Interaction Lab & Mixed Reality Lab

Communicate Share, Adapt: A Mixed Reality Framework for Facilitation Robot Integration and Customization

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Objective

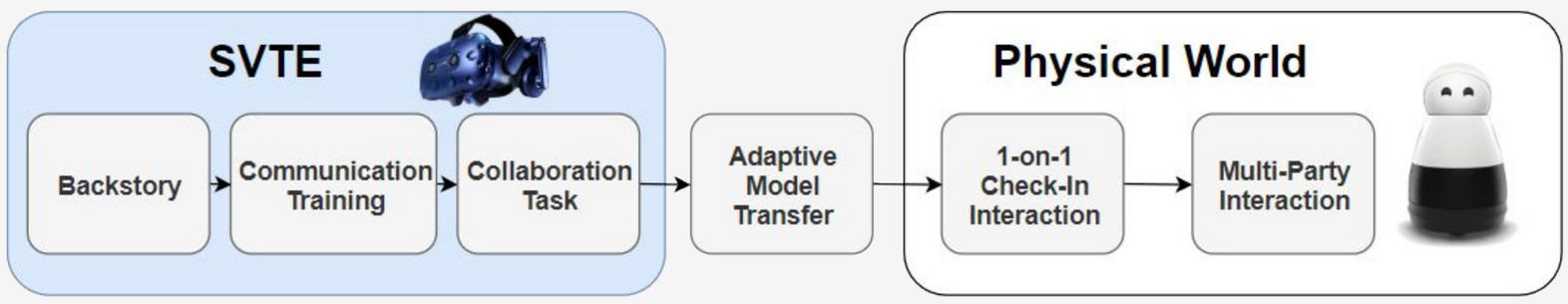
Develop a Shared Virtual Teaching Experience (SVTE) for the elderly leveraging the immersive interaction potential of virtual and augmented reality (VR and AR) to: teach users how to communicate with robots, build user-robot rapport through sharing, and adapt robot behavior for real-world interactions based on the training from the immersive experience.

Background and Motivation

- Research has consistently found that older adults are open to robots as companions, but that they want robots to perform at the level of a human carer, specifically in ways that require more advanced social skills. [1]
- The significant need for personalized integrated co-robots for the rapidly growing elderly population requires natural bi-directional communication, but key barriers include limited perception and signaling affordances of robots. [2]
- Users do not understand the limitations of robot communication and cognition, often leading to frustration and abandonment of co-robots. [3]
- Using immersive technologies to enable non-experts to communicate in HRI contexts has shown promise; studies have explored showing users camera views from the robot [4] and natural deictic gestures. [5]
- A key challenge for human-machine interaction in general and HRI in particular is *personalization* to the user [6] where the data rich environment of mixed reality could be explored.

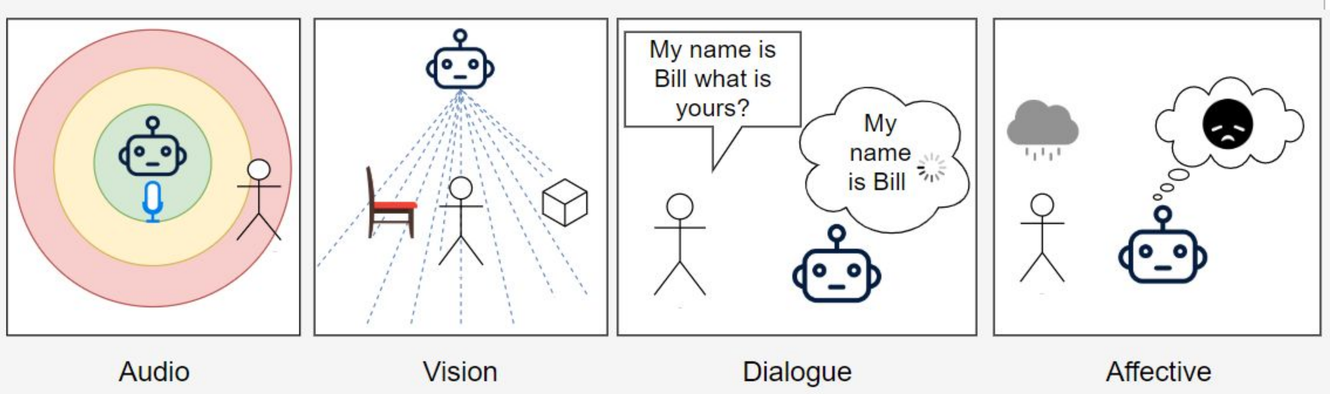
SVTE Interaction Setup

Users will first take part in the SVTE within a head-mounted display (HMD), doing a collaborative task with the robot. The user model obtained in this virtual experience will then be transferred to the physical robot for multiparty interactions.



Capability Signalling

We are exploring how to portray two types of robot communication:
1) Functional: the robot's ability to sense audio, vision, dialogue, etc.
2) Affective: the robot's ability to estimate a user's affective state.



Real World Model Transfer

During the SVTE, the robot will develop a model of the user, consisting of the user's understanding of its own capabilities and details of the user history and personality. We will explore how the robot can make use of this model in the physical world to improve the quality of the user experience in one-on-one and multi-party interactions. We will test how these personalized models increase user engagement and subsequently decrease robot abandonment and disuse.

Timeline

Year 1

Exploratory Analysis

- Meeting with elderly collaborators and caregivers to discuss and design the SVTE content.

SVTE Development

- Conducting 3 studies to validate communicating functional and affective capabilities within SVTE.

Year 2

Robot Backstory Studies

- Evaluating backstories to build rapport and elicit user sharing.

User Model Generation Studies

- Evaluating creation and transfer of personalized models of users in SVTE for real-world interaction

Year 3

End-to-End Evaluation in Elder Care

- A comprehensive study of the SVTE will be conducted with elderly residents of a care home.
- Participants will experience the SVTE before interacting with the robot in a group activity.

Outreach

- Annual events to familiarize K-12 students with human-centered robotics.
- Showcasing NRI work at USC's annual Robotics Open House (1,000-2,000 visitors, mostly inner-city K-12 students).

References

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Acknowledgments

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