Networks, Centers, Observatories, and Field Stations

Best Practices for Virtual Participation in Meetings: Experiences from Synthesis Centers

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The earth environment is a complex system, in which collaborative scientific approaches can provide major benefits by bringing together diverse perspectives, methods, and data, to achieve robust, synthetic understanding (Fig. 1). Face-to-face scientific meetings remain extremely valuable because of the opportunity to build deep mutual trust and understanding, and develop new collaborations and sometimes even lifelong friendships (Alberts 2013, Cooke and Hilton 2015). However, it has been argued that ecologists should be particularly sensitive to the environmental footprint of travel (Fox et al. 2009); such concerns, along with the time demands for travel, particularly for multi-national working groups, provide strong motivation for exploring virtual attendance. While not replacing the richness of face-to-face interactions entirely, it is now feasible to virtually participate in meetings through services that allow video, audio, and file sharing, as well as other Web-enabled communication.

In addition to reducing the environmental impacts of travel, remote participation can also increase social inclusivity, creating a more level playing field for a wider variety of collaborators than might be possible if relying solely on face-to-face meetings (Fraser et al. 2016). Travel is time-intensive and expensive, and even in countries or sectors where financial support for science is comparatively good, funding is declining. Moreover, the complexity of the environmental challenges we face, which often cross borders, demands con-

Fig. 1. Working groups from the National Center for Ecological Analysis and Synthesis (NCEAS) involve participants from all over the world. These connections are visualized from NCEAS publications.

necting people from around the world. For some, remote participation may be the only option, particularly when visa complications create significant transactional costs. For others, virtual attendance can allow for navigating complex professional or personal commitments (such as the care of children or elders). An extensive study on the use of virtual meetings across agencies in Sweden showed that nearly three-quarters of participants reported increased work productivity as well as reduced stress levels (Arnfalk et al. 2016).

Although technology now exists to enable high-quality virtual participation in meetings, participants frequently encounter technological and sociocultural obstacles. For instance, virtual participants sometimes become peripheral collaborators during face-to-face meetings due to inattention on either side or audio-visual difficulties. Meeting organizers and participants are often unfamiliar with techniques that can help minimize these difficulties. Modest changes in our behaviors, communication techniques, and use of technology can vastly improve virtual participation and help to create more positive experiences for virtual and in-person participants.

A central function of synthesis centers is organizing meetings of participants from disparate disciplines and locations (Rodrigo et al. 2013, Lynch et al. 2015). The more diverse the participants are disciplinarily or culturally, the greater the communication challenges and the more important it is to focus on facilitating meetings (Crowston et al. 2015). These challenges become even greater when there are virtual participants in meetings, so careful attention to practices that minimize poor communication can dramatically enhance meeting effectiveness and the quality of the experience. Our goal in this study is, from our considerable experience, to share some lessons learned that promote a higher-quality experience working with communication technologies, and that can move our community toward more inclusive and lower environmental impact modes of collaboration. Specific suggestions are as follows:

For the meeting organizers:

1. Share materials with participants beforehand, for example, an agenda, background documents, and presentations, in case the video connection fails.

2. Specify in advance who will troubleshoot the any technology problems—ideally, this will be an IT (information technology) professional; make sure that person is immediately on hand at the start of the meeting (when most problems happen) and easy to find throughout the meeting so that "downtimes" are minimized.

3. Consider bandwidth issues that could arise when you have more than a few virtual participants; discuss with an IT professional well before the meeting.

4. Test the technology and connections well ahead of time. This helps "build the commitment" of virtual participants and reduces chances of technology failure.

5. Have a backup plan if the technology fails—many organizers set up two ideal options (e.g., Zoom and Skype), and then a backup conference call phone number.

6. Use an external camera, microphone(s), and speakers; do not rely on just the internal capabilities of a personal computer if you are setting up a meeting with more than two in-person

Fig. 2. Participants in a meeting of synthesis center directors that took place at the U.S. Geological Survey's Powell Center for Analysis and Synthesis in September 2016. Remote participants maintained presence both on the large screen, as shown, and via the "robot" shown in Fig. 3. Sometimes time zone conflicts are unavoidable, and the participant shown is in New Zealand where she worked in the meeting between 2am and 10am local time, demonstrating commitment to the group.

attendees. Seeing and hearing your virtual participants is important. Projecting their faces on a prominent screen reminds in-person attendees that others are "in the room" (Fig. 2).

7. Provide the virtual participant a clear view of the room. Some organizations with dedicated meeting space have cameras that can follow the speaker's voice, multiple microphones throughout the room, or the capability for the remote attendee to control the camera or even move about the room as a "robot" (Fig. 3).

8. Screen sharing can allow you to "give the floor" to the remote participant.

9. Create a virtual space for collaborative note-taking (e.g., Etherpad or Google Docs), and be sure to provide the URL to this document in advance of the meeting.

10. If you are drawing on a physical whiteboard, it will be an issue for your participants to see its contents and participate in its use. Currently there are no ideal technical solutions, and solving it still requires some creativity.

11. Articulate clear mechanisms and/or pauses to solicit input and feedback from virtual participants, particularly if they are quiet compared to in-person attendees.

12. Be sensitive to time zones for remote participants when setting up the meeting.

13. Task an in-person participant with looking after the remote participants—stopping the chatter that a remote participant cannot hear, or indicating when a remote participant is having trouble getting attention.

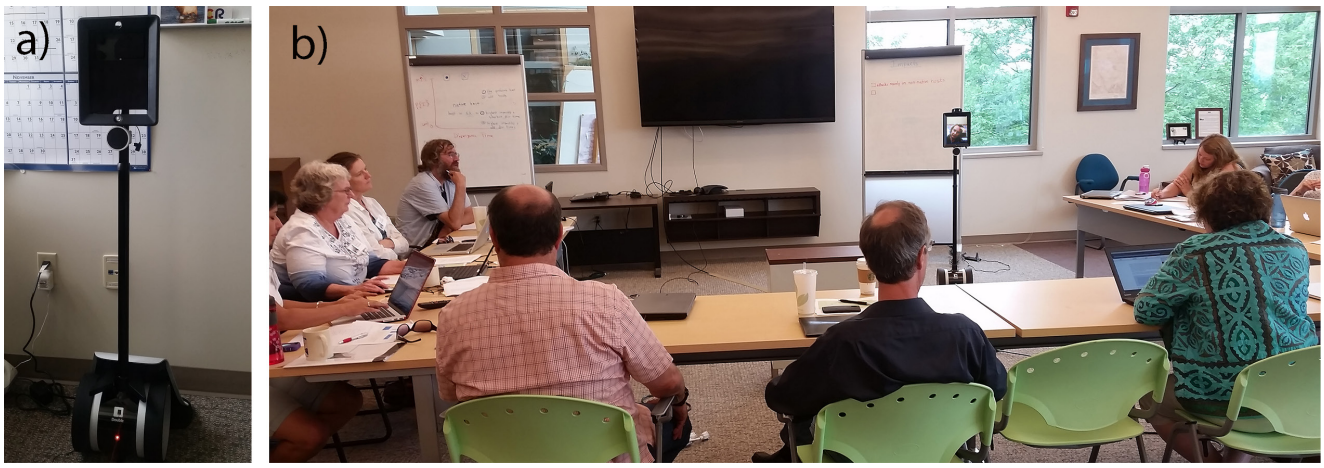

Fig. 3. (a) The Powell Center's "robot" that (b) allows remote participants to move around the room.

14. If you are planning a series of meetings, consider beginning with a face-to-face meeting to establish trust and division of labor prior to moving to a virtual platform.

15. When a group meeting moves to breakout groups, be sure you plan for the remote participants to follow a group with their interests. This can be achieved through designated smaller rooms enabled for video and audio, or simply a laptop carried into the room if the breakout group is 2–3 people.

16. For interdisciplinary collaborations, be aware that members of different fields may have different levels of conversance and experience with the use of virtual technologies.

For the virtual attendees:

1. Overall, treat it like a meeting where you are all attending together in a physical space. This means putting yourself in an office setting (at work or home), even dressing up a bit so that it feels more formal (like a meeting). Shut down your other activities and be there—maintain presence of mind and attendance.

2. Use available technology to maximize the experience on your side—a camera so your face is clearly shown to attendees and headphones with a good microphone.

3. Choose a location with the best possible Internet connection—a slow connection on your end can erode the experience for everyone.

4. Test your connection, and familiarize yourself with the video-teleconferencing software before the meeting. You may need to download or update software, or use a different headphone system to optimize your audio fidelity. You can usually test this in advance with a technology support person at the hosting institution, or often there is a "test connection" hosted on the video-teleconferencing software's Web site.

5. Know how to mute your microphone when you are not speaking. Whenever possible, join the meeting from places that are unlikely to have much background noise.

6. Choose a seating location that is not heavily backlit, for example, not having a bright window behind you.

7. If you must leave the meeting for some reason, let the group know that you will be leaving, and if applicable, when you will be back. This will help with organizing discussions in which you may play an integral role.

For all participants:

1. Nonverbal cues are well known to influence trust-building, and because remote participants typically are not privy to these, brief informal (often social) exchanges with virtual participants contributes to stronger relationships and more productive teamwork.

2. Periodic repeating/rephrasing key points, particularly those made by the virtual participants, can enhance mutual understanding and a sense of inclusivity.

3. When the virtual participant is speaking, look in the direction of the camera that is transmitting video to the participant; this is good to do periodically even when the participant is not speaking.

4. Learn and be comfortable with using the technology well ahead of time.

Conclusions

New technologies have clearly transformed the conduct and social organization of scientific collaboration (Olson and Olson 2000, Cummings et al. 2008, Olson and Zimmerman 2008), particularly as the size of scientific teams and the spatial distribution of their participants continue to grow (Wuchty et al. 2007). Technologies devoted to virtual forms of collaboration are becoming more sophisticated but have yet to achieve the richness and depth of face-to-face interactions in terms of efficiency of communication, transmitting tacit forms of scientific knowledge, and establishing trust, cohesion, continuity of purpose, and clear working roles (Cooke and Hilton 2015). Virtual collaborations are not a panacea and these technologies are a long way from entirely replacing face-to-face intellectual engagement, but properly used and aided and abetted by co-located meetings, they can provide a solid foundation for a more productive and inclusive scientific teamwork.

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