Human-Robot Interaction, Accessibility, and You

Towards a More Inclusive HRI

Elaine Schaertl Short, Tufts University
March 2021

Developed with support from the TeachAccess Curriculum Development Grant

Some Notes on Language

- **Person first**: “people with disabilities”
- **Identity first**: “disabled people”
- Preferences on language vary by geography and community; this presentation uses person-first and identity-first language fairly interchangeably; often, PWD for “people with disabilities”.
- **<u>Having the right attitude is the most important thing</u>**
  - … but don’t be a jerk: there **are** terms that are offensive and/or outdated
- If you or someone you care about holds an identity that we talk about in class and you have a strong preference, feel free to send me an email and I will use that language.

Americans with Disabilities Act

ADA

- Passed in 1990 (!!)
- Prohibits discrimination on the basis of disability in employment, public spaces, and government services (other laws govern housing, etc.)
- Requires “reasonable accommodations”

https://adata.org/factsheet/reasonable-accommodations-workplace

ADA Amendments Act

ADAAA

- Passed in 2008 (!!)
- Widens the scope of what constitutes a “disability”
  - Includes physical and mental impairments (or the *perception* of impairment)
  - Corrects previous narrowing of the definition of “disability” under the ADA

https://www.eeoc.gov/laws/regulations/adaaa_fact_sheet.cfm

The Medical Model of Disability

aka The Individual Model

- Historical approach to disability; disability is an individual problem
- Prevention- & cure-focused (“fix **the person**”)
- Help PWD by providing treatment and “prosthetic” devices; goal is to restore/reach “normal” functioning
- Advantages: can reduce overall human suffering, especially when treatment is straightforward; goal is to get everyone to the same place ability-wise
- Disadvantages: can be very paternalistic (the doctor will “fix” you whether you like it or not); historical connections to eugenics; no good answer for “uncurable” conditions

The Social Model of Disability

- Emerged in the 70's and 80's; impairment is individual, but "disability" is caused by a societal failure to accommodate
  - Social justice focused ("fix **society**")
  - Help PWD by providing accommodation & access; goal is to allow people with diverse abilities & characteristics to participate in society
  - Advantages: not all impairments lend themselves to cure; empowering for PWD; can be more effective for allowing people into the public sphere; prevents needless suffering inflicted in the name of "fixing" PWD
  - Disadvantages: not always a clear answer to competing access needs; for some conditions many people do want treatment or a cure if possible

Universal Design

One Approach to Accessibility

- Designing artifacts so that they can be used by all people all the time
- Considers the needs of more than just the normative human (i.e., make sure your design works for many ways of perceiving, thinking about, and acting in the world)
- Treats non-normative needs as being as valid and as important as the needs of the white, male, adult, english-speaking, literate, cisgender, straight, right-handed, non-disabled, etc.

Principles of Universal Design

Story, 1998

Principle:	Equitable	Flexible	Simple & Intuitive Use	Perceptible Information	Tolerance For Error	Low Physical Effort	Size & Space for Approach & Use
Definition:	The design is useful and marketable to people with diverse abilities.	The design accommodates a wide range of individual preferences and abilities.	Use of the design is easy to understand, regardless of the user's experience, knowledge, language skills, or current concentration level.	The design communicates necessary information effectively to the user , regardless of ambient con-ditions or th e user's sensory abilities.	The design minimizes hazards and the adverse consequences of accidental or unintended actions.	The design can be used efficiently and comfortably and with a minimum of fatigue.	Appropriate size and space is provided for approach, reach , manipulation, and use regardless of the user's body size, posture, or mobility.
Robot Hardware Design Examples	participatory design; testing with disabled users	modular input and output	Intuitive input design; non-text input; non-verbal input; human-centered robot design	alternative displays; capability for both visual and audio communication	compliant actuators; ergonomic design	assistive capabilities; easy-to-use physical interfaces	robot size and shape
Robot Software Design Examples	participatory design	Customization & personalization	automation; UX design; anticipation and goal prediction	multi-modal communication	explainable behavior; error recovery	automation; assistive behavior	social spacing

Molly Follette Story M.S. (1998) Maximizing Usability: The Principles of Universal Design, Assistive Technology, 10:1, 4-12, DOI: 10.1080/10400435.1998.10131955

Accessible vs Assistive Technology

- Accessible Technology: enables disabled users to access technology; more aligned with the social model of disability
  - Example: A robot that both uses text-to-speech and displays the spoken text on a screen
- Assistive Technology: directly addresses the needs of disabled users; can be more aligned with the individual model of disability
  - Example: A smart wheelchair that can climb curbs
- Assistive HRI ≠ Accessible HRI

Assistive HRI Dos and Don’ts

- **DO**
  - Ensure that all materials are accessible to intended user population
  - Test with disabled users and involve them in the research process
  - Partner with advocacy groups and build relationships with people with disabilities, especially “super users” who will give you critical early feedback
  - Make sure that your technology supports disabled users’ goals and not *just* the goals of clinicians and/or caregivers
- **DON’T**
  - Write papers that describe disabled people as burdens on society
  - Assume all people with the same diagnosis are the same
  - Claim your system will be useful to people with disabilities without validating its performance with people with disabilities
  - Ask users with disabilities to come to inaccessible lab spaces, read inaccessible documentation, or accept inaccessible (or useless) compensation

For more, see “Working with Disabled Users”, Chapter 16 of Research Methods in Human-Computer Interaction by Lazar, Feng, and Hochheiser

Accessible HRI Dos and Don’ts

- **DO**
  - Ensure that all materials are accessible
  - Support accessing information and robot capabilities through multiple modalities
  - Build accessibility into HRI systems from the start
  - Think about how users with disabilities could access your system
- **DON’T**
  - Assume all users are non-disabled (e.g., “all pedestrians could step off the sidewalk to make room for the robot”)
  - Treat accessibility as an optional “add-on” — and then never get around to adding it
  - Forget that accessible designs often have significant benefits for non-disabled users (e.g., hands-free phone use for drivers, subtitles for watching TV in noisy rooms)

For more, see “Working with Disabled Users”, Chapter 16 of Research Methods in Human-Computer Interaction by Lazar, Feng, and Hochheiser

Accessibility in State-of-the-Art HRI

Activity 1

Paper Scramble

Groups of 3-4

- Give students access to the last 3-5 years of proceedings of HRI, ICRA, Ro-Man, RSS, and IROS (optionally: just focus on HRI and/or Ro-Man, or pick your favorite HRI venue)
- Emphasize that students should read papers quickly — typically skim the abstract, introduction, and results
- Assign one group to each of the question blocks on the next slide; they will be asked to both count papers and find exemplars
- Give groups 30-50 minutes; optionally separate the counting portion from the exemplar-finding portion of the task
- Ask groups to present their findings to the class

Questions

Address one question in each group

- How many of these systems use the social vs medical model? How many use a mix? What kinds of mixes do you see? Which paper most embodies the medical model? Which paper most embodies the social model? Why?

- How do these papers talk about disability in their motivation sections? Are disabled people discussed as a burden on society? Which paper did the best job of talking about disability in a non-stigmatizing way? Which paper did the worst job? Why?

- How many focus on the needs and perspective of disabled people rather than the needs of caregivers and/or clinicians? Which paper did the best job of centering the needs of disabled users? Which paper did the worst job? Why?

- How many use non disabled users for some or all of their testing and development process? Do you think they did this in a reasonable way? Which paper did the best job? Which paper did the worst job?

- How many of the papers use a purely deficit-based model of disability? How many use a strengths-based model? How many talk about “difference” rather than deficit? Which paper was the most deficit-focused? Which paper was the least deficit-focused? Why?

- What design guidelines could we come up with based on these papers? Do they align with a disability justice perspective? Which papers have the most disabled-person-friendly design implications? The least disabled-person-friendly design implications?

A More Accessible HRI

Activity 2

Robot Redesign

Groups of 2-6

- Have each group pick a robot (from earlier in class, from a list that you provide, or from the most recent 1-2 years of HRI)
- Each group should redesign the robot (or study) to be more accessible according to the principles of universal design
  - Including at least one change to the physical design of the robot, one change to the design of the robot's behavior, and one completely new robot capability
- Give students materials to illustrate their design (physical pen & paper, online presentation software, or use their laptops)
- Give the groups 30-50 minutes to work
- Regroup and have students present their design to the class, focusing on what changes they made and why

Accessibility in State-of-the-Art HRI 2

Activity 3

Robot “Film Festival”

Groups of 2-5

- Direct students to the video session in the companion proceedings of HRI in the ACM Digital Library (example; optionally: pick your favorite other HRI venue)
    - You will probably need to show them how to click through and scroll down to get to the video
- Assign each group one year of the conference and have them watch the videos from that year
- Ask students to choose one nominee from the videos for “Least Accessible Robot” and one nominee for “Most Accessible Robot”
- Give groups 20-40 minutes; be sure to leave lots of time for the full-group discussion
- Ask groups to show the videos for their nominees to the class and explain why they chose them
- Optionally: discuss as a class how one design element from the most accessible robot could be transferred to the least accessible robot
- Optionally: have students vote for most- and least-accessible robot from among the nominees (I recommend having some kind of brackets in a large class)