The event will begin momentarily.

- This event is being recorded
- Captions are available by clicking the CC icon in the Zoom toolbar below
- ASL is provided
- For more information and to download presentation materials visit: www.access-board.gov/av

Inclusive Design of Autonomous Vehicles: A Public Dialogue

Accessibility for Passengers with Sensory and Cognitive Disabilities: Part 1

Ride hailing and on-board communication

United States Access Board

ODEP Office of Disability Employment Policy

ACL Administration for Community Living

Agenda

- Rutgers University
  - Dr. Cecilia Feeley
  - Andrea Lubin
- University of Michigan
  - Dr. Robin N. Brewer
- National Federation of the Blind
  - Anil Lewis
- Gallaudet University
  - Dr. Christian Vogler
- Open Dialogue

PowerPoint slides are available for download from:
www.access-board.gov/av

How to Participate

- Ask Questions to Presenters
  - Submit questions using Zoom's Q & A feature throughout the event
    - Ex. "Question – What are wheelchairs?"
    - Ex. "Question for the first presenter – Did your study look at scooters?"
  - Moderator will paraphrase question to presenters
    - We may not get to all questions
    - As an alternative, you may submit questions via email: events@access-board.gov
- Contribute to the Open Discussion Today
  - Request to speak using Zoom's Q & A feature
    - Ex. "Microphone – I'm Beth from XYZ Company and would like to talk about automated doors"
    - Ex. "Microphone – I'm Alex and I'd like to share my experience using an AV"
  - Host will unmute you (in Zoom), but please check your microphone
    - Moderator will call on you by name to speak
  - ASL – If you wish to be visible for signing, please put that in your request
- Continue the Online Dialogue
  - http://transportationinnovation.ideascale.com
  - For assistance, email: ePolicyWorks@dol.gov

Dr. Cecilia Feeley

Rutgers University

Andrea Lubin

Rutgers University

RUTGERS

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Accelerating Mobility for All:

Highlights of Focus Group Feedback from Persons with Disabilities Following Autonomous Vehicle Rides

Cecilia Feeley, Ph.D. and Andrea Lubin, M.S.

U.S. Access Board
Accessible AV Forum
April 7, 2021

PRINCETON
UNIVERSITY

PROJECT OBJECTIVE

To expand limited body of research on designing & deploying Autonomous Vehicles (AV) to accommodate diverse needs of persons with disability(s)

How?

Convene a series of focus groups with persons with disabilities who experienced an autonomous shuttle ride to capture their feedback

WHY AUTONOMOUS VEHICLES?

- Transportation access KEY for successful integration of persons with disability(s)
- AV innovation could offer a VIABLE transportation option
- USDOT & NHTSA supportive of AV development
- Many states moving towards AV legislation

METHODOLOGY: QUALITATIVE RESEARCH

- Joint research initiative - Rutgers University and Princeton University
- Focus groups (4) with a total of 21 participants
- Study inclusion criteria
- Study limitations

Bottom photo credit: Steven Schultz

Characteristics	Respondents	Percent
Gender		
Male	14	67%
Female	3	14%
No Answer/Not Disclosed	4	19%
Race		
White not Hispanic	7	33%
Black not Hispanic	1	5%
White Hispanic	4	19%
Black Hispanic	0	0%
Asian	3	14%
Native American	0	0%
Hawaiian/Pacific Islander	0	0%
Other	0	0%
No Answer/Not disclosed	6	29%
Age		
18-21	3	14%
22-29	11	52%
30-39	3	14%
40-49	0	0%
50-64	2	10%
65+	0	0%
No Answer/Not Disclosed	2	10%
Education		
High School No Degree	2	10%
High School Degree	5	24%
Some College No Degree	4	19%
Associated Degree	2	10%
Bachelor's Degree	0	0%
Graduate Degree	1	5%
No Answer/Not Disclosed	7	33%
Living Arrangement		
With Parents	14	67%
With Spouse/Partner	2	10%
Group Home	1	5%
No Answer/Not Disclosed	4	19%

PARTICIPANT DEMOGRAPHICS

FINDINGS:
INITIAL IMPRESSIONS

- Vehicle initial impressions
  - Physical appearance
- Entering & exiting – “easy” & “smooth”
  - Participants with visual impairments note handrail and low-step very helpful

“It looks so cool”

“It looks so futuristic”

“Amazing”

FINDINGS: ON-BOARD EXPERIENCE

- All enjoyed the trip:
  - “Smooth,” “Comfortable,” “Slow”
- On-board sounds/noises
  - Only one shared negative noise feedback
- Large windows **+**
- On-board video monitoring **+**

FINDINGS: AV INTEREST

- 17 of 21 interested in traveling again via AV…..***Why*?**
  - Travel “freedom”
  - Increased “independence”
  - Decreased “isolation,” “depression,” “jealousy”
- Preference over other modes, especially if available “on-demand”

FINDINGS: AV INTEREST

- Oh, the Places You'll Go!

- On-board personal assistance?

FINDINGS: CONCERNS WITH AV

- Vehicle accessibility critical
  - Kneeling feature
  - Wheelchair lifts
  - On-board audio capabilities & multi-sensory supports
- Vehicle safety
  - On-board cameras
  - Capable audio and visual sensors
  - On-board attendant
  - Three-point seatbelt configuration
  - Maintain speed with traffic flow

FINDINGS: CONCERNS WITH AV

- Communication interface
  - How can I schedule my trip?
  - Can I engage in a ‘conversation’ with the AV communication interface?
  - Can I secure live assistance via the communication interface?

FINDINGS: CONCERNS WITH AV

- Comfort and design
- Availability
- Cost

CONCLUSIONS & TAKEAWAYS

Very POSITIVE feedback on vehicle initial impressions & trip experience

Most interested in using AV again

Most did not anticipate needing personal assistance on-board, but support an on-board attendant for safety reasons

AV concerns & recommendations focused on accessibility, safety, communication interface, design, cost & availability factors

Most feedback did not differ based on participant disability type

For More Information

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Questions?

Dr. Robin N. Brewer

University of Michigan

Automated Vehicles for Blind and Low Vision People: Open Design Challenges

Dr. Robin Brewer

04.07.2021

SCHOOL OF INFORMATION
UNIVERSITY OF MICHIGAN

“While blind people get around by using mass transit and other things, we don't have the flexibility the autonomous vehicles will present”

John G. Paré Jr., executive director for advocacy and policy at the National Federation of the Blind

Blind Driver Challenge

National Federation of the Blind, Virginia Tech

1. Designing for barriers of automated vehicles

DESIGN FOCUS GROUPS

2. Designing for AI-powered transportation challenges

INTERVIEWS WITH RIDESHARING PASSENGERS AND DRIVERS

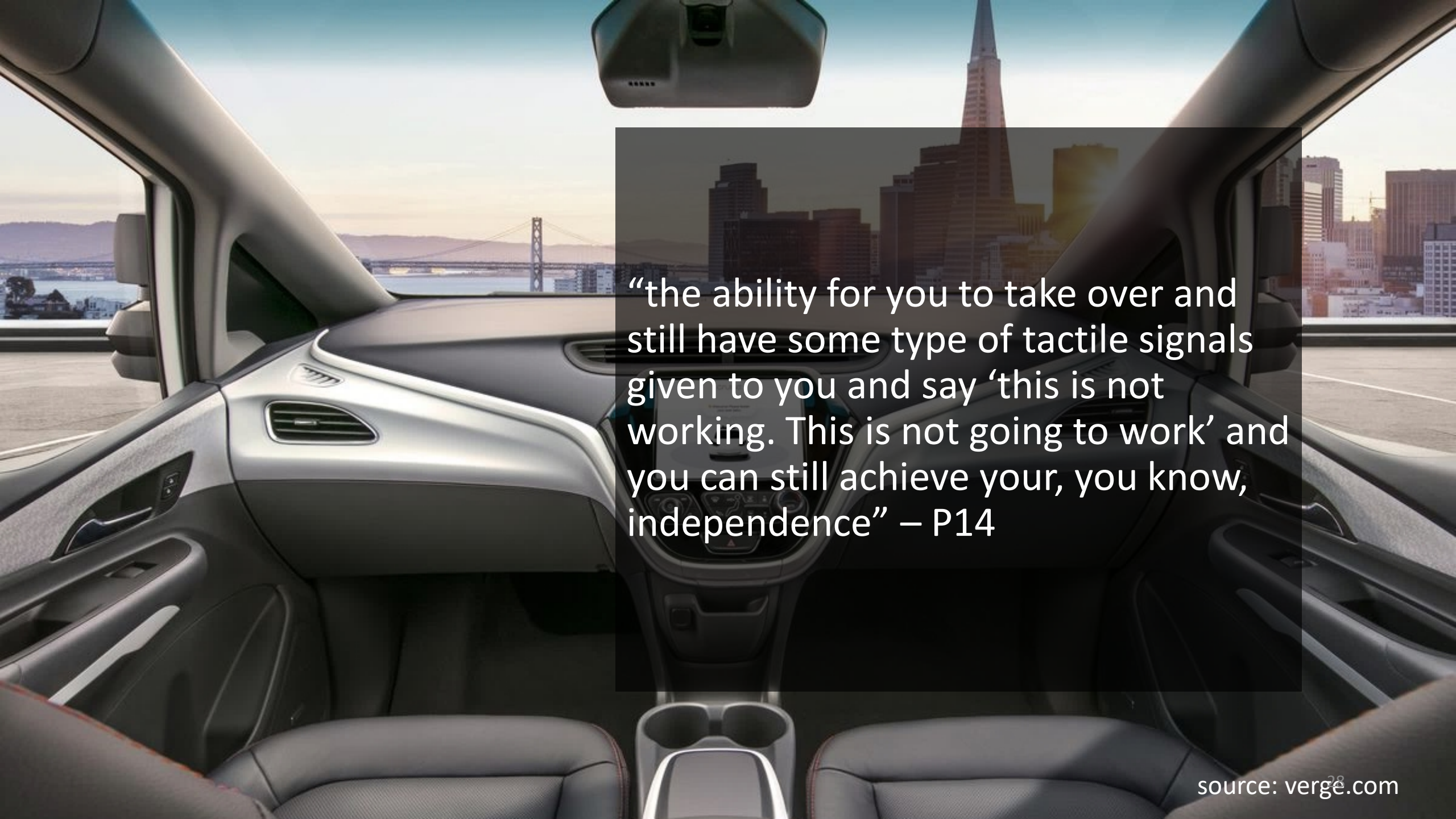
RQ:

How can we design accessible systems to support blind and low vision people with differing levels of control in automated vehicles?

2 focus groups with N=15 blind and low vision people

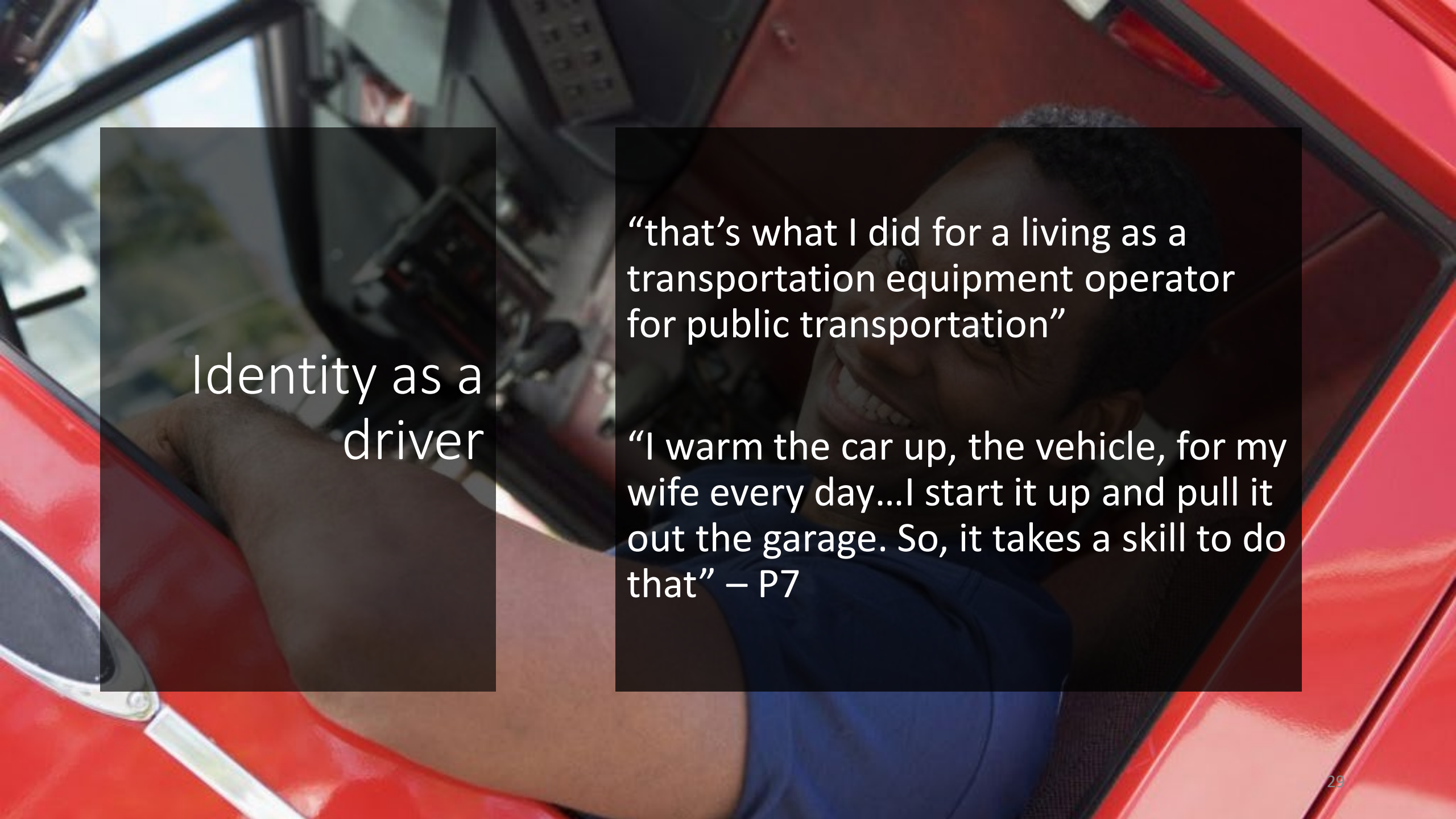
(7 women, 35-76 years old, mean = 59)

Brewer, Robin N., Kameswaran, V. "Understanding the power of control in autonomous vehicles for people with vision impairment." *Proceedings of the 20th International ACM SIGACCESS Conference on Computers and Accessibility*. 2018. https://bit.ly/blindavcontrol



“the ability for you to take over and still have some type of tactile signals given to you and say ‘this is not working. This is not going to work’ and you can still achieve your, you know, independence” – P14

source: verge.com



Identity as a driver

"that's what I did for a living as a transportation equipment operator for public transportation"

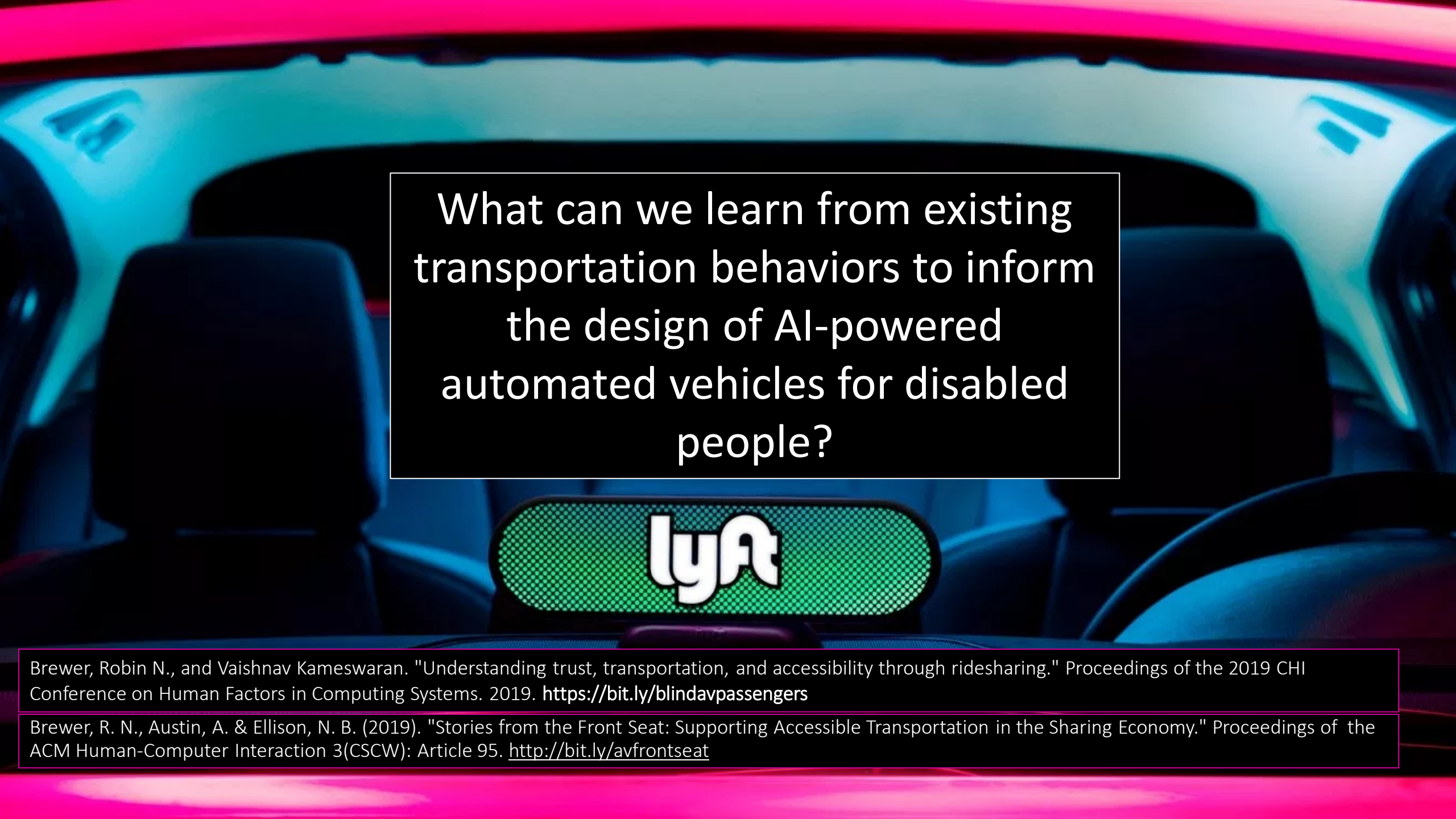
"I warm the car up, the vehicle, for my wife every day…I start it up and pull it out the garage. So, it takes a skill to do that" – P7

Designing for Control

1. Malfunction
2. Misinterpretation
3. Trust
4. Anxiety

Metaphor-Based Design

“as you’re driving with your hands at 10 and 2, you can use your thumbs …So, it’ll work kinda like a Refreshable Braille Display that can move up as vehicles are approaching on the left and right” (P14)



Brewer, Robin N., and Vaishnav Kameswaran. "Understanding trust, transportation, and accessibility through ridesharing." Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems. 2019. https://bit.ly/blindavpassengers

Brewer, R. N., Austin, A. & Ellison, N. B. (2019). "Stories from the Front Seat: Supporting Accessible Transportation in the Sharing Economy." Proceedings of the ACM Human-Computer Interaction 3(CSCW): Article 95. http://bit.ly/avfrontseat

Methods

Semi-structured interviews

16 blind and low vision ridesharing passengers in Greater Detroit area

Experiences, challenges and perceptions of other transportation modes

10 male, 6 female, mean 41.6 years

18 ridesharing drivers with experiences with blind, low vision, and other disabled passengers

12 male, 6 female, mean 51 years

Role of the driver

The inevitability of entry and exit assistance

"Well, sometimes they can’t always see where you are. They think you can see them and you tell them you can’t… For example, I waited out by my garage before and a guy swore he was at my house. And I said, ‘You’re not at my house ’cause I’m at the garage.’ He goes, ’I’m at the garage.’ I said, ’No you’re not, ’cause I’m right here’... He drove around, and he finally saw me."

Roles: (1) Physical labor

Drivers performed physical labor roles that required disability disclosure

“

‘I’ve just got a few things to move’. He goes, ‘would you mind helping me?’ I grab boxes…We load them up, take him to his new apartment, and he goes,…’would you help me carry these up the steps?’ No problem, I would’ve done it if he wouldn’t have asked, I would’ve offered.

…He goes, ‘would you let me hold onto your arm, and you walk me around the room so that I can memorize where everything is at?’…We walked around and we got to the thermostat for the heating and cooling. And he goes, ‘tell me what each button is for on this’… (P13)

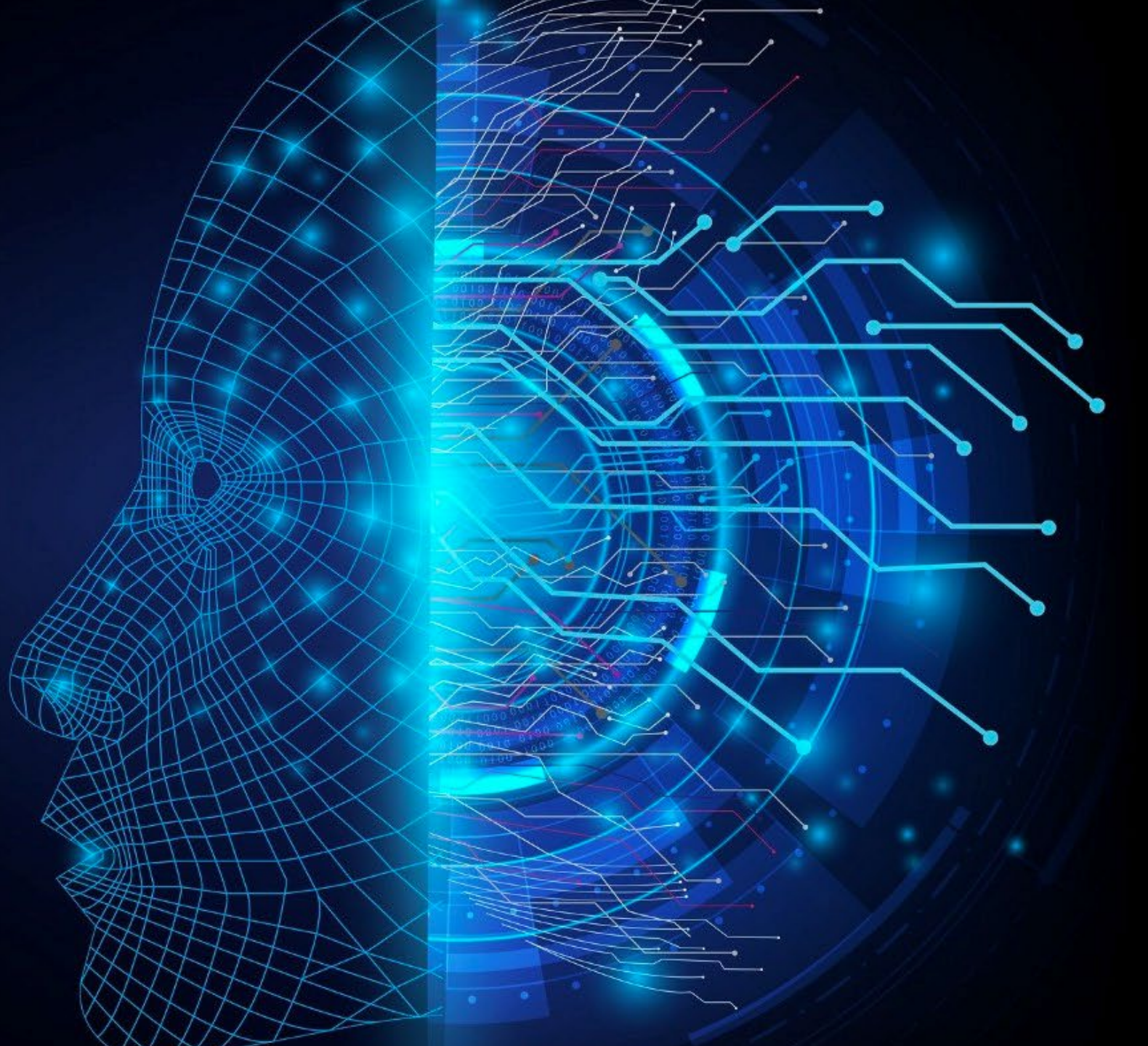
”

But: drivers acknowledged that others might use disclosures inappropriately

Drivers expected people to disclose their disability as it helped drivers feel more comfortable in knowing how (much) to assist

“as a driver it would be nice to know ahead of time. However, I get the fact that they wouldn't want to tell us that ahead of time, also. … There are predators out here and if somebody knew that that was a visually impaired person, they could plan it … try to figure out some way to **take advantage of them**… (P2)”

If we replace the human decision-maker (the driver) with an algorithm, does this problem go away?



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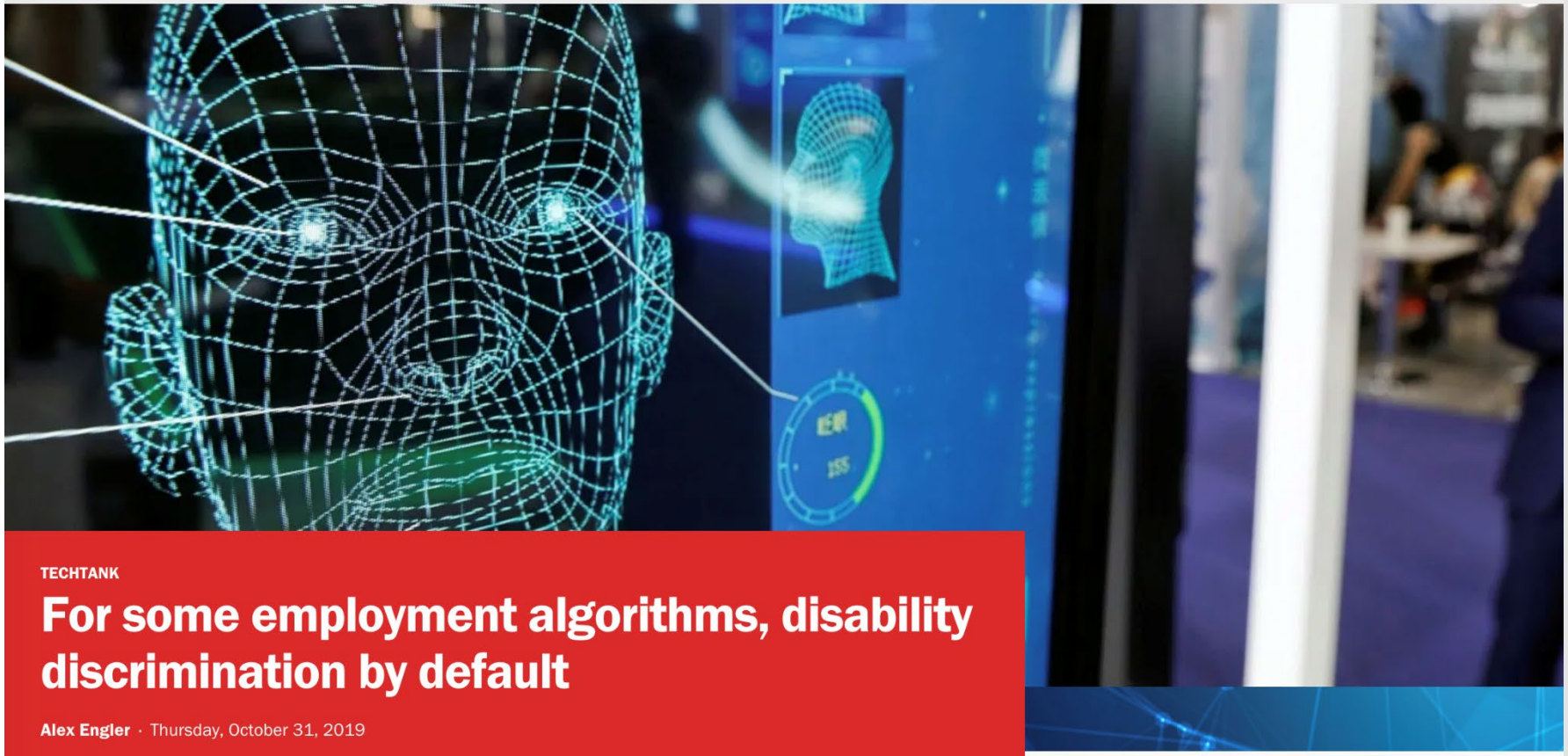
BROOKINGS

AI POLICY 2020 CITIES & REGIONS GLOBAL DEV



TECHTANK

For some employment algorithms, disability discrimination by default

Alex Engler · Thursday, October 31, 2019

Last week, *Washington Post's* Drew Harwell reported that HireVue's artificial intelligence (AI) software has assessed over a million video job interviews. Its autonomous interview system asks questions of candidates, films their responses, and then uses the resulting video and

1

Designing for AV barriers

DESIGN FOCUS GROUPS

1. Control is a spectrum, should it be a choice?
2. Designing with assistive tech metaphors

2

Understanding transportation

INTERVIEWS w/ RIDESHARING PASSENGERS AND DRIVERS

1. Drivers play a critical role
2. Bias may still be a concern, even without drivers (people) making decisions

Thanks! Questions?

Robin Brewer
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Special thanks to collaborator, Nicole Ellison, and student researchers Vaishnav Kameswaran and Amy Austin

This research was funded by the Center for Connected and Automated Transportation

Anil Lewis

National Federation of the Blind

Anil Lewis

Questions?

Dr. Christian Vogler

Gallaudet University

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TECHNOLOGY ACCESS PROGRAM

Autonomous Vehicles from a Deaf/Hard of Hearing Perspective

Christian Vogler, PhD
Director, Technology Access Program
Gallaudet University

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It’s all about communication

- Communicating to the vehicle what you need
- Vehicle communicating key information to you
- Communicating with entities outside the vehicle

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Deaf/HH communicating to the vehicle

- Voice commands are convenient for many, but a big problem for the deaf/hh
  - May need a different communication modality (e.g. ASL)
  - May prefer to talk, but voice interface doesn't understand a deaf-induced accent
  - May need or prefer a tactile interface
- Research priority: Robust, limited set of gestures and signs for command & control

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Vehicle communicating to deaf/hh

- Need visual alternatives to vehicle's speech
  - Visual alternatives must provide appropriate detail, and appropriate level of alerts
  - Routine info must be helpful and not be distracting
- Audio must be compatible with hearing devices
  - Direct wireless and loop connection options
  - Must be able to provide audio both to hearing device and through speakers in mixed deaf/hh/hearing passenger set

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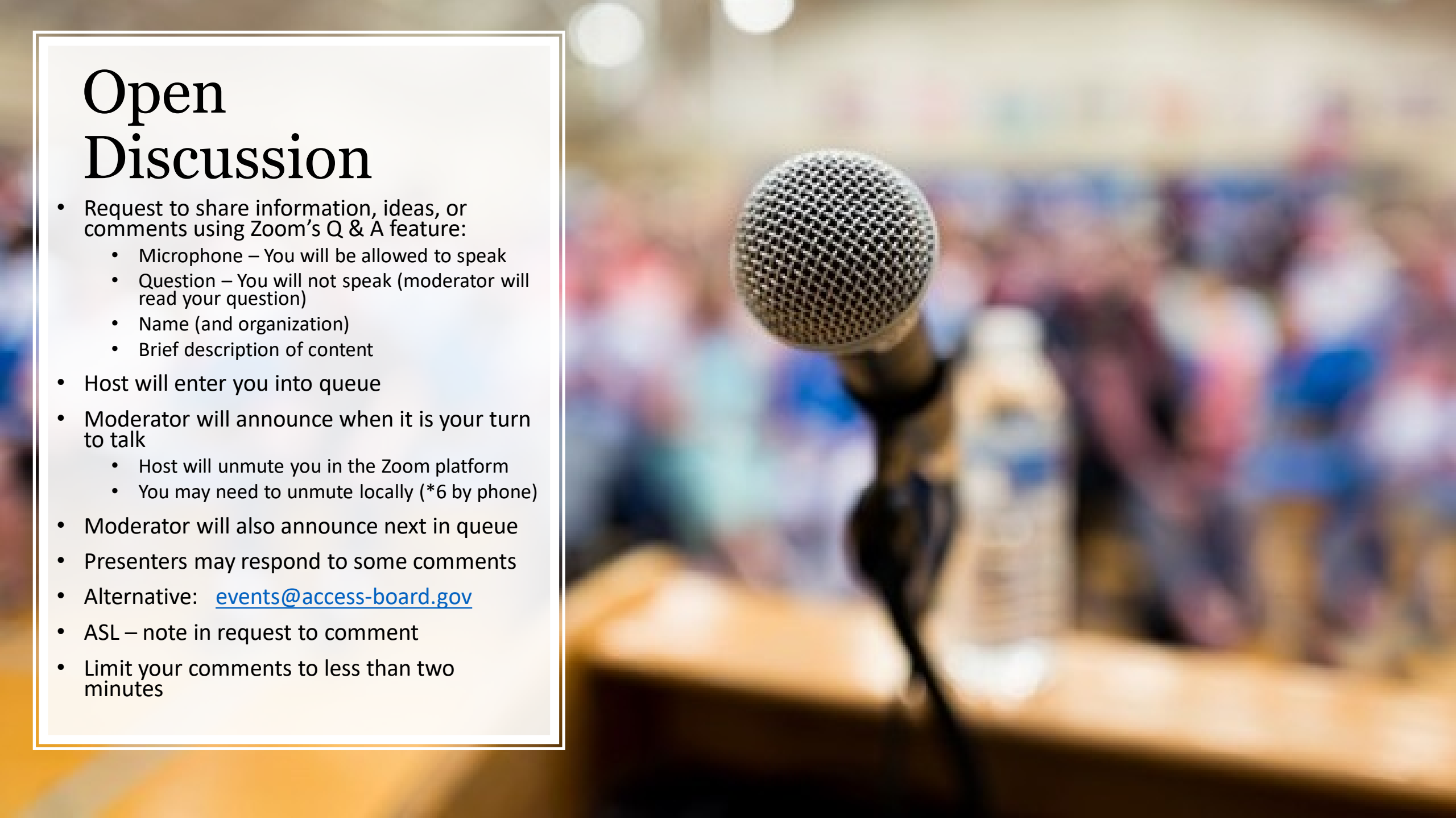
Communicating with the outside

- Any audio-based communication with the outside must also have visual and text alternatives
- The interfaces for visual and text communication must be accessible

Questions?

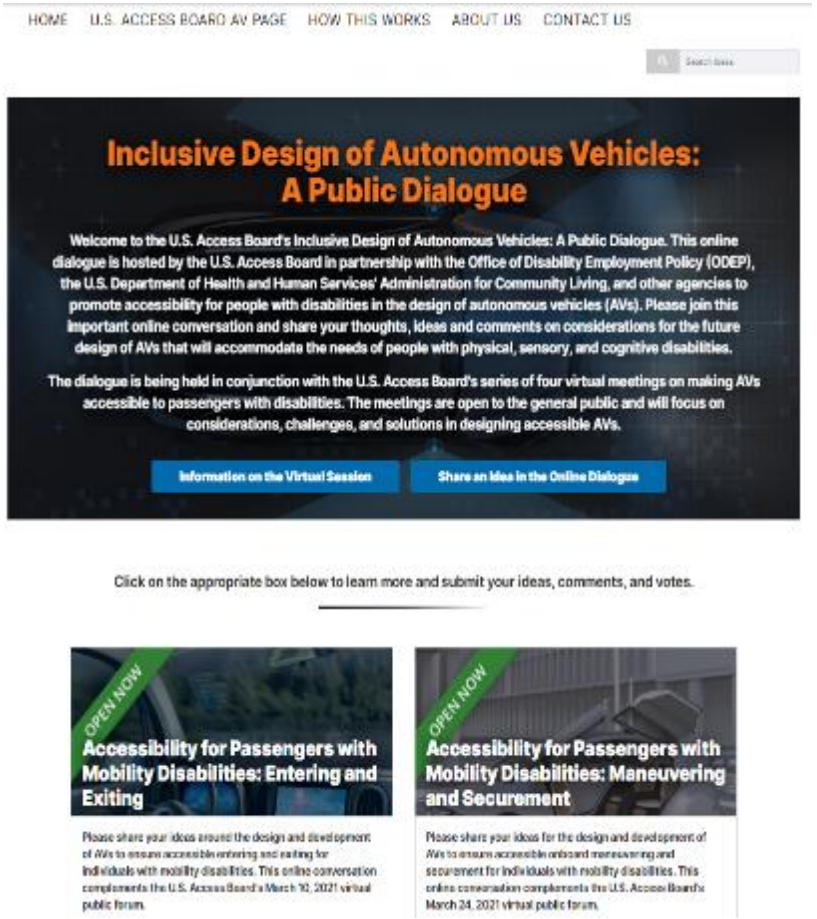
Open Discussion

- Request to share information, ideas, or comments using Zoom's Q & A feature:
  - Microphone – You will be allowed to speak
  - Question – You will not speak (moderator will read your question)
  - Name (and organization)
  - Brief description of content
- Host will enter you into queue
- Moderator will announce when it is your turn to talk
  - Host will unmute you in the Zoom platform
  - You may need to unmute locally (*6 by phone)
- Moderator will also announce next in queue
- Presenters may respond to some comments
- Alternative: events@access-board.gov
- ASL – note in request to comment
- Limit your comments to less than two minutes



Online Dialogue

- Continue the conversation Online
  - http://transportationinnovation.ideascale.com
  - Share ideas, comment, vote
  - For assistance, email: ePolicyWorks@dol.gov



Next Session

Accessibility for Passengers with Sensory and Cognitive Disabilities: Part 2

This session will continue discussion of communication accessibility in hailing and interacting with autonomous vehicles for passengers with hearing, visual, or cognitive disabilities.

April 21, 2021, 2:00 – 3:30 (ET)

Presenters:

- Dr. Aaron Steinfeld, Carnegie Mellon University
- Dr. Gregg Vanderheiden, University of Maryland
- Darryl Cooper, Federal Communications Commission
- Ted Guild, W3C
- Bruce Bailey, U. S. Access Board

For updates, please see our AV landing page at: www.access-board.gov/av

Thank you for attending today's session.