

Problem Definition

Robots encounter barriers they are not programmed to handle → **must ask humans for help**



Fig. 1: Pololu encountering obstacle. PC: Natalie Lim

Different age groups have various levels of comfort with robots → **inconsistent and unreliable reactions to a robot's plea for assistance**



How can these robots best ask for assistance in a way that does not incite disgust, fear, or discomfort from any person of any age group?

Impact

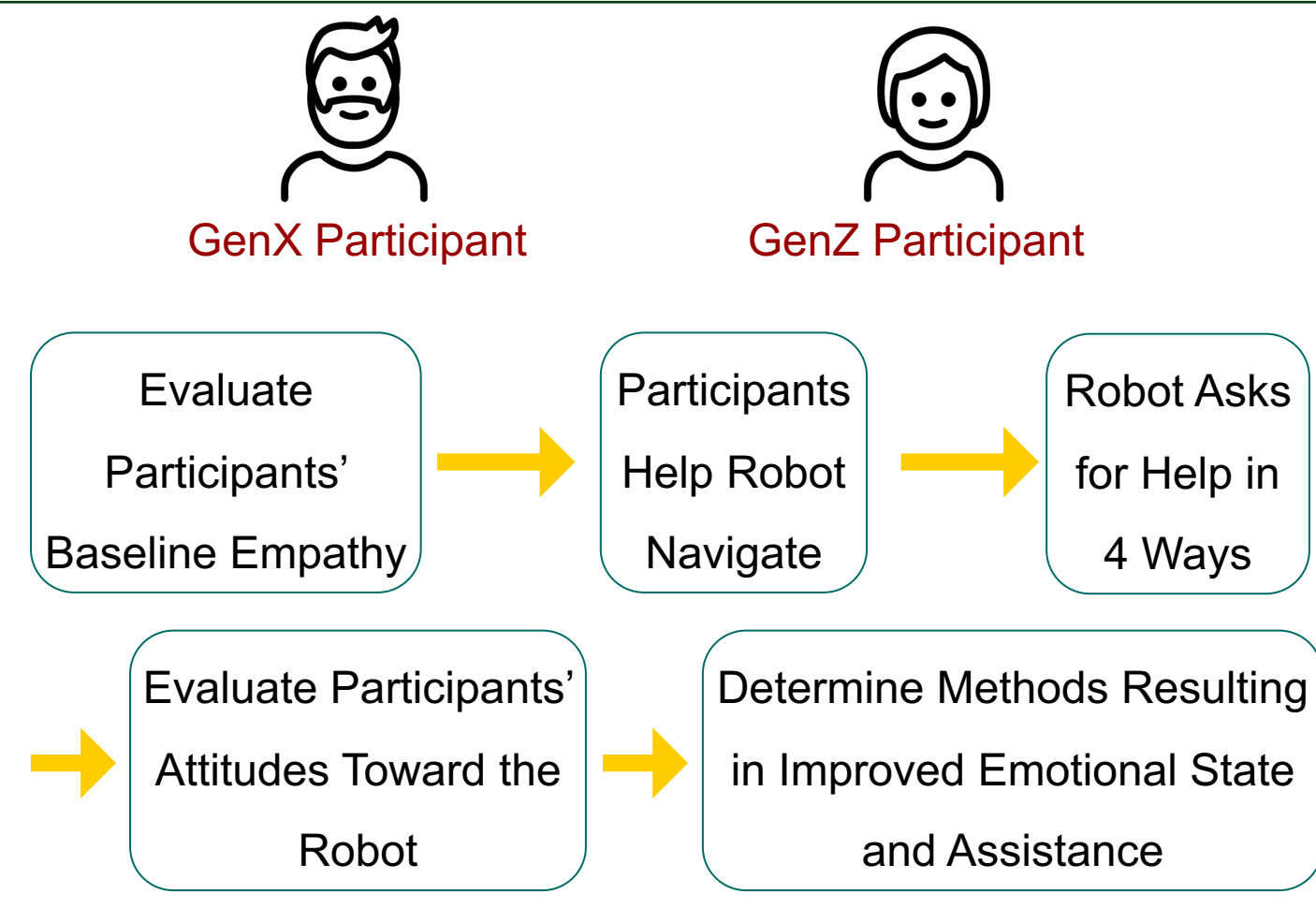
Robots can more effectively ask for aid without inciting negative emotions → **appeals to a wider user base and leads to more efficient troubleshooting**

People of all age groups are more comfortable with robots → **bridges the technological divide between generations**

Generáció	Mean	N	SD	Min.	Max.
Generation Z	63.32	235	11.441	20.00	90.00
Millenials	61.44	190	12.764	22.00	89.00
Generation X	55.41	271	14.248	20.00	86.00
Baby boomers	48.34	148	16.413	18.00	87.00
Total	57.71	844	14.627	18.00	90.00

Fig. 2: Habitual mobile use score of each generation. Excerpt from a Hungarian Study that measured the relationship between generations and disparities in technology use. PC: [3]

Protocol



Methodology

1 Pre-Experiment Empathy Baseline Questionnaire:

Evaluate baseline disgust, fear, and sadness on a 7-likert scale [2]

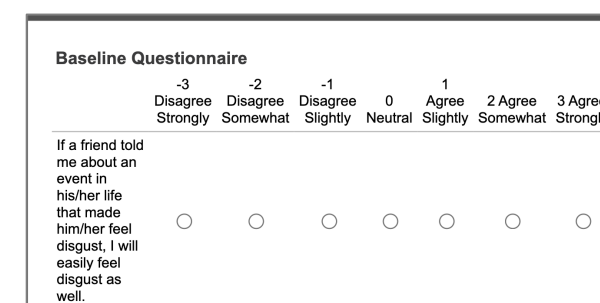


Fig. 3: Baseline Questionnaire Excerpt. PC: Natalie Lim

2 Maze Navigation:

Robot asks for help in different ways and participants aid in circumventing obstacles

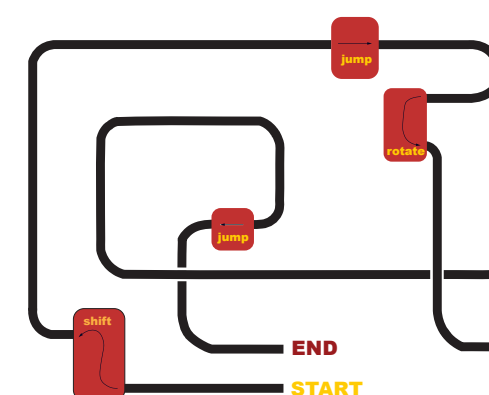


Fig. 4: Maze Mockup PC: Natalie Lim

3 Post-Experiment HRI (Human-Robot Interaction) Questionnaire:

Anthropomorphism, animacy, likeability, perceived intelligence, and perceived safety on a 5-likert scale [1]

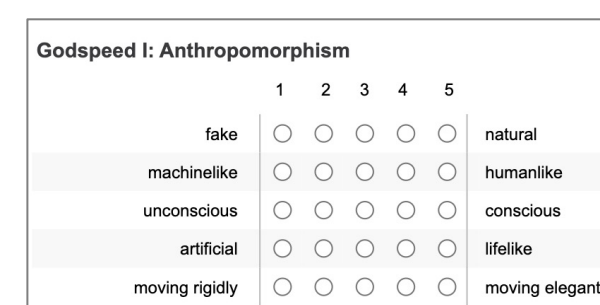


Fig. 5: HRI Questionnaire Excerpt. PC: Natalie Lim

Pololu 3Pi+



- RGB light
- Micro SD Card + Card Adapter
- Miniature Breadboard
- Voice Coil
- Reflectance Bump Sensors
- QTR-RC Line Sensors

- 1 **Follows a Line:** PID line following program using reflectance sensors
- 2 **Bumps Into a Laser-Cut Obstacles:** uses the bump reflectance sensors on the front of the robot
 - 2a **Flashes a Light:** utilizes a softly pulsing RGB light to ask a human for help
 - 2b **Repeatedly Bumps Into a Wall and Emits "Ow":** plays audio of a male, female, or child voice
 - 2c **Emits a High-Frequency Siren:** plays siren sound
 - 2d **Emits "Help me":** plays audio of a male, female, or child voice

Acknowledgements

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References

1. Bartneck et al., "Measurement Instruments for the Anthropomorphism, Animacy, Likeability, Perceived Intelligence, and Perceived Safety of Robots."
2. Olderbak et al., "An Emotion-Differentiated Perspective on Empathy with the Emotion Specific Empathy Questionnaire."
3. Pásztor, J., & Bak, G. (2020). Digital divide: A technological generation gap. *Management, Enterprise and Benchmarking in the 21st Century*, 158-168. Retrieved from <http://libproxy.usc.edu/login>
4. "Library." *OpenMoji*, openmoji.org/library/#group=people-body. Accessed 16 July 2022.