

Objective

To develop algorithms to enable socially aware, expressive, and personalizable mobile remote presence (MRP) co-robot systems for the purpose of improving access to the in-school learning environment for K-12 students.

Background and Motivation

- Each year, more than 6.5 million Americans miss significant amounts of school, causing educational and social issues.
- Online learning and personal tutoring can address missed educational experiences but fail to address the lack of peer-mediated social experiences that can have **serious effects on social and cognitive development**.
- Current MRP systems target environments and users that do not have the same needs as the classroom environment, making it important to identify and understand the MRP use cases for remote student participation in classroom activities.
- Important research problems **for MRP systems in classrooms** include communicative signaling (i.e. expressiveness) to co-located students, social integration, training, and personalization. Tools are needed for collecting data on these topics.

Classroom Deployments for Homebound Students

We have completed three long-term deployments of our system with high school students who cannot physically attend class. An overview for each case study is in the table below.

ID	Context: Health	Location	Duration
P1	Speech and motor challenges	1 classroom	4 weeks
P2	Mental health challenges	2 classrooms	2 weeks
P3	Speech and motor challenges	1 classroom	6 weeks

Research Questions

RQ1: [Learning Experience] How well is the homebound student able to participate in classroom activities via the MRP system?

RQ2: [Social Experience] Is the homebound student accepted as part of the class? How do they relate with other students via the MRP system?

Findings

1. Accessibility issues limited what students with motor challenges could do with the MRP system
2. P1, usually confined to bed, enjoyed the system's mobility
3. The limited field of view helped P2 focus
4. The ability to attend school for only 1 hour per day and log out at any time greatly improved P3's classroom experience

Outreach

- Sponsoring events to promote robotics and familiarize students with MRPs and robots.
- Showcasing NRI work at the annual Robotics Open House (1,000-2,000 visitors).

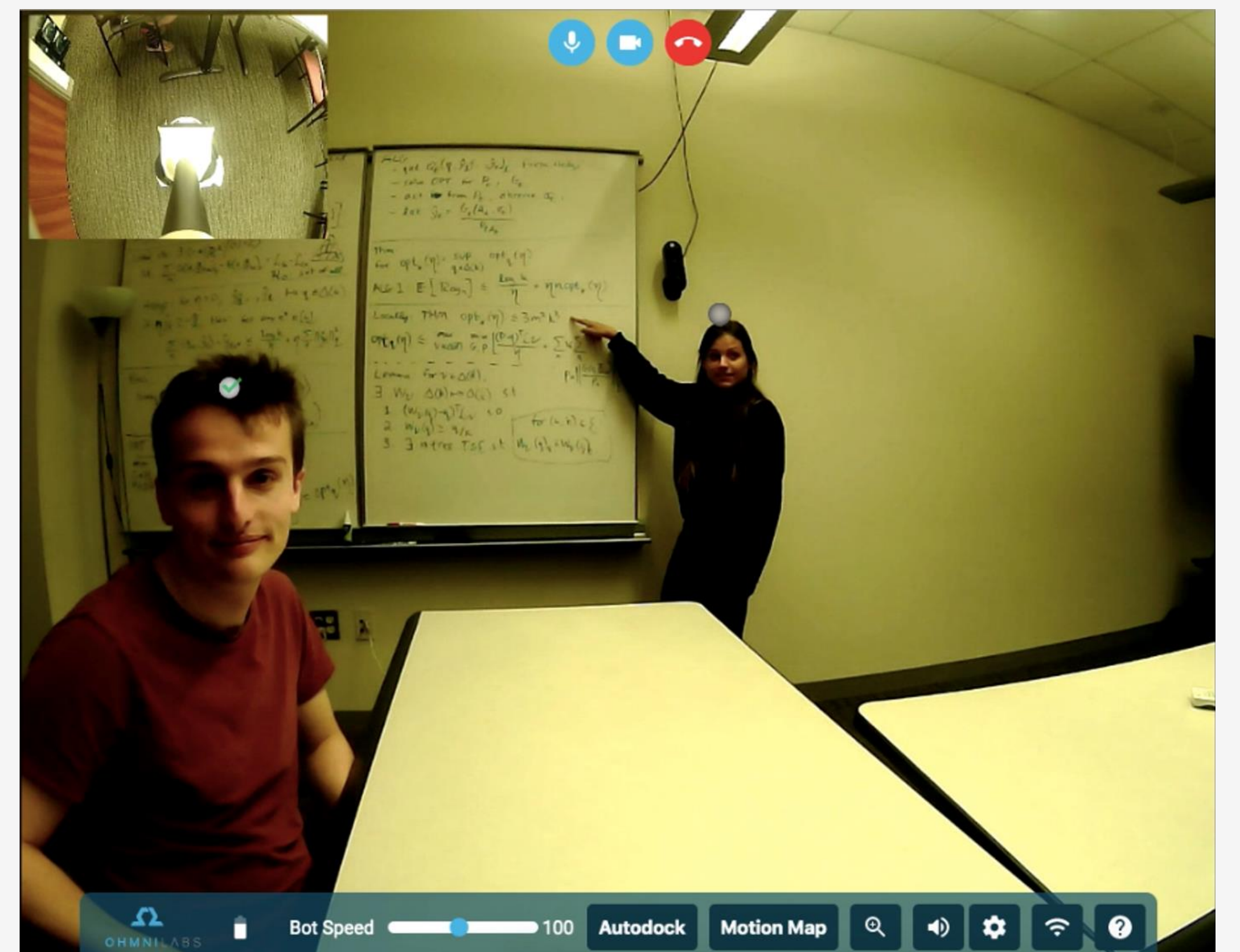
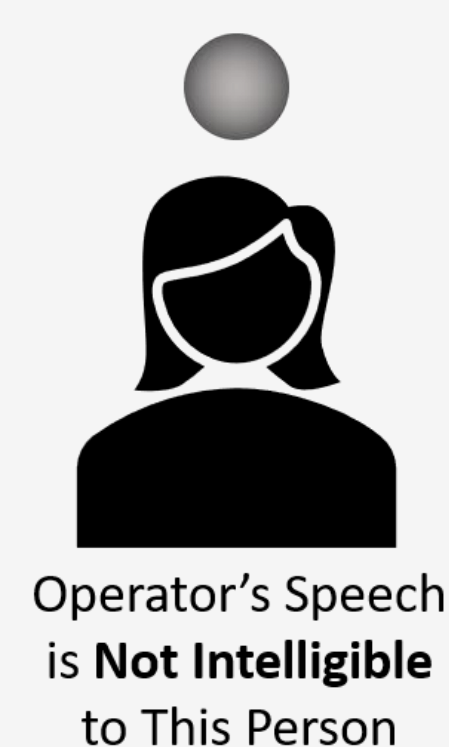
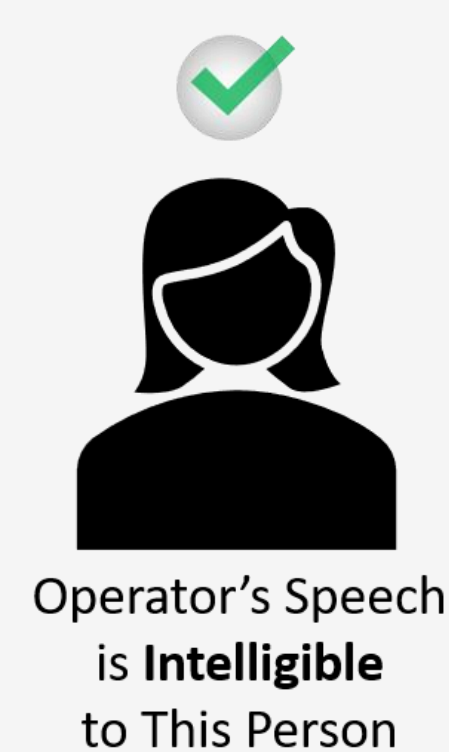
Recent Publications

[1] Matthew Rueben, Thomas R. Groechel, Yulun Zhang, Gisele Ragusa, and Maja J. Matarić. "Increasing Telepresence Robot Operator Awareness of Speaking Volume Appropriateness: Initial Model Development", In *Companion of the 2020 ACM/IEEE International Conference on Human-Robot Interaction (HRI '20)*, Cambridge, UK, Mar 2020.

[2] Naomi T. Fitter, Luke M. Rush, Elizabeth Cha, Thomas R. Groechel, Maja J. Matarić, and Leila Takayama. "Closeness is Key over Long Distances: Effects of Interpersonal Closeness on Telepresence Experience", In *Proceedings of the 2020 ACM/IEEE International Conference on Human Robot Interaction (HRI '20)*, Cambridge, UK, Mar 2020.

Model of Speaking Volume Appropriateness

We have found that MRP users struggle to keep their volume setting at an appropriate level. We are testing how on-screen feedback about whether a certain listener can hear you will influence social interactions in our classroom deployments [1].



Effects of Interpersonal Closeness on Presence

We have recently published findings [2] from two studies of interactions between pairs of people via a telepresence robot. **Study 1** tested our hypothesis that personalization improves the robot operator's sense of presence, but instead found that this sense of presence was higher for participant pairs who reported a closer relationship at the beginning of the study. **Study 2** confirmed that robot operators who are closer friends with the individuals co-present with the robot tended to have increased feelings of social presence.

Acknowledgments

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