



# Automotive Transportation Experience for Visually Impaired Individuals

**Spring Research Findings and Implications**

**Sarah Papp and Ross Rybalov**

5/2/2018

## Contents

### **1 Overview**

Recap of goals and project focus and executive summary

### **2 Methodology**

Methods, sources, and participant information

### **3 Insights and Implications**

Findings and impact to work going forward

### **4 Bias Reflection**

Specific instances of bias, either our own or from others and how that influenced our work

### **5 Next steps**

Overview of summer work

## Overview

The primary goal of this project is to increase personal agency and autonomy for persons with visual impairments through an improved transportation experience. This requires developing a greater understanding and empathy for this population and acquiring a deeper knowledge of the context around the technology and systems in development already.

To help us create a solution rooted in the needs and experiences of our target user group, we've undertaken a round of primary research in which we sought answers to the questions to the right.

In this document, we'll share our findings, what they mean for the current experience, and how they'll shape our work going forward.

- 1. What products, services, and systems are already in place to assist persons with visual impairments? What about them is successful? How might they be improved?**
- 2. What relevant autonomous technologies, trends, and policies are emerging?**
- 3. How might autonomous vehicles be designed to optimize the experience for persons with visual impairments?**

## Executive summary

### KEY FINDINGS

Critical needs for the in-vehicle transportation experience:

- Relevant trip information
- Orientation to destination
- Safety at all stages of the trip

### IMPLICATIONS

- **Give riders the agency to control their experience**
- **Make route/journey information easy to access and change during the ride**
- **Technological affordances need to be as salient as possible so that access to this information is simple**
- **Provide easy access to escalation and intervention methods**

## **1 Overview**

Recap of goals and project focus and executive summary

## **2 Methodology**

Methods, sources, and participant information

## **3 Insights and Implications**

Findings and impact to work going forward

## **4 Bias Reflection**

Specific instances of bias, either our own or from others and how that influenced our work

## **5 Next steps**

Overview of summer work

# Methodology

**Formats:**

Phone interviews, in-person interviews and observation sessions

**Recruitment:**

Personal network and partnership with Associated Services for the Blind in Philadelphia

**Participants:**

9 (7 phone interviews, 2 in-person) people of ranging visual impairment, all unable to legally drive

**Timeframe:**

March 23, 2018 - April 16, 2018

**Interview topics:**

Current and recent transportation modes, experiences, and behaviors.

**Analysis and synthesis:**

Grounded theory

## **1 Overview**

Recap of goals and project focus and executive summary

## **2 Methodology**

Methods, sources, and participant information

## **3 Insights and Implications**

Findings and impact to work going forward

## **4 Bias Reflection**

Specific instances of bias, either our own or from others and how that influenced our work

## **5 Next steps**

Overview of initial concepts and summer work

## Critical Needs - Insights and Implications

Within our data, we were able to identify several important themes to consider in a successful design. In the subsequent slides, we'll share detailed insights and what their impact might be.

- 1. Safety**
- 2. Trust**
- 3. Efficiency**
- 4. Relationships**

## Insights and Implications: Safety

### INSIGHT

Contending with other passengers can be a major source of danger for passengers with visual impairments--either through physical obstacles in the aisles, unavailable seating, or physical aggression.

*"Recently on a trip to Reading Market, the bus driver announced that riders in the disabled seats would have to move so I could sit. This doesn't happen very often, but it really helps." S6*

*People with visual impairments, especially women, experience a higher rate of violent crime than those without visual impairments. US DoJ, 2017 Report*

### IMPLICATION

Without a human driver, other means of intervention need to be available.

## Insights and Implications: Safety

### INSIGHT

Passenger pickup and drop off presents unique challenges--vicinity to venue entrance needs to be close and map data must be accurate without visual cues to guide either the driver or passenger.

*"My Uber driver said he had pulled up, but was actually around the corner. He didn't want to move to help me get to the vehicle, so it was pretty hard to find him." S6*

### IMPLICATIONS

The route the vehicles take needs to take this into consideration and leverage the most up to date information possible.

A means of intervention or escalation needs to be available to help passengers should this information be inaccurate.

## Insights and Implications: Trust

### INSIGHT

Often leaving the house requires a leap of faith and some modes of transportation require a bigger leap than others, whether it's because of scheduling, delays, assistance availability, or exposure to unpredictable environments.

*"Probably one of biggest issues I have with Uber or taxis is construction. If there's construction shutting down the road that my destination is on, and this happens sometimes, there's not a lot I can do." S9*

### IMPLICATION

Explore how we might decrease the uncertainty of using shared autonomy to make it a practical transportation option for people with visual impairments.

## Insights and Implications: Efficiency

### INSIGHT

The fastest mode of transportation isn't always the best option. Other factors, like weather, amount and type of human interaction, budget, and nature of trip, play into a passenger's decision of how to get where they need to go.

*"If it's close and the weather is nice, I'll just take my cane and walk. I try to stay as active as I can." S2*

*"If I'm going to a regularly scheduled event, then I'll take paratransit, but for other things, I might walk or take an Uber." S8*

### IMPLICATION

Regardless of the mode of transportation, a passenger with visual impairments will need roughly the same things from the in-vehicle experience to be successful: navigation, internal orientation, and information presentation.

## Insights and Implications: Efficiency

### INSIGHT

The route, and when they will arrive, is a key aspect of the in-vehicle experience. Passengers with visual impairments are generally very aware of the route being used and monitor progress closely to make sure they arrive at their intended destination.

*"When I take CCT, it's the luck of that day. I never know how long I'm going to be in the vehicle. For a 30 minute ride, I could be in the vehicle for 90 minutes."*

S1

### IMPLICATION

Make it easy for passengers with visual impairments to access internal route information in real time as updates come in.

## Insights and Implications: Efficiency

### INSIGHT

The interactions required for trust in an in-vehicle experience center primarily around information--where a seat might be, where the vehicle is going, what conditions might impact the arrival time, and where the front door of the destination venue is.

*"Some drivers are unwilling or unable to tell me where we are, so I carry my own GPS. It helps me know where I am in the trip and if there are any traffic or weather delays." S1*

### IMPLICATION

Make the information about the internal vehicle environment as consistent with known interaction patterns and easy to access as possible.

## Insights and Implications: Relationships

### INSIGHT

Transportation is an opportunity for human interaction. Developing a rapport with regular drivers (of paratransit vehicles, rideshare) adds richness to the experience and a sense of normalcy.

*"Even in an unfamiliar place, [with paratransit] you have an arm to help guide you." S2*

*"I get along well with the drivers. We talk about sports and family stuff. Yeah, you get to know them during the drives." S8*

### IMPLICATION

The gains of autonomous vehicle deployment have to outweigh the loss of this point of human interaction.

## **1 Overview**

Recap of goals and project focus and executive summary

## **2 Methodology**

Methods, sources, and participant information

## **3 Insights and Implications**

Findings and impact to work going forward

## **4 Bias Reflection**

Specific instances of bias, either our own or from others and how that influenced our work

## **5 Next steps**

Overview of initial concepts and summer work

## Bias Reflection

### **AVOIDING BIAS IN DESIGN**

Bias in design isn't just in testing the final product to make sure that facial recognition works for all skin tones or the audio interface recognizes accents.

Our goal was to consciously identify our own biases as able-bodied designers throughout our research process and intervene in order to get the best data possible.

All content we created was carefully written to avoid using trigger language and to be as clear as possible to make sure nobody felt unwelcome.

## Bias Reflection

### PROTOCOL & METHODOLOGY CREATION

Some participants may not be employed  
(should avoid asking this question directly)

Confirmation that doesn't require signature  
(provide alternate agreement)

Braille options for consent forms  
(something participant can take home to review if necessary)

Avoiding asking questions that were too broad to their daily lives  
(how do you get to the bus stop?)

Access to technology and ride-sharing is far less common than we anticipated

Being aware and informed about visually impaired people's process for doing simple tasks goes a long way towards building rapport and credibility.

Necessary to void asking ignorant questions, especially "how do you do that" when it's a common activity for everyone.

## Bias Reflection

### RECRUITING & PARTICIPANT INTERACTION

Most effective recruiting is through a trusted source (like ASB) not online ads

Divided participants into phone interviews and in-person observations

Participants will rely on you for very clear physical directions about where you will meet them

Being aware of ailments that prevented them from understanding us that well

Participants weren't able to jot down notes (emails, phone #s, names, etc)

It's easy to get stuck in a bubble of traditional methods. We quickly realized that posting ads on Craigslist or offering specific online gift cards was not appropriate for everyone.

Although backed by saturation in findings, our results are biased by the small research pool and geographic location of participants.

## **1 Overview**

Recap of goals and project focus and executive summary

## **2 Methodology**

Methods, sources, and participant information

## **3 Insights and Implications**

Findings and impact to work going forward

## **4 Bias Reflection**

Specific instances of bias, either our own or from others and how that influenced our work

## **5 Next steps**

Overview of initial concepts and summer work

## Next Steps

### *Ongoing work through the summer semester*

#### **OUTCOMES**

Pictorial components (intro, images, findings, proposed solutions)

Plan to submit pictorial for DIS 2019

Presentations/posters for mobility conferences

#### **ACTIVITIES**

Participatory design

Prototype development

Concept validation

Documentation

## Initial concepts

### DESIGN OBJECTIVES

#### **Orientation**

Help passengers be aware of their in-car surroundings and spatial relationships.

#### **Navigation**

Provide understanding of where passengers are geographically as well as status with the trip (ETA, delays, road conditions, other drivers, etc).

#### **Information Presentation**

Determine how best to present content in an easily accessed, understood, and retained fashion.

#### **User Control**

Identify opportunities and methods to deliver control and agency over surroundings and the journey.

## Initial concepts

### TECHNOLOGIES FOR SOLUTION

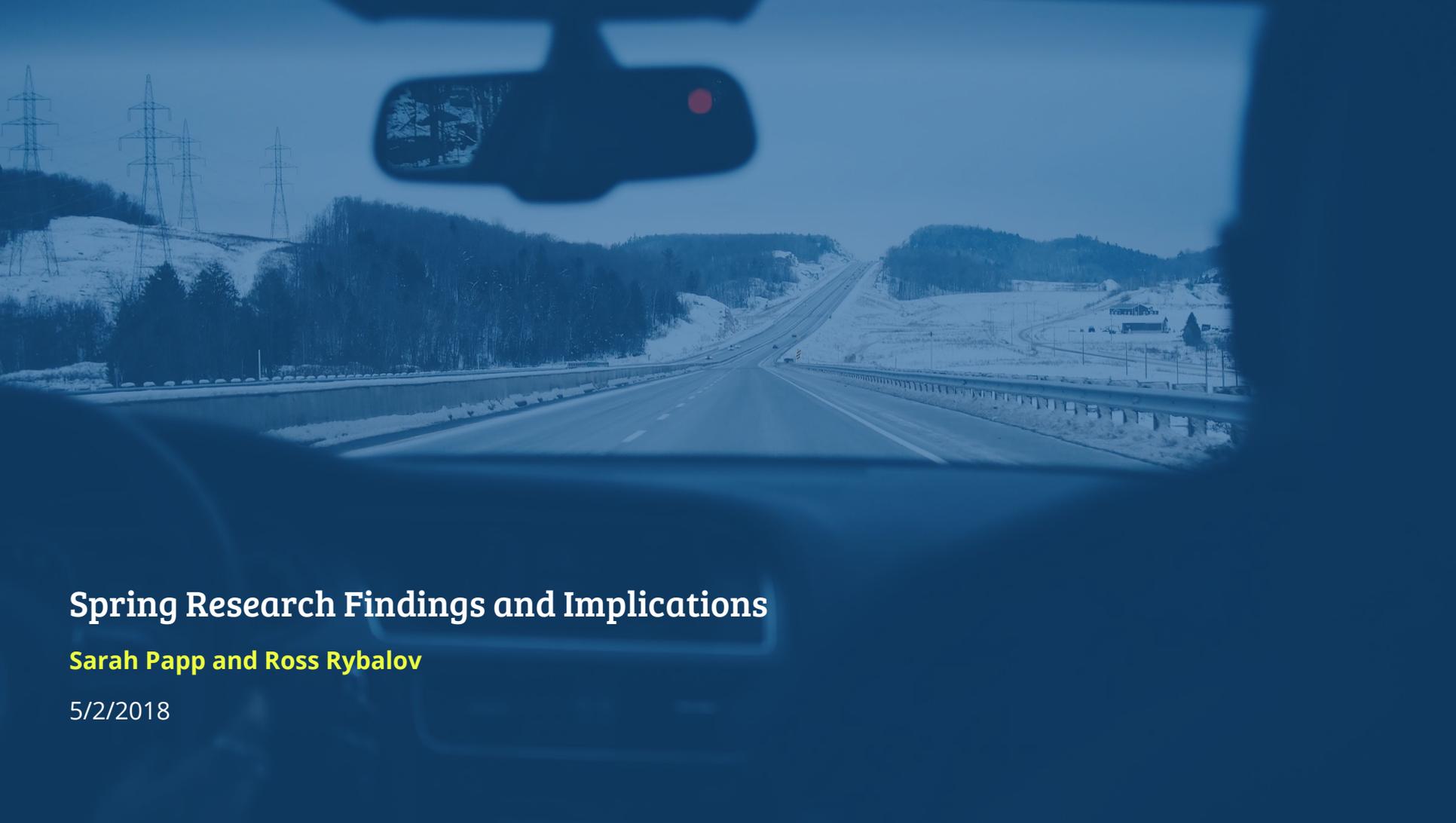
#### **Conversational Agent Interface**

Main mode of interaction between the AI of the autonomous vehicle and the visually impaired user.

Physical controls (proprioception) are too complex due to a higher learning curve to be the primary interface modality at this stage for this population.

#### **Technologies to enable VUI**

- Sensors inside cabin
- Detailed mapping/nav
- Real time data feed/network connectivity
- Trained customer service/helpdesk



# Spring Research Findings and Implications

**Sarah Papp and Ross Rybalov**

5/2/2018