THE DIGITAL EXPERIENCE IN AN AUTONOMOUS VEHICLE

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Abstract

This report was completed in partnership with SonicRim, a design research agency. A major automotive company worked with SonicRim to better understand the digital experience people want in autonomous vehicles. Transportation is something that is always evolving and changing particularly with advances in new technology. Autonomous vehicles with be another change to transportation options in society. The project was conducted in three months including mobile ethnography, written homework, and in-person participatory design sessions with participants in Phoenix and Miami. The key focus of the thematic analysis was to better understand what participants expect in a digital experience in an autonomous vehicle. There were constraints and participants were able to conjure up their expectations and dreams.

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CHAPTER ONE

PROJECT INTRODUCTION

Introduction

Technological advances are nothing new. Autonomous vehicles breed excitement for many people but may also trigger trepidation about safety or efficiency. Anthropologists have been working closely on the development of autonomous vehicles. It has yet to be seen what the future holds for autonomous vehicles in society, as they have the potential to dramatically change car ownership and transportation patterns (Jordan and Wasson 2015).

In a car-centric society, these changes will likely have major impacts on the ways that users think about the future of transportation (Jordan and Wasson 2015). For example, the thought of autonomous vehicles may strike fear in people, suggesting situations of technology running amuck or people may be anxious about using something unknown. But at the same time, the autonomous vehicle may excite people who look forward to liberation from car ownership, driving, and searching for parking. Autonomous vehicles also have the potential to provide more transportation options for people who have mobility constraints, seniors, and people with disabilities (Jordan and Wasson 2015).

As the development of autonomous vehicles advances and the future of driverless cars becomes a reality, it is important for designers, engineers, and businesses—who will be designing and producing these vehicles for mass consumption—to understand how users perceive and interact with them. Anthropologists perform this type of work, and this study is designed to provide insight into this issue.

Project Format and Organization

This project report consists of three chapters. In the first chapter, I explain the history, problem, significance, detailed methodology, and theoretical background. The second chapter is a stand-alone article that encompasses the full project, including the methodology, findings, discussion, analysis, and recommendations. The third chapter summarizes the findings and provides recommendations for future research.

History of the Project

In this study, I sought to understand how people view, interact with, and use autonomous rides, with a focus on the digital experience of the autonomous ride (e.g., non-human interactions, mobile apps, video screens in the car, communication between vehicle and person). This project is not a vehicle ownership project, but a ride-hailing project. My project partner is SonicRim, a co-creation and design research consultancy based out of San Francisco.

SonicRim uses social science and design thinking to help companies envision futures, improve experiences, and find clarity, consensus, and purpose to expand innovation capacity (SonicRim). A major automotive company hired SonicRim to do the research and I was an intern where I contributed to the project. My external advisor at SonicRim, Uday Dandavate, is interested in understanding how people will accept autonomous vehicles, what they expect the digital experience to be like in an autonomous ride, and how car companies can best deliver that experience.

The results of this project will provide SonicRim with a detailed analysis of the research question, including the most valuable uses and the design criteria for a digital assistant. The

deliverable is a report to fulfill the requirements of San Jose State's applied anthropology program. This report will describe how people experience a new technology, what they expect, what they believe the future should be, and how transportation will change.

Developing the Problem Statement

The problem came from the client, who sought the assistance of SonicRim, a design research firm, to perform ethnographic research on the digital experience in an autonomous vehicle. The client is developing autonomous vehicles and needs to better understand the digital experience users want in an AV. The ability to have complete freedom to do what you want in a vehicle without a driver is not something that currently exists. Couple that with technological advances that include mobile devices, laptops, Bluetooth, and more, the options can be endless. Understanding when people want to use an autonomous vehicle, whether it's for commuting daily to work, running errands, or for longer trips will help them understand what they want in their digital experience.

Significance and Deliverables

The research can contribute to anthropological knowledge of autonomous vehicles by helping companies that are developing AVs to better understand what users want. It will provide the necessary background for designers, engineers, marketers, and others tasked with developing the digital experience in autonomous vehicles. This research project contributes to fulfilling SJSU's applied anthropology master's program requirements.

Framing Literature

The literature I reviewed for my project includes a background in why anthropology and ethnography are important to researching humans. It dives further into design research, which is the type of research that was done for my project. Lastly, it encompasses research conducted by anthropologists on autonomous vehicles, which primarily revolves around automation. Furthermore, it incorporates additional research from news sources that describe the digital and cabin experiences in an autonomous vehicle.

Anthropology/Ethnography/Design Research

Including anthropologists in research has been difficult for corporations to understand according to Jordan and Wasson (2015). The authors argue engineers tend to seek specific solutions that are more quantifiable, while anthropologists see problems as multifaceted and are open to several solutions. Building off ethnographic methods, anthropologists can have many careers in corporations in the field of research, including UX Research, Design Research, Market Research, and Business Strategy. Anthropologists study humans and it is their responsibility to represent the humans, and the consumers in the development of products, services, and advertising (Cesafsky et al. 2019).

Anthropologists take into consideration the individual, the group, and the setting not only among other people but in the full environment in which they live, how it affects them, and how they are affecting it. When researching people, it's not just important to understand the individual but also understand where they live, work, and play and who they do it with, including family, friends, co-workers, or peers. The individual may be the direct user of an

AV, but others will be involved in the usage, whether it's friends or pedestrians, or even those that repair the vehicle (Youngblood and Chesluk 2020).

Ethnography provides information about the way people act in material configurations. It provides more than just a methodological approach; it creates a user narrative that is important in designing products (Bloomberg and Darrah 2015, 75). According to Karen O'Reilly ethnography is the "iterative-inductive research (that evolves in design through the study), drawing on the family of methods … that acknowledges the role of theory as well as the researcher's own role and that views humans as part object/part subject" (Pink et al. 2016, 3).

Design anthropologists work with designers to develop new products. Corporations or design firms often employ them. A design anthropologist's work can be done at the beginning of the project development cycle. This research is often described as exploratory, which will help explore consumer needs and conceptualize the project. Research performed by anthropologists can influence the outcomes and possibly drive the development of the work, but this is not always the case because the work is done after it leaves their hands (Wasson 2016).

Anthropology is vital in design because anthropologists examine social orders and the interplay of materiality, meanings, and practices (Escobar 2018, 53). Designers need researchers to better understand human needs. Researchers and designers work together on broad-based problems. The gap between the designer and the user is far too great for designers to try to close the gap with personal perspectives. Design research fills that gap and provides user insights during the development of the design, testing a prototype, and

continuing to perform research that tests the product's efficacy once it is launched (Zeisel 2006).

The design process not only includes researchers, designers, engineers, and others fully employed by a company, but it also includes the users. Researchers work with users to better understand their current reality. Designers can create products that offer services to consumers by understanding their behavior. By designing a product in a specific manner, it can provide the services that are necessary for the user (Bloomberg and Darrah 2015). The user is the one who understands their practices, and the researcher must work to unearth their cultural behaviors (Escobar 2018, 184). Participatory design sessions allow researchers to involve participants in the design process where ideas and experiences are exchanged between the two.

The first part of this project on autonomous vehicles employed digital methods, known as mobile ethnography, where participants used their smartphones to record their experience for a first-time ride in an autonomous vehicle. Digital ethnography allows for technological devices to be used between the researcher and participant rather than the direct interaction that had been done in the past. It is not very different than traditional ethnography. Digital media is part of human relationships, but it does not necessarily change the relationship. Digital products become part of the wider arrangements of people's activities (Pink et al. 2016).

User/consumer research is conceived around what people use and consume. Research is performed and documented to better understand the product that is in development and the needs of the user. The problem here is that the findings identify the specific needs to create a

product but leave out the larger picture of how people interact with each other and things. Cultural values need to be brought into the world of industry, not only to provide actionable insights for product development but to enhance the position of the corporation to have a broader impact on the social landscape of their industry for the greater good by creating shared values (Venkataramani and Avery 2012).

Autonomous Vehicles

For autonomous vehicles to be successful, researchers will need to understand the social life and cultural behaviors relating to current modes of transportation (Wasson 2016). This study went beyond the digital experience in an AV because participants wanted the space to have the same digital tools as an office, a bedroom, or a family room. Anthropologists have done research in the past that has examined autonomy and human interaction, including interaction with humans in and outside the vehicle. News articles have addressed digital technology and how it will affect passengers inside the vehicle.

Ethnographic studies have examined the interactions between humans and autonomous technology in vehicles. These ethnographers used actor-network theory in their analytical frameworks to better understand what tasks the person wants to be automated, what they want to do themselves, and how they can maintain control of the vehicle. Findings from the research included people who want the vehicle to perform unenjoyable low-level tasks while they want control over more high-level tasks, such as relaxation, relationships, and hobbies (Brown and Osborn 2019).

Additional research in this area of control had the same results. Participants desired autonomy when the vehicle took care of things that they disliked. In this study, people had a

remote operator assisting in their rides, which was a concern for some people because if the vehicle made any mistakes, they would like to be given control of the car. There is a fine balance between understanding how much autonomy people trust a car to have, what they feel is best for remote operators to contribute, and how much control they want and feel comfortable having (Stayton et al. 2017).

In a study by Nissan Researchers, they explored the balance of Human-Autonomy Teaming (HAT). HAT is the interaction between artificial intelligence (AI) and remote human involvement. The researchers worked in an AV Innovation Lab with SAM, a Seamless Autonomous Mobility system, which provides support for autonomous vehicles. Researchers found that humans and AI can work together, and humans must manage highly automated systems. One such example is the ability of an autonomous vehicle to cross a double line on the street. While this is technically against the law, humans do this all the time to avoid an obstacle. HAT can be useful when remote mobility managers think creatively and assist in the movement of an autonomous vehicle (Cesafsky et al. 2019).

The autonomous vehicle will rely on GPS to determine its precise location and find objects on the road, but even the GPS is imperfect, especially in downtowns with tall buildings. There are social considerations, such as children playing on the side of the road. The autonomous vehicle must not only recognize the children but also what their activities are to behave properly (Vinkhuyzen and Cefkin 2016, 526). The AV must understand that people reasonably break traffic rules, such as crossing a double line when making a left-hand turn. Developing the software in autonomous vehicles must consider all these scenarios (Vinkhuyzen and Cefkin 2016, 527).

Developing fleets of autonomous vehicles that provide ridesharing opportunities will take many personal cars off the road while providing environmentally friendly transportation solutions that have more direct routes than public transportation. Vehicle interiors, the focus on the environment, and the experience on the route have prioritized comfort and technology over speed and engine power. Electrification, technology, and cabin interiors have inspired cutting-edge digital, and physical experiences inside an autonomous vehicle that create a microenvironment where the actual vehicle becomes a destination itself. The cabins inside a car become living spaces where users can share experiences with people through working, relaxing, and entertaining with all the modern technological advances of acoustic, visual, and health benefits (Keskar 2023).

Autonomous vehicles are new and make people wary of using them, but it is estimated that human error is the main reason behind 90 percent of crashes. The idea of using autonomous vehicles to transport people around the clock is another benefit because traditional vehicles spend over 90 percent of their time parked and unused. Autonomous vehicles will also help transport children, the elderly, and the disabled. With the increasing cost of cars, shared autonomous vehicles will provide an option that is a hybrid between private and public modes of transportation. With increased demand, AV service and accessibility will improve for users (Haboucha et al. 2017).

While a lot of the talk around autonomous vehicles conjures up dreams of the future some have criticized that a rider's productivity may not be that great. It's hard to replicate a train car experience, which provides more comfort and productivity because the space is larger and, in many cases, comes equipped with tables. Compounding the problem, an

autonomous vehicle commute could include a shared cabin creating a cramped space. There are also issues with acceleration and deceleration at a faster pace than in a train, making productivity more difficult (Singleton 2019).

Study Methods

Data collection was done in Chandler, AZ, and Miami, FL. Chandler was the most intuitive and important place to collect data because Google operates a fleet of Waymo autonomous vehicles that are available for public use. Participants in Miami could view the autonomous vehicle experiences on video for this project.

SonicRim employed two focus group facilities to recruit a diverse selection of participants. Our team chose twenty people to complete the homework assignment in each city. A sub-sample of 10-15 participants was then chosen to participate in follow-up participatory design sessions in each city. The sub-sample was selected to maximize diversity, including modes of transportation (whether they used a personal vehicle or public transportation), and a demographic mix, but there were no strict guidelines.

To analyze the data, I used Dovetail, an online program that allowed me to import the videos from the participatory design sessions and have them transcribed. I reviewed both the videos and transcripts. I took the transcriptions, imported the data into MAXQDA, and used inductive methods to code the sessions for common themes (Bernard, Wutich, and Ryan 2017).

This methodological approach was useful because it had distinct phases. Choosing Chandler, AZ as a field site was clear, as it is the only place where autonomous vehicles are currently operating. By using a three-phase research plan, including mobile ethnography,

homework, and participatory design sessions, the research provided observational, experiential, written, conversational, and participatory data with people. The phases of research provided data on different levels, including first reactions in an autonomous vehicle taken by video, thoughts through written homework, and interactions with participants designing their ideal transportation scenarios. The various levels of data provided depth and context to the human experience. (A longer description of the methodology is in Chapter 2.)

CHAPTER 2

THE DIGITAL EXPERIENCE IN AUTONOMOUS VEHICLES

Abstract

Autonomous vehicles have arrived. They have been in development for several years and are now on a few select streets. Understanding the digital experience that people want in these vehicles will contribute to the development of this new technology. I partnered with SonicRim, a design research consultancy based in San Francisco, to conduct my research. The research included mobile ethnographies of people using autonomous vehicles along with participatory design sessions about current modes of transportation and their expectations of the digital experience in an autonomous vehicle. Findings suggest people expect autonomous vehicles to have all the current technology in their lives that can contribute to entertainment, relaxation, and productivity. People feel that device connectivity in your office or home for work, entertainment, or relaxation should also be available in an autonomous vehicle. Participants want autonomous vehicles to be a refuge from the outside where they can reclaim time.

Keywords: Autonomous Vehicles, Digital Experience, Transportation, Digital Connectivity

Introduction

In the coming years, autonomous vehicles will provide ridesharing opportunities that will add a new transportation option and create significant change to how people get around. Many people are excited about autonomous vehicles, but some also have fear and anxiety about these new robotic cars and technology that may malfunction. Knowing this, some

people may hold significant trepidation about how autonomous vehicles will work and how they will integrate into (or disrupt) their lives. They may wonder: Are the vehicles safe, are they fast, are the rides affordable, are they comfortable? Conversely, these new cars can assist in transporting people who need assistance, allow people door-to-door service without concern for parking, and create a new form of transportation that in many cases is more seamless (Jordan and Wasson 2015).

Researchers at Nissan found that users desired autonomy when the vehicle took care of functions that the participant disliked. In the study, there was a remote operator if the AV needed to be controlled, but the participants preferred to have control over someone who was not in the vehicle (Stayton et al. 2017). This project builds from this work and seeks to understand participant perceptions of the digital experience of an autonomous vehicle specifically. The digital experience is the interaction between a participant and the autonomous vehicle that is made possible because of digital technologies. Because digital technologies are interwoven into our lives now, from mobile devices to the connection between devices, the options are limitless.

Autonomous vehicles must meet the needs and wants of passengers to be successful. People have other transportation options, such as driving themselves, using ride-hailing services, public transit, and other forms of transportation. The digital experience in an autonomous vehicle needs to draw people in and fulfill their expectations. This is a participant experience research project that will inform product and service development to contribute to a more effective and socially sensitive design.

Study Overview

My partner, SonicRim, is a design research consultancy based in San Francisco. We conducted ethnographies and participatory design sessions in Chandler, AZ (Phoenix area) and Miami, FL. This research project was not an autonomous vehicle ownership project, but an autonomous vehicle ridesharing project. Ridesharing is ordering an automobile for yourself, your family, and friends, or a seat in a vehicle shared with someone you do not know.

We designed the study to understand the digital experience in an autonomous vehicle without many constraints. In collaboration with SonicRim, we developed the primary research question: How can digital content enhance the experience in an autonomous vehicle? The digital experience includes anything digital that connects with a ridesharing autonomous vehicle. These features could include, ordering the vehicle on an app, the door opening automatically, the ability to connect personal mobile devices, and features in the vehicle that provide temperature, lighting, sounds, visuals, and information.

Methodology

We performed fieldwork in Chandler and Miami. Chandler was the most obvious and important place to collect data because Google operates a Waymo fleet of autonomous vehicles that are available for public use. Here participants were able to do mobile ethnographies in autonomous vehicles, create videos, and answer questions about their experience. Following their experiences, they attended participatory design sessions where we could dive deeper into their current modes of transportation, autonomous vehicle experience, and what they imagine an autonomous vehicle may offer them. Miami was

chosen as the other location, where participants were able to view the autonomous vehicle experiences on video, offer hypothetical questions for people who rode in autonomous vehicles, and attend participatory design sessions.

Recruitment

SonicRim employed two focus group facilities to recruit participants. Recruitment was done from an existing database and participants were contacted over the phone and by email. We asked a few screener questions, and SonicRim selected the best participants for data collection. To better understand the opinions of those who would most likely be using autonomous vehicles in the future and are more comfortable with technology, we wanted a diverse group under the age of 50. In one study researchers found that those that are more comfortable with autonomous vehicles are younger, higher educated, urban dwellers, students, and professionals/managers (Hudson et. al. 2019).

Sampling/Data Collection

Data collection followed a two-part design. First, we tasked participants with a homework assignment designed to give them an autonomous ride experience. About 20 people were chosen in each city. The homework in Phoenix included participating in autonomous rides in a Waymo vehicle. Participants downloaded the Waymo app and used an autonomous vehicle to run errands, get to and from work, or explore something new. On this ride, participants used their smartphone camera to document the experience while answering specific questions on their ride. After they completed their ride, they submitted several written answers for review. Since Miami does not have autonomous vehicles, the homework

included watching a Waymo ride online and preparing hypothetical questions for the person who just took the ride.

Second, participants took part in a participatory design session in which they designed their ideal autonomous ride experience. We selected participants based on their completion of their homework and diversity, including modes of transportation (whether they used a personal vehicle or public transportation) and a demographic mix. In Phoenix, there were three groups of five people in each participatory design session. They discussed their experience, answered questions, and participated in more autonomous vehicle simulations with a moderator from SonicRim. In Miami, there were three groups of 3 to 5 people who followed the same discussion guidelines.

The participatory design sessions had four sections. The first section was an introductory period where participants introduced themselves, their professions, how life has changed during COVID, and in some cases their experience doing the homework activities. The second section was spent doing an activity on paper where they mapped out different modes of transportation they took during the day, whether by public transportation or a personal car, and what the moments were like. The third section was a similar activity where they mapped out an experience they could have in an autonomous vehicle. They took some of their descriptions from their current transportation options and imagined how those moments could be different in an autonomous ride.

From there, they were put into two groups of about three people in which they acted out a scenario in an autonomous vehicle. Two rows of chairs were placed in the room that was set up like a vehicle. One person acted as the autonomous vehicle, and the other two were

passengers going on a fictitious trip. The last section was a discussion of activities that a person could experience in an autonomous ride, such as gaming, work, therapy, or planning a night out, and whether these activities would be of interest to participants.

Data Analysis

To analyze the data, I used Dovetail, an online program that allowed me to import the videos from the participatory design sessions and have them transcribed. I reviewed both the videos and transcripts. I took the transcripts and imported the data into MAXQDA and used inductive methods of theme identification to code the participatory design sessions for common themes (Bernard, Wutich, and Ryan 2017). I reviewed the data collected and found ideas, patterns, and concepts and coded the data into high-level and specific categories described in the findings section. I found repetitions, similarities, and differences. From there I cut and sorted the data into themes with codes (Ryan and Bernard 2003). The analysis component of the project was inductive and generative, as the project was created for discovery purposes.

Findings

The participatory sessions were designed to elicit how participants imagined an ideal experience in an autonomous ridesharing vehicle. Overall, they envisioned a seamless experience that provided a litany of services and largely functioned as a refuge from the outside world. Participants imagined a car that would turn into a mobile bubble, a place to recapture time and escape the busyness of the outside world to rest or complete tasks for themselves.

Participants largely focused on using this refuge for four major objectives, which I outline in my findings: relaxation, entertainment, personal productivity, and work productivity. They indicated the value of an autonomous vehicle lay in modern technology, the ability to connect devices while being safe and secure, and the meaningful time they could recapture in their lives. All the themes were largely individualized, through work or rest without others in the vehicle. Still, when it came to entertainment it could include both solo activities and activities with families and friends. A quote from one participant encapsulates the findings well:

> "The car is like kind of my travel buddy, you know, something that, that enables me to get from point A to point B, but in a way that is memorable in a way that I can, I guess it's both a travel buddy and it's kind of there in the background doing everything so that I don't have to think about it. And I can share moments with family, play games, with friends, pet my dog. It's nice."

Entertainment

Participants saw autonomous vehicles as an opportunity to be entertained, especially with advanced technology. They stated that because they could take their minds off the road and the process of driving, they could more fully participate in the AV experience. For instance, participants described imaginative scenarios that go beyond audio and visual. They believed their ride in an autonomous vehicle should complement the activity they were going to. One participant said an AV could be used to transport her and her friends to a club or bar, and they could get the party started with the right music and lighting, simulating a club experience. Another suggestion is that when on vacation, it would be nice to have information about their destination or where they are driving through.

Participants envisioned scenarios where an autonomous vehicle would pick them up from an airport or train station and provide commentary and information about where they have arrived. A man in Miami discussed the availability of,

> "VR headsets so you can really get immersed in it…Let's give it a little overview of some of the areas that you're going to see on your trip in Miami…This is the history behind this park. And you know, you see this building here, that was the freedom tower, and you know what it stood for."

An expected feature is a map on one of the screens with a live location and estimated time of arrival. Other screens in the car can be used to choose what participants want to watch such as seamlessly streaming entertainment from mobile devices.

> "I think it would be great if there was like a car play or like airplay type interface where you have your phone, you can either show up, you can cast to the screens in the car, like a Netflix or a sports game or any other type of streaming thing from your phone."

Recapturing time was a theme brought up across any activity in the autonomous vehicle. One participant felt he could enjoy one of his favorite shows in the car, which would allow him to spend time at home doing something else, whether it's enjoying another form of entertainment or getting to bed earlier.

> "I was thinking if we have a Netflix show that we're going to stay up late and finish the season of the show, if we could do that while we're driving and then we get home and then we can get ready for bed earlier because we were having this extra time to watch the show. To me, that would be valuable."

Participants also brought up the ability to have some of the same features and connectivity as in their homes. For instance, one participant, a gamer, brought up that he would like to continue his gaming in the autonomous vehicle:

> "Here's where I go a little wild. I love the option to sync video game accounts. So I could play or continue playing a game I'm playing at home…but playing with somebody else in the vehicle, or even sky's the limit playing with people outside of

> the vehicle, maybe there's a chat function, you know, so you could be playing super smash brothers or something that would be, you know, a way to make more memories out of something that wouldn't necessarily otherwise be memorable for me."

Participants expect the AV to have options for them depending on their interests, mood, and who they are with. They saw their time in an AV as an opportunity to choose their own adventure, from watching a show on a screen, to gaming with people around the world, and learning about areas they are driving through.

Relaxation

Most participants mentioned the ability to relax when they get in an AV, especially during difficult commutes after a long day at work. The ability to disconnect in a personal car without having to worry about driving themselves, interacting with others, and taking care of themselves is very attractive. The autonomous vehicle provides a break from the outside world, where they can escape work, responsibilities, or small talk, which is sometimes required with a driver. The AV becomes a private place, which is not always easily replicated when at home with family or in a social work environment.

Participants discussed what relaxation means to them. For some, it was a soundproof car, with the ability to choose music and adjust lighting. The sounds of rain, the ocean, soft music, or just silence are options a participant might want to relax.

> "I'm very often sleep-deprived. One thing I think I like about airplanes is that I never feel guilty when I'm on the airplane wasting time, because whenever I'm home, I can't take a nap. I always have chores to do. If I'm in the car, I think I would have a similar experience to the airplane. If I close my eyes for 20 minutes, it's not like I could be doing chores right now or anything like that. I think it'd be a perfect place to be able to relax. I think it'd be a good time to meditate."

One participant mentioned the autonomous vehicle should know that a trip could take 30 minutes. If the participant requests a meditation exercise, it could be automatically set up for 25 minutes during the ride. The participant could then choose what they would like during their meditation. It could include options such as sound, visuals, silence, and a specific amount of lighting.

> "After a long day at work or when I'm with my family, you know, I'm an introvert-extrovert. So sometimes I want to talk to people, but sometimes I don't want to. So, the idea of getting in a car and not having to make small talk for me is very nice at the end of a long day… Comfortable, you know, being able to just, you know, relax, not answer somebody's questions, you know, I know that personal connections are important, but there's also a good chance to disconnect that kind of space."

Work Productivity

Continuing with the theme of refuge, participants discussed their thoughts about uninterrupted work, planning, and productivity. Busyness is part of American society. Technological advances with laptops, Wi-Fi, and wireless devices provide endless options for passengers in an AV without having to share an office or be interrupted at work. Work hours are not always standard for people, and participants want to take advantage of every moment they can get something done and check off their list (Darrah et al. 2007).

The AV transforms into a mobile office. Participants mentioned they could connect their wireless devices, utilize their laptops, or use the multiple screens in the car to work. One screen could be used to make video calls, the other to review documents, another to look at a calendar, or to toggle through various applications and programs using one or two screens, connected to a laptop, smartphone, smartwatch, or tablet.

One participant mentioned that by spending time alone, he can choose his music and provide a relaxing way to prepare for work. He would create an environment where he is

settled and can think about planning his day, mapping out his schedule, and envisioning how he may deal with a client. “I get to listen to my own music. I have conversations by myself, planning my day. What am I going to do with this client? What am I going to say? And then, you know, I have the back and forth.”

During the participatory design sessions, imaginations started to run wild with thoughts about having multiple screens, and the ability to connect multiple devices in complete privacy, somewhat like an air traffic control tower where participants can get work done at the touch of their hand.

> “I would have all three screens in use. One screen would be used to check inventory for the task I'm about to complete. The next screen would be to organize the volunteer schedule and the tasks that each of the volunteers are responsible for completing. And then the last screen would be kind of like a budget of what I need to purchase in conjunction with that supplies inventory throughout the ride.”

The ability to reclaim time was brought up again and again. Participants mentioned that sitting in traffic behind a wheel is unproductive for them, so the ability to get work done is valuable. One participant mentioned countless meetings he attends that he could lead without having to drive himself.

> “I live and breathe on Microsoft Teams with my, all my team at work. I would use that time to collaborate with my team, we do a lot of presentations for our software. So being able to do a presentation like that if I'm going to the airport. Cause sometimes if you're stuck in traffic, it's 45 minutes. And if I have to miss a meeting to do something like that, that's a big problem.”

Personal Productivity

For many, organizing their personal lives and finding additional time to focus on things is time well spent. Personal interests are different for everyone, and ideas ran the gamut around how time in an AV can improve personal productivity. For some, the ability to spend time

watching their favorite TV show would provide more time at home to do other things, while others want to be entertained by podcasts and catch up on news or the stock market. “I commute an hour each way and I use that time and try to productively listen to podcasts. So those moments feel a lot more meaningful. I'm able to be in the moment.”

For some, the thought of the additional free time didn’t mean getting current tasks done, but it opens the door to new opportunities, such as learning a new language, practicing an instrument, or exploring new shows.

> “I want to have the option to do things that I normally wouldn't be able to do on this hour commute. I want to be able to learn a new language or learn how to play an instrument, like using the screens for some program that I normally wouldn't have access to.”

Others wanted to take full advantage of technology, with the ability to have the AV go over their daily schedule, use the screens to multi-task, and connect to their devices.

> “I love watching news stuff on TV, I pictured myself in the back with both TVs on one to a news channel, the other two, a stock business channel. And since I'm a stock investor, I have to stay up on the news if I have time because the news events affect stock prices. And since I can't do this, normally when I'm driving, if I want to react to a news event, I could use my phone to place the stock trade.”

Others wanted to spend the time thinking about their schedule, including chores, children, or volunteer activities. They don’t want to actively search their own devices but rather have an assistant in the autonomous vehicle that broadcasts their upcoming events. “I'd love to hear a voice telling me what my schedule for the rest of the day is so that I don't have to look at my phone or my date book and say, all right, you've got this appointment at three o'clock. You have to prepare…”

Discussion

This research project brought together participants who were largely curious and unknowledgeable about autonomous vehicles. What resulted from their experience was amazement about what possibilities the future could hold with AVs on the road. Participants saw this technology as futuristic and marveled at the potential of a revolution in transportation. Their nerves were on end, but they all dove in, and most were quite impressed.

Many people are grappling with time constraints throughout the country, whether it's because they work long hours, have long commutes, or are just short on time. People dove into creating a refuge and reclaiming lost time. In this study, participants' minds quickly went to a few different places – entertainment, relaxation, or productivity – all ways they felt they could spend time on quality activities.

According to participants, connections with family and friends are considered the most meaningful time spent, which was illustrated in some of the experiences that were conjured up during the participatory design sessions. The ability to focus and live in the moment in a vehicle instead of focusing on the drive allows people to do this. Themes discussed by participants included taking your child to school, enjoying entertainment with friends or family, and getting things done so you have more time with family at home.

Time is a void participants felt they could take advantage of and wanted to use in the best way possible. An autonomous vehicle can provide solitary time to relax or nap, while at other times it could include family time on a trip. Whatever activity was taken care of in the vehicle would be checked off a list, and what remains could be done at home. For example,

if someone can take care of work in an AV, it could translate to quality time with family at home, or simply go to sleep earlier.

Limitations

There are a few noteworthy limitations of this research study. First, this was not a representative sample of the United States. All participants either lived in the Phoenix or Miami metropolitan areas. While recruitment was done to ensure ethnic, gender, and age diversity, it was not a requirement. By performing the studies in two large metro areas in the Sunbelt, the perspectives of residents in rural areas or colder snowy climates were not part of the research study. Developers purposely chose Phoenix to test autonomous vehicles because the topography is flat with less precipitation, creating safer roads to test a new mode of transportation.

Ethnic and gender differences were not considered for the discussion guide, nor was the data analyzed in a way to compare differences between ethnicities and genders. Some participants had to be cut because they did not complete the homework and therefore were not considered for the design sessions. This limited the diversity of participants in some of the groups. While some perspectives were certainly left out, this is a starting point for additional qualitative and quantitative studies.

Recommendations

Based on the findings in this study, autonomous vehicle developers may benefit from focusing on updated technology, seamless transitions, connectivity, and personal settings. This study showed that when participants thought about entering a car, they truly expected it

to replicate an office to work, a bedroom to nap, or a family room to enjoy entertainment. With technology today it is possible to bring these types of features to an autonomous vehicle in the mind of participants. In addition, new thoughts such as getting in the mood for the destination are also important. For example, a group of friends spending a night out may request special lighting and music, while a person riding home in the evening may just be watching a favorite show so they can get to sleep earlier.

In most examples, participants expect the latest technology to be available in an autonomous vehicle. They envision an experience where they can connect their digital devices to the AV, such as by projecting media onto the screens. More than one screen is important allowing participants to multitask. For example, one screen could be used as a map, another to project their laptop, and the other to watch news.

When ordering an AV on an app they would like to have personalized settings for temperature, lighting, and sound, with the ability to save settings and update them as needed. For example, a participant may order an AV for a ride to the airport. They may request good lighting and the ability to connect their laptop as soon as they enter the car. On a ride home from a long day at work, they may choose relaxation.

Conclusion

Autonomous vehicles may have consequential effects on transportation in the future. Some consequences outlined by industry experts include fewer cars per household and AVs disrupting the ridesharing industry. Others note that the development of autonomous vehicles could potentially expand the notion of carpools helping to decrease congestion. These factors will significantly impact urban movement and transportation at a societal level. This study,

however, shows how people envision autonomous vehicle ridesharing will impact them at an individual level. The participants involved in this study overwhelmingly agreed that the major benefit of the digital experience within an AV rideshare is the ability to reclaim time. They see AVs as an opportunity to transform transportation from being a burden to a place of refuge with digital options.

CHAPTER 3

PROJECT REFLECTIONS, LIMITATIONS, AND FUTURE STUDIES

Introduction

The goal of my research was to better understand what users want in a digital experience in autonomous vehicle ridesharing through an ethnographic study. The specific objectives of my research were to 1) understand participants' perspectives on autonomous vehicles, and 2) understand what type of digital experience they want in an AV. My research helped gain insight into people's expectations of autonomous vehicles with the advent of digital technology enabling them to create a desirable ride.

Summary of Findings

I assisted with mobile ethnographies in Phoenix and Miami, including homework assignments and three in-person participatory design sessions in both cities. Based on the results people were largely nervous about their first ride but quite impressed with the technology of autonomous vehicles. There were small bumps in the road, such as stop-and-go traffic in parking lots, but the fact that autonomous vehicles were functional did impress participants.

Busyness is a fact of life for many people. They feel overstretched with obligations, particularly from work, including commutes, meetings, and long hours. Participants wanted to spend their time doing meaningful things, which unsurprisingly gravitated toward family and friends, such as going on vacation together or sharing a car ride, while creating meaningful experiences with those they care about. Meaningfulness could also mean being

productive, because if you are productive in an autonomous vehicle, that will allow you to have more meaningful time to do what you want later.

An example is taking their children to school with the ability to fully focus on their children instead of driving. It is no surprise that people gravitated toward viewing the car as somewhat of a refuge from the outside world, a place to reclaim time for what they chose to do, which largely revolved around activities of entertainment, relaxation, work productivity, or personal productivity.

Participants envisioned the autonomous vehicle as a bubble they were able to jump into and do whatever they wanted with the advent of technological advances we have today. Just like a private room, they could use their computer and turn on multiple screens, with the ability to connect their devices if they choose. Options are important and options should be endless. Each person felt whatever they could do in a room in their house, they could probably replicate in the autonomous vehicle. Granted autonomous vehicles are not kitchens or bathrooms with running water, but there is an idea that they can function as a bedroom (a place to sleep), an office (a place to work with computers), a family room (a place to relax, read or watch a screen).

If they go out for a night of clubbing or bar hopping, they expect to start the party in the autonomous vehicle with lights and music. When relaxing they would like to draw the shades, listen to relaxing music, and set their devices to do not disturb to take a nap. Besides taking a nap, other options such as meditation were brought up. Productivity includes both personal and work tasks. Participants mentioned the ability to connect devices, go over schedules, be given verbal reminders, host virtual meetings, and use multiple screens to

multi-task. The autonomous vehicle becomes a bubble with everything connected electronically just like their home or office.

Client Report

I created an additional report for the client in Google Slides that included similar parts of this report: background, research plan, methodology, and findings. It also included a practical component that would bring the findings to life. I created composite personas for each theme: entertainment, relaxation, work, and personal productivity.

The first personas were a couple who were on vacation in San Francisco and used the autonomous vehicle to get around San Francisco and Napa. Their experience included tourism recommendations, entertainment, and relaxation. The second persona was a married father who used an autonomous vehicle to get to and from work and pick up one of his children, using the autonomous vehicle for work productivity and relaxation. The third persona was a busy mom who was shuttling her children around, and the last persona was a man who needed a break from recent events in his life through meditation and a hike.

The report was well received by my partner, Uday Dandavate at SonicRim. This written report is not conducive to industry so my partner helped me develop a presentation that can be used in industry that is more creative and colorful. I enjoyed the process of working with Uday and learning how to develop a cohesive, creative presentation.

Recommendations for Future Research

This research touched on the digital experience in an autonomous vehicle and a litany of broad topics, which brought various answers that could lead to additional research.

Recommendations for future research include focusing on a specific digital experience, such as doing more in-depth research on topics that were brought up frequently: entertainment, relaxation, work productivity, and personal productivity.

There are opportunities for more in-depth research, such as the length of the ride, the purpose of the ride, and whether it is for commuting or pleasure. A daily commute may elicit different digital needs than a ride with family or friends during a night out or on the weekend. How would people like their digital experience if they were alone, with family, with friends, or in a shared vehicle with people they don't know? Additionally, how does transportation look differently among users of different income levels, ethnic groups, genders, or locations, such as urban, suburban, or rural residents? Depending on each situation the digital experience could be extremely varied, and designers and engineers must create an autonomous vehicle that meets all needs.

Looking at these specific areas, qualitative groups could be formed that focus on specific ages, ethnicities, or usages to understand better what each group needs and wants for their digital experience. If a representative sample is needed a survey could be deployed addressing some of these specific topics to retrieve concrete statistically significant answers. Qualitative research could inform the stimuli tested in the survey, and the survey results could create additional in-depth, conversational qualitative research.

Closing Remarks

Overall, this research study shows that autonomous vehicles elicit excitement from people with the possibility of having a robust and diverse digital experience in one. Participants were largely positive while dreaming up scenarios in an autonomous vehicle.

While it is unclear how far a digital experience can go in an autonomous vehicle and how users will respond to it, opening the topic for research and discussion will help create autonomous vehicles that work for users and continue to add necessary features.

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