Navigating between Different Forms of Embodiment in a Synchronous Hybrid Doctoral Course

William Cain
Michigan State University
East Lansing, MI 48824, USA
cainwil1@msu.edu

Dr. John Bell
Michigan State University
East Lansing, MI 48824, USA
johnbell@msu.edu

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Abstract
UPDATED—24 February 2017. This case study describes how we used a mix of robots and other modes of telepresence to help remote students enrolled in an on-campus doctoral level course stay connected with both people and content during synchronous hybrid class sessions. Overall, we learned that while robotic telepresence and video telepresence each had significant merit for class interaction, navigating robots during transitions was a real drawback. We also learned that quick and seamless transitions were ideal from the point of view of both students and instructors. We also learned it can be challenging to design a system for quick transitions between modes of telepresence that is easy for students and instructors to master while they are focused on the content of the course.

Author Keywords
Synchronous hybrid learning; telepresence; embodiment

ACM Classification Keywords
H.4.3.; H.5.3

Case Study Background

Context: A doctoral level course featuring synchronous hybrid class sessions (physically present and telepresent students taught at the same time)

Design Goal: To help telepresent students maintain their connection to people and content during the synchronous hybrid class sessions

Participants:

- 1 instructor
- 1 teaching assistant
- 10 physically present students
- 5 telepresent students
- 1 Technology Navigator

Introduction

In the spring of 2016, a professor in the Educational Psychology and Educational Technology doctoral program at Michigan State University was scheduled to teach a class on motivation theory. The course was listed as being available to both on-campus and Hybrid (online) students. Fifteen students total enrolled for the course. Ten of these students enrolled as on-campus participants, while the other five enrolled as Hybrid students. The design for this course was that when the students and the instructor would meet together at the same time for class, they would engage in what we call *synchronous hybrid teaching and learning*.

Synchronous hybrid teaching and learning describes real-time educational contexts in which some participants are physically present and some are telepresent. There are many instances when it is necessary and/or advantageous to host a single class for both physically present and telepresent students but doing it well can be challenging. What drives synchronous hybrid learning is the desire to ensure all students are receiving comparable learning experiences regardless of location. The challenge of these models lies in designing and implementing both pedagogical strategies and technological systems that deliver those comparable learning experiences.

Understanding the complexity of synchronous hybrid teaching, the professor for the course on motivation theory reached out to us in the CEPSE/COE Design Studio ("Design Studio") at MSU's College of Education. As an in-house innovation and research unit for teaching and learning with emerging technologies, one of our primary goals has been to help faculty refine the synchronous hybrid models they use and to develop strategies for refinement and innovation. Our expertise in this area is based on years of working with faculty and students to understand what works in synchronous hybrid learning environments and what can be improved. Central elements of this work are the ongoing discussions and feedback sessions with the instructors both prior to their courses and during the semester. We also provide technical assistance during actual class sessions in the form of a Technology Navigator (TechNav), an assistant with both the technological and pedagogical knowledge to help troubleshoot any issues that arise.

Vision for In-Class Interactions

After enlisting our help, the professor described the details of the student enrollment and her vision for the class sessions. The enrolled students (15 total) would be divided into Base Groups of 3 students each. Each group would have 1 telepresent student and 2 physically present students. The class would meet roughly every other week for a total of 7 synchronous hybrid sessions during the semester.

The professor's vision for the 3-hour class sessions was straightforward. Each class would begin with course announcements to the whole class lasting 3-5 minutes. Students would then move to their small Base Groups to discuss and present research reports on the week's course readings, each student getting 5 minutes to present to others in the group. Base Group meetings overall would last around 15-20 minutes. Students would then come together for seminar style, whole class presentations and discussions led by the professor. The professor planned to use PowerPoint slides as the basis for the whole-group meetings, which

Background (cont.)

Technology & Set-up:

- 1 videoconferencing platform (Zoom)
- 5 robotic telepresence devices (Beam)
- 5 student stations
- 1 instructor station
- 1 course website (WordPress) with links to different videoconference sessions

would last 70-90 minutes depending on what needed to be covered.

The professor stressed that one of the activities she liked to do after whole class discussion was to have students visually "model" various concepts of the course using whiteboards in the room. The professor also liked the option of being able to use whiteboards herself during class for different activities such as modeling or brainstorming. Modeling and other collaborative activities would usually last 30-40 minutes. The last 5-10 minutes of class would be used for upcoming course events and a final Base Group checkout.

Facilities and Technologies

Hearing her vision for in-class interactions, we were excited because the course was scheduled to be taught in the College of Education's *virtual flex classroom*. This is a room specially designed to support real-time interactions and collaboration between instructors and students, even when some people are not physically present. Moreover, the virtual flex classroom had in fact been designed for a mix of both small group and whole class interactions, with furniture that could be quickly moved between student stations (for small group work) to the center of the room (for whole class discussions).

We should also note that at the time the professor asked for our help, the Design Studio had just come into possession of a small fleet of *mobile telepresence robots*. The manufacturer (Suitable Technologies) had made these devices available to us by for the purpose of research on robotic telepresence in educational settings. People can log into these robots through the Internet and pilot them around like remote controlled devices. These robots also feature a 17" screen, 1 speaker and 6 mics, 3x digital zoom forward-facing and navigation cameras, and are fully mobile. This means that pilots can drive the devices wherever they need to be in order to see and hear, as well as be seen and be heard, when they cannot be physically present in a particular location. We eagerly anticipated being able to use devices in the course, along with other telepresence technologies like videoconferencing (Zoom) and shared cloud-based documents (Google Docs and Google Slides).

Guiding Framework

Finally, we should note that in our work with faculty and in our own research, we have been developing a framework centered on the concept of embodiment. We use this framework to aid our understanding of potential connections between embodiment (of both people and content), strategies for embodiment, and social presence. Very briefly, we are finding evidence that suggests that higher or enhanced levels of embodiment can lead to higher levels of social presence among students and teachers, and that different modes of embodiment are a better "fit" with some activities than they are with others. Our work with synchronous hybrid learning has helped us realize the impact different modes of embodiment can have when it comes to learning and teaching interactions in the classroom.

Initial Design Solution

With the classroom interactions the professor had in mind, and based on our guiding framework, we developed strategies for the 2 main configurations for the class interactions: *whole class interactions* led by

the instructor; and *small group interactions* led by the students. Briefly, this is what we envisioned for each type of interaction:

Whole class interactions (see Figure 1) – students gathered as a single group to listen to and discuss course concepts with the professor. The students were situated in a semi-circle in the center of the room in positions where they could see the professor and presentation materials on the large monitors. Physically present students were seated in front of tables, while telepresent students piloted robots (Beam) into positions in the circle similar to the physically present students. We felt using robotic telepresence (as compared to video telepresence) for whole class interactions would give telepresent students individual embodiment for greater social presence with the professor, meaning the professor could more easily pay attention to and interact with each student on an individual basis.

Small group interactions (see Figure 2) – physically present students gathered around tables in front of each of the student stations, while telepresent students joined the group via videoconference (Zoom). All students used links on the course website that allowed them to quickly access the appropriate videoconference session for each group (5 links in all for the different sessions listed on the website). Physically present students would "host" the Zoom sessions on the station computer. Individual students were expected to share their presentations on readings and other course activities through the "Share Screen" option in Zoom. For activities involving modeling or other collaboration, students used Google Slides (shared, cloud-based documents that students can access and edit simultaneously). We felt using videoconferencing for small group interactions would work best because students needed to share their presentation materials with each other and screen sharing in Zoom seemed to be much easier and more effective than screen sharing between robots. We also felt using Google Slides was a better option than using traditional whiteboards because it allowed both physically present and telepresent students to be embodied in the same collaborative content space (similar to physically present students gathering around a traditional whiteboard).

Overall, it was our intention to make sure that both physically present students and telepresent students were effectively embodied in ways that they could easily access the content of the course in real-time, be it in the classroom or online. The following is what we initially proposed for a typical class session:

1. **Whole class announcements** – physically present students gather at the center of the room in front of the instructor station in a semi-circle while telepresent students join the group via robots (Beam)
2. **Base Groups** – physically present students from each group go sit at 5 different student stations while telepresent students join their assigned groups via 5 different videoconference sessions (Zoom)
3. **Whole class discussions** – same as whole class announcement, physically present students gather around the center of the room in front of the instructor station in a semi-circle while telepresent students join the group via robots (Beam). Both physically present and telepresent students view PowerPoint presentations on the two front 80" monitors.

Figure 1: Students gathered at the center of the room for whole class interaction. Physically present students are seated at tables in a half-circle in front of the professor (seated far right). Telepresent students are situated in the spaces between tables to give them a view of the professor and individual presence in the group circle.

4. **Small group work** – same as Base Groups, physically present students from each group go sit at 5 different student stations while telepresent students join their assigned groups via 5 different videoconference sessions (Zoom). When necessary, both physically present and telepresent students would use shared Google Slides files to collaboratively model key course concepts that could then be presented and shared with the whole class.

5. **Whole class wrap-up** – same as whole class announcements, physically present and robotically present students gather around the center of the room in front of the instructor station in a semi-circle.

Additional In-Class Support

In terms of supporting faculty in synchronous hybrid learning models, our approach is to have a TechNav present when class is in session and the technologies are in use. The TechNav (the first author) was responsible for setting up the Zoom videoconferencing sessions for both the Base Groups and small-group work sessions. He was also responsible for leading technology orientations that helped online students learn to pilot the robots, as well as troubleshooting potential problems with the devices during class. Finally, he was present in the classroom as well as online to help troubleshoot any technical problems related to both hardware and software issues. Our TechNav was therefore in an excellent position to provide first-hand accounts of the challenges of supporting the different synchronous hybrid configurations.

Figure 2: Initial Base/small group interactions using individual student stations. Students are using Zoom videoconferencing to share presentations within their individual groups. Beam robots can be seen parked in the background.

The Trouble with Transitions

As the first class began, it became apparent that navigating transitions between the 2 main configurations – whole class interactions and small group interactions – presented a challenge for the students. For example, both the physically present and telepresent students (on robots) were asked to gather for a brief introduction to the course. The physically present students quickly moved tables to the center of the room in front of the instructor station and found their seats.

The robotically telepresent students, however, could be seen milling on one side of the room, seemingly unsure as to where to position their robots amid the movement of students and furniture. The professor and the TechNav, as well as some of the physically present students, responded to the uncertainty by verbally helping these students navigate around the room and find different spots to join the class within the half circle. This brief episode indicated that some tasks that are easy for physically present students (like finding one's seat at the beginning of class) were going to be more difficult for robotically telepresent students.

After the course introduction, it was time for the students to go to their Base Groups (small group interactions). The physically present students began moving the tables and chairs to the student stations, while the TechNav turned on the station computers that would host their videoconference sessions. Almost immediately, the robotic telepresent students began to ask, "What do you want us to do with the robots? Should we park them in the docking stations or do you want us to just leave them where they are?" It was a

good question, and very understandable from the students' point of view. Since it took time and effort to get them into position in the first place, wouldn't it be easier for them to just leave them there for when they returned to them again for whole class discussion? On the other hand, if the robots where left where they were last used, would the robots be in way of the physically present students? Again, the central issue was what would work best for everyone in terms of transitioning from one form of embodiment to another, and from one type of interaction to another. At the time, we decided to have the telepresent students return the robots to their docks. The students at this point were becoming more adept at driving the robots around the room but it still seemed like a clumsy process to have them put the devices away before they could transition to videoconferencing.

The Importance of Transitions

Navigating the transitions from one form of telepresence to another was clearly an issue for a couple of important reasons. One reason was time. The professor generally had tightly scripted lesson plans that left little room for lengthy transition times. Indeed, the first few classes always felt tight on time, with the professor rushing through content she would have preferred to cover in more depth. Another reason transitions became important was the impression they made on the students in the room. In 1-1 interviews conducted during and after the course, a number of both the physically present students and the telepresent students expressed frustration with how long it took to go from one configuration to another. One telepresent student expressed her anxiety that the time it took her to transition would take away from the learning experiences of others in the class. Some students even wondered why the robots were being used at all, when videoconferencing telepresence seemed so much easier to establish (1 click access, no moving around) and seemed to do an adequate job of including the telepresent students. Others including the professor, however, appreciated the sense of individual, physically embodied presence the robots gave to the telepresent students but again wished the transitions could go more smoothly.

A Succession of Temporary Solutions

The professor, the TechNav, and the students tried a number of ad hoc solutions during the course to help with the issue of transitioning from one form of telepresent embodiment to another. For example, the professor suggested that classes should start with everyone in their Base Groups, with the telepresent students joining via Zoom. She would then make whole class announcements, speaking loudly enough so that she could be heard through the individual speaker/mics at each of the student stations. This would eliminate the problem of students piloting the robots into position for a few minutes of class announcements, only to have to pilot them back to their docking stations to transition to their Base Groups.

At another point, the professor suggested having the TechNav move the robots into position for a whole class discussion while the students were in their Base Groups, rather than have the students pilot the robots themselves. As the semester went on and the telepresent students got better at piloting the robots to where they needed to go, this option was abandoned but the idea of quickly moving robots into position by hand seemed to stick with people who were physically present in the room. The TechNav observed people

Figure 3: Small group interaction with 2 physically present students and 2 telepresent students. Note that one telepresent student is still using videoconferencing while the other has opted to join the group via robot.

(including himself) on several occasions reaching out to pull or push robots into position when the pilots seemed to be taking too long or were having difficulty finding the right spot.

A number of telepresent students even opted to try and avoid the issue of transitions all together. Some students would stay in the Zoom sessions they used for their Base Group, saying they could see and hear what was happening in the room from their different vantage points at the student stations. Other students opted to start class on the Beam robots and never leave, preferring to pilot them where they needed to be and finding ways to interact that met the present needs (see Figure 3). Even in Base Group and small group work interactions, they would simply share their presentations and collaborate with their classmates through Google Slides. All the students eventually went back to transitioning between the different modes of embodiment but it was still fascinating to watch them experiment with different solutions as they wrestled with this challenge.

Lessons Learned

In the end, we found that navigating or "task switching" between different forms of embodiment is costly in terms of time and mental effort until it becomes automatic or second nature. As we stated earlier, most of the people in the class were satisfied with how both robots and videoconferencing performed in the different configurations as forms of embodiment *while the interactions were taking place*. That is, robotic telepresence was a good fit for whole class interactions, while a combination of videoconferencing and cloud-based shared documents worked well for the small group interactions. What caused the most frustration at first was moving between these 2 configurations and it simply took both the students and professor time and practice to figure out how to do this quickly and with a minimum of fuss. It has been, and continues to be, our informed opinion that it takes time and practice for people to become accustomed to and master different forms of telepresence. And as obvious as this sounds, this is no trivial matter. We know from experience that instructors in synchronous hybrid courses often leave little time in their lesson plans for their students to learn how to use the core technologies, let alone how to use them well. For future iterations of this course and other synchronous hybrid courses, we plan to institute a type of mandatory "driving test" designed to help students not only use individual technologies well, but to transition between different forms of embodiment with speed and ease. We also plan to encourage the instructors we work with to set aside time in the first one or two classes to let synchronous hybrid students practice using the technologies in a low stakes fashion before using them for more critical class activities.

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