Emerging Telepresence Technologies in Hybrid Learning Environments

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ABSTRACT

The last several years have seen a strong growth of telerobotic technologies with promising implications for many areas of learning. HCI has contributed to these discussions, mainly with studies on user experiences and user interfaces of telepresence robots. However, only a few telerobot studies have addressed everyday use in real-world learning environments. In the post-COVID 19 world, sociotechnical uncertainties and unforeseen challenges to learning in hybrid learning environments constitute a unique frontier where robotic and immersive technologies can mediate learning experiences. The aim of this workshop is to set the stage for a new wave of HCI research that accounts for and begins to develop new insights, concepts, and methods for use of immersive and telerobotic technologies in real-world learning environments. Participants are invited to collaboratively define an HCI research agenda focused on robot-mediated learning in the wild, which will require examining end-user engagements and questioning underlying concepts regarding telerobots for learning.

CCS CONCEPTS

• **Human-centered computing** → **Collaborative and social computing systems and tools**; **Accessibility technologies**.

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1 BACKGROUND

COVID-19 has impacted all aspects of human life, and the expectation is that we will be managing its impact for years to come. In the spring of 2020, many educational institutions temporarily transitioned to online teaching and learning. While the pandemic made online teaching and learning a necessity, it also highlighted the need for hybrid classrooms (where some learners are physically present and others are attending virtually). There is an enthusiasm to learn from these experiences in order to broaden education and to better accommodate the needs of remote students for short or long periods of time due to medical conditions, disabilities, or other mitigating circumstances.

During the pandemic, when all learners were expected to be remote, conventional video conferencing tools (e.g., Zoom, Microsoft Teams) were used by necessity, but they are not without limitations (e.g., lack of bandwidth, internet accessibility). These tools, initially designed for corporate use, are extremely useful when everyone is remote. However, we recognize that stationary online video-conferencing tools are not ideal for hybrid classroom discussions, group work, and design activities such as sketching and diagramming, as well as creating and manipulating physical prototypes.

Researchers have identified a correlation between the frequency of students' interactions with their school environment and students' levels of motivation and engagement [1, 3, 4]. Students who physically attend classes and interact with their classmates, instructors, and school environments tend to be more behaviorally, emotionally, and cognitively ready to be involved in the classroom activities and learning processes. Thus, remote attendance technologies that promote direct social interaction would be expected to be beneficial for remote learners [2, 7].

Emerging telepresence technologies such as stationary and mobile telerobots (e.g., Mobile Robotic Presence [MRP], stationary telepresence robots, robotic arms, and holograms) have the potential to alleviate the problem of social interaction for students who are not able to attend in person, attenuating the limitation of inaccessibility and creating a more inclusive classroom environment. Concretely, these technologies allow the interchange of non-verbal signals between participants that greatly influence the effectiveness of in-person communications [8]. For example, MRPs which consist of a video conferencing system mounted on a mobile base that a remote user can move [5, 11, 22] offer mobility, thus meeting the needs of navigating a remote space and around objects to view them from different perspectives. According to Rae et al. [19], robot-mediated communication takes us one step closer to face-to-face interaction. Other studies found that MRP improved the interpersonal social connections between the user and their interlocutor [6, 14, 18, 24] and empowered the users [13, 15, 23]. Another example is the robotic arm, which is a less familiar type of telerobot and consists of a stationary movable limb, such as an arm, combined with a source of visual information from the local environment [16, 20]. A robotic arm can manipulate objects and make sketches on a whiteboard. Another path to alleviate the difficulties of not being physically present in the classroom is the use of immersive technologies (e.g., VR) for telepresence [10, 12]. By having a fully immersive experience, remote learners can increase the sense of presence in the classroom, which has a positive impact in the conveyance of empathy and attention. [9, 17, 21]. While these technologies have positive affordances, they also present limitations. For instance, many commercially-available MRP units do not have hands to manipulate objects; many robotic arms cannot move independently around the classroom; and wearing VR headsets for long periods of time causes fatigue to the users. Likewise, these technologies have opened privacy challenges for students and teachers that must be analyzed and discussed.

In this workshop, participants will have the opportunity to discuss the impacts, affordances, and limitations of different emerging telepresence technologies that can be used in various learning contexts. In particular, we expect to discuss the following (and other related) topics:

- Emerging telepresence technologies used in learning environments
- Case studies in classrooms and other learning contexts that use telepresence technologies
- Challenges surrounding the use of telepresence technologies in learning environments
- Best practices for the use of telepresence technologies in learning environments
- Ethics and social norms in classrooms where telepresent learners are included
- Telepresence technologies for students with medical conditions and/or disabilities
- Design methods and principles for the development of telepresence technologies

2 PARTICIPATION

This workshop is intended for HCI researchers, designers, and educators who are interested in or may be using telepresence technologies in hybrid learning environments. Workshop applicants are invited to submit two pages in the CHI extended abstract format via email to telepresence4learning@gmail.com. Participants should include in their submission: details about their research interests, a short motivation statement describing why they want to participate in this workshop, and their experiences with remote attendance research and/or telepresence research.

3 ORGANIZERS AND KEYNOTE SPEAKER

This workshop is organized by a team of researchers who are currently working in the area of Human-Computer Interaction and Human-Robot Interaction:

- Houda Elmimouni, PhD
  Houda is the main contact person for the workshop. She is a Computing Innovation Fellow and Postdoctoral Researcher in the Department of Informatics at Indiana University Bloomington. Her main current research area is mobile robotic telepresence in the classroom. She previously organized a SIG on telepresence at CHI2018.
- Veronica Ahumada-Newhart, PhD
  Veronica is an assistant professor of health informatics and human-robot interaction in the School of Medicine, Dept. of Pediatrics and Center for Health & Technology at UC Davis. She brings expertise on robot-mediated child development and learning. Her research on telepresence won an award at CHI 2014, and she is PI of an NSF grant on Robot-Mediated Learning: Exploring School-Deployed Collaborative Robots.
- Selma Sabanovic, PhD
  Selma is an associate professor of Informatics and Cognitive Science at Indiana University Bloomington. Her work focuses on the design and user evaluation of social robots in diverse applications, including education, and contexts such as schools, homes, and different countries. She led a project on the co-design of robot telepresence for local communities with elementary and high school students.
- Susan C. Herring, PhD
  Susan is a professor of Information Science and Linguistics and Director of the Center for Computer-Mediated Communication at Indiana University Bloomington. She researches structural, pragmatic, interactional, and social phenomena in communication mediated by digital technologies. Her recent research focuses on multimodal CMC and communication through emerging technologies such as telepresence robots and smart speakers.
- John Paulin Hansen, PhD
  John is a professor at the Technical University of Denmark,

working for many years in the design and development of assistive technologies. Currently, he studies gaze controlled telerobotics and the use of exoskeletons for rehabilitation.

- Marta Orduna, PhD student
  Marta is a PhD student at Grupo de Tratamiento de Imágenes (Image Processing Group) of the UPM. Her current research is in the area of virtual reality, video encoding and streaming, and quality of experience.
- Pablo Pérez, PhD
  Pablo is a senior researcher at Nokia Bell Labs in Madrid, Spain. His research interests cover the whole area of real-time immersive communications and telepresence, from the compression and transmission problems to the user quality of experience.
- Jennifer Rode, PhD
  Jennifer is an associate professor at the Knowledge Lab in the Institute of Education at UCL. A member of the initial SIG in 2018, she brings a mature understanding of teleprescence and accessibility to this workshop.
- Janet C Read, PhD
  Janet is a professor of Child Computer Interaction with a keen interest in new and emerging technologies for children. Based in the UK, she brings her experience of working with schools and with children with a range of disabilities, as well as expertise in co-design, to this workshop.
- James P. Marcin, M.D., M.P.H.
  James is a professor of Pediatrics and Director of the Center for Health and Technology at the University of California, Davis. He brings expertise in pediatric telehealth, access, and school-based tele-physiatry assistance for children with special health care needs.
- Irene Rae, PhD
  Irene is a Senior Staff Researcher at Google. Her experience in telepresence robots extends to collaborative work environments and the way that the robot's physical presence influences users who are colocated with the robot as well as remote bystanders.

KEYNOTE SPEAKER

- Laurel Riek, PhD
  Dr. Laurel Riek is a professor of Computer Science and Engineering and Emergency Medicine at UC San Diego, and leads research in healthcare robotics and human robot interaction. Current projects include designing accessible technologies to support robot-mediated inclusion for children with disabilities, and robots that support longitudinal neurorehabilitation for adults with dementia. Dr. Riek is the HRI 2023 General Chair and served as the HRI 2020 Program Chair.

4 WEBSITE

The workshop website is available at: https://chi2022emergingtelepresence.godaddysites.com. The website has the call for participation, submission dates, and submission instructions. It also provides background information about the topic, organizer bios, workshop schedule, and participation requirements. The list of accepted papers will be posted on the website and will be available for download.

5 PRE-WORKSHOP PLANS

We will publish a Call for Participation in all relevant venues including HCI, HRI, and UX mailing lists and social media platforms, we will actively target the AccessSIGCHI community on Facebook and the Assets mailing list. We will also target sts-grad, Labor Tech and AoIR mailing lists and reach out to educators who are interested in, and/or may be using, telepresence technologies via the SIGCSE mailing lists and through professional contacts. We will use our website to provide relevant details for submission and to answer questions from participants. We will review submissions and post the accepted papers on the website for all participants to review before the workshop.

6 WORKSHOP STRUCTURE

This workshop is planned to run for one day. An innovation in this workshop is that we will include telepresent participants if the conference is held in-person. This will animate discussion, highlight logistical challenges, and force improvised resolutions. The workshop will begin with a keynote talk from an internationally recognized roboticist, followed by a Q&A session, and then participants will have an opportunity to give 3-5 minute lightning talks on their papers. The afternoon sessions will be dedicated to discussions, ideations, and prototyping. Participants will work in small groups, and then each group will share their ideas and prototypes.

7 TIME SCHEDULE

9:00: Coffee & Prep
9:30: Introductions & Welcome
10:00: Keynote Speaker (Laurel Riek, PhD) + Q&A
10:30: Coffee break
10:45: Lighting Talks: Each participant presents their paper in 3-5 min
12:15: Lunch break
14:00: Participants split into groups to discuss issues around telepresence in hybrid classrooms
14:45: Groups present their ideas
15:15: Coffee break
15:30: Participants split into groups to discuss ideas and prototype solutions to support learning
16:15: Groups present their ideas
16:45: Closing

8 CALL FOR PARTICIPATION

We invite position papers for the one-day Workshop on "Emerging Telepresence Technologies in Hybrid Learning Environments" at CHI 2022.

This workshop is intended for HCI researchers, designers, and educators who are interested in remote classroom attendance via telepresence. The aim is to explore novel forms of interaction mediated by telepresence technologies such as, but not limited to, holograms, Beams, Doubles, Kubis, and robotic arms. We will discuss their impacts and affordances for learning.

Workshop participants are required to submit position papers of two pages in the CHI extended abstract format via email to telepresence4learning@gmail.com. Participants should further include details about their research interests, a short motivation statement describing why they want to participate in this workshop, and their experience with remote attendance research and/or telepresence research. Potential topics for papers may include:

- Emerging telepresence technologies used in learning environments
- Case studies in classrooms and other learning contexts that use telepresence technologies
- Challenges surrounding the use of telepresence technologies in learning environments
- Best practices for educators in the use of telepresence technologies in learning environments
- Ethics and Social norms in classrooms where telepresent learners are included
- Telepresence technologies for students with medical conditions and/or disabilities
- Design methods and principles for the development of telepresence technologies

All submissions will be reviewed based on relevance, diversity of topics, and the quality of the position papers by the workshop organizers. At least one author of each accepted paper must register for the workshop and attend at least one day of the conference.

Please submit your paper via email to email@email.com. More details about the submission for this workshop can be found on our workshop website: www.website.com

The list of accepted papers will be posted on the website and will be available for download.

Important dates:

- Call for participation: December 16, 2021
- Submission deadline: February 24, 2022
- Notification date: TBD (7 days before early registration deadline)
- Camera ready due: TBD (before early registration deadline)

9 POST-WORKSHOP PLANS

With our workshop participants we will produce a report for ACM Interactions highlighting our main findings, proposing an agenda for the future, and incorporating sketches and paper prototypes that address the challenges and opportunities of using telepresence technologies in the context of hybrid learning environments. We will also look to propose a follow-up workshop at CHI or a related venue.

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