In the Hands of Other People: The Experience of Riding a CTA Train For People who are Blind

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Abstract

This research sought to identify any challenges people who are blind experience while taking the Chicago Transit Authority (CTA) train in Chicago, IL. We intended to use these findings to inform the design of a technical or systemic solution to any barriers we uncovered. Through interviews, contextual inquiries, a usability test, and a survey, we learned that the journey of taking a train has distinct stages with varying challenges for people who are blind. Navigating the platform and finding the platform and station exit are the most stressful points of the trip. To address this problem, we pose a design solution in three phases. The phases increase in scope from changes the CTA could implement with existing infrastructure to a redesigned platform system that would eliminate the risk of falling off a platform. Included in these phases are technological solutions, such as a trip planner app that incorporates station layout information and can safely guide people through a station to their destination.

Introduction

People who are blind (PWAB) depend on many modes of public transportation such as the bus, train, Metra, and Paratransit (which offers curb to curb service). However, Paratransit can be unreliable and relying on ride-sharing or taxis is expensive, an added burden on a population that has a high unemployment rate (Holden, 2007). Accessible public transportation can increase independence and decrease expense for PWAB. Focusing on the experience of a PWAB can uncover opportunities to improve the transit experience for sighted and non-sighted people.

PWAB face unique challenges when riding public transportation. A previous study that focused on the transfer experience identified the navigation of public transit rail stations as an area for further research (Dickinson, Law, Pingrey, & Tinman, 2015). The researchers found that participants looked up information on bus stops ahead of time, but were unable to find information on the layout of train stations. A participant in the previous study said "I don't really have the ability… to comprehend the layout of the train station before I get to it."

Researchers at the University of Washington studied the challenges of locating and understanding the layout of bus stops for PWAB (Campbell et al., 2014). They found that using an app to provide layout information helped users locate bus stops and comprehend stop layouts. These findings corroborated the behavior of participants in the previous study.

In this research, we investigated the challenges of navigating train stations for PWAB. We theorized that PWAB could use station information to create mental models of the stations they visit. Also, that the lack of information about train stations makes them more difficult to navigate. We conducted interviews, contextual inquiries, a survey, and a usability test to address the following four questions:

1. What challenges do PWAB experience when navigating CTA train stations?
2. What technologies and strategies do PWAB use to navigate train stations?

3. What opportunities exist for developing a system that would help PWAB safely and independently navigate public transit train stations?
4. Is navigating train stations challenging for a significant portion of our target population?

Methods

Contextual Inquiry

We observed and interviewed four PWAB while they rode the CTA train to gain insight into the challenges that they face, and the techniques and technology they use to navigate. We asked participants to select the route on which we observed them.

Recruitment

We recruited our participants by emailing past contacts from DePaul Accessibility classes. We asked them to participate in a 15-20 minute semi-structured interview and then an observation the length of the route they selected. We solicited consent from each participant via email. All participants consented to participate.

Participants

Our observation and interview participants ranged in age from 26-68. All four participants were female, rode the CTA regularly, and used a cane for the observation. However, it is important to note that P1 normally has a guide dog, but did not have the dog at the time of the observation. The table below summarizes our participants:

Participant	Year of Birth	Gender	Years Taking CTA	Years lived in Chicago	Guide Dog or Cane	Visibility Level
P1	1971	Female	8	8 years	Guide dog	None
P2	1990	Female	3	3 years	Cane	Big shapes, some colors, and light vs. dark
P3	1948	Female	~54	68 years	Cane	Bright lights and some shapes. Some vision around periphery
P4	1949	Female	49	1 month	Cane	Bright lights and some colors

Table 1: This table summarizes our four participants.

Procedure

All four interviews and observations took place in-person. We conducted the interview first and then conducted the observation. Two interviews took place at the participants' workplaces, one took place at DePaul University, and the last interview took place in the participant's home. All observations took place on different CTA train lines. We audio recorded all interviews and observations and transcribed them using InqScribe and Transcriptions app.

The interviews consisted of five main questions with 24 possible follow up questions. We also asked about any interesting topics that came up during the interviews. Topics included: frequency of use, riding to new stations, familiar stations, technology used, assistance preference, challenges faced and demographic questions.

We used a contextual inquiry framework of a master teaching an apprentice. At the beginning of the observations, we provided our participants the following instructions. "*I would like you to show me how you take the train. That is, please guide me as though you were teaching me to take the trains.*" One observer took notes, one observer acted as a CTA customer assistant (CA) when the participant needed assistance, and the last observer acted as the apprentice. We decided one observer would act as a CA to avoid interruptions or confusion from a CA or other riders. To view the full interview and observation protocol, please refer to Appendix C.

Analysis

Our team used Old Saturate app to analyze the data from the interview and observation transcripts. To code the data, we used an open inductive qualitative analysis approach. Each team

member applied codes to transcripts. At the end of the first round of coding, there were 341 codes.

From there, we organized the codes into subcategories. We then grouped the subcategories into 14 main categories. Additionally, we consolidated the code book and combined similar codes, added new codes as necessary, and eliminated redundancies. Upon completion, we had 50 codes. Next, each team member took a new transcript and re-coded the transcript using one of the 50 codes. While re-coding, we added 5 new codes for a total of 55 codes in the final code book.

While reviewing the final codes and categories, we realized that certain groups of codes represented a different phase of the participants' train ride. After defining the different phases, we created a journey map to show the challenges and emotions participants experienced and made design recommendations for each phase.

Survey

Recruitment

To distribute the survey, we shared the URL with our participants and asked that they share it with anyone they know who is blind, over 18, and lives in Chicago. We also posted the survey on the Chicago Lighthouse Foundation Facebook page and contacted the organization directly, which then shared the survey with specific people at the organization. One participant could not access the survey via computer so we conducted it over the phone with her. The survey was active Feb. 26th, 2016 - March 10th, 2016.

Procedure

We created the survey using Qualtrics. Two participants from the interviews previewed the survey to check for accessibility issues. One did so on her phone and the other did so on her computer. Neither found accessibility problems.

Analysis

Given the small sample size, we primarily conducted the analysis by carefully looking through the data. For questions with a strong majority we tested the significance using a N-1 Two Proportion test.

Usability Test

After analyzing the data from the interviews and observations, we brainstormed design solutions. We envisioned a complete system called CTA Guide. The system includes floor guides, kiosks on train platforms, and an integrated travel planning app. We limited this usability test to focus on the app, for which we built an iOS prototype. The goal of this usability test was to understand the type of feedback that could best help a PWAB navigate a train station. We had one

participant for our usability test. The test objectives were to understand if users can navigate train platforms through the use of different cues:

- Can users learn haptic feedback patterns that indicate which direction to turn? Can users follow the directions given through the haptic feedback?
- Can users learn different tone frequencies that indicate various stair locations? Can users navigate to the specified staircase based on these tones?
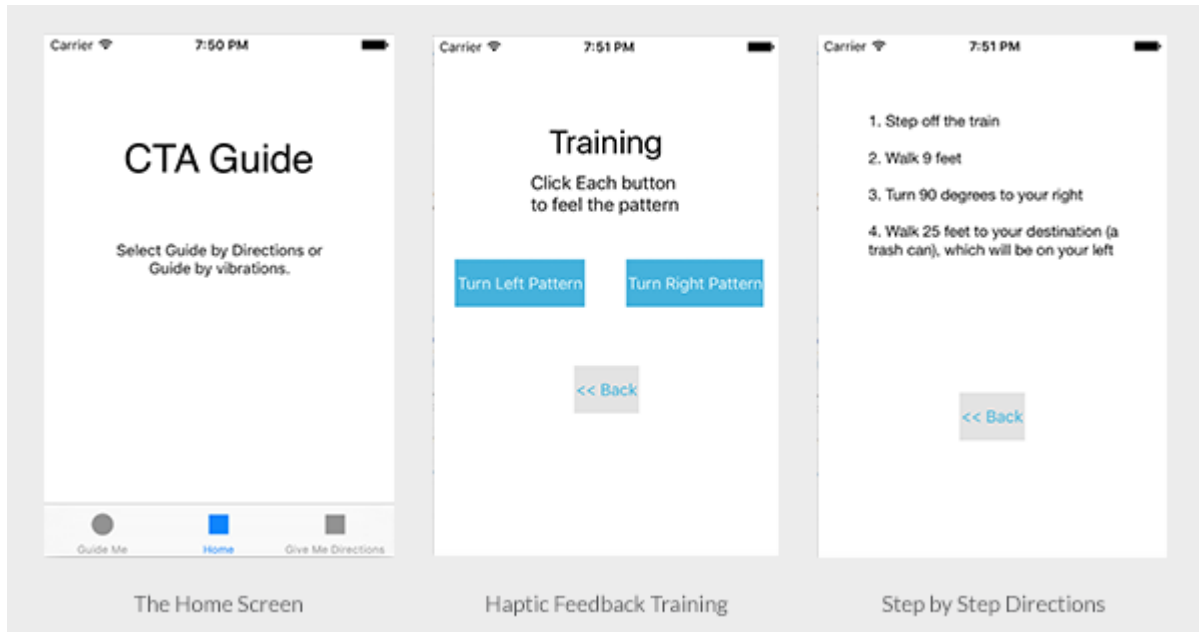- Can users follow turn by turn directions that give distance in feet in order to navigate the platform?

Image 1: Screens from our iPhone Prototype

Recruitment and Participant

We had one participant for the usability test. We recruited our participant by sending an email to past participants. We sent a consent form to the participant via email. The participant agreed and provided consent to participate in the usability test via email. Our participant is male and uses a cane. He is familiar with using the CTA and uses a smartphone regularly.

Procedure

We performed the usability test in a semi-controlled lab setting (a hallway) where we simulated a train platform. The participant attempted to complete a set of task scenarios and provided feedback regarding the usability and accessibility of the app. We directed the participant to provide an honest opinion regarding the usability of the application. The participant also answered a post-session questionnaire and debriefing. We audio and video recorded the usability test.

Task One: Follow the directions given by the app

We presented the participant with an iPhone 4 that had a prototype of the CTA Guide app. We instructed the participant to use the direction feature and follow the directions read aloud by the app. We informed the participant that the task would be complete when they reached the trash can we had set up on the "platform."

Task Two: Find the staircase with the indicated tone

We placed two speakers at either end of the "platform." Each speaker played a different tone, one at a high pitch, and the other at a lower pitch. We provided the participants with the task instructions, detailed in Appendix F. After we gave the task instructions to the participant, we played the two beep tones on each speaker. The participant then began the task.

Task Three: Follow the direction given by the haptic feedback pattern

We once again provided the participant with an iPhone that had the CTA Guide app. Before giving the participant the task instructions, we provided them with task training. Once the participant confirmed that they knew the different vibration patterns, we gave them the task instructions. See Appendix F for the complete test protocol. We asked the participant to place the phone in their pocket. However, the participant informed us that they could not feel the vibration. So we modified the instructions and asked them to hold the phone in their hand. We concluded the usability test by asking the participant demographic questions.

Analysis

Our team took detailed notes of the video recording of the usability test. We then reviewed the notes for each task and discussed the tasks completion success rates, errors made and feedback provided by the participant. Based on this information, we discussed possible design changes to the app.

Findings

Contextual Inquiry

Themes in the Transcripts

In the course of our data analysis several themes began to emerge. We grouped our codes into categories which we then used as codes for the second round of coding. We ended up with 55 codes. This table summarizes some of the more important codes:

Codes	Definition	Sample Quote
assistance from ca	Used to code any section of the interview or contextual inquiry where participants asked for or talked about assistance from CTA's customer assistants.	● P2: "I think that time The CTA worker like found me before I found them, so I didn't have to ask anyone else for help at that point." ● CA: "You need some assistance P3: Yes please"
audio wayfinding cues	Used to code for any situation where participants mentioned or encountered a useful audio cue, such as an elevator or bus shelter beeping button. This is distinct from announcements and train door beeping.	● P1: "I listen for the escalator." ● P2: "So, I'd listen for where the doors are going to open so i know where to get off," ● P4: "OK. I hear an escalator, can I, is that only an up one or a down one?"
challenge: platform/boarding	Used to mark any parts of the transcript where participants mentioned or encountered barriers when walking the platform or boarding the train.	● P1: "...if there were no people around, it would actually make it easier. On the platforms, they are just variables that move." ● P3: "That's a pink line, ok - Now I don't know where the front car is, where do they stop. I have no clue"
fear	Used to mark any parts of the transcript where participants showed or mentioned fear.	● P1: "I've only ever had one incident on the train, at fullerton and my dog fell off the edge of the platform." ● P2: "Its really only if I am in a jamb and I have to go um, that I would try to figure it out on my own, but it always makes me very nervous. I don't like doing that."
language used for navigation	Used to code any text where participants give examples of language that is useful to communicate directions.	● P2: "Yeah, I would say like OK, um like lets say they were going to go take the blue Belmont blue line like after they left me, like I would say Ok, when you walk in, go down the stairs and like kind of veer to the left a little bit, and keep walking straight and like listen for the turnstiles," ● P3: "And if it would say 'turn to the right and go in the same direction as the train and continue walking 50 feet' whatever it's going to say."
no mental model	Used to mark any text where participants seemed to not understand their environment. Also if they complained of not knowing the layout of a station.	● P1: "but again if I forget along the way because I'm stuck in my own little head and I'm like wait a minute, which way am I supposed to go?" ● Interviewer: "Have you ever used the customer assistance button on the platform?" P2: "Nope. I have no idea where it is."
platform physical cue	Used to mark any text where a participant mentioned or encountered a physical object	● P3: "And some of them have the truncated domes, the bumps." ● P4: "Um, they have um of course the standard

	on the platform. Either as an obstacle or wayfinding too.	railings so you don't fall off the platform down in to polk street and um, then they have pretty good um, those, they call them truncated domes at the edge of the platform…"
trip planning: info searched for	Used to mark any text where participants mentioned information for which they searched.	●P1: "that blindsquare one, which is more of a gps and tells you like intersections and directions and businesses and stuff like that…"

Table 2: Our most useful codes for analysis of the riding experience, as judged by the authors.

We knew that we needed a framework to understand this data, so we decided to approach the data through the lens of a user journey. We identified eight stages of the rider's journey.

User Journey

Trip Planning

Any research done before entering the station fell into the Trip Planning stage. Our participants planned their trip using a variety of tools (smartphones, computers and calling into RTA's trip planning service). Our participants all stressed the importance of trip planning. Each one was able to give us examples of information they couldn't find online. Some examples of this information included station layout, elevator outages and information detailing the location of entrances.

Entering the Station

This stage begins once the participant crosses the threshold of the station and ends once they pass through the turnstiles. This was one of the easier stages for our participants. Most of them were able to identify the sounds of the turnstiles. They used this to help them find their way to the CTA assistant. Similarly, some of our participants used escalators as audio feedback to help guide them. Most of the participants noted that once they found the turnstiles, they had no set way to contact the CA.

Navigating the Platform

This stage begins right after the rider passes through the turnstiles and ends when they get to the spot on the platform where they wait for the train. This was one area that all our participants found problematic. Though they had no issues when a CA was present, all our participants reported that navigating this section of their journey would not be pleasant without assistance.

Boarding The Train

This stage encompasses any actions between finding a place to wait on the platform and finding a place to sit or stand on the train. All our participants mentioned that this is a stressful

time for them. They have a hard time finding the train doors while dealing with other riders and fear falling off the platform. Most mentioned that the trains don't stop in a consistent place, so each time the train arrives the doors may be in a different spot. A few of our participants also mentioned that it could be difficult to access the seating reserved for people with disabilities.

On The Train

This stage encompases time spent traveling on the train. This was a more positive part of the ride for our participants, though a few did mention that train announcements were occasionally missing.

Getting off the Train

This stage spans from the train arriving at the rider's destination station to the riders stepping off the train, ideally to meet the waiting CA. Several of our participants mentioned that they had had issues in the past with the CA not being present when they arrived. This forced them to either navigate the platform without aid or accept help from the train driver or another rider. Participants also mentioned that the press of the crowd might made it difficult for them to use their normal wayfinding techniques.

Exiting the Platform

This stage spans from the platform just outside the train door to getting through the turnstile. Participants noted the same difficulties navigating the platform as they did at their departure station. Most commented on the difficulty of distinguishing the stair or elevator from other objects on the platform.

Exiting the Station

This stage spans from the turnstiles to outside of the station, where the person must orient themselves. All participants mentioned the difficulty of finding the right exit of a station as well as orienting once they were on street level. This was especially difficult when the station had more than one exit. Participants mentioned that their researched directions might assume they left the station one way, but that they might leave through a different exit.

Rider Journey Map

We combined our themes and our perceptions of the challenges riders faced as well as their mood in a journey map:

The Experience of Taking a CTA Train for a Person who is Blind

Trip Planning → Entering the Station → Navigating the Platforms → Boarding The Train → On the Train → Getting off the train → Exiting the Platform → Exiting the Station

Mood

"Now I don't know where the front car is, where do they stop. I have no clue..." -P3

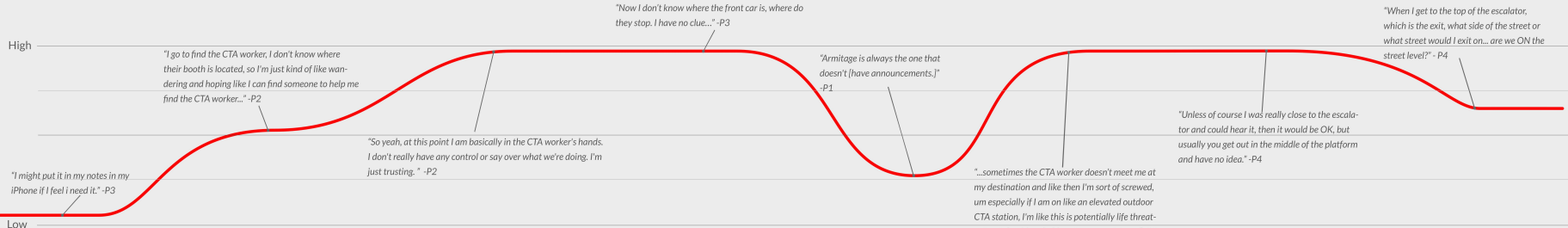"When I get to the top of the escalator, which is the exit, what side of the street or what street would I exit on... are we ON the street level?" - P4

High

"I go to find the CTA worker, I don't know where their booth is located, so I'm just kind of like wandering and hoping like I can find someone to help me find the CTA worker..." -P2

"Armitage is always the one that doesn't [have announcements.]" -P1

"So yeah, at this point I am basically in the CTA worker's hands. I don't really have any control or say over what we're doing. I'm just trusting. " -P2

"Unless of course I was really close to the escalator and could hear it, then it would be OK, but usually you get out in the middle of the platform and have no idea." -P4

"I might put it in my notes in my iPhone if I feel i need it." -P3

"...sometimes the CTA worker doesn't meet me at my destination and like then I'm sort of screwed, um especially if I am on like an elevated outdoor CTA station, I'm like this is potentially life threatening, I should probably get some assistance" -P2

Stress/Fear

Low

Challenges

Trip Planning
- All needed information can be difficult to find, specifically station layout information.
- Details of the trip need to be memorized or written down.

Entering the Station
- There is no consistent way to get a Customer Assistant.
- Inconsistent layout and movement of other passengers can make orientation difficult.
- Escalators can be a help or hindrance - they provide audio feedback, but can also be tough to navigate.

Navigating the Platforms
- Riders want to navigate toward the first car, where they feel safer, but have a hard time navigating to the right spot.
- The large number of obstacles (including people) on the platforms make them difficult to navigate.
- The use of Customer Assistance means that, in the event that the Customer Assistant is not present, riders have very limited navigation cues and mental model from which to work.
- The fear of falling off the platform remains despite the tactile bumps present at most stations. Missing tactile bumps represent a MAJOR barrier.

Boarding The Train
- It can be difficult to find a seat.
- There is not enough warning when the train car doors open.
- Trains don't always stop in a consistent place.
- Fellow passengers are both an aid and a challenge.
- Inconsistent audio announcements can confuse riders about which train they are about to board.

On the Train
- Riders who are blind have little concept of train car layout.
- Audio cues are inconsistent or

Getting off the train
- CTA Customer Assistance is not always there to help them off.
- People can make getting off the train challenging.
- Riders who are blind have to get up early while train is moving to prepare to get off.
- It can be difficult to determine when the door opens – there is no audio cue.

Exiting the Platform
- Riders don't know what to expect or which way to go when they get off due to inconsistent platform layout.
- Distinguishing the stairs/escalator/elevator from other objects on the platform can be difficult.
- Echolocation doesn't always work.

Exiting the Station
- Riders don't always know their orientation as they exit the station.

Design Solutions

Trip Planning
- Provide a more detailed, accessible Trip Planning app, including station layout and information.
- Provide on demand station information as well as to aid in change in travel plans.

Entering the Station
- Guide riders who are blind more directly to CTA customer assistance with audio or floor guides.

Navigating the Platforms
- Look toward station standardization wherever possible
- Provide information about the platform, layout and obstacle via CTA's website.
- Provide audible and physical cues to help guide riders around the platform. Beeping tones at the stairs and textured floors seemed popular with our participants.

Boarding The Train
- Have train doors beep both when opening and when closing.
- Make platform announcements more consistent. Consider announcing all arriving trains.
- Research how to make priority seating more available to those who need it.

On the Train
- Ensure that announcements are working in every car, at every stop.
- This is a good time to provide riders with more information about their destination platform layout via mobile device.

Getting off the train
- In addition to a mobile app solution, a kiosk system could help support riders who cant afford a phone or data program as well as riders who may have lost their devices. Floor guides could lead riders to these kiosk centers that offer audible information about station layout.

Exiting the Platform
- An audio cue at the entrance of the stairs/escalator/elevator.
- While on the train the user can quickly check the app to learn if there are multiple exits, if the exits are in the middle or on the ends of the platform and where the exits are relative to the platform edges (if a middle platform).

Exiting the Station
- Observe more people who are blind navigate the outside environment. Apply navigation cues observed to the development of the previous design solutions.

Image 2: The User Journey Map

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Survey

Demographics

PWAB who had taken the CTA bus or trains in the last six months completed eighteen surveys, including one participant who took the survey over the phone. Six people were 18-39, five were 40-59, and seven were 60+. All but one participant had used a CTA bus and a CTA train in the past six months (one person had not used a train). Ten people use the train 1-2 days a week and six use it 3-7 days a week. There was not a strong preference for mode of transit, with roughly equal groups preferring the train, the bus, or having no preference. The people who prefer the bus cited more reasons related to accessibility than those who prefer the train, who tend to prefer it for its efficiency. Thirteen participants own a smartphone and five do not.

Use of the Customer Assistance (CA) Service

A majority (72%, n=13) of respondents reported never or rarely using the CAs. Twelve people could recall having taken a familiar route in the past six months, of which, half (n=6) had asked for assistance from a CA. Ten people could recall taking a new route in the past six months, of which, a majority (80%, n=8) had asked for assistance from a CA. Of the fourteen who had asked for assistance on one or both of these routes, 64% (n=9) had reported never or rarely using the CA. It therefore appears that the number of people who use the CA might be higher than the self-reported 28%.

Customer Assistance (CA) Service Ratings

Ratings of CA reliability and ease of use were overall positive, but inconsistent. Respondents rated overall reliability, the reliability of finding the CA at the departure station, and the reliability of finding the CA at the arrival station on a five-point Likert scale.

Of twelve responses, the mode for all questions was a four ("somewhat satisfied"). Three people were "very satisfied" with the overall reliability and with finding the CA at the departure station, and two people were "very satisfied" with finding the CA at the arrival station. All of the "very satisfied" responses came from people who reported that they rarely used the CA. Although most respondents reported mixed reliability scores, eight respondents reported that it did not affect how often they take the train, three said they take it more often, and one person takes it less often.

Of the people who have taken the CTA without CA assistance, 79% (n=11) reported they were very familiar with the station in the last trip they took. The two people who were not familiar or somewhat familiar asked for assistance from a fellow traveler at some point during the trip.
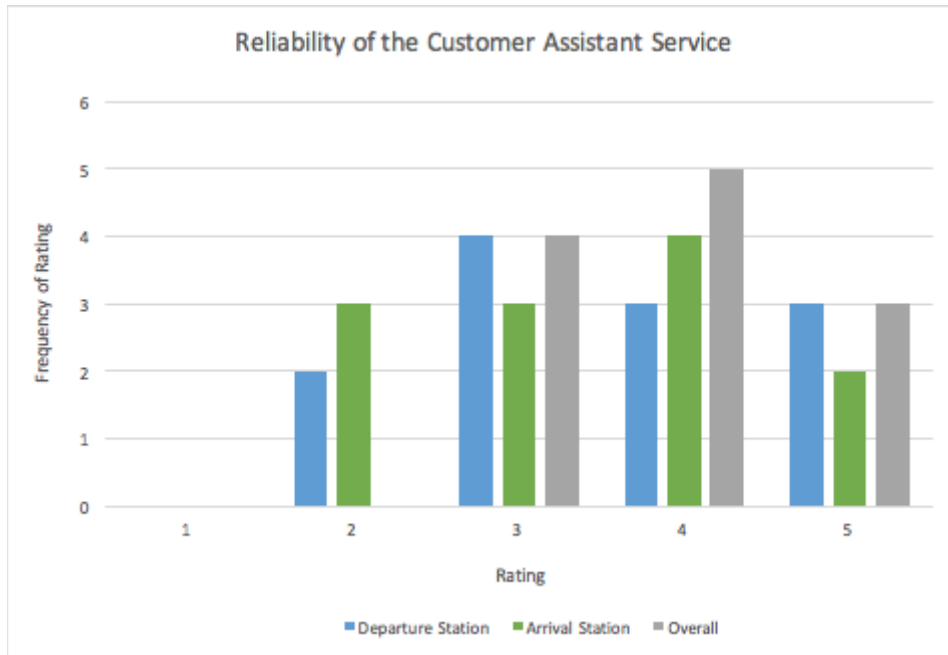
Figure 1: Ratings of the reliability of the CA overall, finding the CA at the departure station, and finding the CA at the arrival station (n=12).

Navigation Challenges During Independent Travel

We asked respondents to select all parts of their last trip without using a CA that were challenging during the departure or arrival stations. Roughly half of participants found at least one part challenging in either station (61%, n=8 in the departure and 50%, n=6 in the arrival). Navigating the platform was the most frequently selected challenge, followed by finding a seat, and finding the stairs, escalator, or elevator to get onto or off of the platform.

Stress Levels During Travel

We asked respondents to rate their stress level on a scale of 1-5 with 1 being not at all stressed and 5 being very stressed at the most challenging parts of their trip. 60% (n=9) reported a low stress level (rating of 1 or 2), 20% (n=3) reported a medium stress level (rating of 3), and 20% (n=3) reported a high stress level (rating of 4 or 5).

Trip Planning

Thirteen people own a smartphone, and ten of them have used it in the past six months to help them navigate during some kind of travel. The N-1 Two Proportion test indicates this is a significant difference (p=0.007). 88% (n=15) of respondents can recall looking up information about a bus stop, train station, or bus or train arrival times before starting a trip in the past six months. The N-1 Two Proportion test found a significant difference (p<0.001). Eight had used a computer, eight had used a smartphone, and five had called someone. One respondent wrote in an answer stating that he/she avoids using the CTA call-in service citing long wait times and poor route recommendations.

We asked our participants if any of the types of information listed in Figure 2 would be of use to them in planning a trip on the CTA. Of the thirteen people who responded, 100% (*n*=13) thought being able to look up which direction to walk after getting off a train to get to the closest exit would be useful. 85% (*n*=11) thought train arrival times and the platform position (middle or outside of the tracks) would be useful. A strong majority of respondents selected other layout details of train stations, as seen in the graph below.
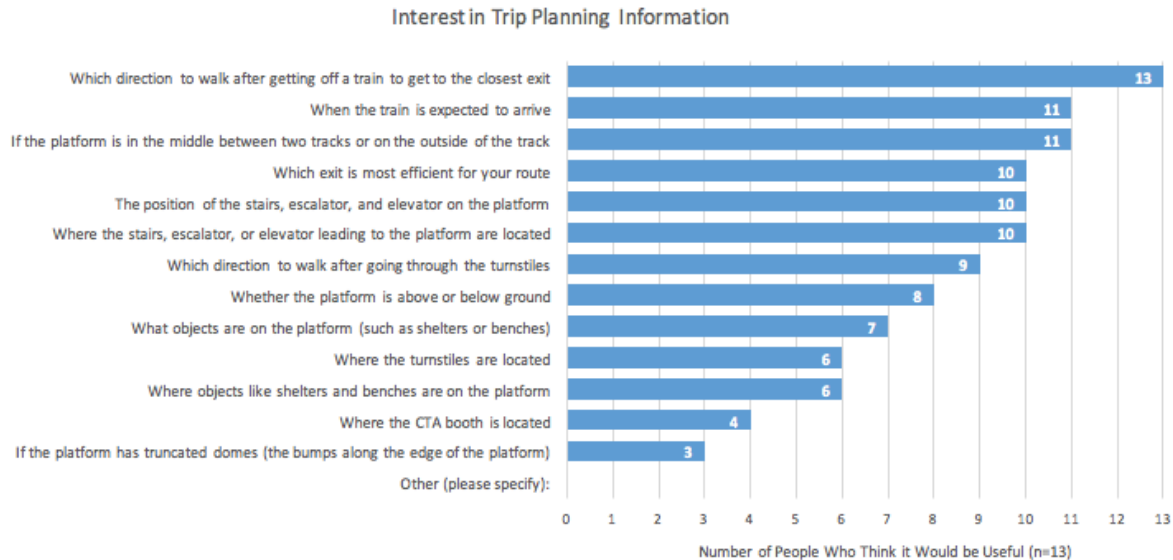

Interest in Trip Planning Information

Which direction to walk after getting off a train to get to the closest exit	13
When the train is expected to arrive	11
If the platform is in the middle between two tracks or on the outside of the track	11
Which exit is most efficient for your route	10
The position of the stairs, escalator, and elevator on the platform	10
Where the stairs, escalator, or elevator leading to the platform are located	10
Which direction to walk after going through the turnstiles	9
Whether the platform is above or below ground	8
What objects are on the platform (such as shelters or benches)	7
Where the turnstiles are located	6
Where objects like shelters and benches are on the platform	6
Where the CTA booth is located	4
If the platform has truncated domes (the bumps along the edge of the platform)	3
Other (please specify):	

Number of People Who Think it Would be Useful (n=13)

Figure 2: Responses to q.31, "Would any of the following information be of use to you while planning a trip on the CTA train? Select all that apply." (*n*=13).

CTA Train Satisfaction

72% (*n*=13) participants report being extremely likely to recommend the CTA train to someone who is blind, while 28% (*n*=5) ranged from somewhat unlikely to somewhat likely. Ten respondents added extra comments at the end of the survey. Three spoke specifically about appreciating the CTA for the independence it provides, two had positive comments about the CTA's accessibility, and one commented that it is more reliable than Paratransit.

User Test

We tested three design conditions to guide the participant to a destination. Two of the conditions were successful.

The participant figured out the UI of the app used for the turn by turn test quickly. However, when getting directions he tried to read the lines one at a time, but the app repeated the whole list. The participant also immediately equated the number of feet described in the text with his strides. He started referring to those directions as "25 steps" instead of 25 feet. We observed this happen as though he misheard the app or equated his steps to the measurement of a foot. The participant failed to complete this condition.

When testing the active audio signal condition, the participant was able to get to the correct destination. He turned the wrong way initially, but after hearing a second beep corrected himself and headed directly toward the correct destination. Due to technical problems, the first time we ran the test for this condition there was only one tone and the participant went directly to the tone.

When testing the haptic feedback condition, our participant quickly navigated the app to the tutorial and played it for both directions. During the test he turned to the correct direction. But he was only able to do so after some adjustment because he said he was unable to distinguish the vibrations when the phone was in his pocket. We had him hold the phone and try again. This time, he identified the pattern and turned in the correct direction.

We also asked the participant for feedback and a satisfaction rating for each condition. When asked his preferred method our participant said, "Normally I would like the [turn by turn], but in the context of an El platform or bus stop with it getting noisy with the pedestrians and people." He also mentioned that he thought the active audio condition was "...fun." We summarized his satisfaction ratings in this table:

	Turn by turn Condition	Active Audio Signal Condition	Haptic Feedback Condition
Satisfaction Rating 1 - 5 easy - hard	3	2	1

Table 3: Summary of participant satisfaction with our three conditions.

Discussion

In this research we sought to identify any challenges or barriers that PWAB face when riding the CTA. We also sought to find any opportunities to design a better experience. In the following sections, we will examine our findings and describe three design solutions of increasing scope. These solutions address the challenges of navigating train platforms uncovered in this study.

Previous research indicated that PWAB do trip planning ahead of time to build mental models of bus stops to help them navigate. However, there is no source of information on the layouts of train stations. We theorized that this may make train stations harder to navigate. Our study corroborates the finding that there is no online source of station information, and seems to indicate that the lack of a mental model makes stations and platforms harder to navigate. Our results were also similar to the prior study in that they show that inconsistencies in the CTA system make it harder to ride the trains without help.

The survey results differed from our interviews and observation findings. The survey respondents reported a higher level of satisfaction with the CAs. They also reported that the platforms were not especially challenging to navigate. Our interview and observation participants each recounted stories of the CAs being hard to find. They spoke about fear of

falling off platforms and difficulty navigating around objects on platforms and finding the exits. We observed these difficulties as well. Although the survey respondents did not echo the stress levels of our interviewees, they did respond strongly to wanting access to information on CTA station layouts. We speculate that the language used when asking about navigating stations and platforms could have biased these results. We asked them to rate how "challenging" it was, and this language may imply a bias of which we are unaware.

In response to the challenges our research uncovered, we propose a system of accessibility to make the CTA train safe and easy to use by PWAB. We have broken the design of the system down into three sections by scope (immediate, medium term, and long-term). The system incorporates technological solutions that bridge accessibility gaps as well as systemic changes to remove the root cause of the barriers.

Image 3: A Wireframe of the Trip Planning app

One immediately implementable technological design solution is to make station layout information accessible online. As the previous study and current study show, PWAB do trip planning ahead of time on their phones and computers, as well as calling stations to learn details. In the system we propose, users could easily find a particular station and learn details about the station. These would include information such as where to find the CTA booth; where

to find stairs, escalators, elevators, or ramps; the type of platform (middle or outside track); the level of the platform (above or below ground); and whether the elevators and escalators are functioning. Our work found that users rely heavily on memory while navigating from a mental map, but that sometimes there is too much information to memorize. Therefore, users should be able to download the information for quick access from a mobile phone, or access it via an app.

In addition to technological solutions, we identified immediately implementable changes to the CTA system that would make a profound difference for PWAB. Currently, train doors beep to signal that they are about to close. This is stressful for our participants. Because there is no tone when the doors open, the doors can be difficult to find. Changing the timing of the beep to begin immediately when the doors open (or just before) would make it easier to locate the doors quickly. Participants also found it challenging to know which train has arrived if they are at a station with multiple lines. Some stations now include announcements indicating which train will be arriving next. All stations with multiple routes should include these announcements. Finally, training conductors on the importance of pulling up to the designated markers in stations would help riders who are blind board and disembark more easily.

The mid-term design recommendations are also both structural and systemic. First, it is imperative for all stations to have truncated domes along the edges of the platforms. Even with the domes participants are nervous, but having no domes is extremely dangerous. Another design feature that would make it much easier to navigate a platform would be to install a strip of distinctive material that acts as a guide to the exits. It should indicate a straight path to and from the stairs and be as far from the track as possible. We also suggest installing kiosks on platforms that provide information about the objects on the platform, give detailed directions to the exits, give orientation information, and provide arrival times for trains. The tactile guide on the ground could help lead people to the kiosks. Finally, placing active tone speakers at the platform exits might make it easier for PWAB to quickly get off the platform. There could be one tone used for stairs and ramps and another for escalators and elevators, so that PWAB and have physical impairments can find an accessible exit.

Anna Green

Anna is riding the train to go meet some friends for a dinner party. Her friend, Teddy, is going to pick her up from the station. She is riding the Blue line towards forest park. The train conductor suddenly announces that the last stop will be Logan square due to track issues ahead. Anna calls Teddy to let him know that she is going to have to get off at Logan Square and he tells her that he will meet her at the northbound exit. She has never been to the Logan Square station.

Anna gets off the train and can hear the beep tone from the CTA Guide kiosk in the center of the
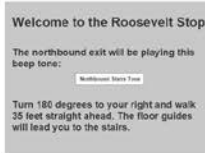
She follows the floor guides to the kiosk.

Welcome to the Roosevelt Stop

Do you want to:

She taps the kiosk and it reads out the menu options "Find an exit, Call CSA, and Station Information". Anna selects find an exit.

Welcome to the Roosevelt Stop

Which exit do you need guidance to?

The kiosk then reads out "Do you want the northbound exit or southbound exit?". Anna se-

Welcome to the Roosevelt Stop

The northbound exit will be playing this beep tone:

Turn 180 degrees to your right and walk 35 feet straight ahead. The floor guides will lead you to the stairs.

Turn 180 degrees to your right and walk 35 feet straight ahead. The floor guides will lead you to the stairs.

Anna then could hear the beep tone for the northbound stairs so she turned right and headed towards the stairs. She found the floor guides so she set her cane to follow it to the stairs.

She went up the stairs and followed the guides to the exit to find her friend, Teddy.

Image 4: Riding the CTA with our proposed design solutions

Our long-term solutions are technological and systemic. We suggest building out the trip planner described previously to act as a step-by-step guide that could replace the CA. This would require a technology precise enough to calculate distances in feet and give consistently accurate directional information that would be sufficient to navigate a train platform. The system should use concise and simple language that references physical markers such as benches or trash cans. A user should be able to reference it while on board a train to learn which direction to turn after disembarking to get to the exit that is most efficient for his route. For situations where a user does not want to listen to his phone, the app could give haptic cues, such as vibrating in a distinctive pattern to indicate whether to turn right or left.

The long-term structural design solution would be to install walls along the track edge with doors that align with the train doors. When there is no train present, the doors remain shut. When the train arrives the doors of the wall and the doors of the train open together. This would eliminate the risk of falling off a platform, and it would provide a helpful guide for people who use white canes. The Paris Metro uses this type of system. If CTA trains integrated well designed implementations of the above concepts, PWAB might have a much easier time riding them.

Limitations of this Study

We were unable to draw statistically significant findings from our survey. Given that we were working with a low-incidence population it was challenging to find respondents. The form of an online survey may have also affected participation rates, especially since the survey took a relatively long time to complete. The language used in the survey may have affected the results. One question in the survey failed to provide an opt-out answer which could have affected results.

In addition to the challenges with the survey, our interviews and observations did not have a balance of age and gender (there was only one participant who was under 40) and also suffered a low n. Our only male participant took part in the usability test. In the usability test we encountered technological problems with the speakers we used, and had a challenging time locating an appropriate setting in which to test.

Future Work

In future work we plan to take a value-sensitive approach to conducting research. Independence is a key value for our participants, and it is important to understand what language to use that respects their independence. We intend to test interview scripts and surveys with a participant to find language that might use inaccurate terms or sounds insensitive or condescending. This process is especially important for online surveys because there will be no human interaction to mitigate the impression of the language. Additionally, we should give survey participants the option to take the survey over the phone because it is much faster and they might not have the necessary screen reader to take the survey online.

Finally, once we have iterated on the current design of the app and have tested in a safe environment will will move the tests to a train platform. It will be crucial to account for environmental factors such as noise, wind, and other people, as well as the stress a person might feel while using the app on a platform.

Appendix

A. References

Campbell, M., Bennett, C., Bonnar, C., & Borning, A. (2014). *Where's my bus stop? Supporting independence of blind transit riders with StopInfo.* Paper presented at Assets 2014, *Rochester, NY. New York, NY: ACM. doi:10.1145/2661334.2661378*

Dickinson, J., Law, I., Pingrey, K., & Tinman, J. (2015). *The Case for Further Research into the Public Transit Transfer Experience for People Who are Blind.* Unpublished manuscript, College of Computing and Digital Media, DePaul University, Chicago, IL.

Holden, B. (2007). *Blindness and poverty: a tragic combination.* <u>Clinical and Experimental Optometry.</u> 90.6: 401-403.

B. Consent Forms

Contextual Inquiry

DULT CONSENT TO PARTICIPATE IN RESEARCH

Assessing Train Accessibility

Principal Investigators: Jessa Dickinson, Nathan Petts, and Alma Sandoval

Institution: DePaul University, Chicago, Illinois, USA

Department (School, College): College of Computing and Digital Media

Faculty Advisor: Dr. Sheena Erete, Human Computer Interaction

What is the purpose of this research?
We are asking you to be in a research study because we are trying to learn more about how we can improve the accessibility of the CTA train stations. This study is being conducted by Jessa Dickinson, a graduate student at DePaul University as a requirement to obtain her Master's degree. This research is being supervised by her faculty advisor, Dr. Sheena Erete.There may be other people on the research team assisting with the study.

We hope to include about 3-4 people in the research.

Why are you being asked to be in the research?
You are invited to participate in this study because you are a person who is blind that lives in the Chicago area and is familiar with the CTA. You must be age 18 or older to be in this study.

What is involved in being in the research study?
If you agree to be in this study, being in the research involves an observation where you will be riding the CTA train with our researchers on a route of your choosing, showing us how you navigate the platforms and trains. Before the ride there will be a 15-20 minute interview and following the ride we will ask wrap-up questions that may take 5-10 minutes. A few weeks after our ride, we will send you a survey and ask for feedback on the accessibility of the survey over the phone. The observation and interview will be audio recorded and transcribed into written notes later in order to get an accurate record of what you said.

How much time will this take?
This study will take about the length of the CTA train route of your choosing for the observation plus 20-30 minutes for questions.

Are there any risks involved in participating in this study?
Being in this study does not involve any risks other than what you would encounter in daily life.

Are there any benefits to participating in this study?
You will not personally benefit from being in this study.

We hope that what we learn will help people who are blind in the future to make trains and stations more accessible

Is there any kind of payment, reimbursement or credit for being in this study?
You will receive $15 cash for completing the survey. If you do not complete the entire study, you will be paid the same amount.

Are there any costs to me for being in the research?
You are responsible for any costs related to getting to and from the location where you will participate in the research.

Can you decide not to participate?
Your participation is voluntary, which means you can choose not to participate. There will be no negative consequences, penalties, or loss of benefits if you decide not to participate or change your mind later and withdraw from the research after you begin participating.

Who will see my study information and how will the confidentiality of the information collected for the research be protected?
The research records will be kept and stored securely. Your information will be combined with information from other people taking part in the study. When we write about the study or publish a paper to share the research with other researchers, we will write about the combined information we have gathered. We will not include your name or any information that will

directly identify you. We will make every effort to prevent anyone who is not on the research team from knowing that you gave us information, or what that information is.
The audio recordings will be kept until accurate written notes have been made, then they will be destroyed.

Who should be contacted for more information about the research?
Before you decide whether to accept this invitation to take part in the study, please ask any questions that might come to mind now. Later, if you have questions, suggestions, concerns, or complaints about the study or you want to get additional information or provide input about this research, you can contact the researcher, Jessa Dickinson: Jessa.Dickinson@gmail.com, 615-585-9116.

You will be given a copy of this information to keep for your records.

Statement of Consent from the Subject:

I have read the above information. I have had all my questions and concerns answered and by emailing or by verbally giving my consent, I indicate my consent to be in the research.

Usability Test

ADULT CONSENT TO PARTICIPATE IN RESEARCH

Assessing Train Accessibility

Principal Investigators: Jessa Dickinson, Nathan Petts, and Alma Sandoval

Institution: DePaul University, Chicago, Illinois, USA

Department (School, College): College of Computing and Digital Media

Faculty Advisor: Dr. Sheena Erete, Human Computer Interaction

What is the purpose of this research?
We are asking you to be in a research study because we are trying to learn more about how we can improve the accessibility of the CTA train stations. This study is being conducted by Jessa Dickinson, Alma Sandoval, and Nathan Petts, graduate students at DePaul University as a requirement to obtain their Master's degree. This research is being supervised by their faculty advisor, Dr. Sheena Erete.There may be other people on the research team assisting with the study.

We hope to include about 1 person in the research.

Why are you being asked to be in the research?
You are invited to participate in this study because you are a person who is blind that lives in the Chicago area and is familiar with the CTA. You must be age 18 or older to be in this study.

What is involved in being in the research study?
If you agree to be in this study, being in the research involves being observed while completing several tasks within the CTA Guide application, as well as answering some questions after the observation. The observation will be videorecorded and transcribed into written notes later in order to get an accurate record of what you said.

How much time will this take?
This study will take about 20-30 minutes.

Are there any risks involved in participating in this study?
Being in this study does not involve any risks other than what you would encounter in daily life.

Are there any benefits to participating in this study?
You will not personally benefit from being in this study.

We hope that what we learn will help people who are blind in the future to make trains and stations more accessible

Is there any kind of payment, reimbursement or credit for being in this study?
You will receive $15 cash for participating in the study. If you do not complete the entire study, you will be paid the same amount.

Are there any costs to me for being in the research?
You are responsible for any costs related to getting to and from the location where you will participate in the research.

Can you decide not to participate?
Your participation is voluntary, which means you can choose not to participate. There will be no negative consequences, penalties, or loss of benefits if you decide not to participate or change your mind later and withdraw from the research after you begin participating.

Who will see my study information and how will the confidentiality of the information collected for the research be protected?
The research records will be kept and stored securely. Your information will be combined with information from other people taking part in the study. When we write about the study or publish a paper to share the research with other researchers, we will write about the combined information we have gathered. We will not include your name or any information that will directly identify you. We will make every effort to prevent anyone who is not on the research team from knowing that you gave us information, or what that information is.
The audio recordings will be kept until accurate written notes have been made, then they will be destroyed.

Who should be contacted for more information about the research?
Before you decide whether to accept this invitation to take part in the study, please ask any questions that might come to mind now. Later, if you have questions, suggestions, concerns, or complaints about the study or you want to get additional information or provide input about this

research, you can contact the researcher, Jessa Dickinson: Jessa.Dickinson@gmail.com, 615-585-9116.

You will be given a copy of this information to keep for your records.

<u>***Statement of Consent from the Subject:***</u>

I have read the above information. I have had all my questions and concerns answered and by emailing or by verbally giving my consent, I indicate my consent to be in the research.

C. Contextual Interview Script

Study Introduction

Thank you for taking the time to participate in our study. My name is _____ and and this is _____. We are graduate students at DePaul University in the Human-Computer Interaction (HCI) program. My research group is trying to understand the experience of taking a CTA train for a person who is blind, and what about that experience is easy or challenging. Through this research we seek to design a solution to any challenges that we find.

As compensation for participating, we are giving you $15. I'll give that to you know, If you want to take a moment to put it away feel free to do so.

First, we will do a 15 - 20 minute interview about your use of public transit.

After the interview, I will explain how the observation will work and we will take the train to _____. Once we reach our destination, we will do a quick wrap-up and get any further feedback that you have.

In about two weeks, we would like to send you a survey to get your feedback on the accessibility of the survey. We could call you whenever is convenient to get the feedback. Would you be willing to participate in that part of our research?

If you have any questions or comments at any time, please feel free to share them. There are no right or wrong answers to any of my questions, and please remember that we are looking for issues in the train system, not you. If you would like to stop the observation or interview during any time, please let me know.

This study should take about _____ including the transportation time.

I would like to audio-record this interview, and my partner will take notes. Would that be ok with you?

If yes - Great. At any time, if you would like me to stop recording, please let me know.
If no - OK. Do you mind if I and my partner take notes?

Do you have any questions before we begin?

OK, let's begin.

- In the past week, how often did you take the CTA?
  - Follow up: Did you mostly take trains, buses, or the Metra?
  - Do you have a preference between CTA trains, buses or the Metra?
  - Probe: Why do you feel that way?
- Can you recall a time in the past month or two when you took a CTA train to a new location?
  - [If yes] Did you do any trip planning before you started the trip?
    - [If no] How did you navigate the train station?
    - [If yes] What information did you look for?
      - Probe: Was there any info. you were unable to find?
      - Probe: What tools did you use to plan the trip?
  - Probe: Did you use any apps during the trip?
  - Probe: Did you ask anyone for assistance during the trip?
- Is there a train station you use regularly?
  - [If yes] Are there any particular features of the station that you use to navigate it?
  - Thinking back to the last time you used this station, did you ask anyone for assistance at any point in your trip?
  - Did you use any apps during the trip to help you orient yourself or navigate?
  - Do you use that station because it's close to your home or work or for some other reason?
- Are there any other apps or technologies you use to help you use the CTA trains or buses?
- IF NOT ANSWERED: Can you recall in the last month a time when you have asked for assistance while riding the train?

- ○ [If yes] Who assisted you (a CTA employee or a passenger)? Could you tell me about the experience?
  - ○ Did you find their assistance to be helpful?
- Do you have preference between asking a passenger or a CTA rep for assistance?
- What do you think is the most challenging part of using the CTA trains?
- What do you think is the best part of the CTA?
- Before we start our trip we would like to collect some demographic information from you, if you aren't comfortable answering any of these questions feel free to decline.
  - ○ How long have you lived in Chicago?
  - ○ How long have you been taking public transit in Chicago?
  - ○ In what year were you born?
  - ○ Are you able to see any colors, shapes, or bright lights?
  - ○ [If no guide dog] What type of cane do you use?
- Is there anything else you would like to add before we begin the trip?

Train Ride Contextual Interview

Great, now we can start the observation. I would like you to show me how you take the train. That is, please guide me as though you were teaching me to take the trains. We will ride from here to the Fullerton stop.

As we ride, I may ask questions as we go. Please speak aloud any instructions you have for me, and I will follow them. As you go, please say aloud what you are thinking as you navigate so we can understand what you are doing. If you ever reach a point where you would get CTA assistance, or assistance from anyone, please let us know, and my teammate will assist you. Do you have any questions?

What route would you like to take? OK, Lets begin.

Wrapup

1. [Ask clarifying questions]
2. Do you have any other comments you would like to add for our study?

Thank you so much for your time, we will be in touch with you in a couple of weeks about the survey.

- wayfinding strategies
- environmental cues, cane or dog interactions
- attitude towards assistance and technology
- How do you determine where you should stand to board the train?
- When you get off a train, how do you find the stairs?

Tools/Tech

Sequence of Actions

Methods of Organization

Interactions

D. Transcripts

E. List of Codes

Audio wayfinding cues
Train Announcements or Beeps
Insufficient or inconsistent announcements
Station entrance/exit physical cue
Platform physical cue
Turnstiles
Stairs/Elevator/Escalator
Train car preference
Finding the train car door
Getting on the train
Seat finding and preference
Getting off the train
Independent navigation tactic
Navigation that is easy
Station familiarity
Outside of station navigation

Mental model
Challenge: station entrance
Challenge: finding CA
Challenge: platform/boarding
Challenge: exiting platform
Challenge: exiting station
No mental model
Assistance from friends
Asks for assistance from stranger
Assistance from CA
CA assistance doesn't measure up
Positive CA assistance
Assistance Preference
Challenge: assistance
Assistance not wanted/needed
Expectation that people will offer assistance
Trip planning: Info searched for
Trip planning: Method
Trip planning: Memorization
Route selection when trip planning
App or website
Trip planning attitudes
When to use apps and tech
Finding current location or address
Language used for navigation
Details needed/design recommendation
Values independence
Frustration
Fear
Confidence
Stress
Embarrassment
Preference for buses
Preference for trains
Reasons for using trains
Reasons to not use trains

Para-transit
Metra
Systemic barriers/issues
Demographics
Observation question
Reason to use bus
Reason to not use bus
Echolocation
Reason to use CTA
on train physical cue

F. Usability Test Plan

Usability Tasks

The research team previously conducted observations and interviews that informed the biggest challenges people who are blind face while using the CTA trains. Based on the data collected and the creation of a user journey map, we have created an all-encompassing system – CTA Guide that will make navigating the CTA Train platforms easier. Due to the range and extent of functionality provided in the system and the short time available to test, we will only be testing the app and the tasks are the most common and relatively complex of available functions.

As the entire system is based on providing people who are blind with physical and audio cues, this is an area that we have deemed important to test. We will specifically test the audio and physical cues given by the app. We want to understand if users can navigate train platforms through the usage of different cues and as a result will test if users can:

- Learn haptic feedback patterns that indicate which direction to turn. Then test if the users can follow the directions given through the haptic feedback.
- Differentiate tone frequencies that indicate various stair locations. Then present users with the different tone frequencies and see if they can navigate to the specified staircase.
- Follow verbal directions that give distance in metrics to navigate the platform.

While this test will be conducted in the app, the language in the app will be used throughout the system and thus, testing these specific areas will be beneficial to the entire system.

Task List:

1. Can a person who is blind learn haptic feedback patterns and use the patterns as a direction guide?
   Training: Show the participant the two haptic feedback patterns and teach them which pattern means turn right and which pattern means turn left.
   Task: Follow the directions given by the haptic feedback patterns.
   Task Instruction: You are riding the train and are standing at the door preparing to get off the train. You are using the app CTA Guide's vibration direction feature to help you navigate the platform. You are now getting off the train, when you step off, turn in the direction you think the vibration is indicating.
2. Can a person who is blind learn different tone frequencies and use the tone to find the indicated staircase?
   Task: Find the staircase with the indicated tone.
   Training: Show the participant the two tones.
   Task Instruction: You are riding the train and are about to reach your stop. You know you have to use the staircase located on the south end of the platform. Your app CTA Guide indicates that the stairs will be playing a beep tone that sounds like this [play tone]. You are now getting off the train, please walk toward the staircase with the specified tone.
3. Can a person who is blind follow verbal instructions to navigate the platform?
   Task: Follow the instructions given by the app.
   Task Instruction: You are riding the train and are standing at the door preparing to get off the train. You are using the app CTA Guide's direction feature to help you navigate the platform. You are now getting off the train, when you step off, follow the directions given to you by the app.

Usability Metrics

The following usability metrics will be used to measure against specific performance goals necessary to satisfy usability requirements:
- Scenario completion success rates
- Error rates
- Time-to-completion
- Feedback from

Introduction

Hi, my name is _____.

Welcome and thank you for volunteering to participate in this user study. Would you mind if we record/take notes during the session to share with my design team?

At any moment during this study, you can stop without penalty if you feel uncomfortable or do not want to continue for any reason.

I will be asking you questions and capturing the process you go through to complete the tasks.

Do you have any questions?

We are performing a usability test, for an app called CTA Guide. This app has been designed to help people who are blind navigate CTA train platforms. We are not testing you, or your knowledge. We know that navigating the CTA train stations can be challenging so we are trying to determine what can make navigating the platform easier.

Think-aloud Instructions

As you are doing these tasks, please tell me about what you are thinking and why you are making the choices you do as you go through the tasks. Basically, we'd like any thought that comes into your head to come out your mouth. If you get quiet, I will remind you to keep talking.

Test Script

Just to remind you, your participation is totally voluntary. If for any reason you start to feel uncomfortable you can stop at any time.

And again, this is not a test of your ability to complete these tasks. We are really looking at how the system could be improved. We have a few different tasks that we are going to ask you to do. So, I might have to ask you to move onto the next item without completing something, so don't worry if that happens.

Do you have any questions?

TASK 1

So, for the first task, you are riding the train and are standing at the door preparing to get off the train. You are using the app CTA Guide's direction feature to help you navigate the platform. You are now getting off the train, when you step off, follow the directions given to you by the app. The task is complete when you have reached the trash can.

Questions:

How was that experience?

Where instructions easy to follow?

Did each step have enough information?

On a scale of 1 to 5, 1 being very easy and 5 being very challenging, how easy or challenging was it to navigate the platform?

TASK 2

Great, let's move on to the next task. You are riding the train and are about to reach your stop. You know you have to use the staircase located on the south end of the platform. Your app CTA Guide indicates that the stairs will be playing a beep tone that sounds like this [play tone]. You are now getting off the train, please walk toward the staircase with the specified tone. The task is complete once you have reached the specified tone.

Questions:

How was that experience?

On a scale of 1 to 5, 1 being very easy and 5 being very challenging, how easy or challenging was it to navigate the platform?

TASK 3

Okay, now for the final task. For the next task we are going to use the vibration direction feature. The vibration direction feature, will give you different vibration patterns to indicate when you should turn left or right. Before we start this task, we're going to teach you how to use the vibration direction feature. Press the button below to feel the vibration for turn right. [FEELS VIBRATION] Okay now press this button to feel the vibration for turn left.

Do you know the different vibration patterns?

Okay, lets begin the task.

You are riding the train and are standing at the door preparing to get off the train. You are using the app CTA Guide's vibration direction feature to help you navigate the platform. You are now getting off the train, when you step off, turn in the direction you think the vibration is indicating.

The task is complete once you have walked ten feet.

Questions:

How was that experience?

Were you able to feel the vibration through your pocket?

On a scale of 1 to 5, 1 being very easy and 5 being very challenging, how easy or challenging was it to tell the difference between the two vibration patterns?

DEMO QUESTIONS

1. How long have you lived in Chicago?
2. How long have you been taking public transit in Chicago?
3. In what year were you born?
4. Are you able to see any colors, shapes, or bright lights?
5. [If no guide dog] What type of cane do you use?
6. Is there anything else you would like to add

G. Contextual Inquiry Participants