

Assistive Robots For Blind Travelers

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IIS 1317989

Human-robot interaction for robots assisting blind travelers navigate unfamiliar urban and built environments

Enable robots and blind travelers to interact in meaningful ways to enhance the safety and independence of urban navigation for all

Approach

Robots live in the building:

- Helps with maps, localization, & batteries
- More appropriate cost model & wider impact

In the context of assistive robots for blind travelers:

- Accessible interfaces for assistive robots
- Assistive interaction between humans and robots
- Effective cooperation between a variety of human-robot and robot teams

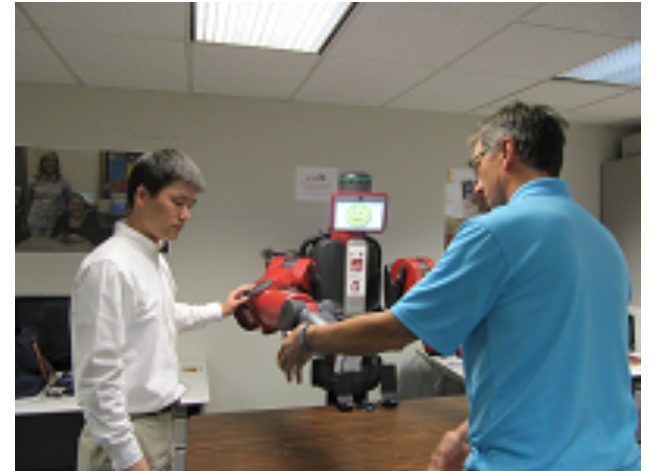
Stakeholders and community partners

Research + Continuous Engagement

Include B/LV adults in our research to inform and evaluate progress

- How to describe a robot?
- What are the right analogs?
- Landmarks and navigation

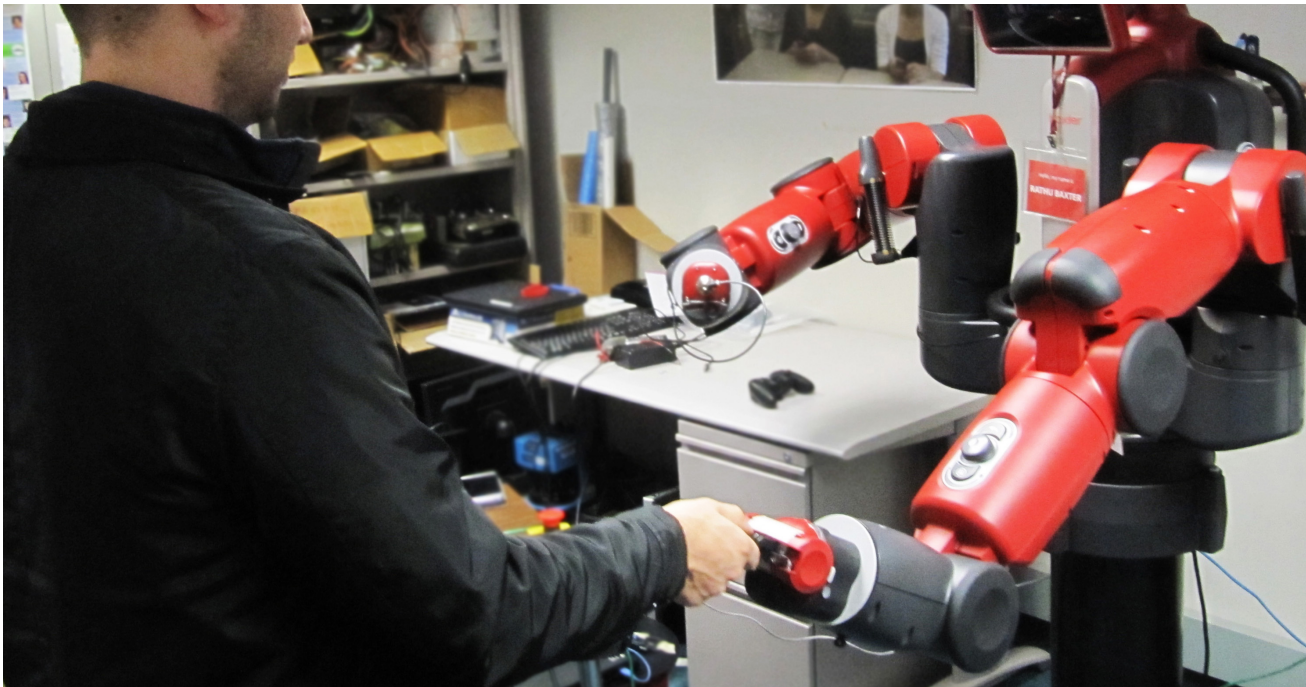
STEM outreach, industry contact, and press visits



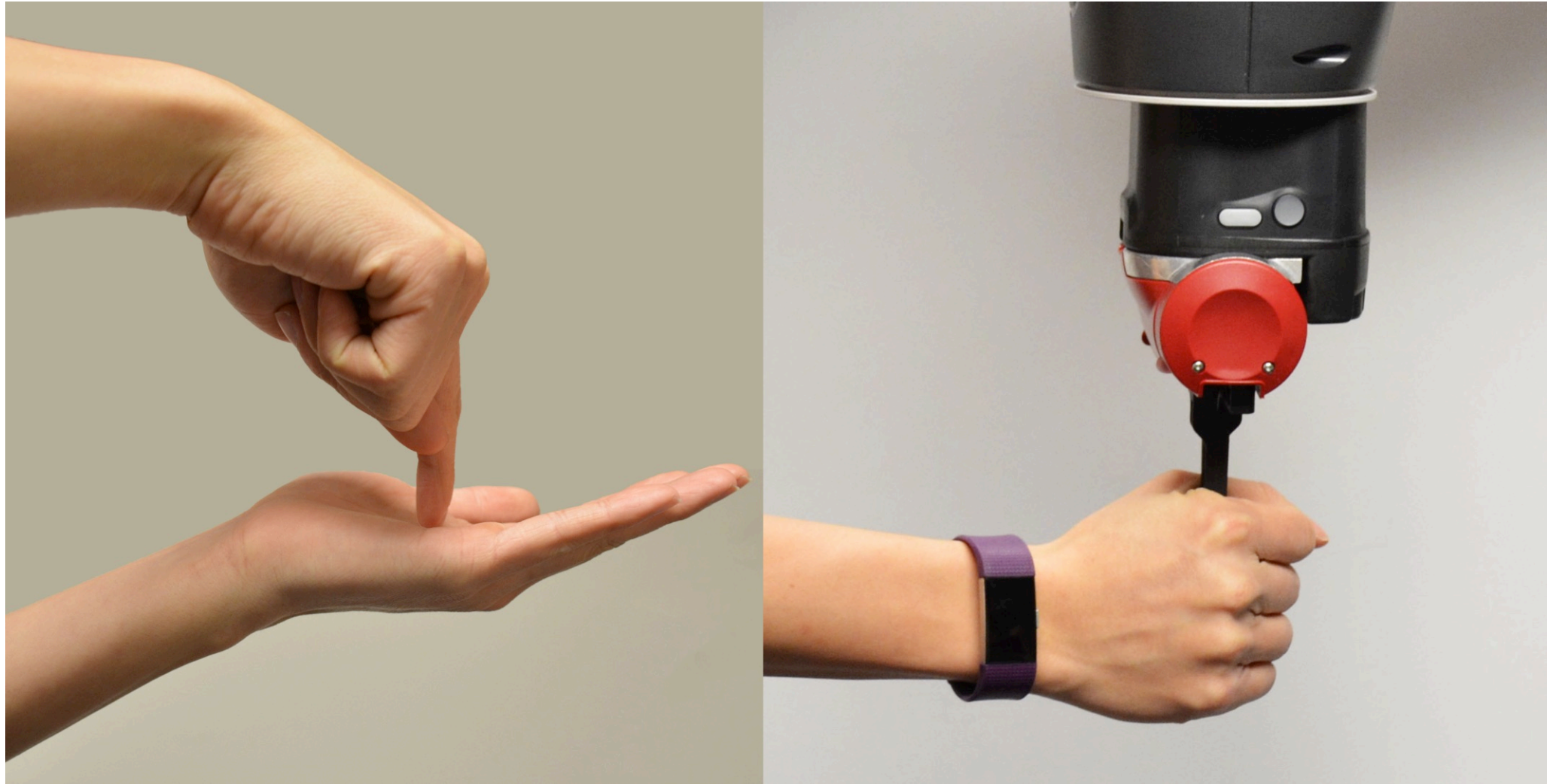
Kiosk Robot (Rathu Baxter)

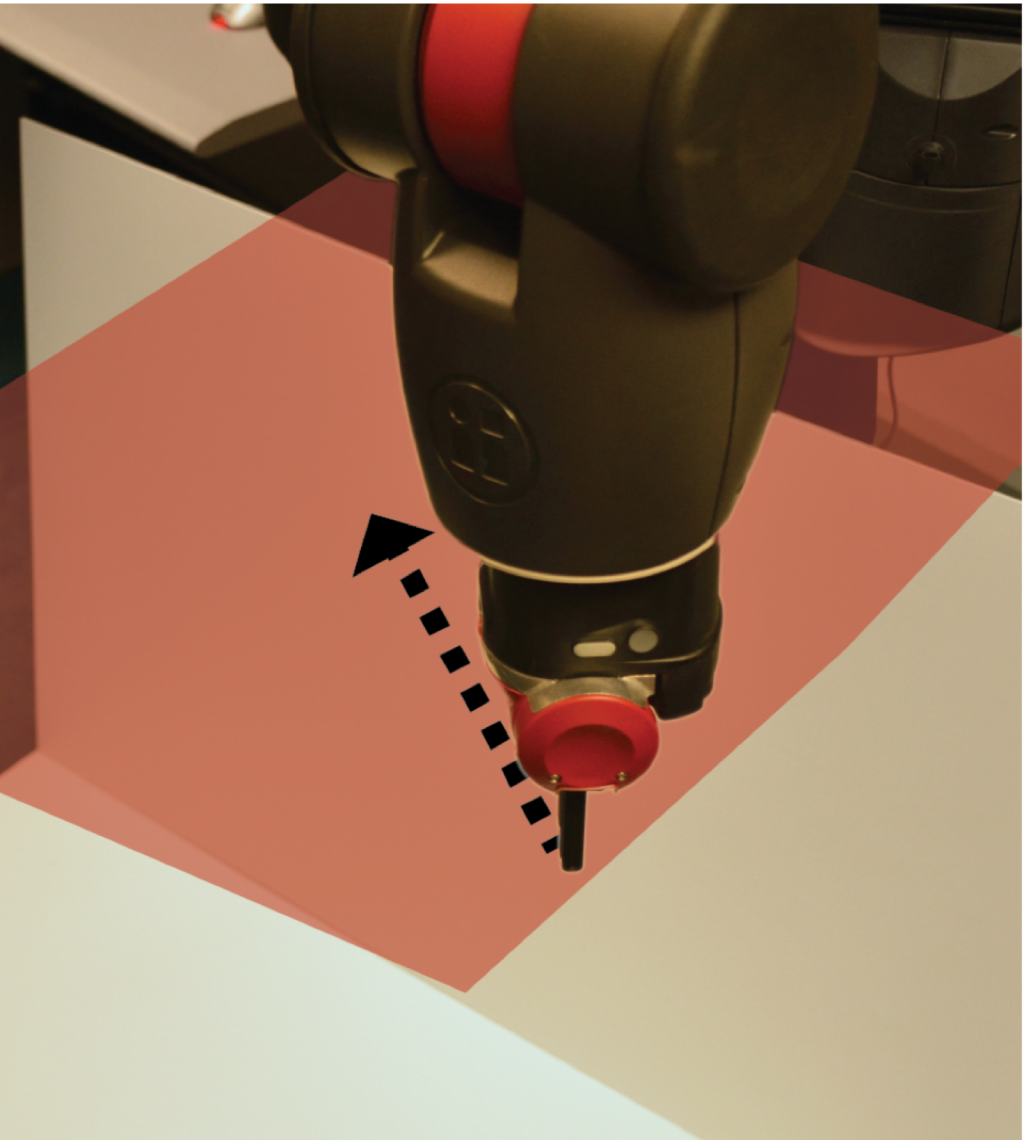
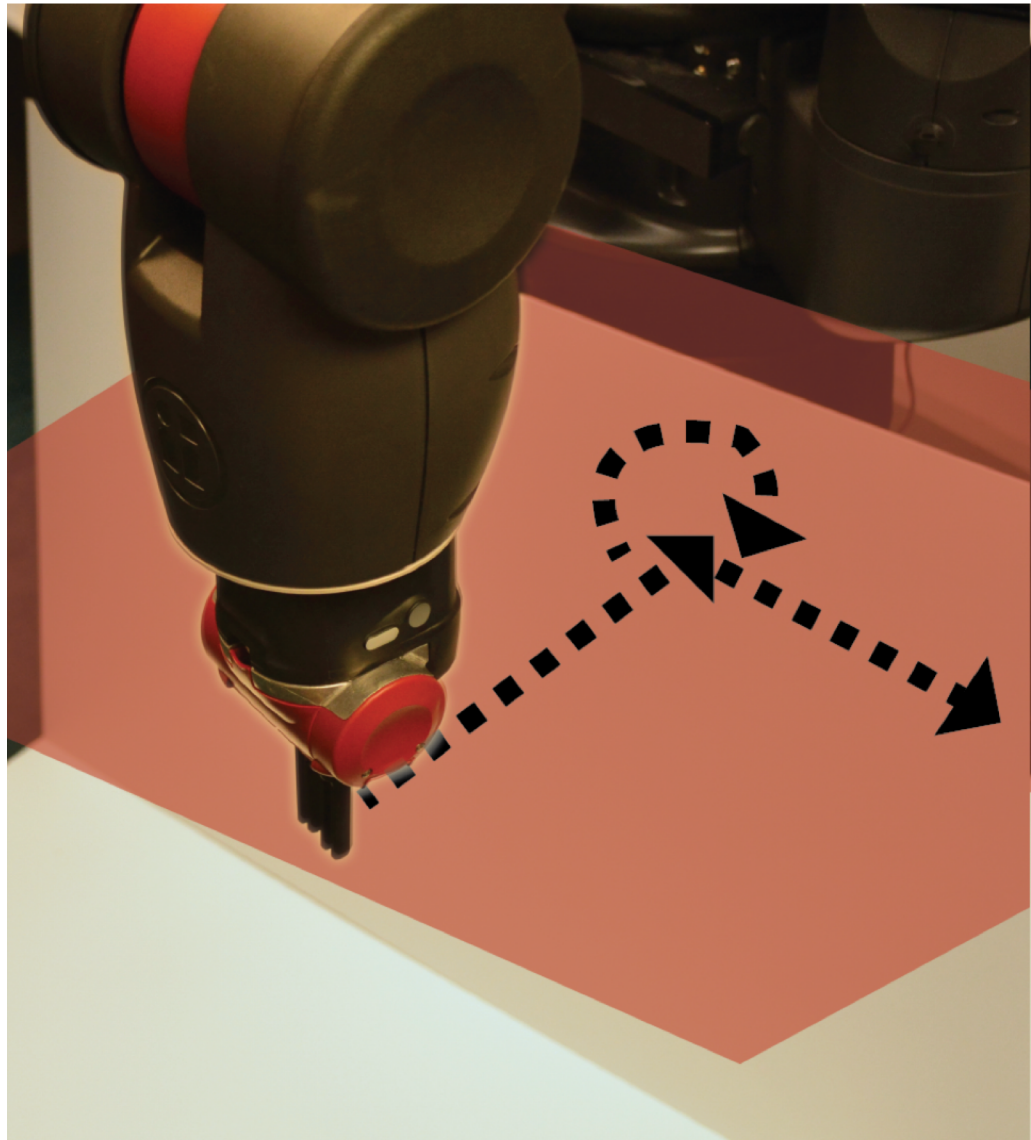
Zhi Tan (PhD)

Kiosk robot, 24/7 information
Spatial information



Map Instruction from O&M Specialists





Guide Robot (Podi)

Amal Nanavati & Joe Connolly

- Undergrads

System integration

Appropriate coupled motion

- Drop-offs
- Rounding corners



Personal Haptic Guidance (Sphero)

Zhi Tan (PhD)

Tan et al 2018 RO-MAN

Prior methods

- Custom hardware
- Single vibration

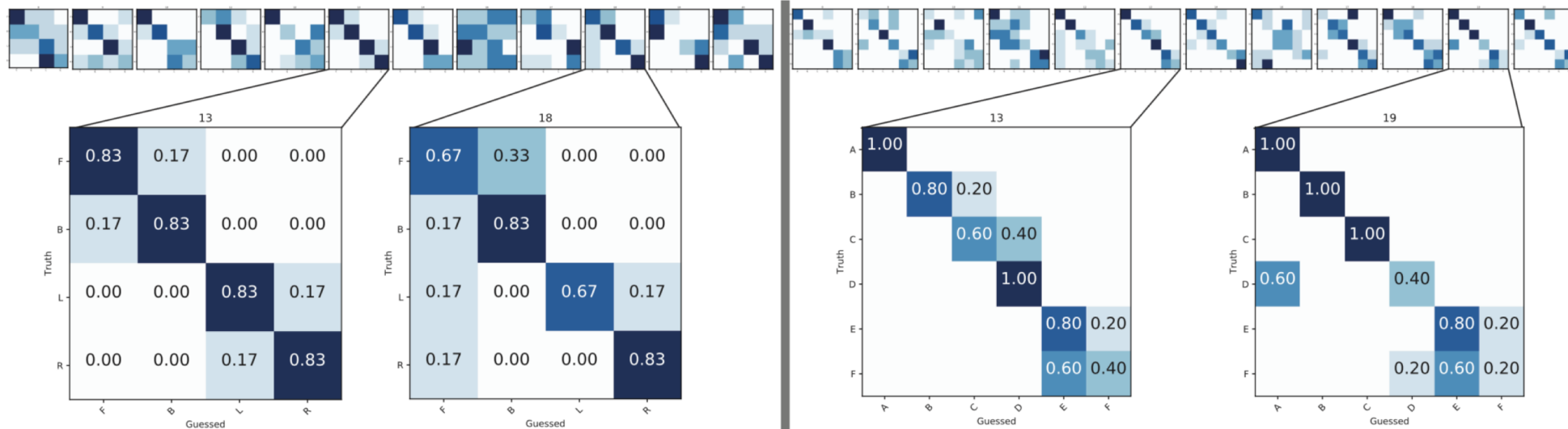
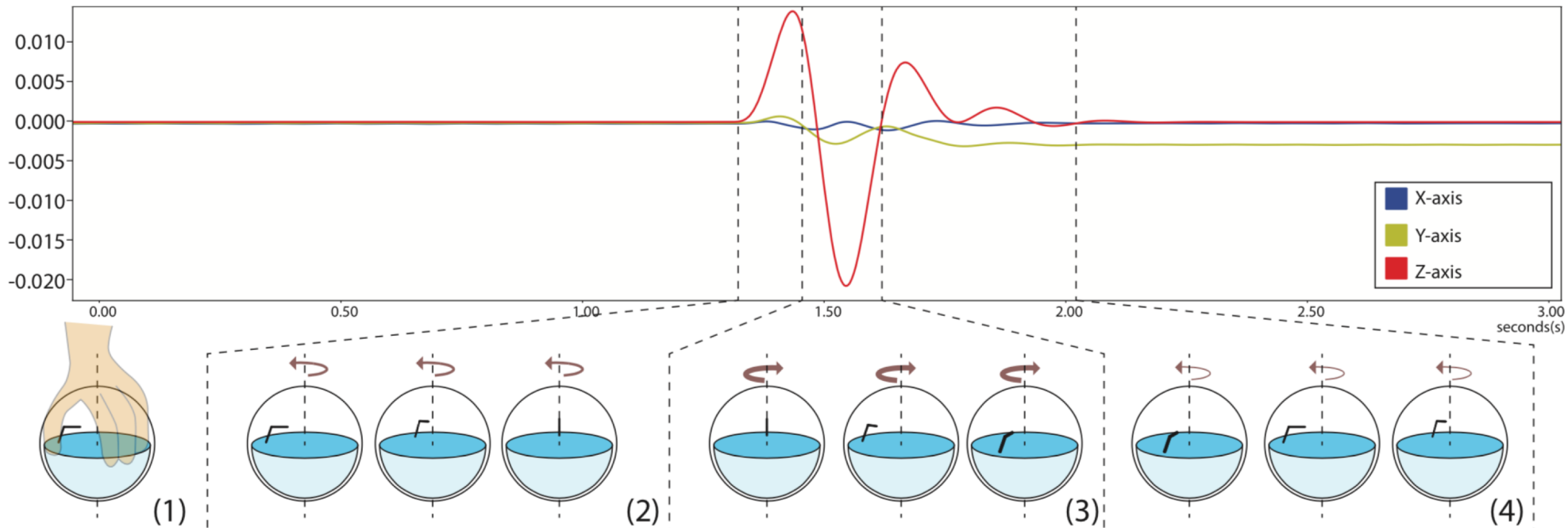
Low cost, commodity robot

Easy to replace

Designed for kids: durable







Robot Abuse

Tan, et al 2018 HRI

People abuse robots

How to encourage
bystander intervention?

Brscić et al 2015 HRI

The image shows a screenshot of a Wired article. At the top left is the Wired logo. To the right of the logo is the article title: "Please Do Not Assault the Towering Robot That Roams Walmart". Below the title is a yellow banner that says "GET WIRED. 3 MONTHS UNLIMITED ACCESS ON US". On the left side of the article, there is a "SHARE" section with icons for Facebook (1139 shares), Twitter, Comment, and Email. The main headline of the article is "PLEASE DO NOT ASSAULT THE TOWERING ROBOT THAT ROAMS WALMART" in large, bold, black letters. Below the headline is a photograph of a white, boxy robot in a grocery store aisle, standing on a metal shelf. The robot has a small screen on its front. In the background, there are shelves stocked with various cereal boxes.

Can Robot Encourage Intervention?

Participant witnesses another person (confederate) abuse the robot

Robot responds with:

- Nothing
- Shutdown
- Emotion

Between subjects



Yes (partially)

People are **willing to help** the robot if the robot is being abused

The **shutdown response** was the most promising response among the responses we tested in preventing bullying behavior

Current Work

Systems level questions

Dovetail into follow-on project

- DRRP on Robotics and Automation for Inclusive Transportation
- National Institute on Disability, Independent Living, and Rehabilitation Research (NIDILRR, 90DPGE0003)
- Map integration opportunities with NavCog app
- www.cs.cmu.edu/~astein/rait

Team

Current team:

Xiang Zhi Tan, Allan Wang

Alumni:

Byung-Cheol Min (Perdue)

Ermine Teves (Apple)

Joe Connolly, Amal Nanavati, Steven Cunden, Kangwei

Chen, Eric Hochendoner,

Aditi Kulkarni, Praneetha Sistla, Ankita Arvind,

Vivek Nair, Lucy Pei, Suryansh Saxena, Lynn Urbina

Visitors:

Alvaro Castro-Gonzalez (University Carlos III de Madrid)

Victoria Plaza (Universidad de Málaga)



**Western Pennsylvania
School For Blind Children**

Fostering a Vision of Independence



**Blind & Vision Rehabilitation
Services of Pittsburgh**

**Carnegie
Mellon
University**

