of the deaths of women and 20% of men in the country, according to the SSA (Secretaría de Salud), approximately 70% of Mexicans are overweight and almost one third suffer from obesity. A third of young Mexicans also suffer from it, whose number has tripled in the last 10 years. (Forbes Staff, 2013)

Hypertension

In just six years, between 2000 and 2006, HBP prevalence increased 19.7% affecting one in three mexicans. (Barquera, et al., 2012) High blood pressure is a disease that is defined as the continuous increase of blood pressure above normal, so that the main organs where the uncontrol of blood pressure is affected are the nervous system, heart, eyes and kidneys, which results in various diseases such as insufficiency Heart failure, renal failure, blindness and dementia, among others. (Federación Mexicana de Diabetes, A.C., 2016)

Diabetes

Since 2000, diabetes mellitus in Mexico is the leading cause of death among women and the second among men. In 2010, this disease caused about 83,000 deaths in the country.

Diabetes is a condition in which sugar (or glucose) in the blood is at a high level. This is because the body does not make or use insulin properly, a hormone that helps cells turn glucose into energy. Without enough insulin, glucose is kept in the blood and over time, this excess can have serious complications. Diabetes mellitus increases the risk of heart disease and stroke, and in the long term can lead to: Blindness, renal failure, sexual impotence, amputations. (Instituto Nacional de Salud Pública, 2016)

Mobility context

Traffic, car amount, vial security. Mexico City is the world's leading vehicle traffic site, according to a study by TomTom. The company studies the days of greater vehicle traffic, extra time per trip, distances covered, among other factors.

According to this indicator, in the afternoons, between 15:00 and 16:00 hours on Friday there was more vehicular traffic for the citizens. In the morning, between 8:00 am and 9:00 am on Wednesday, there was more congestion. On average, a person can get 57 minutes of extra time, daily, for a trip, compared to a day without vehicular congestion. And 219 hours per year, TomTom said. (Forbes Staff, 2016)

On the other hand, mobility has to do not only with traffic but also with vial security in which Mexico City registers a daily average of 1,095 road accidents, which represent 17 percent of those occurring nationwide, according to the Mexican Association of Insurance Institutions. (Notimex, 2015)

In Mexico City 5 million cars circulate daily, plus to that amount, about 2 million that enter the conurbation zone and the more than 200 thousand new units that are bought every year are added. In addition, there are approximately 300 thousand vehicles that can now circulate daily, following the modifications to the program “Hoy No Circula”, which has contributed to the increasingly closer road collapse in the city.

The large number of units adds up to the lack of an efficient public transport system, road construction policies that encourage the use of the car, the situation of urban infrastructure, the carrying out of an average of 20 marches or blockades per day, poor traffic lights and the lack of sanctions for public space users.

To make matters worse, to regulate all this chaos there are only 900 traffic agents distributed in roads, cranes and in programs of immobilizer locks. All of this has made the peak traffic schedules in the city spread to most of the day.

The impact of the problem is especially noticeable in the quality of life of the population: the inhabitants of the metropolitan area of the Valley of Mexico invest daily four hours, on average, for transportation. By contrast, in 1994, a person employed on average 27 minutes to move within the city and in 2007, the average was 59 minutes per transfer. Currently that time has increased 300 percent.

According to one of the surveys, 65 percent of people spend between 100 and 400 pesos per day on transfers, the reason being that they often require up to four modes of transportation, which forces them to invest much of their income in this regard. (Servín, Gómez, & González, 2015)

Environmental context

Air pollution in Mexico City rebates the limits of the health standards and endanger the ecological balance on the life of their habitants

Air pollution is defined as: "the presence in the atmosphere of one or more elements, in sufficient quantity, of such characteristics or permanence as to cause undesirable effects on humans, plants, animal life or buildings and monuments, or interfere with the enjoyment of human beings. These elements may be dust, emanations, odors, fumes, or vapor."

Exposure to air pollutants causes respiratory diseases, asthma attacks, bronchitis, cardiovascular diseases, and even strokes, which can lead to death. Contaminants also wreak havoc on the environment, for example, exposure to ozone reduces the ability of plants to perform photosynthesis, and sulfur and nitrogen oxides upon precipitation affect soil fertility and weaken forests. In lakes and rivers, the deposition of these pollutants raises the acidity of the water, which affects fish populations, among other repercussions.

Nationwide, the main sources of air pollution are: vehicles (34%); Fuel uses (17%); Electricity generation plants (12%); Sources of ammonia (8%); Manufacturing and other industrial processes (6%); Use of solvents (5%); Fires (3%); Mobile sources that do not circulate on highways (3%); Refining of oil and other fossil fuels (3%); Fuel distribution (2%); Industrial combustion of fuels (2%); Mining (2%); Other area sources (2%); And fugitive dust (1%).

So far several experts from the Center for Research and Advanced Studies of the IPN (CINVESTAV), and institutions such as the Human Rights Commission of D.F. And organizations such as El Poder del Consumidor, have conducted air quality studies in Mexico City through which they have shown that 9 out of every 10 days we

exceed the limits established by WHO, a matter that endangers the life of the population and which violates environmental quality. (Vélez Ruiz Gaitán, 2012)

As a result of this scenario, Mexico City has a big challenge to prevent consequences, such as solving the lack of coordinated policies to reduce pollutant emissions, improve public transportation and discourage car use.

By 2018, poor quality can bring economic losses for the whole country for more than 20,000 million pesos (mdp) and a balance of 37,488 premature deaths 103,000 hospitalizations and 6 million medical consultations.

From 2010 to 2013 alone, economic costs in Mexico were more than 14,000 mdp, 19,000 premature deaths, 53,000 hospitalizations and 3.1 million medical consultations, according to the Mexican Institute of Competitiveness (Imco), Air Calculator. (Forbes, 2016)

Security context

Security perception

In Mexico, 67% of people consider that their city is insecure, reveals the INEGI, according to the National Survey of Urban Public Security, 69.2% considered that the National Gendarmerie is "very or something effective" in its work related to the prevention and combat of crime, followed by 55.7% of the Federal Police.

The National Public Urban Security Survey (ENSU), already carried out ten times by the INEGI every three months, includes indicators such as feelings of insecurity for fear of crime; Social expectation about the tendency of crime; Attestation of criminal or antisocial behavior; Change of routines for fear of being a victim of crime, and perception of the performance of the Municipal, State, Federal and National Gendarmerie police.

The survey, conducted for people over 18 years old, residing in the capitals of the states or cities with more than 100 thousand inhabitants, showed that in the last three months they have identified in the surroundings of their house situations such as alcohol consumption in (69.8 percent), robbery (67.1 percent) and vandalism (55.9 percent), although the latter behavior declined by 4.1 percentage points compared to that reported in December 2014, less frequent activities were drug sales or consumption (43.5 percent), presence of violent gangs or gangs (32.6 percent) and frequent shooting with weapons (22.1 percent). (El Financiero, 2016)

Car robbery

The State of Mexico and Mexico City lead the automobile theft according to AMIS, in the last 12 months, nationwide, 71,565 thefts of insured cars were recorded, representing a decrease of 9.1% compared to the period 2011-2012 . From July 2012 to June 2013, 22,130 units were stolen, and the State of Mexico ranked as the most robbery in that period, despite the fact that the Federal District showed a decrease of 7%, since In the period 2012-2013 went from 11,427 units stolen to 10,649, is the second entity with more robberies of this type in the country. (Meza Orozco, 2013)

The crime increased 8% for a year throughout the country and vehicle recovery fell 6.2%, reported insurers operating in Mexico. Vehicle theft increased 8% and violence associated with this crime increased by three percentage points, insurers reported in Mexico reported.

According to the report Theft and Recovery of Insured Automobiles of the Mexican Association of Insurance Institutions (AMIS), in the period September 2015 to August 2016, 66,778 cars were stolen. Of these, 57% were violently carried out, three Percentage points more than a year earlier.

The document also highlights a 6.2% decrease in units recovered from vehicles with the highest number of thefts, the most frequent being: the Yamaha 111-250 bike; Is followed by the Tsuru (Nissan); The Pick Up (Nissan); Short, long, chassis (Nissan); The NP300 (Nissan); The Kenworth; The F350 Cab Chassis Stakes (Ford); The new Jetta A6 (Volskwagen); The Classic Jetta (Volskwagen), and the Sentra (Nissan). Regarding the recovery index, the national average is 42 percent. (Castro, 2016)

Wellness context

According to the Organization for Economic Co-operation and Development (OECD, n.d.) Mexi003Cco had shown low levels of well-being and progress in 8 of the 11 areas measured.

In most levels of well-being indicators, disapproving notes were obtained in the following topics: housing, income and wealth, sense of community, education, environment, satisfaction, personal safety and work-life balance.

Although the results seem to be not satisfactory, in other parameters such as health, remuneration and competencies indicators were just below the average of the participating countries.

The metric where Mexico performed better than most of the participating countries, was in the area of civic engagement.

Life quality.

The results obtained show that the income average per capita is 12 thousand 806 dollars a year, lower than the average of the OECD countries, which is 29 000 $ 16 annual figures.

Labor journeys.

An aspect that also affects levels of wellness of Mexicans people are the working hours, which are more extensive in comparison with the other countries.

Education While 76% of countries surveyed finish high school studies, in Mexico only 34% of adults between 25 and 64 completed this level.

Life satisfaction.

In Mexico, overall life satisfaction merited a rating of 6.2; below 65 on average they obtained the 34 member countries of the OCED and more than one point of lead from Denmark was the one who reached the highest figure with 7.5

6.3.2 - Quick surveys

The first step we took after understanding and analyzing the Mexico City's context was finally approaching to inhabitants and getting to know them in a more realistic way, this is obtaining the information in a firsthand manner, talking to real people with real problems and necessities, using some information gathering methods to find out about their needs, thoughts, goals, etc.

The earliest action we decided to take to accomplish this aim, was a survey elaboration that revolved around topics of mobility, car interfaces, brands, and other generalities and specifics. The survey contained 10 multiple and open questions and it was applied via a web application named Survey Monkey, the questions were the following.

First survey (Charleston et al. 2017)

1. How old are you?

2. Regularly, who accompanies your trip? (Nobody, I travel alone, friends, family, boyfriend/girlfriend, pet)

3. Mention 5 car brands you remember. Do you know a model of the FORD brand, which one?

4. What do you use your car for? (For working, for traveling)

5. On average, how many hours do you drive a day?

6. List the next items from 1 to 8, according to the most important aspects a car should have, 1 being the main one and 8 being the least important. (Equipment, Power, Fuel savings, Places/Space, Price, Safety, Care environment, Appearance)

7. What other functions do you use during your journeys? (Music, Radio, Air conditioner, GPS, Phone)

8. While driving, do you find any difficulty in the use of any of the above functions?

9. Generally, what stresses you while using your car? If so, do you try to do something about it?

10. In what percentage are you familiar with the use of these interfaces: (Voice, Display, Gesture)

Findings

-People use their cars mostly for commuting, from home to work/school and back.

-Most of the interviewed people drives alone, and spends from 3 to 5 hours daily just commuting.

-The main cause of stress while driving was being stuck in the traffic.

-The GPS is the device that most of the interviewees used, especially in order to reduce stress.

-They found more familiar the use of displays.

-The surveys were impersonal so further methods will be executed to gather more reliable findings. As mentioned before, these were our first approach to the users, and led us to some topics for focusing and develop further.

Second survey

Another survey was released, this last one to gather information about health and wellness perception. The survey contained 10 multiple and open questions that were the following (Charleston et al. 2017):

1. How old are you?

2. Do you consider yourself a healthy person?

3. Mention 3 words that you associate with wellness.

4. Do you take care of your health steadily?

5. What activities do you do to keep healthy? (Mention 3) (playing a sport, having a balanced diet, relaxing activities, etc.)

6. List the 3 activities you think are causing you the most stress.

7. List 3 activities you that consider relax you.

8. What are the main constraints that you consider that keep you from been healthy in an optimal way? (Mention 3)

9. Are you a driver?

10. Do you consider that the transport has had an impact for or against your health, why?

Findings

-People associate health and wellness with haziness, exercise and healthy diet.

-Sleeping or recreating activities like reading, dancing o listening to music were activities that make them feel relaxed.

-Most of the interviewed people answer that the main cause for not taking care of their health was time restriction.

6.2.3 - Quick interviews

The surveys conducted, led us to a new stage for knowing the user that was actually talking to them, observing and analyzing their reactions and answers, in a pleasant environment where they felt comfortable in, while creating a connection with them to obtain more honest answers.

For this stage we interviewed 5 people, to whom using a car have a great impact in their life: Arturo, a young entrepreneur, Everardo an Uber driver, Elena a housewife, Adriana and Gerardo, both undergraduate students. These interviews were conducted face-to-face, via telephone and videoconference.

The interview questions were as followed, although these were only a script for us to remember covering some topics, it is relevant to mention that the questions were asked in the form of a dialogue, not as a question-and-answer dynamic (Charleston et al. 2017).

Questions

1. Do you eat at home?
2. Do you follow a diet?
3. What kind of food do you prefer (Mexican, Japanese, home-made...)?
4. What is your favorite dish?
5. What do you eat throughout the week?
6. Where do you eat?
7. What is the dish you eat most often?
8. Do you have a specific eating schedule?
9. Do you consider your diet to be healthy?

10. How often do you visit the doctor?
11. Do you have any type of medical insurance?
12. Which of your habits you consider healthy and which ones not?
13. What do you understand by well-being?
14. Why did you buy the car you have?
15. What do you like the most about your car?
16. Is there anything you dislike about your car?
17. Would you buy a new car from the same brand?
18. Besides driving, what other activities do you do in the car?
19. Have you had any bad experiences in your car? Which ones?
20. How much time do you spend in the car approximately?
21. What do you use it for?
22. When you feel that you are falling asleep or are very tired and you are driving, what do you do?
23. Have you tried to take advantage of the time you use while transporting?
24. Do you use any another type of transport?

The interviews were recorded and were summed up into some resources such as:

- Journey maps

- Empathy diagrams

- Persona files

Findings

- People feel tired driving early mornings or nights (Rush hours)

- Tiredness make the user less alert while driving

- Driving without traffic or interacting with someone makes it an enjoyable experience

- Insecurity and weather conditions causes anxiety on user

- Most of their journeys are done alone

- Most of them do not have fixed eating schedules; they eat when they are feeling hungry or when they can

- Do not do frequent medical check-ups, just when they make specific appointments like dentist, or common illnesses

- Drinking plenty of water seems to be most healthy habit stated

6.2.4 - First rapid prototyping

Having had our first approach with the user through the surveys and quick interviews, we wanted to gain a better understanding of the way people interacts during their journeys, their preferences, behaviors and the emotions involved, with which we decided to make some rapid prototypes and simulators to know how the response would be to certain situations.

The simulations consisted in testing three different cases, one of them based on the user necessity of not feeling locked up during their travelling, being that they can create nuisances like stress or lack of focus, while the next two trials were focused in the human-machine interactions (Charleston et al. 2017).

Objectives

- Know how users behave and respond to non-familiar stimuli, inside and outside the car.
- Understand the way people interact with machines using quick tests
- Have a fast input for user observation in a controlled environment

Proposed prototypes and findings

Interface Test

Nowadays, almost every device requires an interface, and the success of a product or service in the market is getting more and more difficult to achieve. For this reason, it is vital that the interface gets as user-friendlier as possible, so it can be well accepted by the costumers. There are many ways a user can interact with a machine, and some of them are could be better for certain people while many others can work better for others. So, we wanted to make a prototype that was simple way to differentiate with which kind of interface our possible users accommodate better to solve a well-known game: Tetris (Charleston et al. 2017).

Testing

The test consisted on a simulation of the Tetris game projected on a wall, where the user would have the notion of controlling the pieces, moving and rotating them, while using three different simulated interfaces. First, they were going to play using buttons, then by voice, and finally by gestures.

The main objective was for the user to achieve the same goal, using three different ways to get there, and to select the one they felt the most comfortable with, or which one he/she preferred whilst giving us feedback of their reasons for the choice made. The results showed that people preferred using the buttons and voice commands than the gestures' one, the main reason being that it was what they were used to interact with in their everyday interactions.

Findings

Despite the buttons command were the more intuitive, we noticed they had to take their eyes off the screen to look for the buttons, they tended to use 2 hands (the positions of the buttons may be the cause), and they also required previous memorizing or study, to know where the buttons were going to be.

While commanding by voice, some users told full instructions instead of the commands we previously specified them to say (Ex: "All to the left" instead of "left, left, left") which would be a great inconvenience if the machine would only function with those specific commands.

Despite the fact that gestures were not the preferred command, it was the most enjoyed by the users, they felt that controlling the game by gestures was a more natural reaction, because while speaking, people tend to make gestures all the time. That was well shown action made during the voice command, users frequently used gestures while saying the command.

Voice Test

As mentioned before, one of the main tools used nowadays for the Human Machine Interactions are the interfaces, particularly the voice commands. This section alone entails a vastly range of factors that makes one voice interface better than the others. One of them being what type of voice the machine is going to use, what are people going to understand better, will it be annoying or soothing for the user to listen to constantly? The

human memory sometimes remembers things better than other things, most if the time subconsciously. That was some of the paths we decided to try for (Charleston et al. 2017).

Testing
We recorded 15 sentences with the same length and structure, using 5 different types of voices, going between high and low pitch in the voices, in both, female and male voice. We made our users listen to each of them, and afterwards we asked them which ones they were able to remember.

From the 7 users we tested, 5 were male while the two were female. Men remembered 6 sentences said by men, and 2 said by women, while in the women's test they remembered 6 sentences said by men, and 0 said by women.

Findings
At this moment, male voice seems to help users' memory better than the female voice, but we are still running tests to be able to verify or refute this hypothesis.

Air Curtain
While asking users if they enjoy travelling in a car, we noticed a great variety of answers responding to different satisfaction levels due to different factors, such as stress to comfort, to the number of actions they could do despite being inside a car (Charleston et al. 2017).

Thus, a remarked factor was the people that maintained their cars windows down during their journey. When we asked them about it, the answers revolved around the fact that it made them feel freer, and more connected with the environment outside, what generated a more enjoyable experience for them, furthermore the A/C irritated the eyes of many users, making it a more difficult and a far less pleasurable driving experience.
Nevertheless, in some cases they feel that the airflow can be bothering due to the irregular flow that comes in; sudden strong bursts can be uncomfortable, while bad smells is another fact that makes it not suitable.

Testing
The objective for this trial was to demonstrate that it is possible to control the airflow at the car's window even if it is opened. For this test, a wind curtain was created to control the airflow with a punctured hosepipe, while the user experienced a journey in the car with the window opened at a speed of 40 km/h and he or she told if the wind curtain made a difference to their usual experience.
11 users were tested for this device, 4 women and 7 men between the ages 23 to 30. The results showed that 81.8% felt a difference with the air curtain being on and off, while the rest didn't feel any change.

Findings
What we could gather from this prototype were some unexpected findings like how women with long hair said that the difference was evident because they often prefer not to open the car window because their hair becomes a mess and the wind curtain helped to control it, other users, who use contact lenses, suffer eye irritation while traveling with open windows and they think that the wind curtain could help with that. Another statement was that the air curtain could refresh them even while the car was static but in a less aggressive way compared to that of the common A/C. While this test showed interesting results, a test with a more powerful air curtain than the one provided with the common A/C of a car could get us more consistent results.

6.3.5 - Personas

According to the context of Mexico City we developed with all the research, we have some parameters of what to expect of the city for 2020. Taking into account facts and developments to happen, analyzing which users are more affected by the mobility experience and performing quick interviews, we created 5 personas profiles, with

different characteristics, trying to cover with these profiles the needs of most people in Mexico City. Therefore, we may not have explicitly other profiles, but their needs are covered with one or more of the profiles we have. As an example, we don't have a university student, but maybe he has a flexible schedule as the entrepreneur, or he has a sister to pick up at school, like the Housewife (Charleston et al. 2017).

The profiles developed are the following:

Arturo. Entrepreneur. 20-30 years old.

Fig. 5-1 Profile of persona: Entrepreneur (Charleston et al. 2017)

Doesn't have children and has his own company. He works half time from home, and during the other half he goes to his company or visits his clients. Because of this he has a flexible schedule. For work reasons, he needs to be connected to social media. He takes care of his nutrition and self-appearance. In his free time he likes to play videogames, watch tv series, go to the cinema with friends and go to the gym.

Ana. Office worker. 25-45 years old.

Fig. 5-2 Profile of persona: Office worker (Charleston et al. 2017)

She lives with her partner. Every morning she drives to her office during rush hour. She eats food from places nearby her work office, which is fast and not too expensive. She has specific work hours, but sometimes has to

stay longer. She spends most of the day sitting in front of a computer. She is overweighed and wants to be healthier but doesn't know how or thinks she doesn't have the time to do so.

Juan. Elderly. Shop-keeper. 50-70 years old.

Fig. 5-3 Profile of persona: Shop-keeper (Charleston et al. 2017)

Lives with his wife. He has diabetes or hypertension. Every few days they have to go grocery shopping. He has back problems. Because of his condition, he can't eat certain types of food, takes medication at specific hours and schedule doctor appointments frequently. Their children and grandchildren visit them on weekends.

Elisa. Housewife. 30-40 years old.

Fig. 5-4 Profile of persona: Housewife (Charleston et al. 2017)

Has 2 children in elementary and secondary school. She has to cook breakfast for her family in the mornings, before taking the children to school. She often goes to the supermarket, does laundry and other chores during the day. Sometimes she hangs out with friends or goes to the gym after leaving the children at school. She also drives her children to their extracurricular classes, such as swimming, foreign languages, music, etc.

Jorge. Uber driver. 45-70 years old.

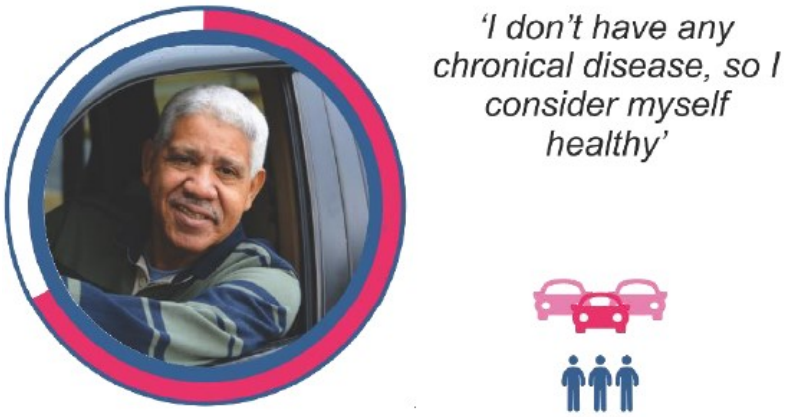

Fig. 5-5 Profile of persona: Uber driver (Charleston et al. 2017)

He has a partner and children. He uses the car as his way of work, therefore he spends most of the day in it. He needs certain functions inside for the job, like GPS, depending heavily on the cellphone to be able to work. Every day he may travel from one end to the other of the city. Often gets stuck in traffic jams. Due to work conditions, he needs to maintain a good attitude with costumers. He often works the night shift during weekends.

6.3.6 – Deep interviews

Based on the personas and scenarios we developed, we conducted some interviews covering our two main focus points, mobility and health, in order to know the preferences of the user, their habits, experiences, concerns, understanding and lifestyle (Charleston et al. 2017).

First, we looked for people that fitted our five profiles, and met with them. We asked the first questions in order to make the interviewee feel comfortable and, therefore, sincerer with his answers. After this we asked them about a normal day in their life, as an introduction to the mobility section. We heard their personal experiences, in which we could get to know how an everyday experience in their life was. We moved further by asking more about their mobility experience, and, later, we moved to the health section. From all this process, of approximately one hour and a half per user, we were able to know the user, as well as his highlights and nadirs in the mobility experience, some of them varying greatly in priority from

one type of user to the other, while others stood out by having the same pattern for most of the interviewees. We got important findings, which are described in the following paragraphs.

Insecurity was one of the most worrisome issues for all type of users interviewed; it brought out negative emotions of fear, stress and wariness while driving, and even when they were not inside the car. As an example, when they left the car parked in the street, especially in an unknown area. Or while waiting in a traffic light, they feared being victims of assaults or robberies, which recently have been known to be increasing in Mexico City.

Another key factor that every driver feels is stress. The main cause of it being the traffic, where people feel they are wasting their time, not moving, and not doing something productive. Also, they worry about the fact that the surrounding drivers tend to do reckless driving maneuvers to try to get faster out of traffic jams, compromising their safety (Charleston et al. 2017).

On the other hand, their journey was more enjoyable when they were travelling accompanied by a friend, a family member, a friendly passenger (in the case of the Uber drivers) or simply when they were talking on the phone with another person. Furthermore, planning their agenda makes them feel that they are not wasting their time completely. This happens because their attention is diverted from the stressful situation to the social or productive event.

We noticed that due to the long working hours they spend, coupled with having to get up with anticipated hours to be at work on time, and not sleeping enough hours for a proper rest; commuters and students primarily spent their journeys tired, and trying to stay as focus and concentrated as possible, to reduce the risk of an accident.

It is a known fact that driving for a long time can lead to aches and discomforts for the driver and passenger, and it was a notorious inconvenience for the elderly users interviewed, who described presenting back and knees pains after driving for a certain amount of time.

It is important to mention, that most users didn't find that mobility had a direct impact on their health, apart from walking less perhaps, or headaches and stress. Even in their daily life, most of the users don't normally do medical checkups, they only go to the doctor when it is necessary. One of them admitted to practice self-medication and another one said he had not gone for a medical checkup in the last 10 years. Knowing the user's concerns let us understand what could be points of interest, based on real necessities from the users, which we concluded to be:

-Insecurity

-Concentration/alertness

-Time perception

-Stress relief

-Physical pains

6.3.7 - Final experience prototype for first cycle

Objectives

Introduce a new experience, improving somehow health and wellness experience in mobility, through the findings we have from all the previous steps of the process.

Proposed prototypes

The design team proposed several options through brainstorm, such as (Charleston et al. 2017):

Parking Maps: Since users showed a lot of concern about finding a parking spot when getting somewhere, feeling sometimes insecure, we thought of an application that helps you finding a parking space and tells you if the zone is safe to park in.

Healthy Food: Based on information about the user, along with constant monitoring, we thought of an app that, being connected through the internet to several food places, recommends the user a healthy place and dish to eat according to the user needs and medical condition.

Foursquare+Uber: Using head up display technology for people using a taxi or an Uber, the car gives them information in real-time of what they are seeing, one mode enables a touristic experience that displays information and videos about a building, or historical info depending on the month, etc.

Proxy light: Watching how insecurity is such a big concern to users, mainly when they are stuck in traffic, we proposed a light or camera that, when detects movement near the car, points a light toward it so the user is aware of his surroundings.

Taxi sleep: Thinking mainly about relaxation and the amount of time a person spend in the car, we had the idea of a service where, besides getting to your destination, during the trip you get stimuli that help you relax and sleep for the duration of you trip.

Drivingamification: In this idea, we had a lot of possibilities. Mainly we planned it to reduce stress by making the user feel it like a game, but also it was about keeping the driver focused on the road by this. For all the options we considered Virtual Reality as a possible technology.

Health-coach: Since our main goal is health and wellness, we considered also a personal coach inside the car system that, keeping track of you, guides you through healthy choices in a lot of aspects.

6.3.8 - Final prototype (first cycle)

After the brainstorming and analyzing which possibilities could help more changing these points by changing the experience, we created our first experience prototype (Charleston et al. 2017).

From the deep interviews, we obtained that a lot of the users would prefer to be somewhere else instead of the car during traffic jams, being their main choices the nature or the beach.

So, the team came to the conclusion that in the prototype it was expected to know if we could make the user feel like he/she was somewhere else while driving, making him feel relaxed.

Together with this, and as several users said they practice breathing exercises to relax, we wanted to know also if they could practice such exercises while driving without getting distracted from driving, and mainly, if these exercises helped them feel more relaxed.

The materials used in this prototype are the following:

-Driving simulator software.

-LCD screen for displaying the simulator.

-Steering wheel with pedals.

-Video projector

-Essences: Sunscreen & Eucalyptus.

-Sound equipment.

-Oximeter.

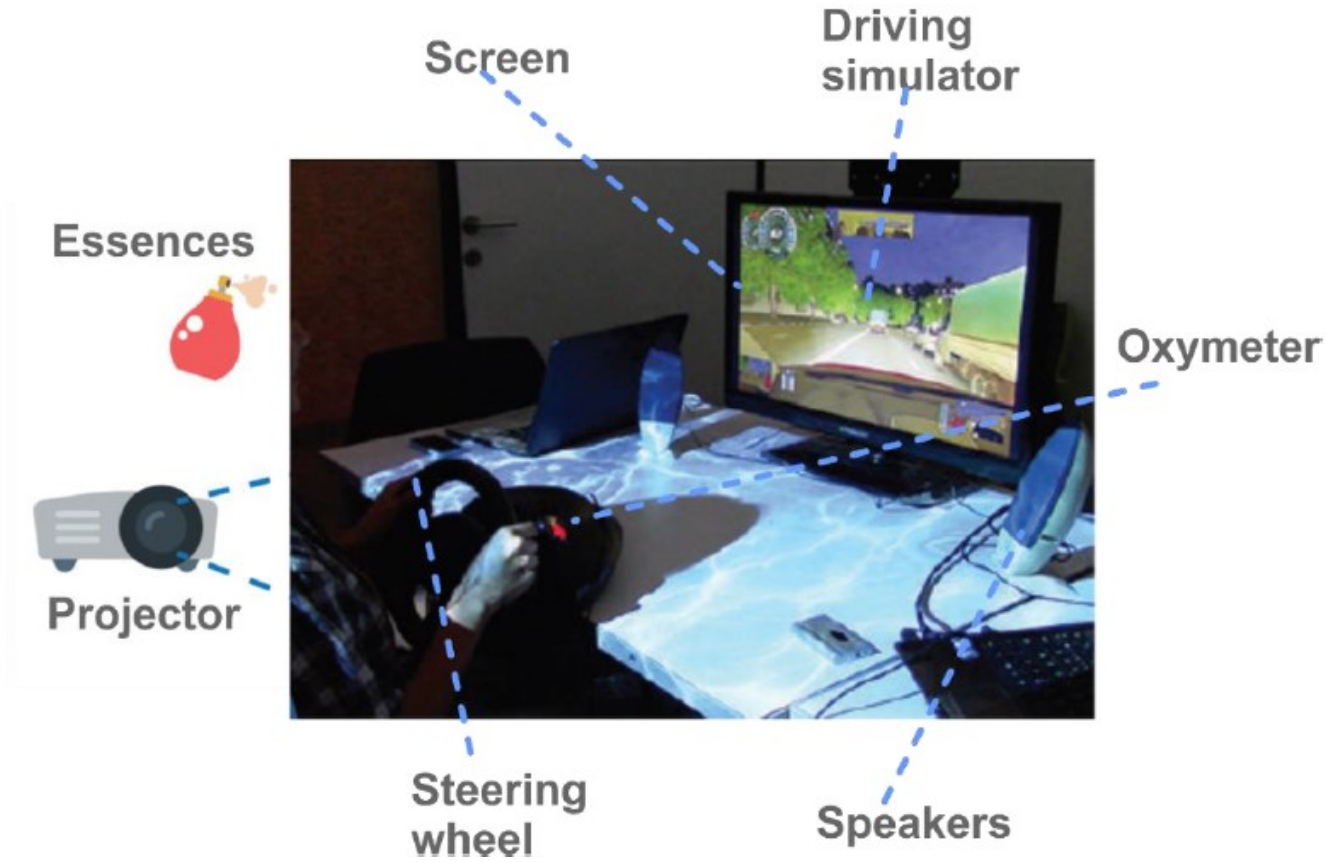

Figure 6-6 Experience prototype and its components. (Charleston et al. 2017)

The process of the test was the following (Charleston et al. 2017):
1. We made the user drive for a while, in order for them to get familiar with the controls and sensitivity of the simulator, asking them to follow real-life rules like speed limits, using turn signals and respecting lights.
2. On the next phase, we asked them to follow certain directions, mainly through crowded streets.
3. During this phase, and as they were getting stressed, we introduced the environmental changes, using the video projector to change the light of their surroundings (green light for the forest and blue light for the beach, both with texture to resemble the corresponding place) releasing the corresponding essence (sunscreen for the beach and eucalyptus for the forest), and playing the corresponding audio file.
4. Next, as the light from the projector was changing its intensity following a time pattern, we asked them to follow this intensity through their breathing, without losing focus on the road.
5. Finally, we asked them to follow the same breathing exercises, this time being guided with voice instead of the light.

Findings and results

-7 out of 8 users relaxed due to some of the environmental changes.

-Heart rate increased visibly when submitted to sudden changes, such as close calls or, in one case, the sudden change in light.

-The environmental stimuli reminded them of the places we had as objectives, but the users didn't necessarily feel in a different place.

-Breathing was very difficult to synchronize with the light intensity, but it was so much easier when the instructions where through voice commands, which was visible in their heart rate, which decreased.

-Breathing exercises visibly led to a more conscious driving, since some users slowed down and respected more the driving rules.

-There is a required amount of stress for awareness (this is called eustress)

6.3.9 - Process' main findings

A list of findings was developed by the team, it is divided in three categories as shown below (Charleston et al. 2017):

Situations that cause people to be stressed / unwell / uncomfortable

- To be stuck in traffic:
- "I will be late, my children/boss/girlfriend… wait(s) for me!"
- Insecurity (fear of being stolen/harmed by a criminal while stopped)
- "I'm wasting a lot of time"
- Unpredictable behavior of pedestrians and drivers that suddenly do something unexpected.
- Driving through an unknown city zone at night (mainly for taxi/uber drivers)
- Weather conditions, mainly rain or sunbeams.
- Speed limit (recently lowered in MX City)
- Have an accident/crash or hit a hole (holes are very common in MX City)
- To forget something (it is worse if he/she realizes it in the middle of the traffic)
- Can't find parking
- Space between cars is too narrow
- Signals are wrong/not well placed (including no lanes, double lanes, broken traffic lights, etc.)

- The streets are constantly changing (new holes after a rain, new speed reductions that are not painted, closed streets, new ridges or pots that narrow lanes, new public works)
- Do extra hours at job
- Having no time to eat
- Bad sleep
- Other personal problems

Situations that distract the driver
- External noise
- Cell phone
- Alcohol/drugs
- Tiredness/sleepiness
- Other car's lights
- Billboards mirrors
- Personal problems

Situations that cause people to be happy
- Chat with somebody
- Be with their pets
- Travel (many people talk about the beach, for example)
- Receiving a message from somebody that they don't see in a long time
- Spend time with family/friends
- Sing/Listen to music

6.3.10 – Conclusions of the first cycle

Throughout this process we gathered some findings that will function as the base point for the next cycles of the project, we mean that we will continue developing further on these, to build the structure that will led us to our final concept and prototype.

The user observation we have been doing, gave us direction for the experience prototype we tested out, from which we obtained different insights and better understanding for the user reactions and behaviors to certain situations.

The first thing we learnt from these experiences was that users could actually be guided through some directions and sensations towards a healthier lifestyle during their journeys, even if they didn't necessarily know we were trying to achieve that goal.

Even more important, most of the people are not aware of the condition of their health out of obvious sickness or how they feel, so even if they do have some anomaly, due to ignorance they don't actually try to improve their health. We realized that by making people aware of their condition, they became conscious of it and try to find a way to stop it or reduce it, like with their stress or alteration, and with the help of some breathing exercises and techniques they found it easier to do it.

Lastly, for the results to be better, we noticed the instructions and stimuli needed to be as intuitive as possible, and to be perceived by the user almost unconsciously. Not as much as to evidence their health, but more like offering some solutions or actions that gave them an enjoyable experience, while gaining benefits to their wellbeing, with or without their perception of it.

6.4 – Second cycle

6.4.1 - Dark horse & visit to Stanford University

A dark horse, in horse racing, is a contender who most people don't think will win,but may turn into an unexpectedly strong performance and produce a huge payoff.

The Dark Horse activity consists in generating and making prototypes from ideas that are intended to be something far out there or nearly impossible. In the best case, dark horse ideas might end up winning the race. However, even in the worst case, they can give us tremendous design insights and prevent design fixation, where the design space shrinks too rapidly.

There are three requirements for dark horse ideas:

-First, they must be "dark": they must explore a space that is risky, radical, infeasible, and/or in a direction orthogonal to previously explored solutions. They should feel slightly uncomfortable.

-Second, they must be brainstormed after the more traditional ideas — you can't have a dark path without a traditional "light" path to contrast it against.

-Third, they must be refined enough that they could be prototyped and objectively tested. That is, it cannot be infeasible: it needs to be something that we could put in front of real people to see whether it would work.

The team was invited to go to Stanford University as part of the ME310 winter kick-off, where the main goal was to get to know our design partners from Stanford. At this point we were working in knowing the user, as well as our Stanford teammates in USA. The final UNAMStanford team was integrated in January. Together we worked during two weeks in the development of a “Dark horse prototype” at Stanford University; then the team was going to continue working together with this project in Mexico and USA respectively, until June 2017 (Charleston et al. 2017).

6.4.3 - Idea creation

As a part of this activity, we decided together to go further on our creativity to develop more knowledge about the user. We wanted to generate a new experience that was a great contrast and risk regarding our previous passive breathing and massage views we had been presenting, which means that instead of making user relaxed in a passive way, we made a prototype that make users relaxed through an active way liberating their frustration with physical movements, while at the same time could act as a musical beat release with every punch.

6.4.4 - Punching to the beat interface

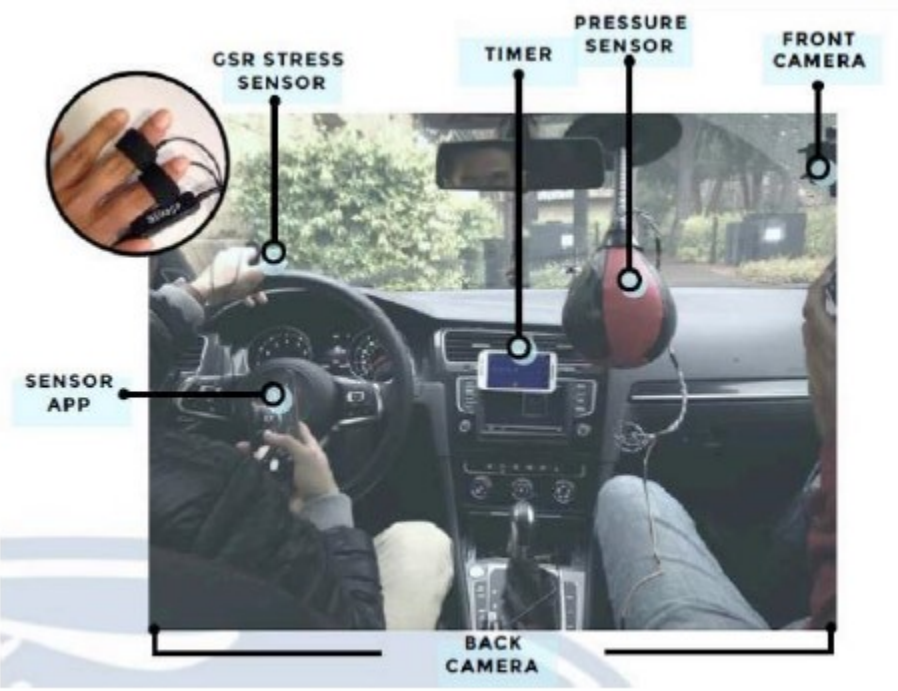

Fig. 6-7 Dark Horse prototype and its components. (Charleston et al. 2017)

Facts

After a long period of time inside the cars during the rush hours, most drivers experience certain levels of stress. In spite of this fact most of them still choose driving as their primary way of commute.

Challenge

Could we decrease stress through a physical stress reliever?

Why is it Dark?

Why is stress management always linked with peaceful activities, which require time and concentration to work out? 66 Are there other ways to relieve it?

How does it work?

So, we developed a device as an immediate relief solution that the user can punch when they feel stressed. The current prototype includes a micro controller and five pressure sensors will detect punching and play sounds from the car audio system. Two skin conductance sensors are attached to user's fingers to evaluate the stress response of the users.

Findings

-Different ways to relieve stress

-User needs customized punch ball position

-Despite the size of the device, some users find it easy to ignore it

-Force the attention on the road

-Tapping vs. punching

-Experiment environment was not stressful enough

From data

-Physical activity will increase conductance

-Stress gradually increases during first round
-Stable during second round
-Sudden funny ringtone possibly reduces stress

Finally, with this collaborative activity, we remarked some work that we needed to do like decide whether we want to keep the current project direction, testing other concepts and prototypes, and make tests with a wider range of test subjects.

6.5 – UNAM's second dark horse

Back in Mexico City, to further abroad our challenge, and testing other concepts and prototypes outside the common way, we continued trying to generate new ideas, proposing a concept which aim to fulfill different user needs through the same principle, it was focused on the substitution of one sense with another one (Charleston et al. 2017).

6.5.1 Concept

Proximity vibe: a vibration device with multiple terminals surrounds driver shoulders and back. Intensity/frequency of vibration indicate proximity, the terminals that are vibrating indicate position of a moving vehicle and the sequence of vibration indicates the external vehicles velocity.

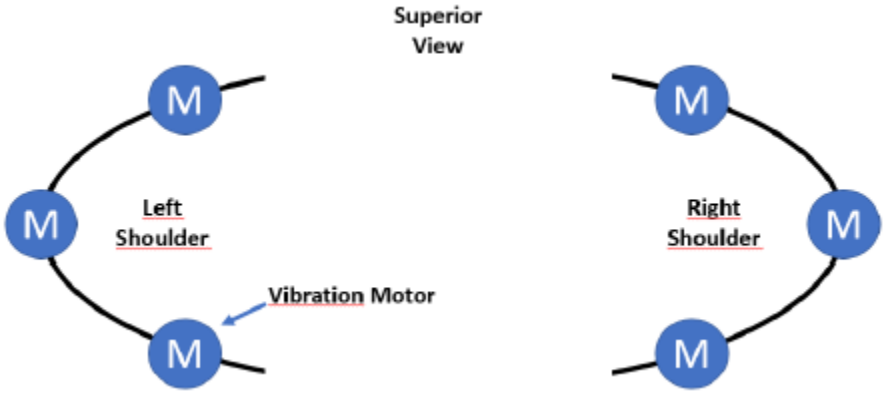

Fig. 6-8 Scheme of the vibration device

Fig. 6-9 User testing the prototype of the vibration device (Charleston et al. 2017)

Problem/need

Mirrors on the sides (the mirror itself or the blind-point alert given by radar are both sight inputs for the driver) provide an important information input in order to avoid accidents. While driving at high speed (on the road or performance driving –perhaps driving a motorbike-), while driving a heavy unit or when you need an additional input (for elder/distracted/insecure people to feel safer) it could be useful to have additional info of the surroundings.

Challenge

Is it possible to intuitively substitute sight with other senses?

Why is it Dark?

It is a frightening concept for drivers, or even people without any visual problem, to lose the sight sense, for most of us would be an impossible task to do anymore. So, having to complete journey without being able to see, is why we consider our prototype a dark horse.

Potential users

-Performance drivers (high performance/amateurs)

- o Drive fast
- o Need to feel that he/she has the control

-Elder People

- o Human being sensorial capacities decrease with age
- o Redundant inputs could make them feel safer.
- o It is recommended to do “different” things or an extra effort in order to maintain the brain in good shape. This device could be the extra effort.

-Truck Drivers

- o Heavy trucks have a lot of blind spots (and A LOT of mirrors)
- o Redundant inputs could be a benefit for people who are tired due to driving.

o It could reduce the bill of insurance.

-Motorcyclists

o Often enjoy driving fast on the road.

o Need to be super conscious of what is surrounding them anytime.

-Distracted Drivers (People having concentration problems)

o Eyes and ears could be distracted but it is more difficult to distract your shoulders.

How it works

-The user had to be blindfolded and walk through a maze (13 meters long).

-We put 6 vibrator motors on the shoulders (2 at the back, 2 at the front and 2 at the sides).

-Vibrations indicated the location of obstacles, so the user would know where not to turn.

Fig. 6-10 Maze and obstacles for the user testing. (Charleston et al. 2017)

Testing with users

Users were given few instructions consisting in having to complete the labyrinth blindfolded, with the help of some vibrating motors that would indicate an obstacle was in the direction they felt the vibration. Afterwards they ask about their experience and proceeded to do a quick interview.

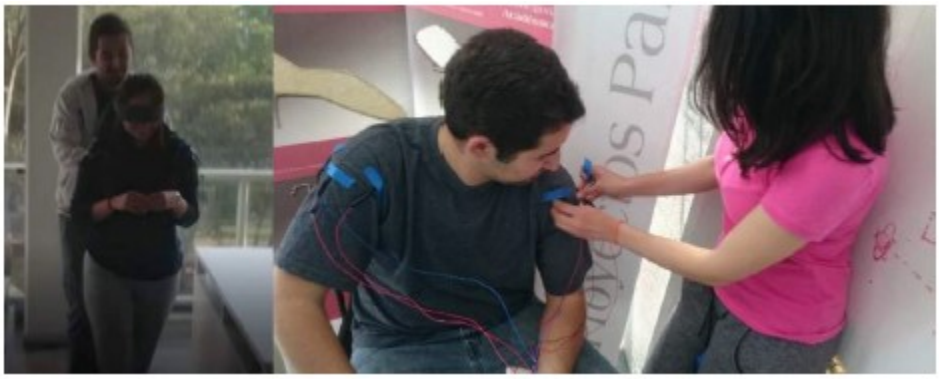

Fig. 6-11 Users testing the prototype (Charleston et al. 2017)

Results

-2/9 didn't finish the test

-7/9 said that the device was intuitive enough to follow (they used it for less than 2 minutes)

-Who finished the test accomplished the maze in 1 to 2 minutes (13 meters)

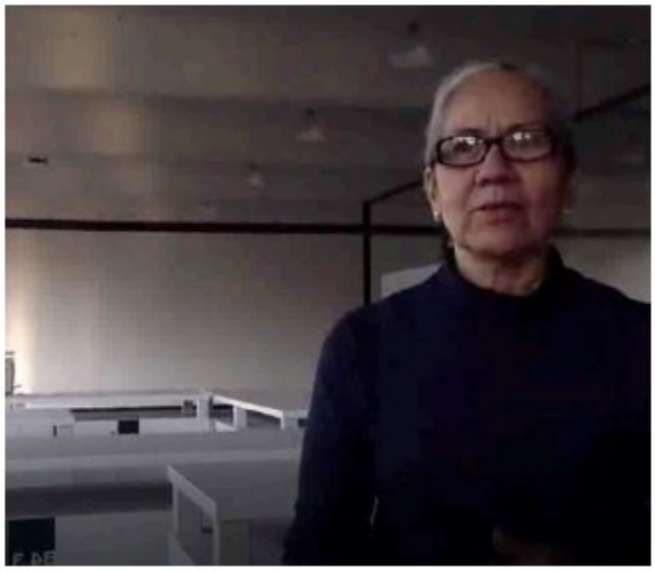

Figure 6-12 One of the users during the interview. (Charleston et al. 2017)

Findings

-To avoid confusions, vibration patterns should be easily differentiated from a cellphone vibration/notification.

-Different vibration intensities/patterns could help detect the proximity of the obstacles, as well as the angle of rotation.

-Determining different ranges for different user-obstacle distances would increase user notion of surroundings.

-For the reason that the motor's responses were activated by a human, they had different ranges, so it confused the users of the precise location of the obstacles.

-Proximity of motors causes difficulties while differentiating direction. Adding one input right at the front and back would improve user's response.

-Most users needed only few seconds to understand and get used to the device, which increased their trust on it.

-Focusing on the main obstacles would help users not to collide with objects.

-They can trust in a device like this

-Some of them feel very insecure while walking blind-folded, but they were less stressed due to the input of the device.

Finally, the design team was interested in accurately describe the environment surrounding the user through most of his/her senses.

6.6 – Change of the project focus according to findings

After analyzing our users' main problems, and the solutions given to them through our benchmarking, we could see a vast array of different implementations and technologies that solve most of the problems. While going

back and forth through our observation, we notice a factor that we hadn't consider before but was present through our research since the beginning, but we never got too deep into, until doing much further analyzing. This factor was the "Driving with kids experience". Therefore, the Ford Team decided to dig deeper into this problematic, since we all found it and its relation with Health & Wellness very interesting (Charleston et al. 2017).

Looking deeper into this, we realized this situation is a journey that a great amount of parents, most of the time mothers, has to do every day just to take the kids to and from school. In Mexico City alone, there are approximately 4,200 public elementary schools and 1,140 private schools of the same level.

Between 45% to 50% of the students from private schools are taken in private cars, with an average of 1 kid per car, accounting for 20% to 25% of the vehicles circulating through those times, that in most cases occur during rush hours. Leading to at least 30 minutes, average time, just to take children to and from school. (Secretaría del Medio Ambiente, n.d.)

Furthermore, recent global research suggested that children are 12 times more distracting to a driver than talking on a cellphone, during and average 16- minute car trip parents are distracted by their children and not paying attention to the road for more than 20% of that time (Monash University, 2013) and 43% of parents admit feeling anxious, irritable, or simply angry when traveling with their children. (Peugeot and One Poll, 2011)

6.6.1 - Problem

As a result of the problematic presented in the context, many children then have to spend more time in the cars to go to school, visit family, get to malls or any other car journeys that may be required. Where they get restless, desperate, angry or simply curious, and parents have to suffer the consequences of that, while trying to calm their child down, that ends in them losing focus on their driving.

6.6.2 - Personas and scenarios

After much debating between the team members regarding whether the kid was the user or the parent was. We concluded that both of them take part of the experience but they are affected in different aspects, by different factors.

We deduced that the children act as the problem actioner as planted by the problematic, and the parents act as a secondary problem or result, based from the kids' actions and reactions. Resulting on us dividing our users in primary and secondary, which are children and parents respectively. Reasoning that our design would be focused for the kid, and in return, the parent will receive a benefit from it. Based on that, we selected our final user: kids between 6 to 9 years old.

Based on that we selected and redefined our persona:

MAX
8 years old
Has a 6-year-old sister
Lives in Mexico City
Goes to elementary school
Both parents work
On weekdays mornings he is taken to school in a private car by his mother, and is picked up in the afternoons when his mom gets out of work, on both times they are always stuck on the car congestion near his school. On weekends he and his family goes to visit his grandparents, that live at the north of the city, or go out to eat or the movies, but he needs to be ready with 2 hours of anticipation cause most of the time they get stuck in traffic

at some point of the journey, which makes him become desperate, angry, hungry, fight with his sister and not getting enough attention from his parents to entertain himself (Charleston et al. 2017).

6.6.3 - Challenge update

All of this had us re-defining the challenge once again, as a mean of finding a solution that solves a problem that had been there all along, but not many users and car companies realize, the distraction of kids. So, our new challenge derives from that, and states as how to entertain the kids during the car ride duration, to reduce distraction to the parents driving.

6.6.4 - Current in-car solutions

Conversation mirrors

Many family cars have been integrating this small, convex plastic mirror that flips down from the ceiling near the rearview mirror and provides an ideal angle to quickly check in with back passengers, which implies no head turning or rearview mirror adjustment necessary. But does not provide any entertainment for the kids, just security for the parents.

In-car displays

These ones have been in the market for a long time now, but although many people still use them, they are increasingly being replaced by tablets or smartphones, since these only allow you to watch movies, or reproduce videos and no further interaction.

Tablets/smartphones

Everyday more and more parents rely on these to keep their children entertained inside and outside cars, kids have become more adept at manipulating them, so it makes them a great entertainment for them. The downside, it's that it tends to alienate the kids, and makes them stop paying attention to anything else, and, as they learn more about them, it also becomes more difficult to monitor the content the kid can interact with.

Car games

Commonly use in long car rides as it requires nothing but the passenger attention and view, the most popular being the "I-spy" game. But these games don't usually last longer than a few minutes due to not many interesting things to spy on, or the speed, or the different views from the parent and the kids that make it difficult to find the same object.

Kids podcasts

Teaches the kids, and provide a security to parents of safe content for their kids, but are dependent on very few schedules, and while most of them will maintain the kids entertained, at least as long as it lasts, some parents get bored/annoyed at having to listen to kids podcast every ride.

6.6.5 - Current entertainment options for children

Popular apps for children

TOCA BOCA offers multiples apps greatly accepted by kids and parents due to a grand variety of themes that help stimulate the imagination of the kids. Many times it also some form of learning to the kid through different games.

Also, any other game that offers a simple interface, with few commands, is really attractive for a child, mainly the ones which enable players to build, explore, resource gathering, crafting, and combat.

Gaming consoles

As to games and video games comes, there has been an increasing competitive market for them, from which kids constitute a great percentage of the users. Videogames consoles have been evolving, making great use of sensors and gesture control interfaces with physical controls or just body parts, the most popular for kids being Nintendo Wii U, Xbox 360, Sony Playstation and Microsoft Kinect.

Mobile devices

Smartphones and tablets are now the most popular devices used for gaming, along with portable gaming platforms like Nintendo DS, Sony PSP or, as of most recent, Nintendo Switch, due to their portability

Different interactions with interfaces

To stay competitive on the market, companies nowadays have to innovate in the way users are going to interact with their products. As a consequence, kids are exposed to new technologies, which they accept and become adept at them quicker than it was before. The most common being the touchscreen due to easy access to smartphones and tablets. Voice commands is another feature they have come to know closer too, interacting with smart assistants like Apple's Siri and videogames consoles, as well as gestures or move commands like on a Kinect. But many new technologies are being put to practice by innovation companies, such as a well mentioned Virtual Reality (VR), and more recent one, Augmented Reality (AR).

Virtual reality

VR headsets are currently being used to immerse the user in a virtual environment through realistic images, sounds and other sensations that replicate a real one or create an imaginary setting. Commercial VR head seats include the Oculus Rift, HTC Vive, Sony PlayStation VR and Samsung Gear VR.

Augmented reality

Augmented reality is a live direct or indirect view of a physical, real-world environment whose elements are augmented (or supplemented) by computer-generated input such as sound, video, graphics or GPS data. Probably one of the most known implementations is the "Pokemon Go" app, where using the smartphone, one can find pokemons while walking around.

6.7 – Concepts brainstorming for experience prototype

Having a bigger panorama of what technologies kids are used to, and what kind of games they like to play with, and in regards of the current problems and challenge we are face with, we proceeded to a brainstorming of ideas by all the members of the team, where each of us showed the basic interaction and content that were important according to the interpretation of the information obtained so far. Some of the concepts are the next ones (Charleston et al. 2017):

1. Reality modifier where the child can add "new bodies" or voices to people passing by or even him/herself, inspired in applications popular today, like snapchat, where kids enjoy changing themselves or other people. The application could also let the child find secret messages across his path, using location points and technology like augmented reality to determine the position.

2. Personalized space for the kid inside the car, where he can choose to transform it into the environment he/she desires, making him a explorer of many places, where he can intervene and interact with it, through sound, light and touch.

3. Screen where the child can see the view seen on the car's windshield, with some endangered animals' drawings, that the child can re-draw on a time limit, and the interface can give him a score while teaching him some learning, making him aware of the situation of the animals. This also aims to improve their motor skills.

4. The child can choose an environment that is going to have different elements and characters that he will be able to add to the current environment. He will be able to see a hologram version of the element before deciding to add it to the window. He can also double-tap the window when he is content with it, to save a screenshot and share it with his parents or friends.

5. Spatial environment where the kid is transported to that dimension, where elements of the space are going to appear in front and beside him, through connected screens where images passes from one to the other mixing up with the current environment.

6.8 – First concept prototype

After submitting and analyzing the pros and cons of each proposal, we decided to generate a new concept idea, taking the points that were more interesting for the design considering what we wanted to prove with the children, and how we could implement, interact and receive feedback from. The outcome was a concept for the kid's entertainment on the back seat of the car, resulting in the following concept view (Charleston et al. 2017):

VR and AR inside car, to create a new environment inside the car to entertain the kids during the trips, and reduce parent's distractions caused by them.

Furthermore, for this concept we also considered giving them entertainment through an educational interface. Thinking about health awareness, and how some children have trouble understanding or putting into practice some healthy habits and personal care activities. Being mindful that those are things that people need to have, but as one gets older, it is more difficult to follow those habits.
So, we consider it is important to teach kids, and set an example, because the earlier they are taught those values, the faster it is for them to understand why it is important, so they can grow up following a healthy lifestyle. It could be interesting to follow and construct a design based on those themes for future development. As an important note, and for prototyping and time concerning issues, for this prototype we are using a solar system educational interface, but the goal is to introduce the kids to the healthy habits panorama.

6.8.1 - What is it?

An interactive system that allows children to interact through gestures, using educational themes that guide the kid through a story and let him/she intervene the current environment according to the theme through augmented reality technology on the windows, and virtual reality in the ceiling.

6.8.2 - What is to be tested?

- Children position and interface reach
- Intuitive usage of the prototype
- Entertaining period duration
- Acceptance of the kid

6.8.3 - How does it work?

Fig. 6-13 The design team preparing the prototype for test with users (Charleston et al. 2017)

This prototype features simulated augmented reality in the windows that changes people's faces to alien faces, through TV screens hanged on the outside of the car displaying a pre-recorded car travel. In front of the child, there is a screen where he/she is going to receive feedback through an astronaut character.

It features a projected interface on the car's ceiling, that displays a solar system application that give the children the notion of being controlled by gestures, even though it is secretly controlled by us simulating the kid control.

Fig. 6-14 projection on the car's ceiling (Charleston et al. 2017)

It also features an educational interactive interface that teaches and shows the solar system to the child, letting them immerse in it. To begin the test, the kid starts a normal ride in the backseat, sitting inside the car and buckling up.

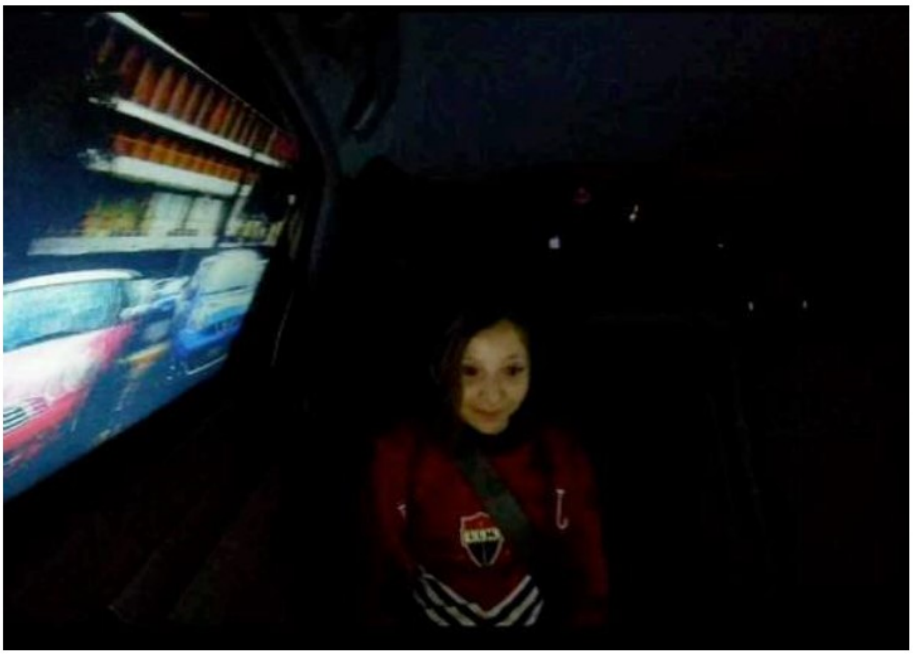

Figure 6-15 Side screen of the prototype to simulate movement

The front screen introduces the directions to interact with the interface, via different commonly known gestures: Zoom In: Separating both hands from middle to the sides. Zoom Out: Joining both hands from sides to middle. Select: Pointing at the desire object, and “clicking”. Move left/right: Sliding one hand from left to right, or vice-versa.

The kid is instructed to move around “the space” to find something (for example, the sun), so then they can receive visual and audio feedback.

Fig. 6-16 Interactive screen of the prototype

6.8.4 - Findings

- After finishing the test, most of the kids ran to their parents to share their experience
- Smaller kids struggle with the gesture interface because the seatbelt was too high
- They found the voice of the interface annoying or scary
- The instructions were not clear enough, possibly for the poor contrast of the digital image

- Kids find it more intuitive to interact with the front screen, touching it, than the gesture one on the ceiling
- Younger children had more trouble doing the gestures, showing less motor skills control.
- Half of the users found it boring because of the low interaction, or lack of game reality.
- One kid interacted with the augmented reality characters in the windows pretending to be shooting at them with and imaginary gun.
- Not to assume one kid represent the personalities of all kids, when it is not. One child can love the interface, while others will absolutely hate it.

6.8.5 - Additional information

After this prototype, and the findings gathered, we decided to dig more in regards of the family interaction that we saw as a pattern in practically every user test, and found some surprising additional information that we were compelled to take into account.
In regards of parents and kids inside a car journey, research shows that at least 55% of parents admit losing their temper with their kids on long car trips (Peugeot and One Poll, 2011), and even more concerning, more than 40% of parents said that being stuck in a car with their kids was more stressful than work. (Keene, 2012)
Having this information, we wanted to know how relationships are between parents and kids nowadays, and we came upon with interesting results. According to a family sociological study, 29% of parents consider they spend enough time with their children, thinking that they prefer playing video-games or being with friends, on contrast, a surprisingly 63% of children would like to spend more time with their parents. (Urra, 2015) 72

Before, we talked about things that cause stress and distraction, nevertheless when we talked about things that make people happy, we also mentioned being with family, and talking with somebody while traveling or commuting, we know that it sounds a little contradictory, but the possibility of solving that contradiction is what would make this concept a powerful one.

6.9 – Re-definition of the challenge

It became imperative for us then, to give our challenge a new perspective, seeing as time has become increasingly shorter for parents and kids to be together, and time inside cars has increased, why not promote quality family time in those longer car rides, and with that create a better experience for both of them? Then…

How can a new experience turn the stressful car rides with kids, into pleasant one's, while strengthening family ties between parents and kids?

6.9.1 - Design criteria

To decide on what were the basic requirements and what our final concept should offer, we created some criteria for the design, and decided what was more important for the team to consider on the final concept. After analyzing, brainstorming, and a team debate, we gave each criteria a value from 1 to 3, 1 been the lowest value, and 3 the highest value. The results are shown as followed (Charleston et al. 2017):

VALUE	CRITERIA
1	Must be able to be used by the kid without parents help
3	Parent interaction to a minimum that doesn't intrude with their driving focus
3	Device must be safe for both parent and children
1	Must be able to use it while sitting with the seatbelt on
2	Content safe for kid, on a kid's language
1	Reduce distraction from driver
3	Promote parent-kid interaction
2	Mantain kid's attention during the car ride
3	Keep motion sickness to a minimum
3	Physical interaction by the kid
1	Give feedback
2	Promote child interaction with the surroundings
1	Give educational feedback to child
2	Novel interface

Fig. 6-17 design criteria (Charleston et al. 2017)

We can see that the ones with the highest values were the ones concerning the safety and health of the users inside the car, as well as the interaction with the system. It is important to notice, that these criteria are the ideals for the project, but the order may change according to more research and findings, and all of them are to be taken into account one way or another, seeing as we consider them all to be part of the system.

6.9.2 - Final concept ("For'dKids")

The concept features AR on windows in an interactive system that allows parents and children interaction between them and their surroundings to reinforce family ties during car rides (Charleston et al. 2017).

What is it?

It is a system that enhances parents and kids interaction, through augmented reality technology that fosters children to interact and personalize their environment, to create and share new stories every ride.

How does it work?

Three main systems:

1. Window interface
2. Front camera/interface
3. Parent's display.

Modes

Winpedia (discover mode)

This is the main interface function, the kid will be able to pick at any object that interest him/her, and will receive feedback from the interface of its name, and a brief description of it, via audio.

Each object found will be added to their collections, depending on the object (Ex. Bicycle, car, cable car, etc. In the Transport collection). If they wish to see how their collection is going, or hear again their descriptions or names, they can go to the folder Collections and scroll through the ones they want to see.

Explorer mode

This feature gives the kid daily searching goals that he can choose to complete, while selecting the binoculars icon four different items of a certain category will appear (as shown in the example, it could be mammals) that the kid can look for in his/hers surroundings.

To make it easier and more enteratining for the kid to find the objects, the items are digital objects put on the surroundings by Augmented Reality, kind of like the Pokemon Go app.
Once he finds an item while driving around with his parents, he can select it, and as the main interface, will give him basic information of the item.

Tourist mode
The tourist feature is thought as a way for the kid to get to know his city or surroundings. Everytime there's one nearby, a camera icon will appear, and the kid can select it to receive information also. Then they will also be saved to their tourist collection for future reference, and as a way to save memories of the places they visit.

It can also give him information of what other attractions are near them, to look for them if they want.
The whole interaction with the system is thought to be through an avatar. The main purpose of the avatar is to keep the kid engaged with the system. Through research, we found that the avatar is one of the most engaging aspect of today's games. The avatar gives the kid the possibility to upgrade his/her avatar through the activities and features of the system, like collecting points or even items for his/her avatar.

Story mode
The kid would be able to choose a theme from a category, that it is going to be updated frequently to ensure it keeps new and updated material.

After that, the kid and the parent can try to guess which characters should be in the story, and after deciding on one, the kid will draw it on the window surface. It does not have to be the perfect drawing, the interface will recognize what the kid drew through machine learning artificial intelligence, based on other kids drawings, and it will set a predetermined animated bear that it's going to start moving immediately. This process would be the same with any other character added to the environment.

Then he can choose to give him an action regarding other characters, by selecting him and dragging to the other character (ex. bear "chases" bunny) and it will start to do the selected action. At any time, the kid can capture a photo or record a video of their story, and share it with the parent.

The child can also choose to record a sound for it made by him or his parent, and add it to the characters. Any character added to the window, will automatically be added to the front screen, where he can watch them move around over himself or his parent, and also have fun with it.

The parent will also be able to monitor his child if desired, through the car system on the side dashboard, they will also receive notifications in case their kids share something with them, and will be able to see it only when the car is not moving.

Features

Front and back seat cameras: The design team observed that kids are social by nature, and want to share and interact with others, especially their parents, and a vital part for them is to feel that they are being paid attention. One of the main points for them is the eye-contact establishment, which takes a great part in every face-to-face interaction. On the other hand, the front camera for the child acts as a way for them to monitor their child, something that every parent does, just to be reassured to know what's happening back there.

Car system interface: This will enable a sharing interface that doesn't require any added hardware in the sense that could easily be integrated to any car system without much difficulty. It will be able to communicate with the "ForDkids" system, and receive, save and share system related information.

Audio system: Will allow to record and reproduce sound, and give audio feedback to the user. Added to the front and back seats, to enable better and clearer communication, to avoid parents to turn their head to listen better to what the kid is saying, and for the kid to understand quicker what the parent says from the front.

Front screen: Will show secondary interface for the kid interaction, mostly, it will serve as a starter for window interaction, and will also display the camera to see the parents face or as a mirror camera to watch him/herself. AR window: Augmented Reality (AR) technology on the side windows where the main interaction is going to occur, being the interface where the kid will be able to draw, and select some options, such as record and select an action in real-time.

AI interface: Machine Learning artificial intelligence interface (AI) will take a part too on the window interface, this technology will recognize the drawings the child draw, based on other children's drawings. It is called machine learning, because as more and more children keep using and drawing for the interface, the system will become more adept and accurate at recognizing the next drawing.

In-car Wi-Fi: Nowadays it is something more and more integrated systems are adding up, due to the facilities it provides. In this case, it will allow receiving and searching information, to keep updated, and to send files to solve storage issues, and social sharing aspects.

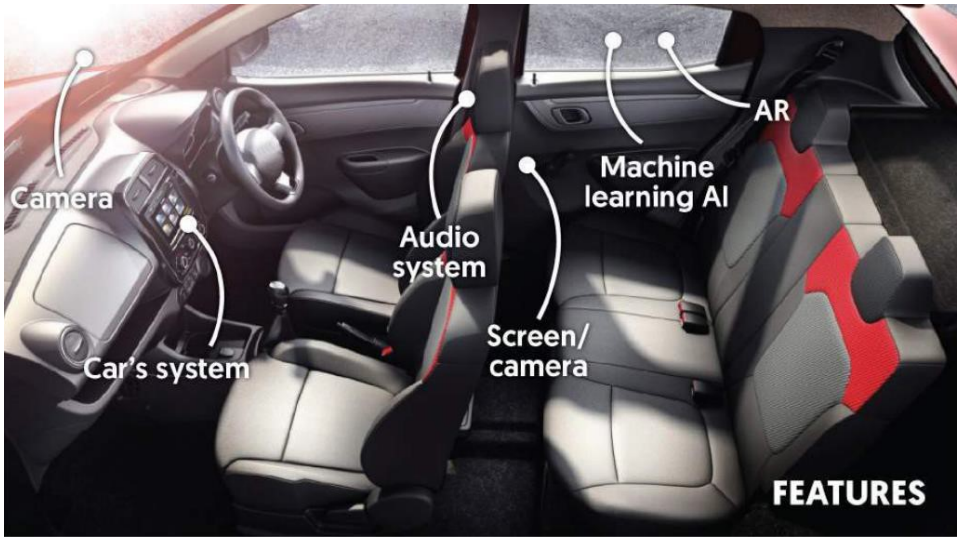

Fig 6-18 Features of the concept (Charleston et al. 2017)

Advantages

As the concept kept developing, it was important to consider the advantages that were going to make this product different from any other solutions existent, that will be deciding factors on why potential clients would want to buy this product, which consequently would derive why a company like Ford would like to produce the system.

Therefore, the main advantages we found our concept to offer are:
- The child becomes more aware of his/her surroundings.
- Promotes family interaction.
- Doesn't alienate the kid.
- Reduces the stress for both the child and the parent.
- Captures pleasant moments to be remembered.
- The system maintains the child entertained for a longer time.
- Creates new experiences every ride.
- Allows social sharing.

Benefits

As well as the advantages given, we have to have clear idea of the benefits that the system will offer. What everyone will gain from its obtaining and use, which are presented next:

- Prevent unpleasant situations inside the car.
- The family ties between kids and parents strengthen.
- Reduces children demand of parent's attention.
- Save family memories.
- Share stories, share family love.
- Positive promotion and image for Ford.

6.9.3 - Conclusions and learnings of the second cycle

Through the duration of this cycle it can be shown the development and constant changes the challenge had to endure, which is the result of every additional information that we continue to gather but help us to come up with a more defined final concept, considering the increasing number of related factors.

We learnt that an infinite number of factors can cause the driver to be distracted or stress, especially living in a city like Mexico City. Being stuck in traffic at rush hours is something practically anyone can relate to, or have experience at least once in their lifetime.

So, for us to discover that parents that have to travel with their kids not only has to suffer from the common stress-factors every commuter have, but also add up the kids-stress factors to them, brings a lot into perspective to everyone else that do not have to endure it.

Then, the research, observation and testing realized have opened a great opportunity panorama for us, which has brought many findings and learnings to have in mind. From the main ones to consider we have:

- Kids attention and interest proceed in a quicker form that any adult, needing renew content and goals that make them maintain their focus.
- They also have infinite personalities, so they are going to respond different to certain stimuli.
- They are very physical, and curious, so a direct interaction it is preferred.
- As the way the new generations have been growing up with, they are more adept to accept and understand new technologies easier, because they are at a stage where learning is vital and easier to understand if given correctly.
- Children are social by nature, and the parents being their main contact, they tend to share and involve their parents as much as possible.
- Parents take for granted that they spend enough time with their kids, but in reality,

This learnings and findings led to the development of the final concept, which improves the mobility experience for the children, as it does is in consequence for the parents. This concept attacks many of the negative aspects of the mobility experience, while improving the good ones. Therefore, we can conclude that the concept can be successful as well as the functional prototype product of this, which will be developed in the next cycle.

In this stage of the project, we learned a lot regarding the project, but we also learned a lot about teamwork. This stage was crucial since a definitive team was selected from the University of Stanford, and a lot was learned from this new team members, from their view points, experience and expectations on the project. The communication between the members of both universities was engaged more often than in previous stages, therefore we learned how to treat differences in points of view, language and even cultures. Also, in comparison with previous stages, interaction with Ford was engaged also more often, with video meetings, as well as live meetings in its headquarters in Mexico City and California.

Because of all of this, this cycle represented a great experience and professional learning for all the team members, at the same time that the expectations on the project became clearer for each one of the participants.

Note: Section 6.10 has been removed from this document due to confidential purposes as it contains the technical information about the final solution, such as the research results that led the team to choose the final proposal.

7 Results

Note: Sections 7.1 – 7.5 have been removed from this document due to confidential purposes as they contain the technical information about the final solution, such as the specifications of the components, diagrams, interaction among the devices, etc.

7.6 Final results: Prototype testing

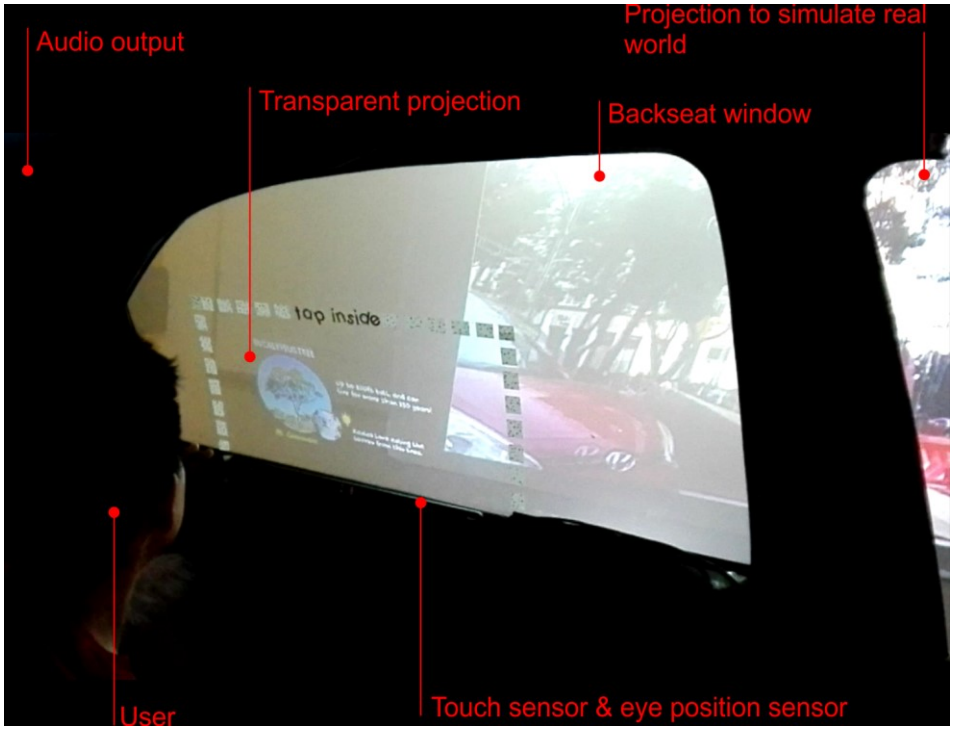

Fig. 7-28 The prototype and its main components (Charleston et al. 2017)

The following are the main results obtained through prototype testing at the Expe event:

- More than 80 people successfully tested the prototype's experience, among them, several children

- The prototype demonstrated to be stable enough for continuous testing for more than 4 hours

- The system tuning was correct: users received information about the things they were pointing at through the glass (they pointed at things being projected besides, that is, a simulation of the car's surroundings)

- The children who tested it kept entertained by the system (the experience lasted 5 minutes each)

- People demonstrated curiosity (at least 40%) on some landmarks projected in the simulation, which represented a trip in Mexico City, so it reveals the potential of one of the functions that were conceptualized; tourism mode.

- Some eye glasses may reduce the system accuracy when it comes to recognize what people is aiming at.

8. Discussion and conclusion

The ME3010 methodology is a Design Thinking innovation process that leads the development of new products based on possible benefits that can be delivered to the user. Mixing different cultures and academic backgrounds among the teams of students that are developing those products, different perspectives come to discussion, creating at the beginning a divergent brainstorming process which is focused on an objective that is analyzed from diverse points of view in order to converge at some point. This path from divergence to convergence often create pressure peaks inside the team, in the end, although there is a stablished methodology, design is about people; mainly users and designers analyzing them. Each process milestone pushes the designers to be more concrete and to ground ideas, but often, it is only after several months of research that a team of designers can know the user enough to surprise it or to deliver something that may be qualified as "better than expected product". This way, the highest pressure peak can be reached when it comes to decide whether it is worth to stick to the original plan, (often stated at the first phases of the project) or if it is a better idea to take a different path in order to satisfy high impact users' needs that where just gathered right at the middle of the project, needs that are often not yet well understood in that phase and require then extra experiments and of course time for its comprehension.

For the particular case of this project, the first determinant moment was reached when it came to decide who the main user was; there was not a main user stated by default, as Ford Motor Company wanted to open the project scope to any market, and not only to their current clients. As the design team had the decision in its own hands, this part of the research was the toughest because "user focused design" always considers a determined user, and there is of course a lot less information on how to determine who the user is i. e. who are we designing for. The reason for this lack on information is obvious: this decision depends on divergent facts, such as the designer's personal motivations, market opportunity, a brand's identity, steak holder's expectations, etc. In this case the observation process followed by the design team led the group to focus on a couple of users that was not even defined at the beginning of the process: parents and their children commuting together in a car. The conclusion was taken only on month 5 of the research.

Prototyping and testing are the core of ME310 methodology and are key steps when it comes to ground the ideas and concepts down. It is very important to keep prototypes as simple as possible in order to stick to the budget and available time. It resulted useful to split a concept into different prototypes in order to maintain simplicity and at the same time to have a user's opinion and experience for all key features. As user experience has the highest range, some prototypes can be tricked in order to deliver the desired experience for the team to observe users' behavior, this was the case of the prototypes mentioned in section 6.3.4, specifically the one called "interface test", which function was to compare voice command, touch command and gesture command. Nevertheless this "tricky prototypes" can damage the experience's performance, that it why a system that can perform its functions in an automatic manner is a better way of testing and measuring the user´s reactions, this was the case of the final prototype that was presented on the Expe event at Stanford University.

Through the final prototype the design team delivered a new transportation experience (UX) that was focused on health (specifically oriented to the social aspect of health in terms of improving family relationships) and wellness (particularly to the emotional aspect by avoiding stress). At the same time the design team introduced a novel way of gesture command (HMI) that works by pointing at anything through a cars window and receiving information about that object.

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