With AI and other tech, Anat Caspi focuses on helping people with disabilities

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While walking beneath a canopy of trees on the winding Burke Gilman trail, artificial intelligence researcher Anat Caspi pointed to the evenness of the terrain along the University of Washington campus periphery. "A

lot of times we don't want the shortest path," Caspi said over the din of traffic whizzing by. The scenic route she picked for its level ground, while not the most direct, allowed her to walk and talk.

Caspi is especially keen at noticing raised curbs, downhill and uphill steepness, and the nuances in surfaces that are unique to every path. She has to be.

In her role as the director of the University of Washington's Taskar Center for Accessible Technology, Caspi creates technology focused on people with disabilities such as motor limitations, in many instances applying artificial intelligence (AI).

"It's really about treating people as humans with different needs and preferences," she said as a cyclist passing by rang a bell.

She sees the mapping of pedestrian infrastructure—walkways, sidewalks, overpasses, underpasses and trails—as a necessary lifeline for people with disabilities. Everyone approaches an environment with different levels of attentiveness and perceptual and motor abilities.

Yet a few years ago, Caspi noticed that cities don't have a data standard for tracking pedestrian walkways that reflects the vast spectrum of user ability. So she and her Taskar team created a framework to log the features of sidewalk infrastructure in a project called OpenSidewalks, which is now being used by King County's paratransit service to help people with disabilities navigate any trip.

According to an AI-powered online travel planner called AccessMap that she helped create, the surface of the route that Caspi chose on that sunny Wednesday is made of concrete with a 0.5 % uphill steepness—important knowledge for a person using a wheelchair, for example, who would want to avoid a steep incline when traveling in that

neighborhood.

It's the development of such tools that has catapulted Caspi and her Taskar team to the forefront of accessible technology in the U.S., an emerging field that uses AI—among other things—to help empower people with disabilities. She sees her work as transcending the needs of the worldwide, and "designing for the fullness of the human condition."

Caspi's interest in technology began as a youth in her native Israel, when her mom enrolled her in a programming class at a local community center in the fourth grade. Although her family didn't own a computer, she said the class sparked her passion in programming and provided a framework to tackle problems in a functional way.

Her awareness of the inequities in access to education crystallized a few years later, when Caspi took an AP computer science class in high school after her family moved to California. Although she was initially one of 10 female students in the class, Caspi became the only one her teacher selected to test for advancement, due to her prior programming experience.

"That was my first understanding of a structural bias in the computing field," Caspi said.

A passion for technology spurred Caspi to focus on computer science and feminist studies as an undergraduate at Stanford University. She then pursued a master of science degree in AI and a Ph.D. in bioengineering, knowledge she later applied to her work using machine learning to monitor the effectiveness of DNA sequencing instruments.

In 2013, she moved from Philadelphia to Seattle with her husband, Ben Taskar, and their small daughter to be closer to family on the West Coast. Seattle was the answer to all of their desires: Caspi continued her

job as a scientist at medical device company Thermo Fisher Scientific, Taskar took a prestigious new role as the UW Boeing Professor of Computer Science & Engineering, and their daughter, who has disabilities, had access to medical care.

As a professor, Taskar shared her "vision of equity" and interest in translating research to practical applications, Caspi said — a mission that she stoked in her spare time through collaborations with University of Washington students on projects such as developing technology that operates a device with eye movement.

Her path to helm the Taskar Center was born of loss. Eight months after moving to Seattle, Taskar unexpectedly died of severe heart failure. Guided by the desire to honor her late husband's life and to continue the legacy of their collaborative work, Caspi urged the University of Washington to establish a center focused on educating students and developing assistive technology.

The school's computer science and engineering program created the Taskar Center in his honor two years later and named her to run it.

"Ben was a superstar—someone whose contributions crossed many technical fields, including machine learning, computer vision, and natural language processing. He was also a remarkable person," said Hank Levy, director of the Paul G. Allen School of Computer Science & Engineering. "Anat was the perfect person to lead the Taskar Center for multiple reasons: She shared Ben's commitment to accessibility, she deeply understands the needs of children with physical challenges, and she has a very strong technical background in both computer science and bioengineering."

In the four years since its founding, 32 graduate students and 190 undergraduates have participated in the program.

Interacting with people with disabilities—including her daughter, who has mobility and speech limitations—has informed the work that Caspi pursues at the Taskar Center. Caspi's daughter has tested some of the communication devices and an AI-powered wheelchair developed at the center.

Like many scientists, Caspi is guarded when discussing the intimate details of her life. Her voice drops to a hushed tone as she talks about the details surrounding her husband's passing and the formation of the center. But when she discusses her work, her mouth curves into a slight smile and she speaks with a command and confidence that belies her otherwise soft-spoken demeanor throughout the interview.

Her passion to create inclusive technology along with a knowledge of AI and data organization found a confluence in the field of transportation.

Fixing information gaps boosts mobility

Much of accessing transportation as a person with a disability relies on navigating the minutiae. Missing a bus could mean staying at home in lieu of attending school or seeing the doctor. Information gaps in trip-planner apps, such as the indication of a curb on a route that would be difficult for a person using a wheelchair, could be solved through AI and machine learning, said Caspi.

For people who have sensory limitations, "a system that tells you the context of your travel right now ... can really obviate some of the problems that you experience when you're traveling," said Caspi.

That approach to problems was applied to the Taskar team's project, OpenSidewalks, which uses crowdsourced data to chart the various features of sidewalks. In 2017, the team launched a related online travel planner powered by AI called AccessMap that helps pedestrians choose

the best route based on preferences and needs.

Advertising

It uses AI by relying on Seattle's municipal sidewalk data, crowdsourced information, and algorithms to produce a map of the environment, instead of relying on static data that could change depending on variables such as construction.

Unlike the mostly car-centric navigation tool Google Maps, AccessMap allows users to customize their journey by choosing the percentage of uphill and downhill steepness of a path and whether they'd like to avoid curbs. A pop-up box appears on the AccessMap website, indicating the surface of the walkway and incline percentage. AccessMap also includes indoor usage, so users can travel through open buildings along their route.

Utilizing the tool's "good routes and 'cheats' like using elevators to get up hills has made a huge difference," said Steve Lewis, an AccessMap user and contributor. Lewis began using a wheelchair following an injury a decade ago, and found that elevators were essential in avoiding steep hills. In his former role as the co-chair of the Seattle Commission for People with DisAbilities, Lewis would use the app to learn the operating hours of an elevator that served as the linchpin in his frequent three-block downtown journey from Seattle's Office of Civil Rights to City Hall.

Lewis has helped update the map database to include elevator hours and has tested the app's downtown Seattle routes, and now he mostly uses AccessMap to check the incline level in unfamiliar areas of the city. He added that he wished something similar had been available during a recent trip to Lisbon, Portugal, a city known for its steep hills.

Caspi began partnering with King County Metro paratransit services about four years ago. Now OpenSidewalks organizes the sidewalk data in a common format so users in different areas can customize trip itineraries.

The county's collaboration with Taskar has allowed the transportation department to leverage crowdsourcing data that makes public transit more accessible to all people, said Matthew Weidner, a transportation planner with King County's Access Transportation program.

"What (Caspi) brings is perspective on how we better the environment and better society by taking diverse sets of technologies and computational thinking ... that really helps us deliver something for people with disabilities that wasn't there before," said Weidner.

Mark Hallenbeck, the director of the Washington State Transportation Center at the University of Washington, said Caspi has a unique skill set of data analytics expertise and an understanding of issues facing people with disabilities.

"She has a lot of passion for what she does in an area that is often neglected on the funding side," said Hallenbeck, "She's a great lady."

Caspi is also turning the tables on traditional work and play environments in a project that seeks to better accommodate the needs and preferences of individuals. She points to a clear, hexagonal table atop a wooden platform in her office—a device she and her team at the Taskar Center are designing that uses sensors and cameras to understand and adjust to the needs of its users by swiveling and tilting depending on the situation. For instance, the table could dip toward different participants based on their turns during playtime or work on a collaborative project.

It's an example, she said, of how "technology can be a lot more ambient and encourage us to be more social, more team playing, collaborative, and still be assistive."