

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 Mobility Disabilities: Part 2
Maneuvering and Securement



Agenda

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

PowerPoint slides available for download at:

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 Presenter 1 – Did your study look at scooters?"
 - Moderator will read question
 - May not get to all questions
 - Alternative: Email events@access-board.gov
- Contribute to Open Discussion
 - 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 enable your microphone
 - Moderator will call on you to unmute and speak
 - ASL – if you wish to be visible for signing, indicate in request
- Online dialogue
 - <http://transportationinnovation.ideascale.com/>
 - For assistance, email: ePolicyWorks@dol.gov



Dr. Cecilia Feeley

Rutgers University



Andrea Lubin

Rutgers University

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%

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”

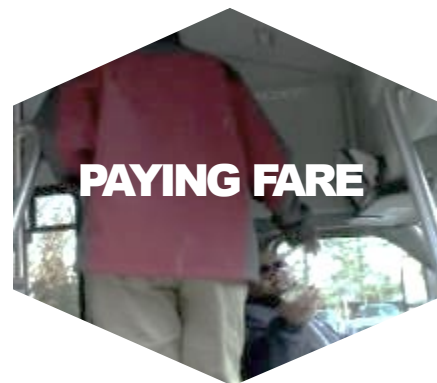


FINDINGS: AV INTEREST

- 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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RUTGERS

UNIVERSITY | NEW BRUNSWICK

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

M | 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 background image shows the interior of a car, looking out through the windshield at a cityscape. The car's dashboard, steering wheel, and front seats are visible. Outside, a bridge and a city skyline with a prominent tall building (the Transamerica Pyramid) are visible under a clear sky.

Unexpected
autonomy

“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

A photograph of a man with short dark hair, smiling broadly while sitting in the driver's seat of a red vehicle. His hands are on the steering wheel. The background shows a blurred view of a city street through the windshield. The image is used as a background for text overlays.

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

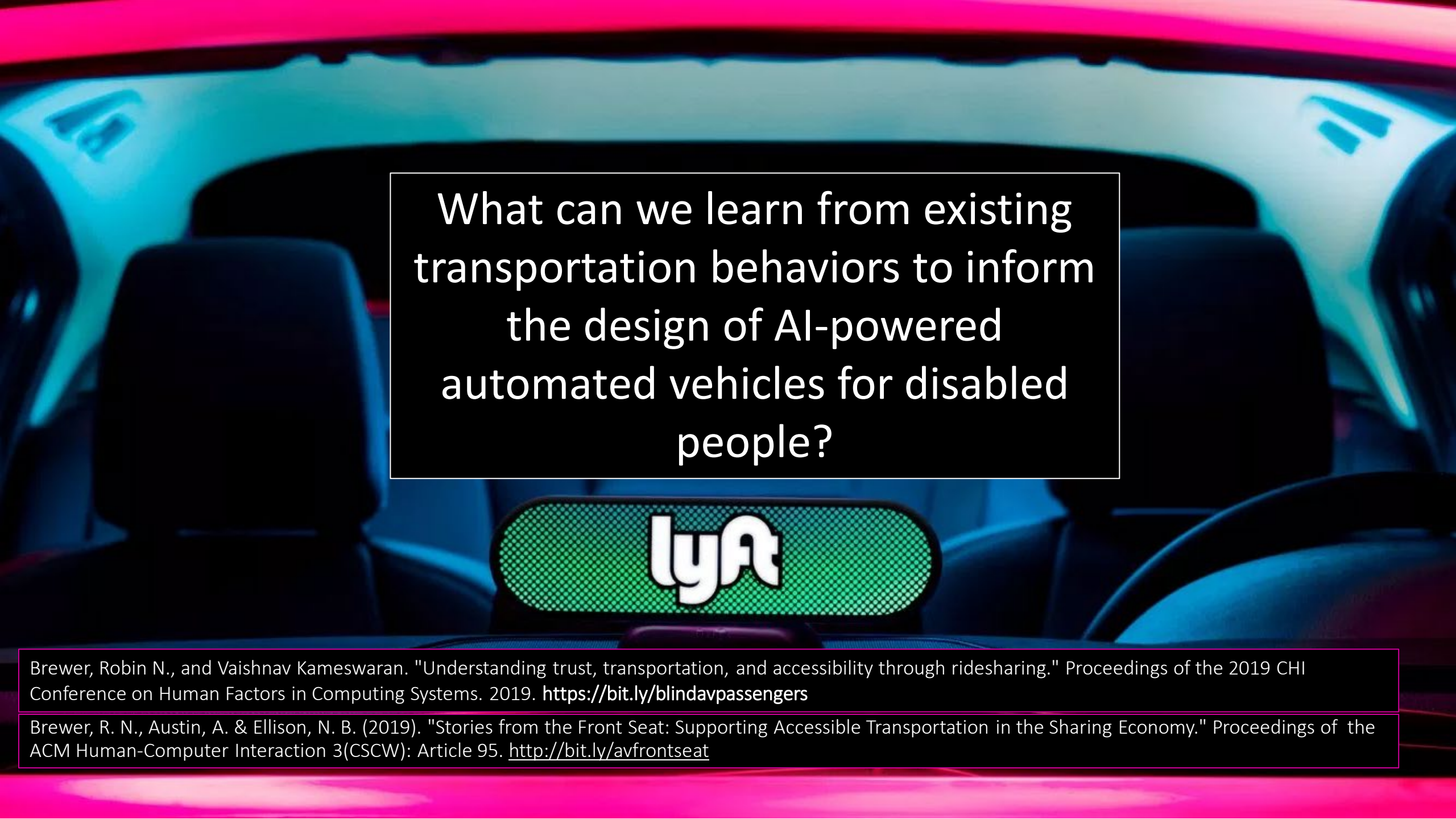
1. Malfunction
2. Misinterpretation
3. Trust
4. Anxiety



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)



The background of the slide is a photograph of the interior of a car, looking forward from the passenger side. The rearview mirror is visible in the center, featuring the white Lyft logo on a black background. The car's interior is dimly lit, with some light coming from the windows. The text is overlaid on a semi-transparent black rectangular box in the center of the image.

What can we learn from existing
transportation behaviors to inform
the design of AI-powered
automated vehicles for disabled
people?

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

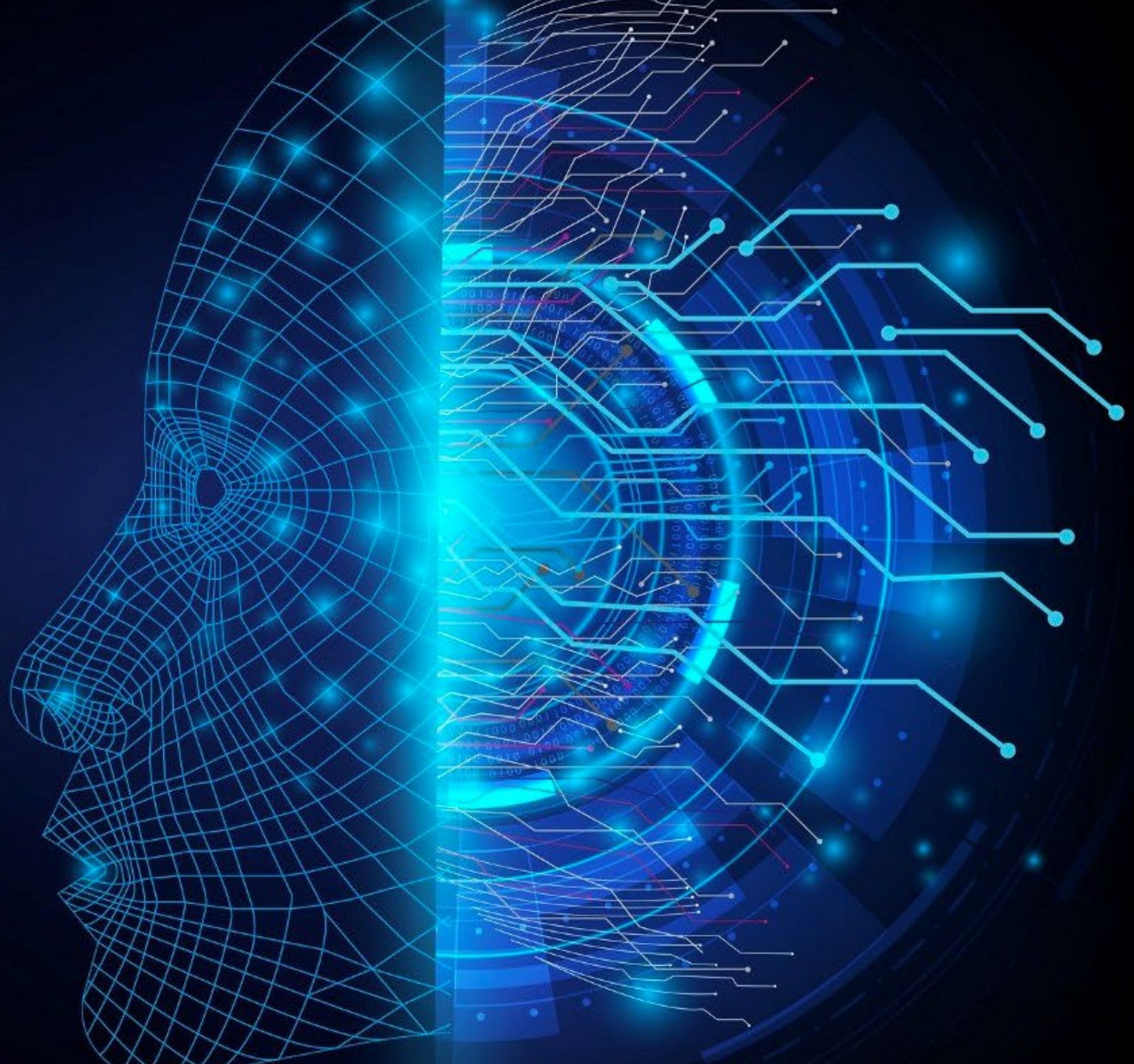
Drivers expected people to disclose their disability as it helped drivers feel more comfortable in knowing how (much) to assist

“

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)

”

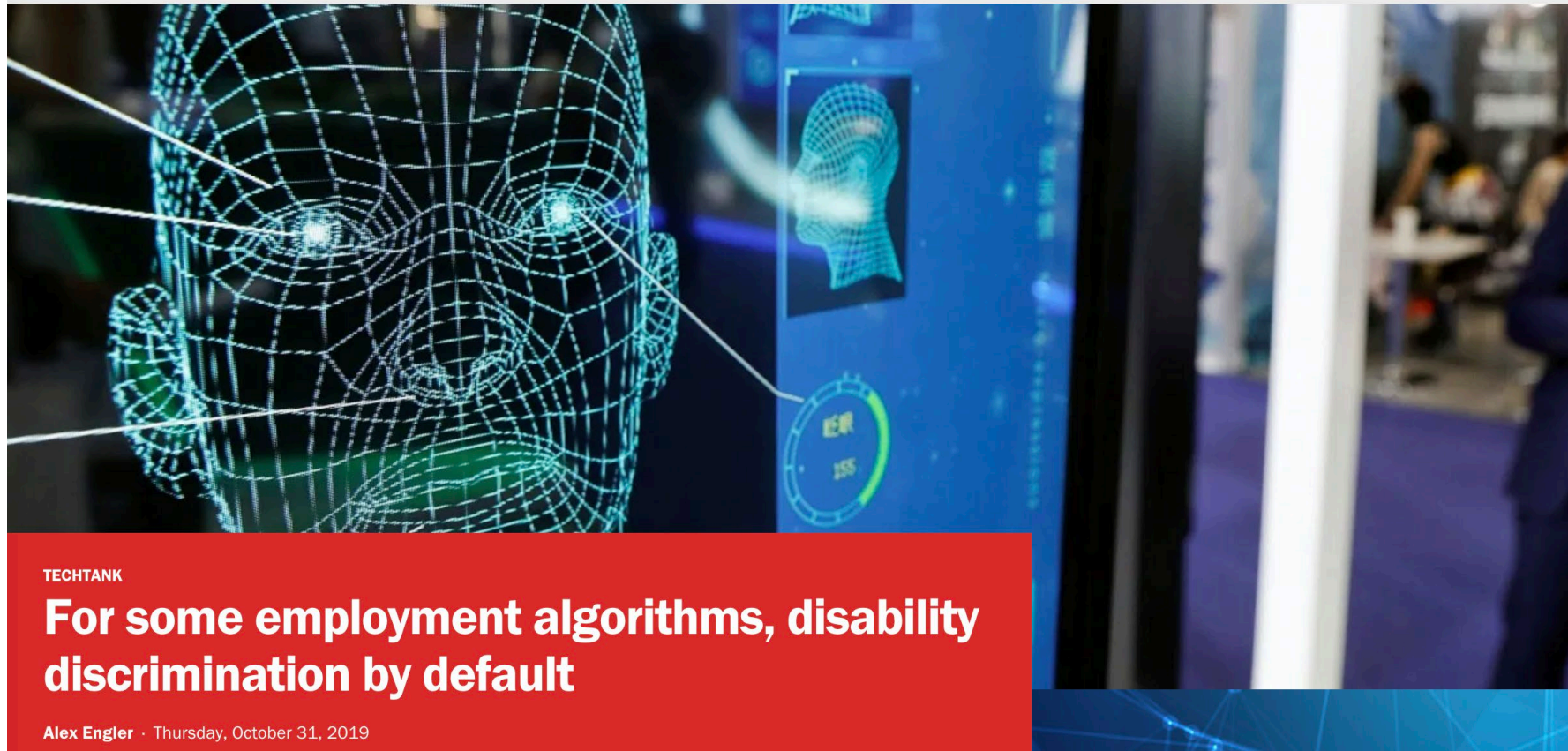
If we replace the
human decision-
maker (the driver)
with an algorithm,
does this problem
go away?



No

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



Designing for AV barriers

DESIGN FOCUS GROUPS

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



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

Questions?



Anil Lewis

National Federation
of the Blind

Questions?



Dr. Christian Vogler

Gallaudet University



TECHNOLOGY ACCESS PROGRAM

Autonomous Vehicles from a Deaf/Hard of Hearing Perspective

Christian Vogler, PhD
Director, Technology Access Program
Gallaudet University

It's all about communication

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

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

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

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 question)
 - Name (and organization)
 - Brief description of content
- Host will enter you into queue
- Moderator will announce when you should unmute (*6 by phone)
- Moderator will also announce next in que
- Presenters may respond to some comments
- Alternative: events@access-board.gov
- ASL – note in request to comment
- Please limit comments to < 2 min.



Online Dialogue

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

The screenshot shows the homepage of the "Inclusive Design of Autonomous Vehicles: A Public Dialogue" website. At the top is a navigation bar with links: HOME, U.S. ACCESS BOARD AV PAGE, HOW THIS WORKS, ABOUT US, and CONTACT US. Below the navigation bar is a search bar. The main content area has a dark background with the title "Inclusive Design of Autonomous Vehicles: A Public Dialogue" in orange. Below the title is a welcome message: "Welcome to the U.S. Access Board's Inclusive Design of Autonomous Vehicles: A Public Dialogue. This online dialogue is hosted by the U.S. Access Board in partnership with the Office of Disability Employment Policy (ODEP), the U.S. Department of Health and Human Services' Administration for Community Living, and other agencies to promote accessibility for people with disabilities in the design of autonomous vehicles (AVs). Please join this important online conversation and share your thoughts, ideas and comments on considerations for the future design of AVs that will accommodate the needs of people with physical, sensory, and cognitive disabilities." Below this is another paragraph: "The dialogue is being held in conjunction with the U.S. Access Board's series of four virtual meetings on making AVs accessible to passengers with disabilities. The meetings are open to the general public and will focus on considerations, challenges, and solutions in designing accessible AVs." At the bottom of the main content area are two buttons: "Information on the Virtual Session" and "Share an Idea in the Online Dialogue". Below the main content area is a section with the text "Click on the appropriate box below to learn more and submit your ideas, comments, and votes." Below this text are two boxes. The first box is titled "Accessibility for Passengers with Mobility Disabilities: Entering and Exiting" and has a green banner that says "OPEN NOW". The second box is titled "Accessibility for Passengers with Mobility Disabilities: Maneuvering and Securement" and also has a green banner that says "OPEN NOW". Both boxes have a small paragraph of text below the title.

HOME U.S. ACCESS BOARD AV PAGE HOW THIS WORKS ABOUT US CONTACT US

Search

Inclusive Design of Autonomous Vehicles: A Public Dialogue

Welcome to the U.S. Access Board's Inclusive Design of Autonomous Vehicles: A Public Dialogue. This online dialogue is hosted by the U.S. Access Board in partnership with the Office of Disability Employment Policy (ODEP), the U.S. Department of Health and Human Services' Administration for Community Living, and other agencies to promote accessibility for people with disabilities in the design of autonomous vehicles (AVs). Please join this important online conversation and share your thoughts, ideas and comments on considerations for the future design of AVs that will accommodate the needs of people with physical, sensory, and cognitive disabilities.

The dialogue is being held in conjunction with the U.S. Access Board's series of four virtual meetings on making AVs accessible to passengers with disabilities. The meetings are open to the general public and will focus on considerations, challenges, and solutions in designing accessible AVs.

Information on the Virtual Session Share an Idea in the Online Dialogue

Click on the appropriate box below to learn more and submit your ideas, comments, and votes.

OPEN NOW

Accessibility for Passengers with Mobility Disabilities: Entering and Exiting

Please share your ideas around the design and development of AVs to ensure accessible entering and exiting for individuals with mobility disabilities. This online conversation complements the U.S. Access Board's March 10, 2021 virtual public forum.

OPEN NOW

Accessibility for Passengers with Mobility Disabilities: Maneuvering and Securement

Please share your ideas for the design and development of AVs to ensure accessible onboard maneuvering and securement for individuals with mobility disabilities. This online conversation complements the U.S. Access Board's March 24, 2021 virtual public forum.

Next Session

Accessibility for Passengers with Sensory and Cognitive Disabilities: Part 2

This session will address design considerations and relevant regulations 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
- Bruce Bailey, U. S. Access Board
- Darryl Cooper, Federal Communications Commission
- Ted Guild, W3C

Thank you for
attending today's
session.

