Supporting Communication Accessibility and Inclusion in Online Meetings for Persons with Complex Communication Access Needs

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Abstract

Communication is said to be one of the greatest predictors of quality of life and life expectancy. One's ability to effectively communicate largely impacts their well-being, interpersonal relationships, and participation in society. The global transition to online meetings resulting from the COVID-19 pandemic, clarified that the ways we meet online and stay connected with our friends, families, and communities, are fundamentally concerned with communication. Therefore, ensuring access to communication when meeting online is more important than ever. Whether online or in-person, interactions can be hard for people with disabilities that affect their communication. Despite the advancement of communication disability rights and web accessibility, what remains unknown are the impacts of online meetings on communication access for persons with complex communication access needs (CCAN)—those with communication disabilities who may or may not use augmentative and alternative communication (AAC). Further complicating this gap is the limited availability of guidance and strategies for supporting CCAN throughout the process of designing, organizing, and running online meetings. These gaps revealed an important design opportunity and area for consideration for the study.

This community-based, participatory research study explores how online sessions can be designed to support complex communication access needs. The use of a community-led co-design approach resulted in a deeper understanding of the individual communication accessibility requirements, barriers, and lived experiences of persons who use AAC, within the online meeting context. Participants ('co-designers') designed and took part in collaborative design sessions aimed at developing ideas for supporting communication access and inclusion throughout the process of meeting online. Through cross-community collaboration, we co-designed an open-source communication access toolkit for online meetings. The toolkit includes accessibility guidelines with a protocol for holding accessible and inclusive online sessions; suggested accessibility features and plugins for meeting platforms; and a document template for participants to share their responses. The design outcomes provide guidance to the general population on how we might ensure that online meetings of all forms are inclusive and accessible for diverse and complex communicators, as we all have a right to communicate with dignity in ways where we understand and are understood.

Keywords: communication access; inclusive design; online meetings; communication disabilities; complex communication access needs; augmentative and alternative communication; AAC; communication access rights; ICT accessibility; community-led co-design

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[1] Full names withheld for confidentiality.

Dedication

This research is dedicated to the international Augmentative and Alternative Communication (AAC) community and the disability community at large.

Author's Note

Dear reader and/or listener,

The pages in this report were breathed into existence through the stories, lived experiences, insights, expertise, knowledge, and collective energy of a diverse community of communicators and collaborators. We connected online across time zones and virtual space to explore the crux of online meetings. By the end of this report, it is my hope that you will have a deeper understanding of the importance of supporting and advancing communication accessibility within the online meeting context.

To the student researcher exploring the wondrous intersections of augmentative and alternative communication (AAC), communication accessibility, and inclusive design, treat this report as your personal guide. Bookmark it, reference it, and cite it if you please, as you continue to peel back the complex and beautiful layers of communication, online and offline.

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List of Acronyms and Terms

AAC. Augmentative and alternative communication
CCAN. Complex communication access needs
CCN. Complex communication needs
ICT. Information communication technology
SLCD. Speech, language, and communication disability

“The silence of speechlessness is never golden. We all need to communicate and connect with each other—not just in one way, but also in as many ways possible. It is a basic human need, a basic human right. And much more than this, it is a basic human power…”

B. Williams, 2000, p. 248, as cited in Light & McNaughton, 2014

1. Introduction

1.1 Personal motivation and problem space

Before venturing into the pages of this paper, I would like to first set the scene. This section outlines my motivation for pursuing this community-based research project. It details how I arrived here and highlights the significance of inclusive design in framing my research. As you go through this paper, I encourage you to keep in mind that I am a student first. Meaning, I approached this research through the lens of a learner. In keeping with the spirit of inclusive design, which intentionally blurs the distinctions between the learner and educator, and non-expert and expert (Pullin et al., 2017), this research, too, blurs the distinction between the researcher and participant (referred to herein as "co-designer"). As co-designers, we are also learners, sharing knowledge and learning from one another toward a shared goal.

I approached this research through the notion of "practicing what I seek to understand" to the best of my ability. At the heart of this project, and embedded within its digital fabric, is the desire to understand and explore the many facets and faces of communication by examining the ways we meet online. I wanted to tackle a practical problem pertaining to communication access that is currently affecting many in the disability community, where the findings and outcomes could be applied right away, throughout the duration of the current research project, and by the broader public. Rooted in an inclusive design practice, which is open, transparent, and collaborative by nature (Pullin et al., 2017), this research, above all, is motivated by communication, connection, collaboration, and community. As someone who experiences communication challenges due to anxiety disorder, I understand the importance of having access to multiple modalities of communication and being able to communicate effectively in the ways that are most comfortable for me. I understand this especially in the context of social settings, such as online meetings, as it impacts the meaningful connections, I am able to form with people. I wish to dig deeper into the inaccessible spaces of online meetings, and information communication technologies (ICTs) at large. I wish to examine not only the online spaces in which we gather, but also the processes and communicative methods we use to access those spaces. I wish to better understand how barriers to effective communication in the online meeting context impact our interpersonal interactions, with the overall aim to remove and prevent barriers to ICT accessibility.

This work is an initial planting of a seed that will hopefully grow to inspire more conversations around communication access in the online meeting context, and the importance of providing people with alternative ways to express themselves, participate, and ultimately connect with

others when gathering online. It is intended to provide guidance to the general population on how we might ensure that online meetings and spaces of all forms are designed to accommodate and support diverse and complex communication (access) needs, because we all have a right to communicate with dignity in a way where we are understood.

Communicating and connecting online in a global pandemic

Communication is said to be one of the greatest predictors of quality of life and life expectancy (Fisher & Roccotagliata, 2017). One's ability to effectively communicate primarily impacts their well-being, interpersonal relationships, and participation in society. The foundation of all human interaction involves some form of communication, whether that is through voice, symbols, numbers, pictures, or signs (Neamtu et al., 2019, p.1). In the wake of the COVID-19 pandemic, the ways we interacted with one another changed almost overnight. Our routines were turned upside down. Some of us had curfews, some of us worked from home, and some of us were instructed to stay indoors and self-isolate. The world was forced to make a great migration online where many of us had no choice but to meet and communicate, almost entirely, through information communication technologies such as online communication and collaboration tools. Video-conferencing platforms became hot commodities. Zoom[2], Microsoft Teams[3], Google Meet[4], and Slack[5] all rose in prominence, as well as free, open-source alternatives like Jitsi[6]. Other video meeting platforms like Gather[7] also grew in popularity as many of us sought out new ways of connecting with friends, family, colleagues, and our communities during this time.

The global transition to online meetings resulting from the COVID-19 pandemic clarified that the ways we meet online and stay connected with our friends, families, and communities, are fundamentally concerned with communication. During the initial waves of the pandemic, communication was greatly diminished due to decreased human contact. As a result, many people turned to technology to communicate with their loved ones, communities, healthcare services, and colleagues, both when meeting offline and online. This was during a time of mass social distancing where staying connected, socially, was more important than ever before, especially for maintaining our mental and physical health. As our post-pandemic world inches slowly back to a new "normal", the use of online and hybrid meeting models continue to rise (

[2] https://zoom.us/
[3] https://www.microsoft.com/en-ca/microsoft-teams/group-chat-software
[4] https://meet.google.com/
[5] https://slack.com/
[6] https://meet.jit.si/
[7] https://gather.town/

Global Business Travel Association [GBTA], 2022). For example, a new report published by Microsoft says that as of February 2022, the weekly time spent in online meetings by the average Microsoft Teams user increased over 252% since February 2020 (Microsoft, 2020). The report also states that the number of weekly online meetings per person increased 153%. It is reasonable to assume that online and hybrid forms of meeting may very well be a permanent fixture in how we communicate and stay connected in our communities going forward. This raises an important question about communication accessibility, specifically, who has access to these online meeting spaces and do they have access to effective communication?

Whether online or in-person, interactions can be challenging for persons with disabilities that affect their communication (Neamtu et al., 2019). According to Communication Disabilities Access Canada (CDAC) (2022-a), over 440,000 Canadians have significant speech, language and communication disabilities (SLCDs)[8] that are not caused by significant hearing loss. Having a significant communication disability can affect a person's ability to speak, understand what others are saying, read and/or write (CDAC, 2022-a, para. 6). Many persons with SLCDs have complex communication needs (CCN), and experience ongoing barriers to participating in educational, vocational, healthcare, and community environments (Light & McNaughton, 2015; Dee-Price, 2020). The term 'complex communication needs' refers to individuals with limited or no use of functional spoken language to meet their daily communication needs (Beukelman and Mirenda, 2013, as cited in Dee-Price, 2019). As a result, they may require communication supports to help them communicate effectively in different ways. These communication methods are commonly referred to as augmentative and alternative communication (AAC), which include all the forms of communication (other than speech) that are used by an individual to help them express thoughts, needs, wants, ideas, and feelings (American Speech-Language-Hearing Association [ASHA], 2022). AAC includes any communication devices, systems, strategies and tools that replace or support natural speech (AssistiveWare, 2014). It is considered "augmentative" when used to supplement or support existing speech, "alternative" when speech is absent or non-functional, or AAC can also be temporary when used by patients postoperatively in intensive care (Elsahar et al., 2019; ASHA, 2022). The main goal of AAC is to support people with CCN (and their families) in the use of communication systems and devices (Dee-Price, 2019), as well as facilitate communication and independence for the person who is using AAC (Icommunicate Therapy, 2022).

As we continue to meet online, now and well into the foreseeable future, understanding, documenting, and supporting complex communication access needs (CCAN) is more important

[8] In reference to speech, language, and communication disabilities, Elsahar et al. (2019) states that, "in the broad context of speech and language, speech is often associated with the motor movements responsible for the production of spoken words, whereas language is associated with the cognitive processing skills of communication." (p. 1)

than ever. In addition, ensuring that persons with complex communication needs are not left behind due to persisting barriers to accessing online meeting spaces. Access today means having ways to participate actively and equally alongside others in the community. This requires an ability to communicate in authentic and meaningful ways (Augmentative Communication, 2008), which is a primary function that online meetings serve. As the evidence states, people with severe disabilities have the right to communicate (ASHA, 1992). Therefore, supporting communication access within the online meeting context is both a matter of human and civil rights, as all people, regardless of their age, status, ability, or communicative capacity, have the right to receive and convey messages, to hold opinions, and express themselves in daily life (ASHA, 1992; Dee-Price, 2021). As stated in Light & McNaughton (2014), without access to effective communication, "individuals with complex communication needs are consigned to live their lives with minimal means to express needs and wants, develop social relationships, and exchange information with others" (p. 1).

While it may be true that the use of online meeting platforms during the pandemic enabled increased participation, diversity and inclusion for many on a global scale (Wu et al., 2021), it also posed new challenges for people with SLCDs, and exacerbated existing ones. In a 2021 survey on the impacts of COVID-19 on communication accessibility for adults with hearing loss (Poon et al., 2021), respondents reported having trouble using the chat box in virtual meeting platforms, as well as poor captioning services (or none), and no access to recordings or transcripts. When asked what could be improved when communicating with others through video calls, respondents reported that three key areas for improvement include: Microphone quality (61%), Captioning available (60%), and Internet connection quality (59%). Similarly, when asked what could be improved to make it easier to understand other people at these virtual events, respondents indicated that key areas for improvement to facilitate understanding of others at virtual events include: Microphone quality (65%), Captioning available (65%), and Internet connection quality (58%). These findings highlight the importance of supporting effective communication in both real-time and recorded formats when meeting online (Poon et al., 2021).

Yet, beyond this initial understanding, it is unknown what the impacts of meeting online are on persons with CCAN. A further consideration that remains unexplored is how persons with communication disabilities who may or may not use AAC are impacted by the additional layer of complexity that the online meeting context poses on their communication access methods and support needs, especially when compared to meeting in-person. There have been increasing efforts in recent years to raise awareness, and develop programs, resources, standards, and guidelines to improve communication access for people with communication disabilities (Speech Pathology Australia, 2020). However, sufficient guidance and strategies for supporting CCAN when designing, organizing, and moderating online meetings remain limited.

1.2 Design opportunity

A deeper, more intimate understanding of access (Mingus, 2011) is needed; one that is informed by the individual communication barriers and access and support needs among AAC users when meeting online, to better support their full participation when connecting with their communities. Without this understanding, we risk perpetuating cycles of exclusion among those that are most likely to experience the greatest barriers within the online meeting context. Such an understanding can only derive from persons with CCAN, whose thoughts, perspectives, and insights are often not collected and, ultimately, excluded from qualitative research on the grounds that they cannot 'speak for themselves' (Teachman et al., 2014; Dee-Price, 2021). In addition, people who use AAC frequently experience co-existing and complex challenges to involvement in developing research outcomes that reflect their diverse needs (Broomfield et al., 2021). This is despite the advancement of disability rights and augmentative and alternative communication (Dee-Price, 2019). Further complicating this gap is the limited availability of guidance on what their individual communication access needs are in the online meeting context, and strategies on how best to support them. These gaps revealed an important design opportunity and area of consideration for the current study.

Thus, the research seeks to understand the diverse and CCAN of persons with SLCDs who may or may not use AAC when accessing online meetings, as well as help remove barriers to online meeting spaces by providing resources and strategies to support communication in alternative ways (through alternative formats). In this study, I seek to extend and reframe our collective understanding of communication access in an online meeting context, and how to support CCAN, from the perspectives of adults with communication disabilities who use AAC, and members from the AAC community. Mia Mingus' (2017) concept of access intimacy provided the conceptual framing for this research. Mingus defines access intimacy as, "an elusive, hard to describe feeling when someone else 'gets' your access needs. The kind of eerie comfort that your disabled self feels with someone on a purely access level." It can be thought of as "a mode of relation between disabled people or between disabled and non-disabled people that can be born of concerted cultivation or instantly intimated and which centrally concerns the feeling of someone genuinely understanding and anticipating another person's access needs" (Valentine, 2021, para. 5). Access intimacy as a concept challenges, what Mingus calls, "able bodied supremacy" by valuing disability and intentionally moving toward it (Mingus, 2017). It asserts that there is value in disabled people's lived experiences. As Mingus (2017) states, "access intimacy is shared work by all people involved, it is no longer the familiar story of disabled people having to do all the work to build the conversations and piece together the relationship". Applying an individual needs-based approach through a community-based lens, informed by access intimacy, supports diversity and inclusion. In addition, research about

CCAN, by people who have CCAN is part of inclusive research practices (Pullin et al., 2017). Inclusive design recognizes and supports diversity and its associated complexity (Pullin et al., 2017). It values the lived experiences of people as expertise, and thus provides the necessary framework for understanding and addressing CCAN at the individual and community level.

The project defines communication access based on Communication Disabilities Access Canada's (CDAC) definition (CDAC, 2022-b):

- Communication methods include speech, gestures, body language, writing, drawing, pictures, symbol and letter boards, speech-generating devices, as well as human services such as sign language interpreting, captioning in real time, informal and formal communication assistance.
- Communication access refers to policies and practices within service entities to ensure that people understand what is said or written and can communicate what they want to convey in face-to-face and telephone interactions, teleconferencing, online learning, meetings, conferences, public consultations, reading (print, websites and digital), and writing (forms, signatures, surveys, and notetaking).

Using the definition of communication as the process of understanding and sharing meaning, the study sought to understand structures of communication access for online meetings from a holistic perspective, which considers the stages before, during, and after attending online meetings, as well as the accessibility and support needs at each stage. A holistic view acknowledges that support for communication accessibility needs to extend beyond the online meeting space itself. Each step of the participant journey requires the use of different forms of communication. Consequently, each participant may have unique communication needs which must be considered when organizing, hosting, facilitating, and presenting at online meetings. The study considers potential barriers in the process of getting to the meeting; the individual communication access needs of each participant at each stage; and the specific accommodations that they may require to actively participate in the meeting. In the current study, the use of the term "complex communication access needs" in the online meeting context encompasses both the: (1) individual communication access (or participation) needs, and (2) communication support needs (or accommodations) of persons with SLCDs and those who use AAC.

2. Research summary

2.1 Research aim

This Master's Research Project (MRP) seeks to address the gaps in research on the impact of meeting online on communication access for persons with speech, language, and communication disabilities (SLCDs) who may or may not use AAC; and increase awareness around supporting complex communication access needs (CCAN) within the online meeting context.

2.2 Purpose

To develop and co-design ideas for supporting CCAN in online meetings with members from the AAC community.

2.3 Research questions

1. How can we design accessible and inclusive online sessions that support CCAN?
2. How can we further develop existing guidance for supporting CCAN within the online meeting context?

2.4 Objectives

1. To gain a deeper understanding of the individual communication access needs, barriers, and lived experiences of persons with SLCDs and AAC users, when accessing online meeting spaces, like Zoom and Google Docs.
2. To apply our understanding to evaluate existing guidelines and develop suggested practices for supporting CCAN, at an individual and community level.

2.4 Contributions of this work

This research comes at an important time in history where the world is in a transitional period resulting from the COVID-19 pandemic. As we continue to shift toward more open, online and hybrid forms of meeting, ensuring proper communication access support for people with CCAN is vital. The implications of this work could be significant, as it could inform the future design and improvements of online meetings and events, conferences, meeting platforms, AAC technology, and accessibility guidelines, standards, and legislation. It also has implications for

the research community wishing to conduct research in an online setting with participants who have communication disabilities and may require special accommodations to participate.

As the literature revealed, there is a lack of existing guidance, protocols, and procedures on how to support CCAN within online meeting spaces, and throughout the process of designing and facilitating online sessions. Through a collaborative, community-led design process, co-designers helped to create an initial draft of communication access guidance and designed concepts for supporting communication access and inclusion in online meetings for persons with complex communication needs. The resulting contributions of this research are as follows:

- A deeper understanding of the dimensions of the online meeting context and its implications on communication access, and persons with CCAN. This contributes to a broader understanding of online meeting spaces and what it means to have access to communicate, meet, and connect online, as well as the alternate methods, tools, and strategies we can use to support and advance accessibility in these spaces.
- Community-designed accessibility guidelines for supporting CCAN when meeting online. The guidelines present a model (or protocol) for meeting organizers, moderators, presenters, and chat box readers to follow when designing and holding accessible and inclusive online meetings, webinars, and presentations.
- Accessibility features and plugins for existing and future online meeting platforms, and a template for a collaborative document for supporting asynchronous participation in online sessions.
- An open source[9] communication access toolkit for online meetings. The toolkit is intended to live online and serve as an educational tool for the wider population on how to support CCAN throughout the process of meeting online.
- An evaluation of existing accessibility guidelines for online sessions in accordance with five identified phases for accessing online meetings based on the lived experiences of co-designers.

2.5 Scope

The focus of the current study is not to generalize across a large group of people, nor is it interested in creating a standardized definition of communication access in online meetings. The current study looks at a diversity of perspectives and approaches to provide a community-designed model for accessible and inclusive online meetings based on the individual needs,

[9] Open source software is "code that is designed to be publicly accessible, which means anyone can see, modify, and share the code. Open source software is developed in a decentralized and collaborative way, and relies on peer review and community production." (RedHat, 2019, para. 1-2)

perspectives, and lived experiences of people belonging to the AAC community and those who have disabilities affecting their communication. This approach recognizes the complex and ever-changing nature of individuals and their circumstances. That is why this project never sets out to prescribe guidelines, but rather guidance in the form of suggested practices to consider following when organizing or attending online meetings. As such, the study centers on developing this guidance with the community, and any resulting ideas for improving communication access and inclusion for online meetings are conceptualized in the form of low-fidelity prototypes, as opposed to a web application, for example.

While considerations for communication accessibility and inclusion are important with offline meetings as well, this study focuses exclusively on the "online meeting context". That is, any form of socially driven meeting or gathering that takes place in a web-based environment with the aim of preserving the same aspects of social connection that an offline meeting may afford. There are many ways of meeting online; however, for the purpose of this research we explore two ways: asynchronous and synchronous online meetings, in particular ones that take place over the internet, using video conferencing and video calling software, including platforms like Zoom, MS Teams, Google Meet, and Jitsi Meet. The current paper will not discuss in detail chat-based social and community gathering platforms like Reddit[10], Slack, Discord[11], WhatsApp[12], and Messenger. As such, online meetings that are held using video conference platforms will herein be referred to as "online meetings". The following literature review provides a summary of communication and communication access, the design dimensions of online meeting spaces, as well as the known barriers of persons with disabilities affecting their communication and persons who use AAC, and why a better understanding of individuals' accessibility requirements when accessing online meetings is needed, at an individual and community level.

[10] https://www.reddit.com/
[11] https://discord.com/
[12] https://www.whatsapp.com/

3. Literature Review

This chapter gives a general overview of the field and concepts relevant to the research and design objective at hand. I conclude that there is a lack of existing guidance, protocols, and procedures on how to support complex communication access needs (CCAN) within online meeting spaces, and throughout the process of designing and facilitating online sessions. I will return to this at the end. First, I will elaborate the concepts of communication and communication access and how we might understand them in the context of online meetings. Second, I will discuss known accessibility barriers experienced by persons with communication disabilities who may or may not use AAC. Lastly, this chapter defines relevant dimensions of the online meeting context and its implications for communication access.

3.1 What is communication?

The foundation of human interaction involves some form of communication (Neamtu et al., 2019). It is the expressive tool that all living beings use to interact and connect with the world around them. At a high level, communication is the process of understanding and sharing meaning (Dee-Price, 2021). It is an interactive, two-way process that includes both understanding and being understood (CDAC, 2022-b), and involves both the sharing and exchanging of knowledge and information. Communication is rooted in the Latin word communis or 'common', which literally translates to 'shared by all' (Online Etymology Dictionary, 2021). The "co" in communication means 'together', which implies that communication, at its core, is always somewhat of a shared act, "by which one person gives to or receives from another person information about that person's needs, desires, perceptions, knowledge, or effective states" (ASHA, 1992).

Communication can be intentional or unintentional; it may involve conventional signals (like nodding "yes" or "no" or pointing) or unconventional signals (like body movements, vocalizations, simple gestures, and facial expressions); it may be linguistic or nonlinguistic; and may occur through different modes of conveying meaning including linguistic, aural, spatial, gestural, and visual modes (Rowland, 1990; ASHA, 1992; Bourgeois et al., 2010; Fillmore, 2016). There are at least five identified purposes of communicative interactions: 1) communication of needs or wants, 2) information transfer, 3) social closeness, 4) social etiquette, and 5) to communicate with oneself or conduct an internal dialogue (Light, 1988; Light & McNaughton, 2014).

In order to design for the complex process of communication, one must first understand it. Communication models shed light on the development of communication and emphasize different parts of the communication process. A communication model is a simplified visual

representation of the different parts and complex interactions of a communication process. According to Al-Fedaghi, Alsaqa, & Fadel (2009), these models help standardize our understanding of communication by providing a way for us to:

1. question and interpret communication systems that are diverse in their nature and purpose
2. provide order and structure to complex communication encounters
3. develop insights into hypothetical ideas and relationships involved in communication

The following sections provide a brief overview of the three most common communication models: Linear (or transmission), Interactional, and Transactional. I also touch on a relevant AAC model that can support our understanding of communicative interactions involving AAC.

Linear communication model

Linear models view communication as a one-way, linear process. Shannon and Weaver's (1949) transmission model famously describes communication as a linear process in which a message (information) is transmitted (sent) from a sender (speaker) to a receiver (listener). In the Shannon-Weaver (1949) model, the sender is the source of the message being sent. The message is information (data), consisting of the sounds, words, or behaviours in a communication interaction. The receiver (listener) of the message is then responsible for interpreting the message (Kuznar & Yager, 2020). Shannon and Weaver (1949) also introduced "noise" as an obstacle to successful transmission in the communication process. Noise refers to any internal or external interruption in the communication channel or distortion of the intended message (Kuznar & Yager, 2020). However, there are notable limitations of the linear model as it does not take into account the dynamic nature of communication in action. When adapted to human communication, "the model proposes a speaker consisting only of a mind (the source) and a mouth (the transmitter), and a listener consisting only of ears (the receiver) and a mind (the destination). It therefore …fails to reflect the many intermediate cognitive processing stages" (Al-Fedaghi et al., 2009).

Interactional communication model

The interaction model views communication as an interaction in which a message is sent and then followed by a reaction (feedback), which is then followed by another reaction, and so on. From this view, communication is defined as producing conversations and interactions within physical and psychological contexts. With this model, senders and receivers alternate roles and can be thought of more as communicators, because messages are sent and received by all actors (Kuznar & Yager, 2020). Feedback involves a receiver sending a message in response to a

sender. Feedback can be verbal, such as saying thank you; nonverbal, such as waving or shaking someone's hand; unintentional; and subconscious. The incorporation of feedback and flow within the interactive model makes communication a more interactive, two-way process (i.e., creating a feedback loop), rather than illustrating communication as a linear, one-way process. The interactional model also emphasizes how a communicator's social context and close social networks influence how a message is perceived (Kuznar & Yager, 2020).

Transactional communication model

Dean Barnlund proposed a transactional model of simultaneous and cumulative interaction of cues (Barnlund, 1970 as cited in Kuznar & Yager, 2020), which expands on both the linear model, in which meaning is sent from one person to another, as well as the interactional model, which views communication as a reciprocal process in which communicators' interactions influence one another and meaning (understanding) is conveyed through conversation (feedback). One of the main components of Barnlund's transactional model is the introduction of cues, which refer to signs (signals) for doing or saying something. As per Barnlund's model, there are public cues, private cues, and behavioral cues. In the transactional model, communication takes place to exchange messages, but also to form relationships and engage with people in dialogue to build communities. The transactional model views communication as a simultaneous transaction (i.e., a cooperative action) in which communicators co-design a shared meaning of reality, and each communication encounter is framed and influenced by social, relational, and cultural contexts. Communication can therefore be viewed as the cumulative "evolution of meaning" (Barnlund, 1970 as cited in Kuznar & Yager, 2020) that continuously shapes the realities of each communicator, beyond the individual communication encounter (Ashman, 2018). Within the context of online meetings that take place through video-conferencing technology, we are dealing with transactional communication as we are constantly engaging in various exchanges or interactions between people and with the meeting environment.

AAC model

Lloyd et al. (1990) proposed the widely accepted model for augmentative and alternative communication (AAC) to describe the AAC process; mainly, what happens during a communicative interaction when one or both participants use AAC methods. Like general communication models, the AAC model includes a sender, a message, a receiver, feedback, and a communication environment (Politano, 2007). The AAC model, however, presents a full picture of the components of an interaction involving AAC, such as alteration of feedback, interfacing with the environment, means of representation, selection, transmission of a

message, and increased potential for message distortion, including the communication environment, and the relationship between factors during the interaction. The model acknowledges that speech is not the only method of message transmission; rather messages are transmitted through multiple modalities (e.g., facial expressions, gestures, touch, graphic symbols, etc.) and typically include more than one modality at a time. In short, the model shows the complexity of message transmission when one or both individuals are using AAC methods. The model places message transmission in the context of a physical environment and a social climate which creates additional variables that can impact the interaction (Politano, 2007). This model greatly influenced a new way of thinking about the field of AAC as it created a framework for future research and clinical practice in the field. Moreover, it creates a framework for exploring communicative interactions involving AAC within an online meeting context.

This section discussed the different models of communication, namely, the linear (transmission) model, interactional model, the transactional model, and an AAC model. The models highlight core features of a communicative interaction such as a sender, a message, a receiver, feedback, and a communication environment (Politano, 2007). Examining these conceptual models even at a high level is of relevance to this research because to design for communication, it is important to invest in a better understanding of it and its process. Moreover, they provide a framework for exploring communicative interactions, especially those involving AAC, within the context of online meetings.

3.2 What is communication access?

Communication Disabilities Access Canada (CDAC) (2022-b) defines communication access as:

> Policies and practices within service entities to ensure that people understand what is said or written and can communicate what they want to convey in face-to-face and telephone interactions, teleconferencing, online learning, meetings, conferences, public consultations, reading (print, websites and digital), and writing (forms, signatures, surveys and notetaking). (2022, para. 2)

Accessibility commonly refers to the practice of designing products, devices, services, or environments for people who experience disabilities (Accessibility Services Canada, 2016). The project pairs this widely accepted understanding of accessibility with a more rudimentary understanding of accessibility, to highlight the base elements of the term. Merriam-Webster (2022-a) defines accessibility as something that is capable of being reached or easy to speak to or deal with; used or seen; understood or appreciated; and influenced. Something that is accessible should be easily used by people with disabilities or adapted for use by people with disabilities (Merriam-Webster, 2022-a).

When applying this view of accessibility to the context of online meetings, for an online meeting to be considered accessible, attendees with disabilities should be able to:

- reach and enter the online meeting space
- use elements of the meeting space and participate in the meeting
- understand and be understood in the meeting

In addition, for an online meeting to be accessible means it is designed to work for as many people as possible, regardless of their hardware, software, language, location, or ability. This means it is accessible to people with a diverse range of hearing, movement, sight, cognitive, and communication ability (Web Accessibility Initiative [WAI], 2005). However, meeting spaces and platforms that are designed and developed with accessibility barriers, and without consideration for individual access and support needs, make these spaces difficult or impossible for some people to use (WAI, 2005).

Communication access needs and support needs

In the context of meeting online, communication access applies to both the process of getting to the meeting as well as fully participating in the meeting. One's ability to access and participate is impacted by their access needs and the level of communication support that is provided before, during, and after the meeting.

- Access needs are anything a person requires in order to communicate, learn, and fully participate in their environment or community (Youth Friendly, 2021). Access needs can also be thought of as accommodations—alterations or adjustments—that are required for persons with disabilities to be able to enter and be in certain spaces, and effectively take part in certain functions or activities," (Valentine, 2021), such as a meeting or an event. Access needs can be physical or emotional and do not just apply to persons with disabilities. Everyone has access needs, which may be met or unmet depending on the situation (Youth Friendly, 2021).
- Communication support needs are what some individuals have if they need support with understanding, expressing themselves, or interacting with others (The Scottish Government, 2011). In addition, individuals with communication support needs may also use computers or other devices with speech output, word prediction, or word processing software. Some people may use Augmentative or Alternative Communication (AAC) devices, which allow users to communicate by typing or through pre-programmed words, phrases, or pictorial symbols. Others may use communication boards, which display letters, words, phrases, or symbols the user can point to (Kovac, 2018). To meet their needs, people, organizations, and service entities have to be

> flexible in how they communicate and the methods that they use, for example by providing information in accessible formats such as audio instead of written form.

According to Valentine, (2021), “meeting access needs involves meeting a standard of reasonable accommodation as described in various human rights policies…Responsibility for claiming access needs typically falls to disabled individuals or an advocate while governmental policies aim to hold public spaces like businesses, schools, local governments, and other organizations accountable for providing ‘reasonable accommodations’” (para. 2). This contrasts with disability justice activism which understands access as, “collective, ongoing, iterative, and relational” (Valentine, 2021). The social model of disability holds the view that disability is a result of barriers created by society, rather than the result of a person’s impairment (Oliver, 2004). Moreover, it posits that it is society’s disabling conditions that prevent people with impairments from participating (Oliver, 2004). Therefore, following this view, it is the responsibility of meeting organizers, hosts, facilitators, AAC manufacturers, and developers of online meeting platforms to consider the communication access needs of their diverse audiences and provide the necessary accommodations to enable better access to online social spaces and information communication technologies. Supporting communication access for online meetings ensures that people who have communication difficulties can access and be included in their communities, and actively participate in community life, in the ways that are most comfortable for them, so they may communicate with dignity in a way where they are understood.

Communication access rights and legislation

We all communicate in various ways, but the effectiveness and efficiency of our communication depend on many personal and environmental factors (ASHA, 1992; Johnston, 2009). Moreover, individuals with severe disabilities may use unconventional and individualized ways to communicate their emotions (AAC Community, 2020). It is the responsibility of all those who communicate with individuals with severe disabilities, to recognize their unique communicative acts and ensure that we are supporting their effective communication in every setting, including online meetings (ASHA, 1992). Like everyone, people with SLCDs have a right to accessible and inclusive services, and these rights are protected by communication access legislation, as summarized in Table 1.

Communication access legislation (CDAC, 2022-c) refers to:

> practices and policies that businesses, services and organizations are obligated to have and exercise to ensure that people who have communication disabilities can use their services. This includes practices and policies about two-way

communication in face-to-face and telephone interactions, teleconferencing, online learning, meetings, conferences, public consultations, reading (print, websites and digital), and writing (forms, signatures, surveys and note taking). (para. 1)

Table 1. Communication access legislation and rights (CDAC, 2022-c, 2018)

Communication access legislation[13]	Communication access rights[14]
People with SLCD's rights to equal access to goods and services are protected by: – The Canadian Charter of Rights and Freedoms (1982) – The United Nations Convention on the Rights of Persons with Disabilities (2006) – Federal, provincial and territorial human rights codes and accessibility laws	Access rights include: – being treated with respect and having their opinions taken seriously – being given the accessibility accommodations and supports they request and/or need to effectively communicate to understand what is being said and/ or to have their messages understood by another person – using their preferred communication methods – having service providers follow their instructions on how to effectively communicate with them – being given the extra time they may need to communicate – expressing their own thoughts and /or validating agreement in a safe way, if they rely on a trusted person to convey opinions about matters that affect them – requesting, authorizing and having access to someone they trust to assist with communication, if needed

[13] *Note*. Adapted from *Guidelines for making services and businesses accessible for people who have disabilities that affect their communication*, by CDAC, 2018 (https://www.cdacanada.com/wp-content/uploads/2020/11/BC-Guidelines-for-Communication-Access-Final.pdf) Copyright © 2022 by Communication Disabilities Access Canada.

[14] *Note*. Adapted from *Communication access rights*. CDAC, 2022. (https://www.cdacanada.com/resources/accessible-businesses-and-services/about/communication-access-rights/) Copyright © 2022 Communication Disabilities Access Canada.

	– connecting over the telephone for services or using another way that works better for them, such as email, text, message relay services or a communication assistant – having opportunities and supports to communicate effectively at meetings, conferences, e-learning and public events – getting written information in ways they can read and understand – accessing websites that comply with the latest web accessibility guidelines – getting accessible forms and surveys – being given assistance they may need to sign documents and take notes – having access to a qualified Communication Intermediary or Speech-Language Pathologist when required for effective communication in critical communication where there may be a need for impartial communication support, such as healthcare services, capacity and consent adjudications, police, legal and justice situations.

The rights of persons with communication disabilities are protected under these laws which means that in the process of delivering goods and services, we must follow these laws to become more accessible. As stated by Employment and Social Development Canada [ESDC] (2022-a), “the removal of existing accessibility barriers and prevention of new barriers will create a more inclusive society that provides greater access and opportunities for persons with disabilities”. (para. 19) Table 1 shows just how vast the communication access rights and needs are among people with communication disabilities. Understanding communication access rights will help us better identify and remove barriers to improve accessibility for persons with disabilities.

In summary, communication access ensures that people have access to all forms of communication when interacting with goods and services. For this reason, communication access is very relevant to the context of online meetings. The Accessible Canada Act (2019), for example, lists information and communication technologies (ICT)[15] as a priority area of focus for identifying, removing, and preventing barriers to accessibility. This means that communication access legislation also applies to the ways in which we communicate online through online meeting platforms, like Zoom, and other online collaborative spaces, like Google Docs, that are used for the purpose of facilitating meetings. Therefore, as many businesses, service entities and organizations today use ICTs to hold online meetings, they are as well responsible for providing access to communication throughout the process. Because supporting and advancing accessibility in these spaces is not just a one-time thing. It is a continuous and intentional process.

3.3 People with complex communication access needs

This section begins with a discussion of two pertinent areas of focus relating to complex communication access needs—people with communication disabilities and people who use AAC. The section concludes with a brief discussion of the known communication barriers experienced by persons with complex communication access needs.

People with communication disabilities

Studies show that up to 1% of the world population is affected by a speech, language, or communication need (Elsahar et al., 2019). In Canada, there are over 440,000 Canadians who have significant speech, language, and communication disabilities that are not caused by significant hearing loss (CDAC, 2022-a). The Participation and Activity Limitation Survey (PALS), 2006 suggested that approximately 1.9% of Canadians older than age 14 years have difficulty speaking and being understood (Statistics Canada, 2006). In the United States, it is estimated that 2.1% percent of adults (4.9 million) 18 years of age and older experience difficulty having their speech understood (Taylor, 2018). In the United Kingdom, it is estimated that up to 14 million people (20% of the population) will experience communication difficulties at some point in their lives (Royal College of Speech and Language Therapists, 2022). Another study suggests

[15] ESDC (2022-b) defines information and communication technologies (ICT) as, “all the things we use to communicate and do business in the digital world. Some examples of ICT are: websites; web applications like email and online banking; documents like PDF and MS Word files, presentations like PowerPoint; mobile phones and tablets; self-service kiosks we use to pay for parking; other things like computers, mice, keyboards, scanners and printers; assistive technology like screen readers and Braille displays; and virtual meeting platforms like Zoom, Microsoft Teams and WebEx” (ESDC, 2022-b, What are information and communication technologies section, para. 1).

that approximately 300,000 people in the United Kingdom have complex communication difficulties that result in the need for communication support, such as AAC (Broomfield et al., 2021). In Australia, it was established that 1.2 million Australians were living with communication disabilities as of 2015 (Australian Bureau of Statistics, 2018). Disabilities that affect communication include hearing, movement, cognition, and language.

People may have communication disabilities as a result of life-long conditions from birth such as cerebral palsy, autism spectrum disorder, Down syndrome, a learning disability, or cognitive disability (CDAC, 2022-a; Broomfield et al., 2021). Others may have acquired disabilities such as traumatic brain injury, aphasia after a stroke, dementia, Amyotrophic Lateral Sclerosis (or ALS), Parkinson's disease, and Multiple Sclerosis (CDAC, 2022-a).

Communication disability can affect one or more communication areas such as a person's ability to speak, understand what others are saying, read and/or write (CDAC, 2022-a). For example, as stated by CDAC (2022-a, para. 7):

- **People with speech disabilities** may have slurred or unclear speech; or they may have no speech and communicate using gestures, pictures, letter boards, communication devices or assistance from a person who knows them well. They may use a voice amplifier if they have a weak voice.
- **People with intellectual disabilities** from birth or who acquire dementia or Alzheimer's disease later may have problems remembering, learning, understanding, or problem-solving, making communication challenging.
- **People with language disabilities** may have difficulty hearing what people are saying or they may hear but have difficulty processing or understanding what another person is saying. For example, people who have aphasia after a stroke or accident may have difficulty understanding others, and speaking, reading, and writing.

Additionally, it is common for people who have communication challenges to also have overlapping (multiple) physical or cognitive disabilities that affect more than their communication skills, such as hearing loss, visual impairment, and mental health disability (Beukelman et al., 2007; Johnston, 2009; Britton, 2017; Fager et al., 2019; CDAC, 2022-a). For example, people with hearing disabilities such as those who are deaf or have hearing loss may find it difficult or impossible to hear what a person is saying and sometimes their speech may not be easily understood (CDAC, 2018). Or, people who have disabilities such as cerebral palsy, multiple sclerosis or amyotrophic lateral sclerosis may have difficulty moving their muscles to speak, use gestures, and write (CDAC, 2018).

People who use AAC

Many people with speech, language, and communication needs (SLCN) rely on augmentative and alternative communication (AAC)[16] to help them communicate effectively. AAC has emerged as a critical tool in supporting complex communication needs (Neamtu et al., 2019). The American Speech-Language Hearing Association (ASHA) defines AAC as all the forms of communication, other than speech, that are used by an individual to help them express thoughts, needs, wants, ideas, and feelings (ASHA, 2019). AAC is considered "augmentative" when used to supplement or support existing speech, "alternative" when speech is absent or non-functional, or AAC can also be temporary when used by patients in post-operative intensive care (Elsahar et al., 2019; ASHA, 2019). AAC consists of a variety of techniques and tools, including manual signs, gestures, fingerspelling, tangible objects, line drawings, picture communication boards and letter boards, and speech-generating devices (ASHA, 2019). These systems are often customized to meet the specific communication needs of users, and they provide them with expressive communication support (CDAC, 2018). The goal of AAC intervention is to enable individuals to achieve the most effective, independent communication possible, to facilitate their full participation in daily life activities and improve their quality of life (Augmentative Communication Inc., 1999; Beukelman & Light, 2020).

Persons who use AAC are not a homogenous group (Broomfield et al., 2021). As stated by Beukelman & Light (2020):

> Their only unifying characteristic is the fact that they require adaptive supports to communicate effectively because their spoken, and/or written, communication is temporarily or permanently inadequate to meet all of their communication needs. Some of these individuals may be able to produce a limited amount of speech, but it is inadequate to meet their communication needs with communication partners who are not familiar with them or in communication situations that are challenging for them, such as speaking in groups, in noisy environments, and about content that is unfamiliar to their communication partners. (p. 5)

There is a range of medical conditions that could lead to speech and communication impairments and, therefore, require AAC intervention. These commonly include (Engelke, 2013; Elsahar et al., 2019):

[16] Augmentative and Alternative Communication (AAC), as defined in Baljko (2000) is, "a clinical research area that focuses on the understanding of communication disorders and the development of interventions for them. All interventions can be described in terms of an abstraction called an AAC system. A component of many AAC systems is an AAC device — a physical entity that must be designed and constructed, which provides another mode of communication to its user (albeit an aided mode of communication)." (p. 1)

- motor impairments (e.g., cerebral palsy, amyotrophic lateral sclerosis (ALS), stroke, and traumatic brain injury)
- neurodevelopmental disorders (e.g., autism spectrum disorder)
- language disorders (e.g., aphasia and apraxia of speech)

AAC systems and devices

AAC comes in many forms, depending on an individual's communication needs, and is commonly classified into three categories: no-tech, low-tech, and high-tech AAC (Engelke, 2013; Elsahar et al., 2019), as shown in Table 2. It is also worth noting that many people who use AAC are multimodal communicators and use a combination of low-tech/no-tech/high-tech communication methods.

Table 2. Different modes of AAC strategies and components (Sehgal, 2018)

Mode	Examples
Unaided no-tech	Facial expressions, gestures, sign languages, symbols
Aided low-tech (mechanical/electronic)	Symbols, communication boards, alphabet supplementation, portable writing system
Aided high-tech (mostly electronic/computer-based)	Speech generating devices, Voice output communication aids (VOCA), and Voice-input/output communication aids (VIVOCA)

Note. From *Dysarthric speech analysis and automatic recognition using phase based representations*, by S. Sehgal, 2018. CC BY 4.0.

- **No-tech (unaided) AAC** does not use external or supplementary tools to aid in communication. Rather, it relies on natural communication (body language) to communicate non-verbal messages through facial expressions, vocalizations[17], verbalizations[18], and voluntary motor movements, such as sign language and gestures (e.g., pointing and waving) (Elsahar et al., 2019).
- **Low-tech (aided) AAC** consists of any non-electronic communication method that requires the use of equipment (tools and strategies) outside of one's body. These may include pen and paper, portable whiteboards, communication books, symbol charts, and display boards with lexicons of pictograms, letters, words, and phrases to support the

[17] Vocalizations are the act or process of producing sounds with the voice.

[18] Verbalizations mean to express something in words.

communication process (Elsahar et al., 2019; Baxter et al., 2012). Low-tech AAC solutions are often the first communication aids recommended by speech and language therapists as they are easier to use and cheaper to obtain than most high-tech AAC devices (Elsahar et al., 2019).

- **High-tech (aided) AAC** integrates electronic devices (hardware), such as smart devices and dedicated AAC devices, and software to support an individual's communication needs. Most modern-day high-tech AAC solutions are speech-generating devices (SGDs), also known as voice output communication aids (VOCAs). The SGD software resides on personal computers or laptops which are used as a communication aid to provide voice (recorded or synthesized) or written output (Elsahar et al., 2019; Baxter et al., 2012).

Design challenges with AAC

The social and physical challenges associated with AAC that are commonly reported among users are slow rates of communication which interrupt the natural flow of conversation; conversational gaps in responses; limited support for extended communication; personalization; and strenuous physical effort needed to access the technology, especially for people with motor challenges and co-existing disabilities (Neamtu et al., 2019; Waller, 2019; Moore, 2020).

Slow communication rates in high-tech AAC devices are an ongoing barrier to effective communication among AAC users. In a study conducted by Todman et al. (2008), they found that users of communication devices were perceived by listeners to be more socially competent if they had a faster rate of delivery (Hawley et al., 2012). While the average human speaking rate is estimated to be 130-200 words per minute (wpm) (Todman et al., 2008; Moore, 2020), and skilled typists can achieve rates of 30-40 wpm, the average speaking rate of an individual using an AAC device ranges from < 1 wpm to a max of about 35 wpm (Moore, 2020). This prevents natural conversation because of the time that is taken and because the delays disrupt the usual processes of communication (Copestake, 1997). Conversation partners also require an increased amount of patience due to potentially delayed responses. These delays in communication ultimately lead to challenges for people with verbal and motor disabilities in education, social development, and careers.

Other problems with AAC devices stem from the lack of adequate support for conversational interactions when using AAC. Traditionally, AAC has focused on providing access to transactional conversations, such as expressing concrete needs and wants and transferring information, rather than interactional forms of conversation, where the goal is the maintenance of social relationships through telling stories and jokes, and sharing personal experiences, for example (Waller, 2006). These interactional forms of conversation are not well-

supported in AAC systems, making interpersonal interaction more difficult for people who use AAC (Arnott & Alm, 2013).

In sum, these design limitations highlight the challenges that AAC users may face in daily interactions with their AAC systems. These same challenges are likely compounded in an online meeting context where, in addition to operating their assistive communication technology in the online meeting space, for example, they must also navigate different conversational interactions, some occurring at the same time, in the chat box and aloud, which some high-tech AAC devices are not designed to effectively and efficiently support, not without interruptions.

Known communication barriers

A person with a communication disability, who may or may not use an AAC method of communication, can experience many barriers when accessing goods and services in their communities (CDAC, 2018). Table 3 summarizes findings from CDAC (2022-c) on the impact of communication barriers, as reported by people with disabilities that affect their communication.

Table 3. Impact of communication barriers on people with SLCDs (CDAC, 2022-c)

Barriers or access challenges	Description of barriers
Ineffective communication (communication disability)	This leads to social isolation, loss of autonomy, reduced access to services, reduced quality of services, increased risk for abuse, and crimes and violation of human rights
Disrespectful attitudes toward persons with communication disabilities	This is caused by assumptions of incompetence, generalization of disabilities, unfamiliarity, and ignorance
Lack of information on how to communicate with people who have different communication profiles	Lack of communication skill among service providers, and insufficient time given to people with communication disabilities to communication and express themselves
Telephone services	Barriers include an inability to connect to telephone services, telephone agents lack information and skills to communicate with people who have communication disabilities over the telephone, and lack of alternate communication options to the phone.
Public consultations, meetings and committees	Barriers include no communication accommodations at events, lack of alternate options to contribute, lack of

	instruction from event moderators on how to facilitate participant involvement, additional communication supports needed such as graphics and symbols
Information and Communications	People with communication disabilities may require accommodations to read and understand written materials, navigate websites and handle paper, access print material in alternate formats, sign documents using alternate signatures, take notes, and complete forms

Note. From *Impact of Communication Barriers* (p. 1), by CDAC, 2022, (https://www.cdacanada.com/resources/accessible-businesses-and-services/about/communication-barriers/). Copyright © 2022 by Communication Disabilities Access Canada.

Table 3 sheds light on the five identified barriers to accessibility for persons with disabilities which include: attitudinal, organizational or systemic, architectural or physical, information or communications, and technological barriers (Accessible Campus, 2017). Primarily, it uncovers the various degrees to which persons with speech, language, and communication disabilities may experience barriers to accessing certain products, devices, services, and environments. Knowing and understanding the barriers that they face is necessary to help remove and prevent the barriers on an ongoing basis.

In summary, this section highlights the impacts of accessibility barriers on persons with communication disabilities who may or may not use AAC. These barriers speak to the challenges they face in everyday life—their lived experiences which they bring with them to the online meeting context.

3.4 Dimensions of the online meeting context

This section explores the dimensions of the online meeting context. It begins with a definition of what a meeting is, followed by a discussion on the important differences in meaning between the concepts of an 'online meeting' and 'virtual meeting'. The section concludes by presenting the various features of the online meeting context, as defined in this project, specifically the: meeting setting; process; roles and responsibilities; and meeting space.

A meeting is defined as an act or process of two or more people coming together at a particular time or place, for the purpose of achieving a common goal through conversation and interaction (Merriam-Webster, 2022-d; Lucid Meetings, 2022-a). The "or" here is significant as it provides flexibility in terms of how, when, and where a group of individuals may choose to come "to gather".

Meetings have three defining qualities which differentiate them from other kinds of conversations, as defined by Lucid Meetings (2022-a):

1. Meetings are declared by someone or some group of people which usually results in a meeting being scheduled.
2. Meetings have a purpose and reason for being declared, even if the purpose is not always clear to everyone in attendance.
3. Meetings have a defined start and end (i.e., a before, during, and after).

Distinguishing online and virtual meetings

The literature is not always clear on the difference between online meetings and virtual meetings, with some authors using the terms interchangeably, and others distinguishing the two. The current study asserts that there is an important distinction to be made.

Virtual meetings

In computing, the term virtual refers to something that does not physically exist; it is "a digitally replicated version of something real…distinguished from the real by the fact that it lacks an absolute, physical form" (Awati, 2022). In other words, virtual can be used to "define an interaction that does not take place in an in-person physical environment" (Castaneda, 2018).

When applied to the context of a meeting, a virtual meeting is thought of by some as:

> A form of communication that enables people in different physical locations to use their mobile or internet-connected devices to meet in the same virtual room…Virtual meeting can be viewed as the broader term encompassing all types of digital meeting options ranging from video conferencing to meetings where attendees may join through cellular data rather than Wi-Fi. (Webex by Cisco, 2022, para. 1)

This use of virtual as it relates to meetings has been challenged by some, as it is thought to be technically inaccurate. As virtual means things that are simulated or not real[19], when meeting online, the meeting itself is real. However, it is the means by which the meeting takes place that are not real. Online meetings embody the human interaction elements, whereas "virtual" in this case, facilitates human interaction, through virtual tools and platforms, like Zoom and Google Docs.

[19] In contrast to 'digital' which means information (or data) that is stored in discrete values like 1's and 0's (i.e., binary; bits). Digital is opposed to analogue which is continuous values (Slyer, 2014).

Online meetings

The term ‘online’ refers to the state of being “connected to, served by, or available through a system and especially a computer or telecommunications system (such as the Internet)” (Merriam-Webster, 2022-b). The concept of ‘online’ is inherently rooted in connection and communication. We use our computers to communicate and connect with a network of other computers or devices over the internet, for instance, and this online communication network has fundamentally changed the ways we interact with others. Unlike the term virtual, which translates to something that is not actual, or not in existence (Castaneda, 2018), the term online can be thought of as the state of something being in, or coming into, operation or existence. With this understanding, and, as argued by Castaneda (2018), “the word [virtual] should reflect the objects that are really virtual. We may meet in a virtual room or craft products on a virtual platform. But our meetings are not virtual, the learning and training we provide are actual, and the interactions we have online are real” (para. 11).

Online meetings pertain to the quality and nature of the interactions, where focus is placed on creating better and closer connections amongst attendees and participants. As Castaneda (2018) writes:

> Let’s frame online interactions altogether differently. Let’s start thinking about all interactions as actual. Let’s stop calling some of them virtual just because participants are not all in the same physical room. It’s not virtual. It's online. It’s not converting in-person content, it's developing online experience. It’s not wishing we could do this in person, it’s delighting in the potential to reach people through the internet or device. By reframing the language we use, we can help to reshape the preconceived notion that online interactions are not actual. (para. 9–10)

Meeting context

Context is conceptualized as, “a set of characteristics and circumstances that consist of active and unique factors that surround the implementation. As such it is not a backdrop for implementation but interacts, influences, modifies and facilitates or constrains the intervention and its implementation” (Pfadenhauer, 2016, as cited in Daniels, 2018). In other words, context is the set of circumstances, time, place, background, environment within which something takes place. It determines the conditions and the meaning in which something is understood (Sniechowski, 2014). Therefore, any given context encompasses the setting, roles, interactions, and relationships within it (Daniels, 2018). Consequently, the online meeting context expands on Daniels’ (2018) definition of context to encompass the meeting process, roles and responsibilities, and online spaces such as the meeting platform and tools.

Meeting setting

Setting refers to, “the physical, specific location in which the intervention is put into practice. Setting ‘‘usually has a narrower focus. It often refers to the place where an intervention is delivered…or the circumstances of an intervention’’ (Pfadenhauer, 2015, as cited in Daniels, 2018). There are three common meeting settings to note: in-person; online; and hybrid, described in Table 4.

Table 4. Description of meeting settings

Meeting setting	Description
In-person	In-person (or face-to-face) meetings are meetings where all the attendees/participants are physically in the same place.
Online	Online meetings are meetings that are conducted over the internet through technology-mediated communication, such as video conferencing, and audio and text chats (“instant messaging”).
Hybrid	Hybrid meetings are meetings or events where at least one group of in-person/face-to-face attendees are together at a physical location, while other attendees join the meeting remotely from different locations.

Meeting process

The online meeting context includes the process of designing, organizing and running the meeting. Chairing a successful meeting commonly involves conventional steps which meeting organizers perform before, during, and after the meeting.

- **Before the meeting**, organizers may define the meeting objective; consider who will participate; set the meeting agenda; determine which materials they will need; schedule the meeting in advance at a convenient time; and select the necessary online spaces (e.g., meeting platform and tools) that will be used.
- **During the meeting**, organizers may encourage participant engagement and adhere to conventional online meeting etiquette such as putting oneself on mute when not speaking or advising participants to be in a quiet location with minimal background noise (RingCentral, 2021).
- **After the meeting**, organizers may choose to reflect on the overall meeting process and collect feedback from participants on how they feel the session went, what worked and

what did not, such as if they experienced technical problems during the meeting, and what could be improved for future online sessions.

In sum, there are different stages involved in running an effective online meeting. There is a preparing stage, etiquette for the meeting, wrapping up, and an after stage where you reflect on the meeting and get feedback. What this process does not reflect is how these steps might change based on a person's CCAN, as well as how we might design and run a successful online meeting in accordance with communication accessibility and inclusion.

Meeting roles and responsibilities

There are several roles that participants might have in a meeting, or when planning a meeting (Table 5). The key roles associated with holding effective meetings are the same for in-person and online meetings. There are typically five key roles for any meeting: organizer or leader (chair), facilitator, timekeeper, notetaker, and administrative support. In online meetings, it is helpful to include two additional roles: tech coordinator and chat reader (or moderator). In some cases, one person might manage multiple roles (e.g., having the same person lead and facilitate a meeting), or multiple people can share a role (e.g., having two co-chairs for a meeting). These roles and responsibilities denote the types of interactions and relationships (Daniels, 2018) that may emerge in online meeting spaces.

Table 5. Common meeting roles and responsibilities

Meeting role	Description of responsibilities
Chair (or Leader)	The person (or persons) who arranges, leads, and concludes the meeting. They are typically responsible for putting together the agenda and assigning other meeting roles. They also take care of several key elements before, during, and after the meeting.
Facilitator (or Moderator)	The facilitator is responsible for the process of the meeting and moderating the session. Facilitator responsibilities may include ensuring that the meeting rules and agenda are being followed, introducing the session and the activities to participants, ensuring everyone is able to participate and supporting the group in the creative process and decision-making.
Timekeeper	Timekeepers are responsible for keeping track of time (i.e., timeboxing) during the meeting to ensure the estimated time allotments are respected from the agenda.

Notetaker	Note-takers help capture important points of the discussion, such as any design ideas or decisions that are made, questions to be answered after the meeting, and action items. This is typically done by taking written notes, but other forms of documentation may be used including audio or video recording.
Administrative Support	This person takes care of the logistics for the session, including booking the venue, purchasing or gathering required materials, and setting up the meeting room.
Tech Coordinator	Tech coordinators take care of all technical details for the team during and before the meeting.
Chat Reader	The person who manages and keeps an eye on the chat box, and either reads out comments or alerts the facilitator to comments posted in the chat.
Attendee	Attendees are people who are in attendance or in the audience for an event, such as a meeting or a course.
Participant	A participant is someone who is taking part in an activity or event. Participants can have a more exclusive meaning than attendees. It suggests that the person is being more than present, they are actively participating. A participant takes an active part in some function or activity.
Observer	An observer is a meeting role granted by some organizations to non-members to allow them to monitor or participate in the organization's activities. Most commonly, observers' rights in the meeting are restricted to observing; they can attend the meeting and listen to the conversation, but they are not expected to actively participate in the discussion and cannot vote or otherwise officially take part in decision-making (Lucid Meetings, 2022-b).

Within the context of online meetings that use video-conferencing platforms, there are certain roles that are specific to the meeting platform (see Table 6). Like in-person meetings, in online meetings that use video-conferencing tools, when organizing a meeting with multiple attendees, roles are assigned to each participant (attendee) to determine who can do what in the meeting (Microsoft, 2022). As such, the meeting controls available to attendees may differ depending on their roles within the meeting. For example, someone who is hosting or

organizing a meeting on Zoom or MS Teams, respectively, can disable certain features for the participants. In-meeting controls allow attendees to control various aspects of the meeting like adjusting the volume and managing participants.

Table 6. Assigned roles within online meeting platforms

Meeting role	Description
Host[20] or Organizer[21]	The user that scheduled the meeting. They have full permissions to manage the meeting and assign predefined roles. There can only be one meeting host.
Co-host	Co-hosts share most of the controls that hosts have, allowing the co-host to manage the administrative side of the meeting, such as managing attendees. The host must assign a co-host during the meeting. Co-hosts cannot start a meeting. If a host needs someone else to start the meeting, they can assign an alternative host.
Presenter	Presenters can do just about anything that needs doing in a meeting, while the role of an attendee is more controlled.
Guest	A guest is anyone who joins the meeting and does not have an account (or is joining from outside of the organization). They will be labeled as a guest upon entering.

Online meeting spaces

When meeting online, we are meeting from our respective, physical locations, and coming together online in a shared space. Fiano MacNeil (2021) defines online spaces as a place "where groups of 3 or more people[22] come together to meet online. These spaces are facilitated via meeting and webinar tools and the format is governed by the people who facilitate and/or attend" (MacNeil, 2021). An online space, therefore, can be a meeting platform like Zoom or a collaborative document like Google Docs. When used in the context of online meetings, online spaces like Google Docs take on the form of online meeting spaces because they are being used for the purpose of supporting a meeting—they are support tools.

[20] This is what Zoom calls this meeting role.

[21] This is what MS Teams calls this meeting role.

[22] Online spaces can also involve groups of two people.

In the article, “Exploring Design Dimensions in Online Spaces”, Marie LeBlanc Flanagan (2020) describes 19 design decisions, or *dimensions*, in online spaces, summarized in Table 7. Dimensions are defined as “one of three coordinates determining a position in space or four coordinates determining a position in space and time” (Merriam-Webster, 2022-c). Understood another way, dimensions are simply an aspect or feature of something. As noted by Flanagan (2020), these dimensions represent “spectrums of possibility” within online spaces, rather than binary opposites.

Table 7. Design dimensions of online spaces[23] (Flanagan, 2020)

Category	Design dimensions
Time	Scheduled <> Spontaneous
	Synchronous <> Asynchronous
	Temporary <> Permanent
Space	Centralized <> Decentralized
	Public <> Community <> Private
	Spatial <> Flat
Interaction	Text <> Voice <> Video
	Structured <> Sandbox
	Ambient <> Direct
	Used-As-Intended <> Repurposed
	Collaborative <> Competitive Creation <> Consumption
	Moderated <> Unmoderated

[23] *Note*. Adapted from *Exploring Design Dimensions in Online Spaces*, by M. L. Flanagan, 2020 (https://marieflanagan.com/dimensions/#hude). In the public domain.

Access	Curated <> Open
	Accessible <> Inaccessible
	Privacy-first <> Data-Selling
Identity	Humanizing <> Dehumanizing
	Anonymous <> Persistent
	Identity <> Onymous
	Connecting <> Alienating

The design dimensions highlight the complexity and diversity of online meeting spaces and further exemplify how these environments are rooted in themes of connection, community, communication, and access and inclusion. The article explores how "online spaces shape our connections" through these various design dimensions, and begs the question: how might we reimagine what online spaces could be and what they afford? This question is especially relevant within the conversation of communication access and online meetings. As Flanagan (2020) writes, since the COVID-19 pandemic, there has been a "massive emergence of online spaces and experimentation with how people connect online" (Flanagan, 2020, Last Thoughts section, para. 1). This creates further opportunity to explore alternative formats, methods, and tools for meeting online to support people who have CCAN. Moreover, it presents an opportunity to extend our collective understanding of what communication access looks like across these alternative online meeting spaces.

In summary, this section highlights that the online meeting context is made up of multiple facets including meeting setting, roles and responsibilities, meeting process, and online spaces such as platforms and tools. Understanding the different dimensions of the online meeting context is important to being able to provide access to communication throughout the process of planning, designing, and running the meeting.

3.5. Limited guidance for designing accessible, inclusive online sessions

The literature revealed that there is a lack of existing guidance, protocols, and procedures on how to support CCAN within online meeting spaces, and throughout the process of designing

(planning) and facilitating online sessions. While some of the documentation found does provide an overview on making online meetings, events, and workshops accessible for people with CCAN, there are three primary gaps, which the current study seeks to address:

1. The guidelines do not account for individual differences in terms of how a person's communication access needs might change based on the meeting format and platform. For example, it is common for people with SLCDs to have overlapping conditions (Beukelman et al., 2007; Johnston, 2009; Britton, 2017; Fager et al., 2019; CDAC, 2022-a) that could impact their communication needs in different online meeting spaces. They may also have their own communication tools and support that they require to participate in the meeting.
2. In addition, as the guidelines are specific to online meeting platforms, it is unclear how they could be applied to other online spaces, like Google Docs.
3. The guidelines have not yet been evaluated by people who use AAC and therefore it is unknown how the use of AAC impacts the ways an individual accesses online meetings. This is especially relevant given the added layer of complexity that an AAC user might experience when accessing online meeting spaces with their communication aids. Without an understanding of their specific accessibility requirements when accessing online meetings, we risk perpetuating cycles of exclusion.

4. Methodology and research design

The current study was carried out using a community-led co-design approach, drawing from the participatory design methodology and an inclusive design framework.

4.1 Participatory design

Participatory design is an iterative and collaborative research methodology that is characterized as "a way to understand knowledge by doing" (Spinuzzi, 2005). Participatory design is based on the constructivism paradigm which states that "people construct their own understanding and knowledge of the world through experiencing things and reflecting on those experiences" (Adom et al., 2016). Similarly, within participatory design, knowledge is generated through the interaction between researchers, participants, activities, and artifacts (Spinuzzi, 2005), and participants' personal lived experiences directly inform the design outcomes. The participatory designer's role is to empower participants to make their own decisions. This is achieved through co-research and co-design, where participants are actively involved in decision-making throughout the research and design process. In addition, "research results are 'co-interpreted' by the researcher and the participants who will use the design" (Spinuzzi, 2005).

4.2 Inclusive design practice

Inclusive design laid the foundation for this MRP. As stated by Pullin et al. (2017), "inclusive design is something the field of AAC signs up to, through the principle of 'nothing about us without us'" (p. 144). Because of the complex range and nature of disabilities among people who may benefit from AAC (Allen, 2002), an inclusive research practice is needed to consider more diverse perspectives and needs. As the practice of inclusive design is compelled to be open, transparent, and collaborative (Pullin et al., 2017), it emphasizes the need for diverse participation and broad contribution from individuals in the community throughout the research and design process. In addition, inclusive research practices imply not just the participation of members of the community but also their shared ownership of this research.

Inclusive design is practiced in the current research process by working within the three Inclusive Design Dimensions (Treviranus, 2018-a):

1. Recognize, respect, and design with human uniqueness and variability
2. Use inclusive, open and transparent processes, and co-design with people who have a diversity of perspectives, including people that cannot use or have difficulty using the current designs
3. Realize that you are designing in a complex adaptive system

4.3 Community-led co-design process

Co-design is the process of designing with people rather than for them. As described by the Inclusive Design Research Centre (IDRC) (n.d.-a),

> Those who are most impacted by the design, especially those with needs least served by existing designs, are involved in the process from the beginning. They are engaged throughout the process, and directly contribute to the creation of designs that meet their unique needs. Participants are not involved as research subjects or consultants, rather as designers engaged in active and sustained collaboration. (para. 1)

For this research, community-led co-design sessions were the primary research activities involving participants. Community-led co-design focuses on developing the co-design process and the research outcomes in collaboration with community members who will be directly impacted by the design. This design approach was selected for this research because it operates within an inclusive design framework by recognizing community leadership; taking place in a familiar environment; creating more engaged communities; and moving from design that is conducted with the community to design that is carried out by the community (IDRC, n.d.-a).

There are three main stages in the community-led co-design process (IDRC, n.d.-b):

- **Stage 1. Discovery** — In this stage, designers meet with community members to gain a deeper understanding of the topic or issue and how it affects different community members. Designers then make sense of what they heard from community members to share it back with the group.
- **Stage 2. Brainstorming** — In this stage, designers create space for community members to come up with and explore lots of ideas.
- **Stage 3. Refinement** — In this stage, community members pick the idea (or ideas) they would like to take further. A functional version of the idea (a prototype) may be created at this stage and community members will provide feedback on the prototype to see how well it works.

The issue of inaccessible online meetings is a problem affecting people at an individual and community level. As such, the co-design process was intended to be led by the community members seeing as they have the most knowledge about their communication access needs when accessing online meetings.

My role as the designer-researcher was to help facilitate and be responsive to the community and their decisions. I was led by what the community wished to do, what the community saw as the problem, and what they saw was the process for addressing the problem. As a result, they

were given agency in determining what we do, when we do it, and how we do it. This methodology was effective for my MRP because it supports a non-linear, iterative, and inductive process, which provided greater flexibility for me to, "continue to learn and adapt based on ideas and artifacts co-designed with participants" (Lee, 2018). At each stage, I was able to adapt the research process, methods, and tools to enable broader participation and accommodate diverse accessibility requirements among co-designers. This ensured that everyone participated in the ways that felt most comfortable for them. Through qualitative research methods, this MRP focused on gaining a deeper understanding of the individual access needs and barriers of people who have communication disabilities and may or may not use AAC, within the online meeting context. The study was reviewed and approved by the OCAD University Research Ethics Board, REB approval #2021-92.

4.4 Participants and recruitment

Participants were recruited as co-designers in this study and as experts with lived experience. I sought to recruit individuals with lived experience and AAC community members who organize and lead online meetings. The reason being, communication access is a community-based approach focused on changing attitudes, skills, and resources, and assists in facilitating community participation (Solarsh & Johnson, 2017) among people who have complex communication needs (CCN). Therefore, I adopted a community-based recruitment approach toward supporting communication access in online meetings at an individual level and a community level.

This research involved participation from members of different AAC community groups and organizations including Ottawa Foyers Partage (OFP)[24], International Society for Augmentative and Alternative Communication (ISAAC)[25], ISAAC's People Who Use AAC (PWUAAC) Online Chats[26] and LEAD Project[27], Bliss i-Band[28], Breaking the ICE (BTI) Canada Conference[29], and individuals who have participated in web-based meetings as members of adult AAC user groups. Since the research and design sessions were being conducted online, there was no requirement for participation to be restricted. Therefore, this study included participants from multiple geographic locations within Canada (Ontario), and the United States (Buffalo, California, and Alaska).

[24] https://ottawafoyerspartage.org/
[25] https://isaac-online.org/english/home/
[26] https://isaac-online.org/english/news/pwuaac-online-chats/
[27] https://isaac-online.org/english/about-isaac/activities-and-projects/people-who-use-aac-lead/
[28] https://www.blissiband.com/
[29] https://www.facebook.com/groups/84888948124

Two groups of co-designers (18 co-designers total) were recruited for this study:

- **Group A (primary stakeholders**) included adults who use AAC (and their communication support persons to assist them with communication at the online sessions), and/or identify as having one or more disabilities that affect their communication.
- **Group B (secondary stakeholders)** included community organizers who organize and chair online meetings for adults with disabilities who may or may not use AAC.

It should also be noted that some participants from Group A take on leadership roles within the AAC community. Thus, these co-designers contributed to the study from both perspectives (Group AB), as shown in Table 8.

Table 8. Co-designer group information

Co-designer Groups	Co-designers
Group A Persons with CCAN	1, 2 & 2B[30], 3, 4, 7 & 7B[31]
Group AB Persons with CCAN who also organize and lead online meetings in the AAC community	5, 6, 8, 9, & 10
Group B Community organizers (Persons who organize and lead online group meetings in the AAC community)	11 to 18

Invitation letters were emailed to AAC community leaders and communication advocacy groups including Ottawa Foyers Partage, Bliss i-Band, Breaking the ICE Canada Conference, and ISAAC's People Who Use AAC (PWUAAC) Online Chats to help identify potential participants from their networks who met the recruitment criteria. I also attended online AAC community group meetups where I was able to introduce my research project to those in the meetings and

[30] Co-designer 2B is the mother and communication supporter of co-designer 2.

[31] Co-designer 7B is the mother and communication supporter of co-designer 7.

recruit participants that way. Co-designers were also recruited by word of mouth. Recruitment posters were emailed to disability advocacy groups to share on their respective social media pages and distribute to their communities via email. Individuals who were interested in participating were sent a consent form which also included screening questions to determine their eligibility.

Inclusion criteria for co-designers with lived experience were defined as adults, 18 years or older, who identify as having complex communication needs and may or may not use AAC. These participants are the primary stakeholders as they have personally experienced communication barriers when accessing online meetings and stand to benefit the most from a solution. Inclusion criteria for community leaders (secondary stakeholders) were defined as adults, 18 years or older, who organize, host, facilitate, and/or lead online meetings in the AAC community.

Adaptations to the consent-to-research process

As was revealed during the gaining consent process, some co-designers with communication disabilities, who also have motor disabilities, had trouble physically signing the consent forms. As a result, adaptations to the consent-to-research process were required, whereby co-designers could use alternate signatures to indicate their consent to take part in the research.

The following alternate signature formats for gaining consent were provided according to the needs and preferences of each participant:

1. **Email consent** — Co-designers could indicate their consent by replying to my email and stating whether they agree to the consent statements, directly in the body of their email response.
2. **Verbal consent** — For co-designers who wished to give verbal consent, I scheduled a phone/video call to read through the consent form and discuss it with the co-designer. I documented their verbal consent digitally, and they were able to ask me questions and request modifications to the form, which I documented in writing.
3. **MS Word/Google document** — In the email that I sent co-designers, I attached an MS Word document and a link to a Google Doc. To indicate their consent to participate, co-designers could “sign” the document by typing their full name in the document and writing “I agree” next to each of the relevant consent statements.

4. **Accessible fillable PDF form**[32] — In the email that I sent co-designers, I attached a PDF of the consent form with fillable form fields. Co-designers could choose to sign the form electronically, or print, sign, and send the form back to me if they preferred.
5. **Online questionnaire** — I provided the consent form in a questionnaire format using an online survey tool, Microsoft Forms.

4.5 Research setting

All interviews and co-design activities took place between March and August 2022. For this project, we explored using two different ways of meeting online through synchronous and asynchronous meetings. Synchronous means co-designers work on something together at the same time and in the same "space" (IDRC, n.d.-e). Asynchronous means co-designers work on the same thing, toward the same goal, at different times on their own (IDRC, n.d.-e). At this point, the pandemic and the associated lockdowns had been running for two years and hence, co-designers had been meeting like this for two years. They had become habituated to using the digital meeting platforms as primary ways of connecting online. The barriers they faced and the comments on the platforms can be said to be solid.

All synchronous sessions were held online in familiar environments using virtual video-conferencing platforms such as Zoom, Google Meet, and Jitsi. In order to provide participants with alternative ways to participate in the research project, each live co-design session had an asynchronous equivalent. Some co-designers who knew each other outside of the research project chose to participate in smaller groups, while others were grouped based on scheduling preferences.

The use of Figma[33], an online whiteboarding tool, during the synthesis and analysis stages allowed all participants in the research project to collaboratively and asynchronously "meet online" at various stages throughout the project. I created shared online collaborative documents using Google Docs and CryptPad for all participants to access and contribute their ideas and thoughts asynchronously on their own time, outside of the scheduled "live" co-design sessions. Participants were given the choice of how they wanted to participate for each session. For those who chose to participate asynchronously, some preferred to share their contributions via email, while others opted for using the online collaborative documents.

Prior to each session, an access guide was emailed to all co-designers to help them prepare for the co-design session. The access guide contained various details about the session such as a rough meeting agenda, information on what they needed to bring, rough activity instructions,

[32] PDF stands for portable document format. The format is used to display documents in electronic form.

[33] https://www.figma.com/

as well as the meeting location and the length of the session. Co-designers were invited to make suggestions or changes to the meeting agenda and activities where they saw fit. Emphasis was placed on free and creative expression and giving co-designers the flexibility to use any combination of their preferred communication tools and methods to express themselves throughout the project such as via email, a poem, an audio or video recording, a drawing, and so on. Co-designers were encouraged to be as creative as they wanted. This allowed co-designers to participate in the ways that were most comfortable for them, which ultimately contributed to diverse participation formats in our online meetings. Apart from co-design session 1, activity topics were decided on as a group and instructions or discussion questions were shared ahead of the meetings so co-designers could prepare any pre-programmed messages.

4.6 Research phases

Following the phases of the IDRC's community-led co-design process, Table 9 shows the methodology for this work, and provides a summary of the research phases, including the co-design activities and features of each phase. Each phase included rounds of synthesis and/or co-synthesis, community involvement, and reflection; here referred to as co-design features. The features served as continuous "inputs" to the co-design sessions and supported co-designers and I as we arrived at the design outcomes.

Table 9. Summary of research phases, activities, and features of sessions

Research phases	Co-design activities	Features
Phase A Initial Discovery	– Expert interviews – Observing AAC community meetings	Community involvement
Phase B Co-designing the online sessions	– Design and plan aspects of the research process with community members	Community involvement
Phase 1 Discovery	– Group semi-structured interview and informal design session with Bliss i-Band community organizers – Co-design sessions 1 to 8	Community involvement, Synthesis, Reflection
Phase 2 Brainstorming	– Co-design sessions 9 and 11	Community involvement, Co-synthesis, Reflection
Phase 3	– Co-design sessions 12 to 16	Community involvement,

Refinement	– Group semi-structured interview and informal design session with Breaking the ICE Canada committee	Co-synthesis, Reflection

The research phases and co-design activities are summarized as follows:

- **Phase A. Initial discovery** — I added an initial discovery phase to the traditional community-led co-design process to highlight the contributions of the experts from the field whom I engaged with, as well as the AAC community meetings and events that I attended. This initial stage helped me gain an understanding of the different conventions used to hold accessible online meetings within the AAC community, as well as what the general challenges and access needs are among people who use AAC and people with SLCDs when accessing online meetings. These two initial steps are included as part of the co-design activities as they helped me build partnerships across the AAC community and provided background knowledge on the research topic which contributed to the co-design planning and directly informed participant recruitment.
- **Phase B. Co-designing the online sessions** — In this stage, I worked closely with members from the community to design and plan aspects of the co-design process. Community members (partners) helped to determine the materials and tools that would be used, as well as define the process and timelines. During this phase, I engaged with various community groups and organizations in areas of disability, speech-language pathology and augmentative communication. In addition, I welcomed feedback from community members on all aspects of the work including guidance on the use of plain language for recruitment materials; which platforms and tools to use based on their accessibility features; and scheduling of our sessions.
- **Phase 1. Discovery** — In this discovery stage, I wanted to gain a deeper understanding of the lived experiences of people who use AAC and people with SLCDs when accessing online meetings. Co-designers with complex communication access needs (CCAN) took part in co-design activities centered around exploring their individual communication access needs and barriers when accessing online meetings and discovering design opportunities. In addition, one semi-structured group interview was conducted with community organizers from an AAC community group (the Bliss i-Band) to better understand the community perspective of meeting organizers and leaders, and the impact that online meetings have had on their ability to provide effective communication support. This interview also served as an informal collaborative design session as we discussed areas for further developing communication access in the online meeting context.

- **Phase 2. Brainstorming** — Following the discovery stage, co-designers with CCAN discussed any ideas that they came up with in the discovery stage, and suggested ways to expand on those ideas further. Co-designers also brought forward new ideas to solve some of the challenges they mentioned in the previous sessions. The purpose of this brainstorming stage was to create space for co-designers to come up with their own ideas to address the specific challenges they face in online meetings. Some co-designers chose to participate in the co-design activities asynchronously and others participated in live sessions using a videoconferencing platform.
- **Phase 3. Refinement** — For the refinement stage, mock-ups were created, and co-designers explored and gave feedback on them, as well as prototype ideas and concepts. In other activities, co-designers helped design different elements and features of the ideas. One semi-structured group interview (and informal design session) was conducted with community organizers from an AAC community group (Breaking the ICE Canada Conference).

The following chapter details the co-design activities performed in each session.

5. Design activities

This chapter walks through the co-design activities in detail performed throughout the five phases of the design process: initial discovery, co-design planning, discovery, brainstorming, and refinement. In each session, co-designers took part in activities to discover, brainstorm, create, and refine new ideas.

The design activities were based on the Virtuous Tornado (Treviranus, 2018-b). This method helps to consider more diverse perspectives and needs and characteristics of the design problem by asking "who is missing?" at each cycle of iteration, with the aim of making the solution more inclusive (Treviranus, 2018-b). This approach helped co-designers and I drill down into their specific edge requirements to figure out how we can design something to address that specific requirement. Then, from there, I brought in the next group of people to see what their requirements are, and so on. At the core of this approach is the desire to create an infrastructure or system that can and will adapt to support a diverse web of edge needs.

5.1 Expert interviews

A total of 11 expert interviews were conducted between February and May 2022. Experts consisted of individuals who have professional backgrounds in communication disabilities, augmentative and alternative communication (AAC), disability advocacy, accessibility legislation, inclusive design, and healthcare. I recruited experts using a snowball method where I relied on experts to connect me with people from their personal networks to either conduct expert interviews with or recruit them to participate in the research study. In general, I asked experts about some unexplored areas related to communication access and the AAC community where I could add some value. I also talked to experts about the networks that were already established in the community. In speaking with them, they helped me narrow my scope, and it was through this exercise that it was suggested I attend some of the community events to get a sense of how members of the AAC community were currently meeting online.

Lessons learned from experts

The expert knowledge provided guidance and suggested practices on how best to support AAC users and people who have complex communication needs in an online meeting context throughout my research. Throughout these expert interviews, a common problem kept coming up. I heard from many of them that a lot of the people who use AAC in their communities experience challenges when meeting online over virtual meeting platforms like Zoom and Google Meet. They also underscored the importance of enabling access to online meetings for

people who have communication disabilities and may or may not use AAC, as these online meetings provide a means of connecting within their communities. One expert noted the temporalities that one should be mindful of in meetings. People who use communication aid are communicating at a slower speed than unaided communicators. Therefore, there are delays and communication problems that may result.

According to many of the experts I heard from, the pandemic introduced a new set of challenges when it comes to meeting online, for people who have communication disabilities and people who use AAC. Whatever communication challenges they faced prior to the pandemic were now exacerbated. In addition to the new technology, they had to use and learn, many of them had their pre-existing AAC technology to factor into that. This ultimately made the transition to online meetings challenging and added another layer of complexity to an already difficult time for many.

5.2 Observing online community meetings and events

Following the expert interviews, I wanted to gain a deeper understanding of how online meetings are organized within the AAC community. I felt that this level of understanding could only be achieved by directly learning from the community and observing the use of AAC technology within online sessions. This contrasts with solely relying on academic literature to inform my understanding of the community and their needs. Biggs, Yusim, and Coppin (2018) refer to this method of "observing working conventions or solutions outside academic literature" (Biggs, 2019) as a "natural laboratory". A natural laboratory (or natural lab) is defined as, "a site of investigation where extensive iteration in culture, driven by selection pressures, has refined a set of artifacts and/or conventions to what are likely to be effective states" (Biggs et al., 2018). In other words, natural labs look at where things have not been intentionally designed by designers but have evolved through culture. Natural labs are constructed externally by the community for the community. They also provide a space for researchers who are new to a given field, to observe naturally occurring phenomena and build off of the work that is already being done within the community. The idea is to study it, understand it, and replicate it. Often when conducting a literature review or co-design session, for example, we are bringing in our own "baggage" and we are listening through our own lens. Natural labs, on the other hand, bring in the perspectives of people from the community. In the case of my MRP, pursuing a natural lab also highlighted the effectiveness of narrowing down my scope through the process of induction. That is, starting with a more open, broad scope and then narrowing my focus as I found out more information.

I attended different community meetups and events online with the aim of:

1. introducing myself to the community
2. observing and gaining insights from these community events so I can apply what I learn to the online sessions that I planned to hold with co-designers in my study
3. reaching out to members of the community to participate in my research

Some of the meetings and events were “invite-only” and some were public (i.e., open for anyone to join). Invite-only means that the organizers do not publicly advertise the event information and meeting time. For someone from outside of the community to attend, they would need an invitation from the meeting event organizer. For the community events that are invite-only, I was personally invited by the organizers of the meetings.

When attending these invite-only and public meetings and events, I let the community know that I would be observing them and the meeting for the purpose of my research. I did this by telling the organizers of the meeting before I attended the event so they could share it with the group before the meeting. I also got permission from the organizers for me to mention it at the beginning of the meeting, so all attendees were aware. I informed them that I was not collecting any names or personally identifying information and explained what I would be observing, such as the structure of the meeting and how long it takes to set-up. I provided my contact information for anyone who wished to obtain more information about the study and/or why I was writing about my experience of attending these events throughout the AAC community. The next section briefly describes each of the AAC community groups that I connected with.

About the AAC community groups

I engaged with the leadership from 3 different AAC community groups: The Bliss i-Band; ISAAC’s PWUAAC Online Chats; and Breaking the ICE (BTI) Canada Conference and Town Halls. Each group brought a different perspective to the project which allowed me to examine a particular aspect of communication access in online meetings through their unique community lens. Attending their meetings enabled me to gain a better understanding of the high-level communication needs of individuals with speech, language, and communication disabilities and people who use AAC. It also provided a good model for me to follow in my own research in terms of how to hold an accessible online meeting with individuals with complex communication access needs (CCAN). The lessons learned from attending the Bliss i-Band’s weekly meetings will be shared as a direction for future work. The community-specific lessons learned from attending the PWUAAC Online Chats and BTI Town Halls have not been formally

included as part of the study. However, some of the meeting organizers and people who use AAC from all 3 community groups did participate in the formal research in this work.

The Bliss i-Band

The Bliss i-Band is a group of adults with physical disabilities, many of whom are non-speaking and use AAC devices, who get together weekly to explore the possibilities of actively making music together with virtual instrument apps found in their Apple iPads[34], such as GarageBand[35] (Bliss i-Band, n.d.). Those in the i-Band are mostly those who cannot speak and who would not be able to typically play a musical instrument. With the beginning of the COVID-19 pandemic, the Bliss i-Band transferred from weekly in-person sessions to online Zoom meetings. Though they experienced technical challenges in the beginning of the pandemic, pertaining to the transmission of music in a virtual meeting room, they have since found ways to adjust the Zoom settings, take turns, use selected instruments, and allow one member to play at a time (Bliss i-Band, n.d.). I attended several Bliss i-Band sessions between March and June 2022.

Breaking the ICE (BTI) Conference and Town Halls

The Breaking the ICE (BTI) Canada Conference is an event created by and for individuals who use Augmentative and Alternative Communication (AAC) and their families. This conference was designed to bring the community of people who use AAC together to share ideas, learn from each other, and create new friendships (BTI Canada Conference, n.d.). The conference engages participants who are underserved in the community, with the goal of promoting independence, community inclusion, and empowerment. Since the COVID-19 pandemic, they have not been able to have the in-person conference, so they started having town halls, which are online community events on a smaller scale than the in-person conference, that happen once every four months. I attended my first BTI Virtual Town Hall event in April 2022.

ISAAC's People Who Use AAC (PWUAAC) Online Chats

The International Society for Augmentative and Alternative Communication (ISAAC) PWUAAC Online Chats are bi-weekly meetings that are hosted and led by people who use AAC, in order for them to meet online for informal chats. The meetings are focused on engaging topics and diverse views from persons who use AAC (ISAAC, 2021). The online chats take place on Google Meet and the meeting format consists of introducing the meeting attendees at the beginning of the meeting, followed by a group discussion of two predetermined topics. These online chat

[34] https://www.apple.com/ca/ipad/

[35] https://www.apple.com/ca/mac/garageband/

sessions are open to persons who use AAC from all over the world, as well as anyone from the public who wishes to attend. Participation is encouraged for all attendees; however, priority is given to those who use AAC. I attended two PWUAAC Online Chats between March and April 2022.

5.3 Co-designing the online sessions

I collaborated with members from the AAC community in the earlier stages of the co-design planning to design important aspects of the co-design process, as they are most familiar with the context and culture of their community (IDRC, n.d.-c). Community members took on a partnership role within the project where we worked collaboratively over email and video-chat meetings to design and build out the co-design process. Community members were free to participate in all stages of the process to the extent that they wanted. They provided direction on how I could design the online meetings to best support co-designers who have complex communication needs. Their contributions applied to both the design outcomes and the design process, and their input consisted of providing guidance on alternative formats to support participation, accessible online meeting spaces, and plain language. It should also be noted that co-designers helped design the process throughout the project, not just in the initial planning stages. They also helped identify potential co-designers from within the community, and helped plan the materials, schedule, and logistics for the sessions.

5.4 Co-design sessions and interviews

In the participatory spirit of "understanding knowledge by doing" (Spinuzzi, 2005), I approached my own research project from the perspective of practicing what I seek to understand. Because my intention was to understand the online meeting context from the stance of supporting communication access and inclusion, I considered every interaction with participants (not just the ones involving video conferencing platforms) as a form of meeting online. Expanding my own understanding and definition of what an online meeting is and/or can be, helped me to consider the accessibility needs and communication preferences of co-designers in a more holistic manner. Our meetings stretched across different times and spaces, occurring in collaborative online documents and whiteboards, live video-chat sessions, chat boxes, and emails. These alternative ways of meeting and connecting online provided unique opportunities for co-designers to participate and contribute.

Alternate ways of connecting online

In addition to the more conventional ways of meeting online through meeting platforms like Zoom and Google Meet, co-designers and I also used various alternative formats for meeting

online. These alternative meeting formats include one-to-one and group email exchanges and collaborating in shared online documents like Google Docs and CryptPad[36], as well as online whiteboarding tools like Figma. Each of these tools highlighted different accessibility barriers and communication needs among co-designers.

Some co-designers preferred to participate in sessions asynchronously (as opposed to a "live" session) by sharing their responses via email or MS Word documents, as shown in Table 10. All co-designers' responses were added in the same shared online documents, which meant that even the co-designers who were in different sessions were able to view what others were saying and contribute to the discussion. The use of Google Docs allowed co-designers to make comments on each other's responses and respond to some of my questions directly in the document, as shown in Figure 1. The shared Google Doc, therefore, served as its own online meeting space that supported participation among co-designers in different ways.

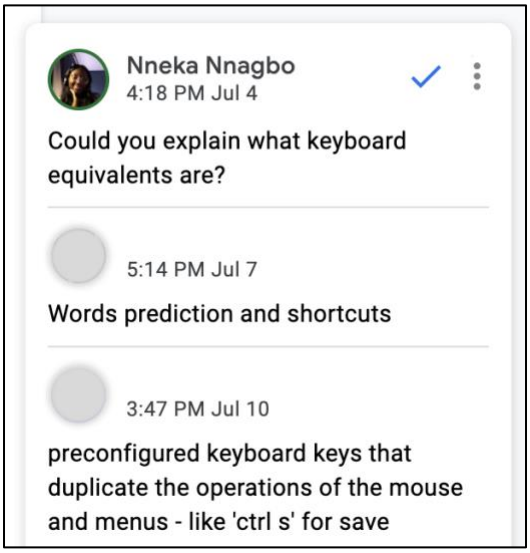


Figure 1. Co-designers' comments and responses in a shared Google Doc

We tested and evaluated different tools that are used to access and participate in online meetings, such as online registration forms and online collaborative text editors, like CryptPad.

In co-design session #12, as shown in Table 10, Co-designer 2, with support from her communication supporter, tried to fill out an online registration form for a community event, shown in Figure 2. She used her keyboard and AAC software to navigate web content, including completing online forms. However, she had difficulty selecting and deselecting the Yes/No radio buttons on the form using her keyboard. During our session, they found that only the Space key worked for selecting the radio buttons and using the Enter key or Space key worked to deselect the radio buttons using the keyboard. This was not a quick and simple process, as it

[36] https://cryptpad.fr/

required extra time and physical effort from Co-designer 2 to make her selection using her keyboard.

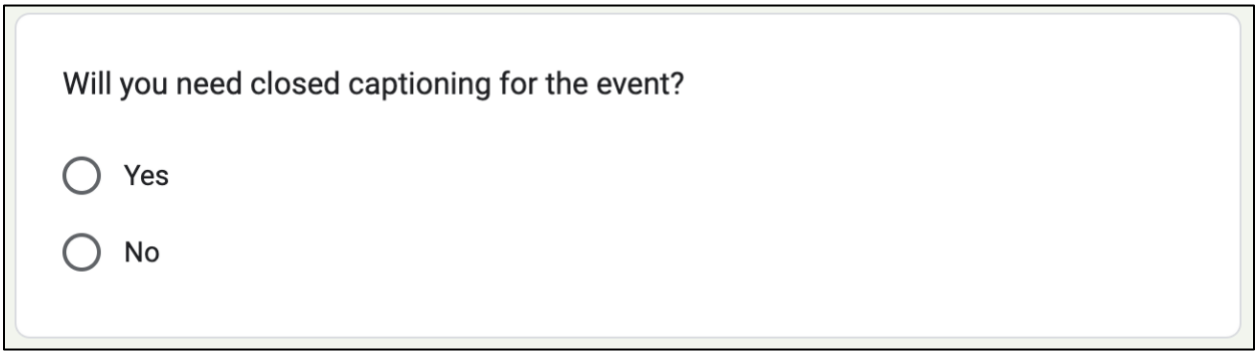


Figure 2. Yes/No radio buttons in an online Google Form

Sessions 1 to 8: Co-writing activity

Co-designers took part in a co-writing activity where they answered open-ended questions in written form (or alternative formats) to gain insights into the ways that they prefer to communicate, and their experience accessing online meetings. Co-designers were asked questions pertaining to their communication needs and preferences for attending online meetings. In answering these questions co-designers pointed out problems they have with meeting platforms and with registering and preparing for, and participating in, online meetings. Initial ideas were then discussed for how to resolve the problems they experience and support their individual access needs. Table 10 summarizes the details and artifacts from each session.

Artifacts produced:

- Co-designer responses were added to a shared Google Doc.
- Findings were organized in a separate shared Google Doc for following sessions.
- Rough mockups were created in Figma.

Table 10. Summary of sessions 1 to 8 with co-designers with CCAN

Session	Co-designers	Meeting format
#1	1	Asynchronous (Email)
#2	2 & 2B	Asynchronous (Word Doc, audio recording)
#3	3	Asynchronous (CryptPad)

#4	4	Asynchronous (CryptPad)
#5	5	Live Session (Zoom, CryptPad)
#6	6	Asynchronous (Email)
#7	7 & 7B	Asynchronous (Email)
#8	8, 9, & 10	Asynchronous (Shared Google Doc)

Sessions 9 to 11: Brainstorming and discussing ideas

Following the co-writing sessions, co-designers reviewed, discussed, and added on to the findings from all previous sessions which were collected in a shared Google Doc. We looked at the rough mockups that were created in Figma, and co-designers suggested changes. They were able to add any other related ideas to the Figma board.

Artifacts produced:

- Findings were further organized by co-designers in our shared Google Doc.
- Low-fidelity prototypes of co-designers' ideas were created and shared in a collaborative Figma board.

In co-design session #11, as shown in Table 11, I met with Co-designers 1, 3, 5, and 6 using an open source video conferencing platform called Jitsi Meet, which none of us had used before. For context, in a previous co-design session (session #9), co-designers 1 and 3 both suggested we try a new meeting platform, besides Zoom, for our next meeting so we could get inspiration for new accessibility features that could be added to new or existing meeting platforms. During our session, co-designers evaluated Jitsi based on whether the platform supported their communication access needs. They identified barriers within Jitsi pertaining to the meeting controls and menu bar which appears at the bottom of the meeting window (see Figure 3).

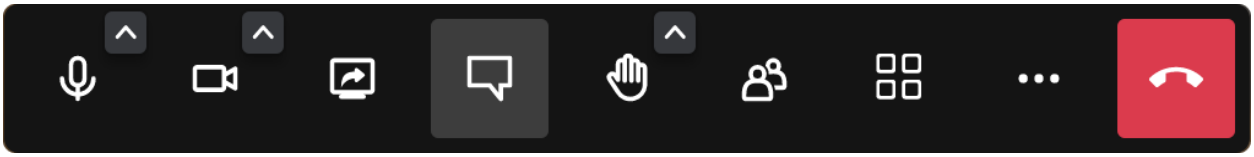


Figure 3. Jitsi Meet menu bar with meeting controls

Some of the issues raised by co-designers included not being able to hide the menu bar and having difficulty clicking some of the menu buttons because they found them too small and required more fine motor control.

> Co-designer 6: “It is more difficult than using Zoom. The buttons are smaller. Also, turning the audio and video on/off was a bit difficult. It requires more fine motor control.”

Having the menu disappear was also noted as an important feature to have for online meeting platforms; without this, it blocks people’s faces, which was the case during our session. Co-designers mentioned that a lot of AAC users use body language and nonverbal communication signals such as facial expressions and hand gestures to communicate. So, ensuring that nothing is covering people’s faces is important, so people can understand what is being communicated during the meeting.

Table 11. Summary of sessions 9 to 11 with co-designers with CCAN

Session	Co-designers	Meeting format
#9	1 & 3	Live Session (Zoom, Figma)
#10	5 & 6	Live Session (Zoom, Figma)
#11	1, 3, 5, & 6	Live Session (Jitsi Meet, Figma)

Sessions 12 to 16: Concept feedback and refinement

Following the brainstorming sessions, we conducted several rounds of concept feedback, as shown in Table 12. In each session, co-designers iteratively and cumulatively contributed to refining our collective design concepts.

Table 12. Summary of sessions 12 to 16 with co-designers with CCAN

Session	Co-designers	Meeting format	Co-design activities	Artifacts produced
#12	2 & 2B	Live Session (Google Meet, Figma)	**Concept feedback and Refine ideas:** Co-designer 2, with	Updated prototypes from session

			support from co-designer 2B, demonstrated how she uses her AAC device to access and interact with online meetings. They elaborated on their responses and ideas from co-design session #2, and refined existing ideas from other co-designers in the shared Figma board.	#9-11
#13	7 & 7B	Asynchronous (Email, Word Doc)	**Concept feedback and Refine ideas:** Co-designer 7 and 7B elaborated on their responses and ideas from co-design session #2, and refined existing ideas from other co-designers.	Updated prototypes from session #12
#14	8, 9, & 10	Live Session (Zoom, Figma)	**Concept feedback and Refine ideas:** Co-designers added new features to the prototypes, which are cumulative artifacts from the end of session #13.	Updated prototypes from session #13
#15	2 & 2B	Live Session (Google Meet, Figma)	**Refine ideas:** Co-designer 2 and 2B added new features to the prototypes, which are cumulative artifacts from the end of session #14.	Updated prototypes from session #14
#16	8, 9, & 10	Live Session (Google Meet, Figma)	**Refine ideas:** Co-designers added new features to the	Updated prototypes

			prototypes, which are cumulative artifacts from the end of session #16.	

Feedback about our sessions

Following each session, I welcomed feedback from all co-designers on what went well during the session and what could be improved for future sessions. Feedback questions and questionnaires were shared in alternate formats following the sessions. Some co-designers chose to share their feedback during the sessions while others opted to send theirs via email, either before or after our sessions.

Feedback questions consisted of the following:

1. What should I start doing in the next co-design sessions?
2. What should I stop doing in our next co-design sessions?
3. What should I continue to do in our next co-design sessions?

The feedback I received pertained to the stages before, during, and after our sessions and helped me ensure that I was providing the necessary accommodations for all co-designers to participate and communicate effectively and comfortably throughout the project. In addition, co-designers in later sessions benefited from the feedback provided in earlier sessions which I applied to all subsequent sessions going forward. For example, early feedback I received from co-designers pertained to sharing the agenda and discussion questions in advance of our meetings. Several participants mentioned that they would appreciate it if I sent the questions, I planned to ask ahead of time so they could prepare their responses on their communication software. In doing this, I found that it made our sessions run much smoother and quicker because co-designers were prepared, and we could have fruitful discussions because of that. This was a piece of feedback that was great to receive at the start of my research because I could implement it as I was going and it benefited everyone in the project, not just those who use AAC.

Start doing

> Co-designer 10: “Could you please put any questions that you have into a Google Doc because the team can work off of each other? Our communication is totally

> words, but it is totally what people are seeing too. Seeing the AAC user typing is a huge deal."

> Co-designer 6: "I think you'll find 2-hour sessions are too long. I do Zoom meetings a lot and most people get tired after about an hour. I'd say 90 minutes tops."

> Co-designer 7B: "2 hours seems long and might dissuade some from participating online. 10 minutes for the guidelines seems long especially given you are providing them in advance, and most are participating because they are advocates and care deeply. Perhaps ask people to read them in advance to save time and then during the online session ask if anyone has any questions while you briefly put them up on the screen (bullet form, short, and concise) for all to see and quickly revisit or review."

Co-designers identified several things that they wanted me to start doing for all of our sessions going forward. These can be thought of as gaps in how the sessions were designed and basic accommodations and preferences that would go a long way in helping them participate in the project comfortably.

- **Start doing before our sessions**: Co-designers requested I give them at least a week to respond to emails about their availability, discussion questions, and requests for design feedback, and factor in any National holidays and time zone differences. Co-designers also requested that I send out any questions I plan to ask ahead of time as it is easier for them to follow along during the session. In addition, they requested that I send a reminder email with a meeting link approximately 30 minutes before the meeting so that it does not get lost in their email inbox and they do not need to spend time searching for it from an earlier email. I also received scheduling feedback on the structure and time allotments for the agenda items for each session.
- **Start doing during our sessions**: Co-designers requested that I share my screen when explaining concepts and activities related to the project. In addition, while sharing my screen, they noted that it would help them follow along easier if I zoomed-in on the content. I also received suggestions for how to support participation of co-designers with online collaborative documents.

Stop doing

> Co-designer 1: “Stop using Jitsi. Use Zoom for our next session.”

Co-designers did not have as many things that they wanted me to stop doing for our sessions. All the feedback I received in this regard pertained to the use of different online meeting spaces.

- **Stop doing during our sessions**: Co-designers requested that we use a common meeting platform like Zoom for our upcoming sessions, rather than Jitsi Meet. The reason is, they are more familiar with a platform like Zoom and certain accessibility features that Zoom has that Jitsi did not have, such as the menu bar disappearing. In our co-writing session, co-designer 5 discovered that there was no easy way to “undo” text in CryptPad; using “Ctrl + Z” on the keyboard did not work. For this reason, he suggested that we use Google Docs for our upcoming co-design sessions instead of CryptPad as common keyboard shortcuts are an important accessibility feature for online spaces.

Continue doing

> Co-designer 3: “Offering the option of a group online forum or simply allowing participants like myself who prefer to answer on my own serves to improve your reach and participation and should be continued. Providing examples allows participants to understand what you are seeking and was very helpful. Keeping it short is preferable. Providing an agenda is great and speaks to thought-out facilitation; however, a 20-minute warm-up serves what purpose - to focus, to build cohesion for a group that isn't expected to last long? Might participants be deterred by this without understanding its purpose? 30 minutes for all the questions might be short unless participants prepare their answers in advance; although it depends on how many participants and how much space/time they have.”

> Co-designer 1: “Continue writing down the ideas and making a plan.”

Focus groups and design sessions with community organizers

Two separate semi-structured interviews were held with the organizers and committee members of two AAC community groups. As shown in Table 13, Session #1 consisted of community organizers from the Bliss i-Band (Focus Group #1), and Session #2 consisted of community organizers from Breaking the ICE (BTI) Canada Conference (Focus Group #2). Both group interviews were conducted online over Zoom. Those participating in the interviews signed consent forms. Co-designers 2B and Co-designer 6, who are members of the Bliss i-Band and Breaking the ICE (BTI), respectively, were already formally participating in the research project prior to these group interviews being conducted. As such, they were not expected to sign another consent form to take part in these sessions.

Each group was asked open-ended questions about their roles within their given community group; how the transition to online meetings during the pandemic impacted their group meetings (and the way they organize their meetings); what their process is for organizing online meetings and events; and how they accommodate diverse communication (access) needs for online meetings. Follow-up questions were also asked based on their responses. Each session involved a group discussion based on my initial questions; however, the discussions did not strictly follow the questions asked. Each group spoke to some of the benefits and challenges associated with meeting online (in contrast to meeting in person), from their perspectives as meeting organizers, hosts, facilitators, and community leaders. We also discussed and explored design ideas that could resolve some of the challenges they face when holding online community meetings that would help them better support the diverse communication needs of the community members. For this reason, I viewed these group interviews as informal design sessions as well, and community leaders were also considered co-designers. Session #1 (Bliss i-Band), which was held during the Discovery phase of the research, focused more on understanding the issues and brainstorming ideas to address those issues. Session #2 (Breaking the ICE), which was held during the Refinement phase of the study, also focused on understanding the issues as well as reviewing and contributing to the design ideas suggested by the meeting organizers and leadership from Session #1.

Table 13. Summary of focus groups and artifacts from each session

Semi-structured interviews and design sessions (Community members who organize and lead online meetings)				
Focus group	Community group and co-designers	Meeting format	Co-design activities	Artifacts produced
#1	Bliss i-Band Co-designers: 11, 12, 13, 14, & 2B	Live Session (Zoom)	Group discussion about meeting roles and ways they support access needs in their meetings. We brainstormed ideas that could help them, as meeting organizers and facilitators, better support communication access for online meetings.	Initial ideas were mocked up on Figma, a virtual whiteboard, for the following sessions with community organizers.
#2	Breaking the ICE (BTI) Co-designers: 15, 16, 17, 18, & 6	Live Session (Zoom)	Group discussion about meeting roles and ways they support access needs in their community meetings. Brainstormed new ideas and contributed to existing ideas from the previous session with community leaders.	New ideas got added to Figma, and initial ideas were refined.

6. Data analysis and discussion of findings

The analytical strategy used in this study combined the production of:

- transcripts to represent the interactions and discussions that took place during the live interviews and co-design sessions
- written and visual data from asynchronous sessions
- observational notes that described important nonverbal communication signals such as hand gestures, bodily movements, and head-nodding to indicate “yes” or “no”

All video recordings were entered into the qualitative data analysis software, Dovetail[37], which allowed me to add descriptive labels and codes directly to the video data. Following each session, observational notes were reviewed, and key themes were pulled out. Data analysis began during the interviews and co-design sessions as a collaborative exercise with co-designers, where all co-designer responses were collected in online collaborative spaces, such as shared Google Docs[38] and the online whiteboard tool, Figma. This allowed co-designers to interpret their responses further, see and build off each other’s responses, and talk through their ideas. This created opportunities for co-analysis (Teachman & Gibson, 2018) and knowledge-sharing. This was followed by organizing and coding the data. The coding approach was created inductively as patterns and themes emerged. Reflective notes were recorded throughout the analysis process to make relevant links and summarize the insights that emerged.

This analysis shares the individual perspectives of people who use AAC, and their experiences of access barriers and support needs when accessing online meetings, followed by the perspectives of community organizers. Their combined insights shed light on the impacts of the online meeting context on communication access support, and the diversity of experiences and accessibility requirements to consider. In addition, it represents a community-level definition of what communication access in the online meeting context means to individuals in the community and speaks to how we might better support complex communication access needs (CCAN) when meeting online.

[37] https://dovetailapp.com/
[38] https://www.google.ca/docs/about/

6.1 Perspectives of people with complex communication access needs

The findings reveal that co-designers with CCAN experience a spectrum of challenges and have a range of needs throughout their journey of accessing online meetings. The findings also reveal opportunities for further developing existing accessibility guidance for online meetings based on these perspectives and addresses the first study aim of filling the gap in research on the impact of online meetings on communication access support for persons with speech, language, and communication disabilities (SLCDs), who may or may not use AAC.

Introductions to co-designers

There were 10 co-designers from the group of persons with complex communication access and support needs. Each co-designer had different methods and preferences for how they communicated and expressed themselves.

> Co-designer 1: "A great way to express myself is to write short stories using imagery based on my authentic feelings and life. [The] best way to express myself is with a smile on [my] face. I like face-to-face; it is really easy to know what [people] are saying."
>
> Co-designer 2: "I use my computer to be my voice. It takes me a little time to compose my message. You have to be patient and give me some time to type what I want to say. I have prepared messages on my computer, but I also use the keyboard with word prediction to type what I want to say."
>
> Co-designer 3: "I am a scriptwriter and a long-time activist for people with communication disabilities. I can communicate verbally a little, but I prefer typing out what I want to say in a meeting because of my speech impairment, being hard of hearing, and I have a bit of anxiety when speaking to strangers. Therefore, I feel more comfortable writing what I want to say at some online meetings."
>
> Co-designer 5: "I prefer to communicate with the AAC programs, Proloquo2Go[39] and Proloquo4Text[40]. I have these programs on my computer, iPad, and iPhone. I am a succinct communicator and prefer the written word as the way that I convey meaning whether it is through poetry, fiction, or essay writing. My ideas are best conveyed in written form."

[39] https://www.assistiveware.com/products/proloquo2go

[40] https://www.assistiveware.com/products/proloquo4text

Co-designer 6: “The type of communicator I am depends on who I'm communicating to. Like anybody else, I communicate differently given the situation. Generally, I type lengthy communications ahead of time. Sometimes I type letters/emails. Sometimes I use my speech-generating devices. Other times I use my voice.”

Co-designer 7: “I can speak but often people do not understand what I am saying which is frustrating causing me to, on occasion, shut down and say "never mind". When I do this and another participant encourages me to try again and gives me the time and space to do so, I really appreciate this. I also spell out words - I know many and learned them by sight. When I know what is required in advance of a meeting, I will write out my comments/answers in advance with the help of someone and put them up on the screen for all participants to see. At times, when I am not understood, I will Google it and show it to the participants. These are the ways I communicate in online meetings. I don't necessarily have a favourite but use all forms. I do have a phone that speaks for me but [I] have not gotten into the habit of using it all the time yet. I use it at restaurants to order. I prepare what I will order in advance with someone’s help.”

Co-designer 8: “I am a multimodal communicator. I have used a speech-generating device since I was about 2.5 years old. I am a speller-user[41], and I am lucky because I could read when I was 3 years old. I like using my speech-generating device, with eye gaze[42]. With my family, and people who know me very well, I tend to use partner-assisted scanning[43] to scan the alphabet so that I can spell to them. I also use facial expression, body movements, sounds, mouthing words and spelling. My communication partners sometimes serve as “word prediction” for me, especially when they know the context of what I want to say. That saves me some energy.”

Co-designer 9: “I’m a positive and strong communicator. Some of my favorite ways of communicating with others are using my communication device, my voice, and my facial expressions. The communication device I use is an Accent 1400[44]. I use direct select[45] to

[41] Shuffle Speller is a typing interface that can be used with brain-computer interface or with other alternative access methods, such as eye tracking (Oregon Health & Science University, 2022).

[42] Eye gaze technology is an electronic device that allows a person to control a computer or tablet by looking at words or commands on a video screen.

[43] Partner assisted scanning is an AAC technique in which communication partners provide scanning by showing/pointing and/or speaking the names of items (Burkhart & Porter, 2006).

[44] https://store.prc-saltillo.com/accent-1400

[45] Direct selection is a method of accessing an AAC system where an individual selects a specific target with a body part or accessory. Direct selection access methods for AAC include touch, laser, head tracking, and eye gaze devices (Communication Community, 2020).

access my communication device. I'm a very social person and I love to talk to my family, my friends and people who are around me."

Co-designer 10: "I totally love using my communication device to communicate with people and/or my laptop. Everybody basically understands me when I use a high-tech device because I communicate with spelling and a keyboard. It is pretty basic stuff. I am an eye gaze user, and I really love eye gaze because it is fast and easy. It just opens up my world so much more. I used to use switch scanning[46] for years and it is totally hard on the body. I used to hurt from my foot to the middle of my back. I really believe in trying new stuff and trying new technology! I love technology. [If]I don't have my technology with me, people will ask me yes and no questions, or [I use] a letter board. I communicate with Morse code using my mouth and I truly love using Morse Code[47] because the communication tool is just my mouth. My SLP [speech-language pathologist] in high school taught me [Morse] code and I still use it today."

Communication access barriers and support needs

Co-designers who use AAC identified a range of barriers they may face that limit their full participation and communication in online meetings, as well as various communication supports, they require to help them overcome certain barriers.

The identified communication barriers and support needs pertain to:

- Assistive technology/hardware requirements and individual meeting setups
- Completing online registration forms/questionnaires for meetings
- Meeting logins and passwords, and sharing meeting links
- Meeting controls and features in video conferencing platforms (e.g., chat box, captions, mute/unmute, and keyboard shortcuts)
- Scheduling and timing of the meeting
- Knowing which materials to bring to the meeting or event
- Having the meeting agenda and discussion questions shared in advance
- Conversational structure of the meeting (e.g., turn-taking and pace), contributing to discussions, and not having enough time to respond
- Understanding what is said and being understood by others

[46] Switch scanning software allows a user to operate a computer through a switch.

[47] Morse Code is, "a system of electronic communication. It uses dots, dashes, and spaces to represent letters, punctuation, and numbers. The symbols are arranged to spell out a message. A machine called a telegraph converts the symbols into electrical signals and sends them across a wire to their destination." (Encyclopædia Britannica, 2022, para. 1)

In addition, the identified barriers and support needs fit under the following seven categories, or steps, of accessing online meetings:

- Scheduling and registering for the meeting
- Preparing for the meeting
- Entering the meeting
- Participating during the meeting
- Preparing to leave the meeting
- Participating after the meeting
- Meeting platform accessibility

The study found that all of the identified barriers and support needs pertaining to the online meeting context apply to and require the support of 1) accessible meeting platforms; 2) meeting organizers and moderators; and 3) communication aids and/or support persons.

Scheduling and registering for the meeting

Before participants can attend an online meeting, it is common for there to be some form of registration process that they need to go through first. However, co-designers who use AAC noted that the registration process for online meetings can be challenging when meetings are scheduled at the last minute or when online registration forms are difficult to fill out with their assistive technology.

Timing of the event

> Co-designer 3: "If a meeting happens to be held on the same day that I have to go to another appointment or the timing of that would interfere with my personal care, I would like to have time to myself to arrange everything around or I cannot attend at all."

Completing online registration forms

> Co-designer 7: "When registering for something new, to access a link, my problems would center around any registration that is long, not simple. I am good with providing/writing my name, e-mail address, cell number, age, but if there were more questions, that might be harder for me and I would seek help…Explicit vs. implicit instructions are the kind I understand. I am better with yes or no [questions]

> or high, medium, low. 5 items on a Likert scale would not result in correct answers. I would become frustrated."

> Co-designer 2: "I need my communication partner to help with registering me for most things because it is hard for me to get the answers in the spaces on the forms that you have to fill out."

Preparing for the meeting

There is a great deal of preparation that participants who use AAC need to go through just to attend and participate in online meetings. The very nature of the online setting presents new challenges, steps, and requirements that in-person meetings may not have had. For example, the online meeting context requires additional hardware for many to be able to participate, such as a microphone, speakers, and an extra monitor or device to join the meeting. A person who uses a communication device, for example, already has hardware that they need to set up for the meeting on top of the extra hardware they now need. In some cases, co-designers noted not having the necessary hardware or needing help from someone to set it up.

Part of the preparation stage for many co-designers who use AAC consists of pre-programming messages into their devices before the meeting. This is an important step for them as it is the difference between them being able to participate fully in an online meeting and not being able to. It underscores the importance of meeting organizers providing the meeting agenda and discussion and activity questions well in advance so participants can prepare their responses and prepare how they will communicate during the meeting. Programming their responses into their devices can take time which is why they require enough time before the meeting to perform this step. When this is not done, co-designers noted feeling rushed during meetings as they are not given enough time to prepare and contribute their responses on the spot.

Assistive technology and meeting setup

> Co-designer 2: "I need two devices in meetings like Zoom because I can't see the Zoom screen as I am typing with Communicator[48]. This sometimes takes a while to set up and ensure there is not any feedback."

[48] https://www.tobiidynavox.com/pages/communicator-5-ap

Co-designer 8: “I usually don’t have problems. I lead web-based meetings for a group of adults who use AAC and our leadership group was meeting virtually even before the pandemic. I use a computer with speech generating software. That way, I can use the speech software and control the meeting software, share my screen, and run slideshows...I need physical assistance with turning on my computer, setting up and positioning my webcam and positioning my access device.”

Co-designer 9: “I need someone to set up my communication device and my Mac for me. I also need them to turn on both devices for me and connect them by a USB plug. So I can control my computer from my communication device.”

Co-designer 10: “When I have meetings online, I use two devices because it is better using two devices. I use my Tobii Dynavox[49] on a low table and I use the Webcam to view my screen on my laptop and myself. People are able to see me when I am typing. This setup works amazing [and is] great for communication skills, when I am working, I have to use my body for communication also besides my communication high tech tools. One of the big problems that I have with using my Tobii Dynavox is, I can’t hook up a bigger screen to it. I believe that AAC devices have to be full computers. I am finding that a little communication device for the community is just wonderful to have and use. When I am home, I use a 17 inch inside-out laptop and this is my work station and my laptop is a total need. I really wish I had the same computer controls [and] tools on my Tobii as my laptop. That would be amazing to have.”

Extra hardware and hardware limitations

> Co-designer 6: “Technology failing. Once in a while my camera/microphone needs to be unplugged and plugged in again in order to work. Usually I don't have someone here who can do it.”

Co-designer 8: “One issue I have is that I have to switch between speakers. One speaker that I have is better for music (our group plays music games and watches concerts online, and I have been a season ticket holder for the Symphony). But, I have a different speaker that works better for people to understand what I am saying. I think that maybe it has less bass than the other speaker.”

[49] Tobii DynaVox provides a suite of assistive technology devices for AAC including communication apps, speech generating devices and eye trackers for people with disabilities.

Materials to bring to the meeting

> Co-designer 1: “It would be helpful if people let me know before that I would need a pen and paper.”

> Co-designer 7: “It is important to know what I will need in advance so I don't have to leave and search these items out during the meeting.”

Knowing what will be discussed in advance

> Co-designer 3: “Sometimes organizers forget that I have to type out my answers and do not give me the questions ahead of time, so I have to struggle my way through some of the meetings.”

> Co-designer 7: “Knowing in advance what will be discussed is very important so I can prepare how I will communicate. Whether it is writing down what I will say and practicing it beforehand and verbalizing my comments during the meeting or the other methods, knowing in advance is imperative to my fully participating.”

Entering the meeting

Co-designers noted experiencing challenges when entering the online meeting room. When a meeting requires a password to gain entry to the meeting room, or if the password or meeting platform changes, co-designers noted experiencing challenges to accessing the meeting in these cases. When this happens, they may require support from a communication partner or a support person to help them join the meeting.

Meeting login, passwords, and sharing meeting links

> Co-designer 9: “One of the problems I have is sending out a Zoom link to my friends in advance, which doesn’t work sometimes. I also have a problem with turning on captions for them in Zoom sometimes. I usually sent out a Zoom link to everyone at the last [minute]. That works for everyone. I would type my message in the chat box

> for them to read instead of caption. I prefer using Google Meet instead of Zoom because it's easier and faster to get on."

Co-designer 7: "Once I have Teams, Zoom, etc. on my computer, I never have a problem with the links that provide direct access. Sometimes when there is a password for a new meeting (not recurring), I don't notice it in the correspondence so seek help. So, links that provide direct access to the meeting is best."

Participating during the meeting

Co-designers shared different methods that they use to contribute to conversations during meetings. These methods included sharing their responses through the chat box; unmuting their microphones; preparing their responses on their communication device in advance; and sharing their screen so people can read the responses that they prepared off their shared screen. Among these varied methods of contribution, co-designers identified several communication and participation barriers that they experience during online meetings, as well as their communication support needs. The challenges they identified pertained to the pace of conversations; issues with turn-taking in group discussions; not having enough time to contribute to discussions; and either not understanding or not being understood by others in the meeting. Co-designers noted that when there are multiple people talking at once in the chat, it is hard to follow and keep track of who is saying what, especially if the conversation is moving quickly. When this happens, it is common for their responses to get lost in the chat and people may miss it. In Zoom, for instance, the chat box does not have a reply feature like other platforms like Microsoft Teams, so when someone adds something in the chat, it is not yet possible for people to directly reply to them.

Conversation pace and coordinating turn-taking

> Co-designer 1: "If too many people are talking at the same time, I can't hear a lot. This is why I like to spend time with people in-person or one-on-one."

Co-designer 5: "It's hard to say something in a meeting where everyone is talking really fast, and going quickly one after another…And it feels like I am interrupting someone when I speak. [I am] not able to provide input without interrupting."

Co-designer 7: “When there are a lot of people on Zoom, because of my communication difficulties, I am often not given the space and time I need to convey what I want to say. However, when there is an effective facilitator/leader who recognizes my limitations and needs and ensures understanding and gives me the time to use my cell to show what I am trying to say, or write it down and hold it up (not in chat) for all to see, that really helps me feel understood and like an equal participant.”

Contributing to discussions during meetings

> Co-designer 5: “I usually say at the beginning of meetings that the main accommodation that I need for the meeting sessions is for people to give me time to write my messages.”

Co-designer 3: “Sometimes I don’t have enough time to type out some extra thoughts. They should give me some extra minutes to type out my thoughts during a meeting.”

Co-designer 6: “Sometimes I share my screen and have people read what I've prepared. Other times I have it prepared in my speech device.”

Being understood and understanding what is said

> Co-designer 4: “People have a hard time understanding my device, so I make sure the chat box is open from the start.”

Co-designer 3: “I would like them to type out some important points during the meeting because I might miss out [on] a few words [during the meeting] because of my hearing impairment.”

Co-designer 7: “Having severe verbal apraxia[50] is my biggest problem— communication, being understood, being given the time to speak. People make assumptions on what I say and then quickly move on impatiently. Some people in meetings seek

[50] Apraxia of speech (AOS)—also known as acquired apraxia of speech, verbal apraxia, or childhood apraxia of speech (CAS) when diagnosed in children—is a speech sound disorder. Someone with AOS has trouble saying what he or she wants to say correctly and consistently (National Institute of Neurological Disorders and Stroke, 2022).

comprehension and end up understanding me. Others are impatient and move on quickly leaving me feeling left out."

Preparing to leave and leaving the meeting

One co-designer shared that they have trouble leaving online meetings due to there not being an easy keyboard option to exit the video call. In these cases, the meeting platform requires attendees to double-click a button to leave the meeting, whereas he expressed that a keyboard shortcut would be much less cumbersome. This initiated a conversation about the different keyboard shortcuts that various meeting platforms have and need to support accessibility.

> Co-designer 5: "So right now you have to click the leave meeting twice in the bottom right corner. And I sometimes find it difficult and would like a keyboard option to exit meetings."

Another co-designer who also organizes and chairs many online meetings with people who use AAC mentioned that before ending the meetings, she usually gives people a five-minute warning, so they have time to prepare and share any final remarks on their communication devices. She emphasizes that if a meeting ends abruptly without this extra time at the end of the meeting, they risk cutting people off who might be in the middle of preparing a message to share with the group. This five-minute warning at least helps ensure that people have another opportunity to say everything they want to say.

> Co-designer 6: "Usually I give a five-minute warning before ending the meeting. That way people can say whatever they want."

Participating after the meeting

Co-designers shared that when they experience communication and participation barriers during meetings, they may participate asynchronously by contributing their responses after the meeting ends. For example, one co-designer mentioned that she sometimes experiences technology failures during the meeting such as her camera or microphone needing to be unplugged and plugged back in again to work. When this happens during meetings, she may not have someone there who can help her do that, so she is unable to actively participate and therefore just listens and emails her responses after the meeting ends. Another co-designer

experiences barriers pertaining to the types of questions that are asked during meetings. He noted that when harder questions are asked during meetings, he does not answer them because he prefers to take his time to respond thoughtfully. As a workaround, he listens and records the meeting, and emails his responses after the meeting.

Asynchronous contributions

> Co-designer 4: "I try the best I can, but I don't answer hard questions because I want to take my time to answer, or I write answers in an email…I am listening to them and taping them because it will take time to respond and I like to think before I answer. Taping is my notes, then I write emails about what I think."

> Co-designer 6: "I use the chat feature [if technology fails]...[or I] just listen then email my responses."

Both examples highlight two different accessibility barriers that prevent communication and participation. One is due to technology limitations and the other is due to a lack of plain language being used during meetings. Although in both cases, the co-designers have developed their own asynchronous workarounds to mitigate the effects of access barriers they encounter during online meetings, it poses the question: what more can be done on the part of meeting organizers and chairpersons to support and advance their active participation in the event of such barriers?

Meeting platform accessibility

Co-designers identified several challenges with the accessibility of meeting platforms which stemmed from issues with changes and updates made to the meeting platforms; a lack of consistent keyboard shortcuts; using the chat box; auto-captions; and the mute/unmute feature. Of all the online meeting platforms we either used or discussed, Zoom was the most used among co-designers. Though it provides a range of accessibility features that people who use AAC may require, such as options for typing, captioning, chat box and keyboard equivalents for functions such as mute and unmute, raise hand (North American Alliance for Communication Access [NAACA], n.d.), it also turned out to be one of the least favourable of the platforms in terms of supporting participants' individual communication and participation needs. Co-designers noted many challenges with the Zoom chat box particularly, things like the

pop-up window for the chat box which some participants found difficult to access and use, or not being able to increase the chat box's font size (or at least make the chat box window itself bigger or being able to zoom-in to enlarge text). Co-designers saw this as a barrier to their ability to participate effectively. Many of the key accessibility features that participants wanted (which Zoom lacked) were surprisingly supported in Webex. One such feature that Webex has that Zoom does not yet have is the ability for those who are hosting meetings to be able to mute and unmute the microphones of other participants, especially those that may need tech support and/or assistance from an in-person helper who may not be present in the room with them.

Changes to meeting software

> Co-designer 8: “It is difficult for people who use AAC when the meeting software keeps changing. That was one of the challenges we had when we were using Google Hangouts (the predecessor to Google Meet). When software has changed and it even looks different, it takes extra time to get everyone up to speed on how to use it.”

Keyboard equivalents (shortcuts)

> Co-designer 2: “I like Google Meet better than Zoom because there are better keyboard equivalents for me to use it independently.”

Chat box

> Co-designer 2: “If the meeting requires me to use chat, I can’t access it with my device….so I need my [communication] partner to help indicate when I want to say something.”

> Co-designer 3: “I think for AAC users it's very difficult for them to go back and forth between windows or their Bluetooth is connected to another device, or they don't have the right keyboard to access [the chat box].”

> Co-designer 3: “I feel that in an online meeting, the fonts in the chat box are too small to read and they give me a hard time to type…Zoom has a very small chat box to type. I would have to concentrate on the chat box to see what I am typing and then I get distracted and miss what other people are saying on the live stream.”

Auto-captions

> Co-designer 8: “Captions. Some people need captions and the captioning does not do a very good job of picking up what people have said. That makes me frustrated because I think that the meetings should be accessible to everyone. Google Meet’s captions look great. But they still need to be better at picking up what people are saying.”

Mute and unmute

> Co-designer 8: “During the [adult community group] meetings, I mute and unmute the people who cannot do it for themselves. That is one reason why I use my communication software on the same computer that I use to do the web-based meetings (and split my screen). We use Webex. For a while, Webex took away the ability for the host to mute and unmute people. But that made it difficult to help people with their access. Even people who do not have disabilities sometimes need help when they are unfamiliar with web-based meetings or the particular software. I have found that people in that situation sometimes also need help with muting and unmuting.”

> Co-designer 2: “I need a communication partner to help me mute and unmute me when necessary.”

In summary, these findings highlight the individual communication barriers and accessibility requirements among co-designers who use AAC when accessing online meetings. It emphasizes the fact that attending and accessing an online meeting comprises many steps and it is more than just showing up. There was significant overlap between their access needs (i.e., what they needed to get to the meeting and participate), and their support needs (e.g., accommodations). In some cases, their communication access needs could also be seen as their communication

support needs. What this means is that sometimes what a person needs to fully participate requires some level of support. Whether that support is from a human or communication device, as meeting organizers and facilitators, it is necessary to be aware of this distinction to better support their needs throughout the entire online meeting process.

Co-designers spoke to the different steps they take to access online meetings, namely, when registering, preparing to attend, participating during the meeting and after. The findings also revealed two additional steps to accessing online meetings that I had not considered previously: joining/connecting to the meeting and preparing to leave the meeting. The findings speak to the fact that attending an online meeting can take time and ample preparation for a person with CCAN. These are things that meeting organizers should be mindful of throughout the process of designing and facilitating online sessions.

In some cases, only one co-designer shared that they experienced a particular challenge when accessing online meetings. Although no other co-designer shared the same challenge, their communication barrier is still valid and worth noting and arriving at a solution for. It once again addresses the importance of treating accessibility barriers and needs as individual experiences that cannot necessarily be accommodated nor resolved through a generalized approach. We all experience things differently and uniquely which these findings reveal.

Timing was also a major factor in the level of communication access a co-designer could obtain. For instance, timing in scheduling the meeting in advance, timing pertaining to sharing meeting materials and discussion questions in advance, having enough time to prepare and program their responses before the meetings, and being given enough time during the sessions to contribute additional responses. Co-designers noted that not having enough time greatly impacted their ability to participate effectively.

There were several points where co-designers mentioned needing additional support from someone. In all these instances, the need for additional support stemmed from an accessibility barrier with the online meeting space. For example, when registering for meetings, if the registration form is not assistive-device friendly or not written in plain language, a person with a communication disability and/or who uses AAC may require support from someone to help them fill out the form. Or, when entering the meeting room, if a meeting requires a new passcode to enter or the meeting platform being used has changed, they may need assistance to enter the new passcode or download or access the new platform. Ideally, we should be supporting independent access and participation as much as possible in these online meeting environments.

6.2 Perspectives of people who organize and lead online community meetings

Speaking with organizers and leadership from the Bliss i-Band and Breaking the ICE Canada Conference and Town Hall highlighted the many roles that are involved in running a successful and accessible online meeting that is also inclusive of diverse and CCAN. The effects of the transition to online meetings due to the COVID-19 pandemic were varied, and impacted both community groups in different and, at the same time, very similar ways. For both groups, the transition to online meetings completely reshaped the ways they previously connected and gathered as a community in-person prior to the pandemic. Both groups noted common technology challenges that people experience such as AAC users wanting to contribute to discussions but the pace being too fast to compose a message in time; or not being able to use their device to speak and watch the meeting at the same time. Moving to online meetings also inspired new ways of meeting online, and created new meeting roles, formats, and communication support strategies. The findings highlight how responsibility is shared among committee members to support effective communication access and inclusion for their members. In-person meetings tend to afford a larger scope, whereas online meetings, while they support broader participation, the scope of the meeting events are reduced. Due to the complex, multimodal nature of communicating online, the social interactions within both groups were directly affected and altered. Although both community groups gather for different purposes, the takeaways from both sessions reveal the variability of communication needs when meeting online, and the importance of providing effective communication support that can both adapt and adjust to meet those needs.

Introductions to co-designers

There were 10 co-designers from the group of people involved in community organizing, of which two, Co-designer 2B and Co-designer 6, overlapped, as they participated in both groups of co-designers[51]. Each had different suggestions and insights to share pertaining to the online meeting process, roles, and responsibilities.

> Co-designer 11 (Bliss i-Band): “The Bliss i-Band community is a smaller group within the larger Bliss[52] community. [We] bring a group of people from that community who are

[51] This research recruited two groups of co-designers. Group A consisted of co-designers with CCAN and Group B consisted of co-designers who organize and lead online meetings.

[52] Blissymbolics or Blissymbols is a semantic (meaning-based) language system and has many capabilities that spoken languages have. Blissymbols is a form of AAC, and can be used by anyone who has difficulty speaking, to complement their speech or replace their speech if they are unable to speak. Bliss can avoid misunderstanding and facilitate clearer communication.

interested in playing music together…The whole online thing changed everything. It completely changed the nature of the program and it has made it much more labor intensive because now there's all these different jobs that didn't exist before. And I think mostly for the better cause it pushed us to do this whole other way of doing things that we would not otherwise have done. I'm the music director. There was a lot of trial and error…and it wasn't immediately obvious what the best way was. Over the last two years, as we've transitioned to Zoom, the whole program has changed quite a bit…We still try to keep, as much as possible over Zoom, the feeling of getting together every week and having a jam session, "slash" music education sessions, "slash" rehearsal of our repertoire. But now there is this whole other dimension with making the videos and doing all of these other roles."

Co-designer 12 (Bliss i-Band): "My role now is administrative. I do the background stuff. I try to help us get money [and] report to the funding people. [Co-designer 11] does this too, so we separate the ones we are responsible for…And I keep the signers active…I'm a firm believer in the signing helping people be aware of chord changes, not necessarily what the chord is, but that it's changing."

Co-designer 13 (Bliss i-Band): "I do the technical support and now that we're on Zoom, because I'm not physically with [the i-Band members], I'm meeting them over Zoom. It can start from as basic as I'm helping them source an iPad. And then once we get the iPad, I'm helping them over Zoom to program it, to get the Garage Band all set up. And we also use another music app called SampleTank[53]. So, I might help them set that up too. It's troubleshooting if they have an issue with recording music, now that we're doing these videos together over Zoom, we work to get them recording their track and then get it to [Co-designer 14], and then he takes over from there. But if there's an issue, I help them pick their music. I just try to do these personal things that normally we would do face-to-face but now we're doing over Zoom."

Co-designer 14 (Bliss i-Band): "My official title is music assistant…musically, I'll fill in wherever I have to. I might lead us through an instrumental song that we might be working on. And I do a lot of music production, music editing, and video editing behind the scenes for the Band and a lot of file management because now that we're virtual, there are a lot of [digital] files and they need to be organized and named and we need to be able to deliver audio files and video files to one another…And little things too, like adjusting our chord sheets and our lyric sheets, and doing emails…here and there."

[53] https://www.ikmultimedia.com/products/st4/

Co-designer 2B (Bliss i-Band): “I have background roles in helping with the videos and narrative videos.”

Co-designer 15 (Breaking the ICE [BTI]): “We all share roles, and we got some new people on board, so they are taking on some of the roles as well. Previously, I have been involved in co-chairing with [Co-designer 6] and now some new people are taking on that role, which means asking some questions and paying attention to who has a message ready to go and trying to make sure that we don't miss somebody that has something to say.”

Co-designer 16 (BTI): “We are a committee of clinicians primarily and we've been going [to the Breaking the ICE Conference] for many years in-person. The committee work was largely around organizing the content of the Conference and finding speakers, who always were people who used AAC; supporting them to get their presentations ready; advertising or promoting with our clients and other people…Then when the [COVID-19] pandemic happened, we decided we wanted to continue keeping people involved. The town hall was just one aspect of the conference, one crucial aspect, but just one part of it. And that was the part we thought would do well virtually. [Co-designer 6] and a few other people were always chairing [the town hall] in the in-person conference, so she's continued to kindly chair it in our virtual events. And it's only recently we've shifted the focus a little bit from more discussion format to trying some different things, like a little bit of lecture and discussion, or watching a video and having some discussion, which probably gets into how we changed things up going virtual.”

Co-designer 17 (BTI): “I joined the Breaking the ICE committee in the fall of 2021. So, I have only experienced the virtual town halls. I’ve done a variety of things since starting. There've been two events that I've been able to participate in. We're all involved in the planning and determining the theme…And then myself and another person have taken on the role of developing the registration links and sending them out to clients and creating the save-the-dates. And I've been informally managing the Gmail account and responding to clients (participants) as they have questions about upcoming events.”

Co-designer 6 (BTI): “I come up with most questions and chair the meetings.”

Co-designer 18 (BTI): “I joined [Breaking the ICE] relatively recently...My role as a clinician is more under the pediatric AAC clinics. I was joining more for learning, to try to fill the gap when our clients leave our organization. How do we help them liaison with adult supporters in adult groups? For me, this is just gathering information, learning, trying to build those liaisons, and hoping to get the 16-, 17-, 18-, and 19-year-olds to start joining.”

Impact of meeting online vs. meeting in-person

This section includes the following three categories: building connections through informal socializing; face-to-face communication; and broader participation. These three categories point to the ways that online meetings impact communication and participation for members of both community groups. Co-designers noted that although the convenience of online meetings supports broader participation among their community members, more so than in-person meetings, co-designers felt that in-person meetings afforded greater opportunities for forming meaningful connections through informal socializing and face-to-face communication; two things that are not as easy to replicate in an online meeting environment.

Building connections through informal socializing

> Co-designer 2B (Bliss i-Band): “I do miss the social a little bit. Zoom's fine; you're seeing people, but it's not the same as being with people. We're not quite in the same room still…it's just not quite the same.”

Co-designer 11 (Bliss i-Band): “It's important to point out that [meeting in-person] was an important part of the overall program too. If people were there to help, they could also get some musical education out of it and be just part of the group playing. So that there's less of a differentiation between the people with the disabilities and the able-bodied people, because it was just a group of people socializing through music. There's a bit less of that now…We do miss something by being on Zoom. We can only have me playing with one person at a time, so we can't really have the whole group playing together. So that's a downside.”

Co-designer 13 (Bliss i-Band): “One thing that I miss is that when we were meeting in person, I felt like I could jump in and play music too, which was very fun for me. Now that we're on Zoom, I feel like I should be more vigilant of what's happening. I should be paying attention to what's going on instead of playing music. I'm sure I could probably do it too, but I feel like it's not as easy. It was fun when we were in person, and I could just grab a chair and sit down and play.”

Co-designer 11 (Bliss i-Band): “There was a lot of value in the informal socializing that happens when the group is gathering and the [meeting] hasn't actually started yet. There was lots of informal socializing as the group was gathering and departing…that doesn't happen on Zoom. And I think that was a big draw for a lot of people coming.”

Co-designer 18 (BTI): “The other thing that happened in one of our first [online] meetings was people didn't want to leave. We had done the structured activity, but they also just wanted a chance to be with each other, even though it was Zoom. Structure's good, but even that little bit of time to have some sort of opportunity [to socialize] is good too. Because again, that's the social side of things. It was an important question to many, that had raised more thoughts, that even though they had pre-prepared their answers, that spontaneous opportunity to socialize, we just didn't have time on the Zoom.”

Co-designer 15 (BTI): “So that goes to…building connections and how important that is to do in person, and people are definitely still missing that.”

Face-to-face communication

> Co-designer 13 (Bliss i-Band): “In the real world, when we meet, a lot of the ways we communicate is…[through] eye contact with each other to make sure that it's okay for us to speak. You might do little gestures, like turn your face to somebody and they know that you want to communicate. Over Zoom, it's a bit more challenging because we're seeing all these many screens and you're not really sure who you're focusing on. So, it's more challenging that way. Face-to-face communication is just harder.”

Co-designer 13 (Bliss i-Band): “When [an i-Band member] was in the hospital and she had her VOCA, [Co-designer 12] and I talked about getting another camera to come in over her shoulder and focus on the VOCA screen as she's typing. When you're face-to-face, sometimes if you're looking at somebody typing, you can often finish the sentence. The conversation can sometimes go a little bit faster because you can see.”

Co-designer 2B (Bliss i-Band): “It’s like word prediction. In face-to-face you would help. In face-to-face, [Co-designer 2] might start to say something you're clearly sure of. And it’s like, “do you mean…?”, and you would finish her sentence. She loves it when people do that, because then she moves on to her next sentence. When we’re Zooming, the fact that you can’t tell whether she’s actually typing a message is really frustrating.”

Broader participation

> Co-designer 11 (Bliss i-Band): “At least one group members said that she prefers to meet on Zoom instead of dealing with Wheel-Trans[54] and coming in person…The other advantage of Zoom is that it removed limiting the group to who was within a reasonable driving distance. Because now we have [members from] Sault Sainte Marie and Owen Sound and Sweden.”

Observed impact on persons with complex communication needs

This section includes the following three categories: different access methods and participation needs; conversation pace and contributions; and technology challenges, limitations, and workarounds. These categories speak to how the online meeting context impacts individuals with complex communication access and support needs in different ways. The process of meeting online may change a person’s accessibility requirements. The way they typically communicate might be altered depending on the nature of the online meeting environment such as the accessibility functions and features of the platform, and the availability and use of a person’s communication supports, such as a communication support person and/or an AAC device when accessing the meeting space.

Different access methods and participation needs

> Co-designer 16 (BTI): “One of the things I like about Zoom is, for people who do understand the technology and have good access, let's say, to a keyboard or a touch screen, [if] I’m monitoring the chat and that's known, the person can just message me if they want. But you can choose who you're going to message or you just [respond to] everyone, if that's easier. The more individual control, even if you don't use them all, gives a bit more flexibility.”

[54] https://www.ttc.ca/wheel-trans

Co-designer 14 (Bliss i-Band): “Some members do use the chat function, and sometimes some members will prepare some words to share with their AAC device. Those are all…ways that people participate pretty often.”

Co-designer 2B (Bliss i-Band): “[Co-designer 2] can't use her AAC device while she's playing. If she has something to say, she couldn't do it independently, without me using her letter board…she can't do both.”

Co-designer 11 (Bliss i-Band): “The nature of [one Bliss i-Band member’s] difficulty with movement is such that [her AAC supporter] is needed. They are there to help stabilize the iPad for her because her motor skills are such that…she could accidentally knock it away. It is necessary for [her AAC supporter] to help hold the iPad still and down while she's playing it…So that second set of hands is needed in that case. That’s the other thing it demonstrates; just how individualized different people's needs are and how individualized different people's experiences are.”

Co-designer 12 (Bliss i-Band): “We had a year when the group’s goal was a wider goal. It was for people with disabilities. [The co-founder] was bringing in the acquired disability group, and I had connections with the congenital people who had a disability from birth. And I think it's important to differentiate. We had to learn to differentiate because their participation was different. And what has happened through the years is that those with the congenital disability, those who were born with cerebral palsy or with some related disability, are the ones who have continued and who are members today. But in the early days, we had both. Those with an acquired disability, they wanted a faster pace. Their goals at the beginning were higher, and so there was a gradual retreat of those people from the i-Band. And I think that's an important thing to be aware of in everything that you do on the computer. Those who have lesser abilities and need more help move at a different pace, and we have to adjust to that. If everyone is in that frame of reference, then it goes fine, but putting the two together did not work.”

Conversation pace and contributions

Co-designer 15 (BTI): “One of the things that was a real learning for me at one of the in-person events, was that some of the signals that people have for [indicating] that they would like to have a turn were being missed. One particular person was missed out on in a town hall meeting cause he happens to have his hand secured to his wheelchair and didn't have a facilitator with him. So, he wasn't able to participate as

much as possible. So, we really try and make sure we're clear on when everyone has something to say [during the online meetings]."

Co-designer 2B (Bliss i-Band): "[Co-designer 2] tends to shut down when she gets in a big group of people who are all talking around her and the conversations moving way too fast. It's not that she doesn't want to contribute. It's almost not worth her time to contribute because by the time she gets it out, the conversation's moved three conversations down and she feels annoyed. She just stops talking…cause it's not worth it."

Co-designer 15 (BTI): "One of the groups–one of the people or squares[55]–that often joins is a group from a group home. That is a tricky one as well. Three of them sat in a room with one camera. So, it's hard for us to see them, it's hard for us to hear them, and they often don't have a facilitator because they're in a group home. So, somebody, their facilitator, would come in and set up the Zoom and then probably be off doing many other things. So those particular three folks don't tend to contribute a lot because they don't have the support around them."

Technology challenges, limitations, and workarounds

Co-designer 16 (BTI): "For many of our clients, if they just have a device, they can't speak, and watch Zoom at the same time."

Co-designer 2B (Bliss i-Band): "When we are in a group where [Co-designer 2] has to participate, I try to use two devices and you have the host of problems that come with that. There's an echo, and you have to make sure it's muted, and you have to make sure the sound volume's down, and sometimes Zoom does weird wonky things. It's a challenge."

Co-designer 15 (BTI): "At the ISAAC Connect Conference[56] last year, we had some social chats, and one fellow was using an iPad for Zoom. What he did was he shared his screen in Zoom so that he could see what he was typing and then shared [what he was typing]

[55] Squares here refers to the participant's video tile in the Zoom meeting room.

[56] https://isaac-online.org/english/conference-history/isaac-connect/

that way. It was very clever and it worked, but at first we were all like, “why are we seeing this guy’s screen? Why are we seeing his communication software?” And it's because that was the only way he could actually see his communication software and participate in the Zoom at the same time. It was clever.”

Access to additional hardware

> Co-designer 16 (BTI): “We met with a woman who works with Google in their assistive technology division. She was profiling all of the new accessibility stuff and some of that is speech-to-text. It speaks again to the hardware that people need in order to have access to these kinds of meetings. Because, in a way, if you could participate in the meeting with your device or computer, and you had a phone or tablet that was meanwhile on the side translating what was being said into your language—cause those software have come miles and miles—then you probably would be able to do it. But it's, again, just having all those different elements…very few of our clients would have access to that kind of hardware.”

Co-designer 16 (BTI): “Some people will contribute through chat because their device doesn't have any speech anyway. I think this is a technology challenge for some people. Some people have a computer, and they bought a separate webcam and they have a separate keyboard; that's relatively easy. If their screen is small and they're trying to have the Zoom window open and have something where they can type…the access to the right technology becomes a real challenge.”

Impact on communication support provided

This section includes the following three categories: sharing discussion questions ahead of time; troubleshooting at the start of a meeting; and building capacity and literacy with online meeting platforms. All three categories speak to the different levels of communication support that meeting organizers can provide when meeting online. Providing discussion questions before the meeting supports participation during the meeting, while offering troubleshooting support at the start of the meeting ensures that everyone can join and participate throughout. Finally, building capacity with online meeting platforms supports individual participation as the more people know how to use the platform and its features, the less they may require support.

Sharing discussion questions ahead of time

> Co-designer 6 (BTI): “We would have 10 minutes of silence and then all at once 10 people were ready to share, if we just post [the questions] at the very beginning [of the meeting].”

> Co-designer 17 (BTI): “We got positive feedback about this…what we would do before [the meeting] is provide people with the questions that we would be discussing in the town hall so that they can come prepared in whatever way they prefer to communicate, ready with an answer, which people seem to really appreciate…We sent out a feedback form after those sessions asking for feedback about the event and people really liked that. So they're ready to go in advance and prepared.”

Troubleshooting at the start of a meeting

> Co-designer 15 (BTI): “Before we even start, we structure the call so that we have about a half an hour ahead of time for people to get on the call. And, especially in the beginning [of the pandemic], we troubleshoot anything that they needed help with. We had one of our team members dedicated solely to troubleshooting and connecting through the chat, or whatever way was available to try and help folks that were having technical trouble with Zoom—with their mic, with their camera, with their sound—whatever it happened to be. As time went on, we found we didn't need as much time for that aspect of it.”

Facilitating contributions and participation

> Co-designer 12 (Bliss i-Band): “That's where Zoom makes it more difficult. If everyone's in person, then another helper can move over and give a little assistance if someone is there on their own…[Participation] can't be so dependent on the person that's going to help them. The dream would be that somehow that's all one thing that's functional for somebody.”

Co-designer 16 (BTI): "[At the in-person events], when someone indicated that they had something to say, we would go make sure they were ready to add their contribution…If [they were using] their device, we held the microphone to their device. If they use some other form of communication, we might get the message and then actually speak it out for them. So we were very aware that Zoom was going to create some challenges for that. So, I think people who don't use devices have really only been able to contribute if they have a facilitator with them that can speak out their message, which has been limiting for some clients who just don't have that person around them. Any adults in their own apartments on their own, they have to hire staff to come in."

Co-designer 16 (BTI): "It requires a lot of our eyes to be on the chat and to be on the screen…We really have tried to limit the numbers on the call. We haven't had to turn people who use AAC away, but just knowing that on our computer screens, as facilitators, we've got…24 spots, I think. And we want to be able to see everybody so we can notice body language and things going on in the background and make sure people can participate."

Building capacity and literacy with online meeting platforms

> Co-designer 18 (BTI): "One of the challenges that is happening to our pediatric[57] [AAC] users are the different school systems only use Google Meet or Microsoft Teams. Some of the platforms are not designed ideally. But that is what they're learning on. And as they move into adult services, they have to now learn something else. So again, how do we build capacity on those [platforms]? Cause they will become adult users as well."

Co-designer 16 (BTI): "We still have some funny situations where you're trying to direct someone, 'okay, go to the top of your screen and click this,' and just that whole literacy with video conferencing. Some of our clients have cognitive challenges, visual challenges, or attention deficits…it is very hard to manage everything that's on your screen if you don't do it often."

[57] 'Pediatric' pertains to the branch of medicine dealing with children and their diseases.

Accessibility limitations of meeting platforms

The research shows that there was a general desire among co-designers for greater accessibility features across online meeting platforms. This section discusses the five main themes: muting and unmuting participants, closed captions and synthesized speech recognition, translating captions into other languages, extra hardware for meetings, and sharing your screen using communication software.

Mute and unmute participants

> Co-designer 14 (Bliss i-Band): “In Zoom, the host is not able to unmute people.”

> Co-designer 12 (Bliss i-Band): “It’s a real pain when I know if I mute them, I will not be able to help them unmute. Sometimes it would be helpful if I could mute and unmute, but the host cannot do that.”

Co-designer 11 (Bliss i-Band): “I might often need to mute somebody because it's a noisy hospital setting and there's just too much background noise in the room that they're in. If they're much older or they don't speak English well, or they're just completely unfamiliar with the technology because they’ve never used it before, I might not be able to get them to unmute. I'm sure there's a reason I'm not aware of, but why is that part of the design of Zoom? That the host can mute somebody, but the host can’t unmute somebody.”

Co-designer 16 (BTI): “Some people have quite noisy backgrounds, or they might hit things on their device accidentally and I'm really tempted to mute them. But then I realize they may not be able to unmute themselves. Some of those controls I might use in a meeting at work with people who have good control of their computers. I have to be really careful what I'm using because that person may have very limited ability to operate Zoom. It might be set up and it's on, and then the staff disappears, and they've got to manage everything else.”

Closed captions and inconsistent synthetic speech recognition

> Co-designer 2B (Bliss i-Band): “Zoom doesn't like [Co-designer 2’s] [AAC] voice. I have to make sure that…I have an external microphone that goes right to the base because sometimes it doesn't pick up the tone. I don't know what it is…[e]specially with the older devices. [Co-designer 2] has a new voice and her new voice comes across better on Zoom than the synthesized voices. The original voice outputs are very synthesized. [One Bliss i-Band member] has an older synthesized voice and his voice on Zoom…it’s a challenge. I have to really…listen to what he's saying, and he might have to repeat it three times.”

Co-designer 11 (Bliss i-Band): “Our hypothesis is that there are certain sounds on Zoom that the Zoom algorithm is perceiving as background noise and it's programmed to filter it out. So [Co-designer 2’s] voice synthesizer is one of those sounds, we think. Usually, but not every day. You might want to find out why there's inconsistencies in this regard. For example, most of the time when somebody plays an electric piano sound on the iPad, it gets heavily filtered out in a way that an organ sound doesn't. So as much as we like the electric piano sounds, we say they're not good for Zoom because Zoom seems to be perceiving it as background noise and filtering it out in a way that it doesn't do with other instruments sounds…It's not always consistent. And it seems that some people's voice synthesizers are also in that category…They get filtered out as background noise. I'm pretty sure it's the algorithm that is differentiating between speech and background noise. And it's not well set up for music in general. Now they've updated Zoom several times over the last two years and it keeps getting better in that regard. But there's still a ways to go and it's way better than it was at the beginning [of the pandemic]. Because it was clear at the beginning that it was really designed for speech and anything other than speech was getting heavily filtered out and considered as background noise.”

Co-designer 16 (BTI): “We have a couple of people who participate, who are deaf or relatively hard of hearing and the closed captioning can be a bit of a problem. I watched a presentation the other day in AAC in the Cloud[58] and the woman used AAC. So her device was being captioned and it was really poor. Even though I could understand it quite well, the closed captioning didn't pick up her synthesized speech with her device, as well as it does natural speech. But again, it's the whole timing piece and it's getting

[58] ‘AAC in the Cloud’ is an AAC-focused online conference.

better than when we first used [Zoom], but a lot of people, even not being deaf, rely on the closed captioning to help them follow what's being said and give them a little bit more time. We tried using the transcript on the side and transcribing ourselves versus letting the closed caption function transcribe it. So that still needs some work."

Co-designer 16 (BTI): "Did you know Zoom has removed its automatic captioning in healthcare accounts? Apparently because the transcription is stored in an external server, or something like that. This is such a huge accessibility issue because many of our participants benefit, not just for those with hearing loss, but also to help processing…They do provide an alternative; an external [closed captioning] provider, which all cost [money]."

Translating captions into other languages

Co-designer 15 (BTI): "Translation into other languages…would be nice. We came up with some clunky ways of doing translation when you have people from around the world that speak different languages, like having Google Translate[59] on at the same time as you're watching an English [presentation]. There's clunky ways to do it, but nothing really streamlined, but really would be helpful…[Participants] in Mexico figured out that they could have Google Translate on, so Google Translate was translating the English subtitles…[the subtitles] were delayed. They were getting it translated into Spanish with a lag, so that they could participate. It was still hard for them to participate, but they could at least understand what was happening if they weren't native English speakers."

Sharing your screen using communication software

Co-designer 2B (Bliss i-Band): "[Co-designer 2] uses a VOCA[60], which takes time to produce a message. So ideally she would like to be able to share a screen so you can see her preparing her message because that's what you would do if you were face-to-face with her. But…there are limitations with sharing your screen. She loses the ability to see you. We have convoluted ways – using two devices, one has to be

[59] https://translate.google.ca/

[60] 'VOCA' stands for voice output communication aid

> muted, and then she's sharing her screen so you can see her preparing her message, and the other screen is her watching the group so she can still see the group."

Like the responses shared by co-designers with CCAN, meeting organizers go through several steps and stages to design, organize and facilitate online meetings for their community members. These findings provide context to the experiences shared by co-designers with CCAN as they illuminate the experiences of the meeting organizers and the ways that they support and accommodate diverse communication access needs throughout the meeting process.

The findings align with many of the findings and categories shared by co-designers with CCAN. They also emphasize the importance of sharing meeting roles in order to effectively support communication during online group meetings and making sure that there are enough people to monitor important communication channels like the chat box, for example. This way no one gets missed if they have something to say. In the cases where people do not have a support person or facilitator with them in person, co-designers mentioned that it is more challenging for those individuals to participate during. As one co-designer pointed out, the most ideal situation would be if the necessary communication supports were built-in to the system so those with CCAN could communicate and participate independently without the need for support from someone in the room with them. Because when and if that person leaves the room, they are stuck if they run into any technology challenges.

6.3 Proposed ideas to support communication access in online sessions

Co-designers with CCAN suggested ideas on how meeting organizers can design meetings to better support their communication and participation during online meetings. They, along with co-designers who organize and lead/moderate online meetings, also proposed several design features and improvements for video conferencing platforms like MS Teams and Zoom that could improve communication accessibility and support. The ideas were broken up into two main themes: ideas for meeting organizers and moderators; and ideas for meeting platforms, as presented in the following sections.

Ideas for meeting organizers and moderators

The following ideas are recommendations for meeting organizers and moderators to ensure accessibility and inclusion for individuals with communication disabilities.

1. Accessible registration forms

Ensure that registration forms are accessible, with clear instructions for assistive devices and pictograms for harder-to-understand questions:

> Co-designer 2B: “It would be helpful if there were accessibility and assistive device instructions for filling out the form. For example, ‘Use the Space key to fill in the radio [buttons]’ and ‘Use Enter or Space to clear your selection’.”
>
> Co-designer 7: “If there were questions [with] harder words to understand that had a pictogram, that might help me understand and not seek out help.”

2. Conversation structure and pace

Establish a conversation structure and pace that allows individuals who communicate differently to participate fully:

> Co-designer 5: “Maybe make people pause after someone says something to see if the person who speaks in an alternative way wants to speak.”

3. Share the agenda and discussion questions

Share the meeting agenda and discussion questions with attendees in advance:

> Co-designer 3: “Presenters or hosts need to discuss what the meetings will be about beforehand...Sending me the questions or topics that’ll be presented during [the meeting], a few days before the meeting.”

4. Alternate ways to participate and share responses

Offer alternate ways to participate and share responses, such as shared documents and different modalities of communication (e.g., visuals, written words, and speaking):

> Co-designer 6: “Shared documents [to] type in words. Just like you're sharing a document now. I open a blank document and use a blank page to type my responses.”

> Co-designer 7: “I participate in [community] activities on Zoom. They do a lot of dance and exercise and will show different options (words and pictures on their screen) to help me make a choice. Using different modalities of communication — visuals, written words and speaking — is very helpful and inclusive and aids in my understanding of what is being asked and in my ability to communicate my answers. The facilitator also gives me the option to answer by Googling and showing him or sending him the link in the chat box. He repeats to make sure he understood me 100% — this is essential.”

5. Seek clarification and allow enough time to respond

Seek clarification and allow enough time for individuals with CCAN to respond during the meeting:

> Co-designer 7: “Seeking comprehension by letting me know what they understood and asking me if that is correct would avoid me being misunderstood, becoming frustrated, and provide me with the opportunity to explain in a different manner.”

6. Provide a communication assistant

If possible, provide a communication assistant for attendees who may need one:

> Co-designer 3: “Communication Disabilities Access Canada has resources on communication assistants who can be hired.”

7. Educate others on how people who use AAC communicate

Educate others on how individuals who use Augmentative and Alternative Communication (AAC) communicate, through videos or live demonstrations:

> Co-designer 5: “More education on the ways people who use AAC communicate and access technology. Maybe videos or live demonstrations of people who use AAC communicating.”

Ideas for accessible platforms

Co-designers suggested several features that would make meeting platforms more accessible. These suggestions aim to provide more options for people with accessibility needs and make communication easier and faster.

1. Bigger chat box and text options

A meeting platform with a bigger chat box and font options for better typing and reading:

> Co-designer 3: “They should find a platform that has a bigger chat box [than Zoom] and fonts for us to type and read better.”

2. Keyboard equivalents for leaving the meeting

Redesign of Zoom's exit meeting function, including a keyboard shortcut for exiting meetings:

> Co-designer 5: “I wonder if Zoom could re-design how you exit meetings so there can be a better two-step solution. Right now you have to click the leave meeting twice in the bottom right corner and I sometimes find it difficult and would like a keyboard option to exit meetings. Maybe an easier 2-step solution like the Apple ‘Cmnd’ [Command] key with the letter Q and then hitting ‘Y’ for yes afterwards.”

3. Knowing when a message is being typed

Have a way to indicate when someone is typing and ready to speak, similar to the three dots in Messenger:

> Co-designer 8: “We need to have some way to know if people are composing/typing. Sometimes we wait for a long time because it looks like someone might be composing/typing, and then it turns out that they are not trying to say something. And sometimes we interrupt or talk at the same time because we don’t know that someone is going to start speaking.”

> Co-designer 8: “I think that we need something like the[3-dots] (“. . .”) that happens in Messenger to tell us someone is typing, and then some way for them to indicate that they are finished and ready to speak.”

4. Support faster typing among AAC users[61]

Any feature that can help AAC users type faster, as it takes a lot of energy, patience, and focus to communicate:

> Co-designer 8: “Also, and this applies to in-person as well as virtual meetings, anything that can help AAC users type faster, would be helpful. Of course, how to do that depends on each person’s individual challenges. But, we all have to work hard to communicate. It takes a lot of energy, patience and focus. So, anything that could make it easier and faster would be great.”

5. Support other ways of participating and sharing responses

Have the option for typed responses to appear under the speaker's picture, instead of in the chat box, to help others understand in real-time:

> Co-designer 7: “When I type something, instead of it going into the chat box, it would be great if it went under my picture as I am speaking or if I could embed a picture of what I am showing. This would help others in understanding me in real time.”

> Co-designer 7B[62]: “When a lot of people are chatting in the chat box, [Co-designer 7’s] gets buried causing him to be frustrated when he is not responded to. If the actual chat went under his name, people would be able to see in real time that [Co-designer 7] is trying to say something. This is important given most people have trouble understanding him, although with time, people do. He has severe verbal apraxia (in other words, the messages the brain sends to the mouth to form words gets all garbled up). You see his efforts and it takes him longer—not all people have patience. This gives him another avenue to communicate where his message doesn’t get lost in the chat box and allows him to participate in real time, not a few minutes later when the topic might have passed.”

[61] This idea could also be supported by AAC manufacturers and developers.

[62] Co-designer 7B is the mother and communication supporter of Co-designer 7.

6. Improving quality of captions

Have interactive speech generating devices that can send text directly to meeting software, to improve caption quality:

> Co-designer 8: “It would be great if the text could go directly from our speech generating devices to the meeting software. Like maybe they could be more interactive and then the meeting software would not have to rely on sound.”

7. Meeting controls for the host (mute and unmute)

There is a need for hosts to be able to unmute people they have previously muted:

> Co-designer 16 (BTI): “The fact that once you've muted someone you can't unmute them is an issue. So having that built-in would be good.”

8. Live translations of captions into other languages

Have live translations of captions into different languages:

> Co-designer 15 (BTI): “Translation into other languages…would be nice…There's clunky ways to do it, but nothing really streamlined. It really would be helpful.”

9. Built-in tutorials to develop literacy and build capacity

Have interactive tutorials to learn the platform, especially for those with accessibility needs:

> Co-designer 16 (BTI): “Within the software, if there was some really interactive tutorials that you could recommend — ‘we are using Zoom for this call, here’s a link to a tutorial’ — that was very interactive, so it was almost like a simulation of doing a call. People could independently explore that platform if they weren't familiar with it and learn where different things are. Maybe that exists in Zoom, I don't know. If it does actually, I'd like to know. Something like that would be really helpful, especially exploring more of those sorts of features that would be relevant to someone with accessibility needs.”

10. Ability to use AAC devices and see people in the meeting

A feature that would allow users to use their AAC devices and still see people in the virtual meeting room:

> Co-designer 2B: “It would be nice if there was a way you could still see the group of people [in the virtual meeting room] and still use the VOCA on the one device. Right now that's just not even feasible.”

6.4 Prototyping process

Based on the barriers and communication access and support needs, co-designers proposed ideas and explored solutions for supporting communication access and inclusion for online meetings, at an individual and community level. In an effort to design for diversity and variability, we co-designed “one-size-fits-one” solutions to address each design need presented by each individual (IDRC, n.d.-d). Ideas were brought forward by co-designers who use AAC) as well as AAC community organizers.

The cumulative and iterative nature of the prototyping process allowed for multiple contributions to the solutions by all co-designers. This meant that co-designers with lived experience could contribute to the ideas brought forward by community organizers, and vice versa. This open, cumulative, and collaborative approach ultimately enriched the design outcomes as they were “validated” through many perspectives; both from the perspectives of meeting attendees with CCAN and from the perspectives of meeting organizers and moderators. This approach also provided an opportunity for co-designers to share their unique perspectives for or against a given idea based on their lived experience. The resulting solutions highlight the importance of designing for individual differences and edge needs (Treviranus, 2018-b). The unique reasons why one person might like or dislike something may be very different from someone else’s reasons. These differences in opinions and preferences are directly informed by their individual needs and lived experience. Although many of the design solutions from co-designers who use AAC were specific to their individual access needs, these solutions still stand to benefit the broader population of people who meet in various online spaces, whether or not they use AAC.

The next chapter presents the design outcomes consisting of our community-designed solutions for supporting CCAN when meeting online.

7. Design outcomes

Together, through a collaborative and iterative co-design process, we explored and prototyped various tools for making online meetings accessible and inclusive for people with complex communication access needs (CCAN). Co-designers decided that the tools would be best communicated and shared in a central location in the form of an online communication access toolkit for accessible and inclusive online meetings. Included in the toolkit are various tools consisting of: (1) accessibility guidelines with protocols for how to host communication-accessible online meetings, featuring (a) an artifact for evaluating which online platform to use when organizing online sessions; and (b) an interactive checklist which serves as a model for designing, organizing, and running accessible and inclusive online sessions that support CCAN. The Toolkit also contains (2) design suggestions with desired accessibility features and plugins for software developers to implement in meeting platforms, and (3) a template of a collaborative online document for meeting organizers to use that provides an alternate way for participants, especially those with CCAN, to share their responses.

As noted by co-designers, to design for communication access, one must first understand what it is. Thus, one part of the toolkit serves as an educational piece meant to spread awareness about supporting diverse communication needs within the context of meeting online. A second part of the tool kit provides concrete suggested practices and templates that meeting organizers can use to improve the accessibility of their meetings.

> Co-designer 2B: “In order to be inclusive you have to understand.”

The following section provides a breakdown of the contents of the Communication Access Toolkit for Accessible and Inclusive Online Meetings.

7.1 Communication access toolkit for online meetings

The Communication Access Toolkit for Online Meetings is a community-led open-source toolkit for sharing knowledge about how to design, organize, and facilitate accessible and inclusive online sessions that accommodate persons with CCAN, before, during and after the meeting.

Shared community goals

The goals of the Toolkit, as defined by co-designers with CCAN, are to:

1. provide an open, online toolkit for sharing knowledge about how to improve access to online meetings for persons with disabilities.
2. educate the public on how AAC users and people who have speech, language, and communication disabilities (SLCDs) communicate and access information communication technology.

Who is the toolkit for

We welcome anyone to use and contribute to this toolkit, especially anyone who:

- experiences communication barriers when accessing online meetings
- organizes, hosts, facilitates, attends, or presents at online meetings, events, webinars, and conferences and wishes to make online gatherings accessible
- designs and develops virtual meeting platforms such as Zoom, Google Meet, Microsoft, Jitsi Meet
- advocates for communication accessibility rights and those who contribute to accessibility legislation

What is in the toolkit

The toolkit contains the following tools for supporting CCAN throughout the process of meeting online.

1. **Communication access guidelines and protocol for online meetings**: This includes considerations and suggested practices for supporting CCAN and inclusion when organizing and hosting online meetings. The guidelines provide both a checklist to help meeting organizers and general education and awarpeness about the lived experiences of persons with CCAN when accessing online meetings.

2. **Suggested accessibility features and plugins for meeting platforms**: These include new accessibility design features and plugins that software developers can implement to help make their meeting platforms more accessible to users with communication disabilities who may also use AAC.
3. **Participant responses template**: This includes a Google Doc template for a collaborative online document that can be used when organizing and running online sessions to support participation and contributions among persons with CCAN.

Where to access the toolkit

The toolkit is currently available on a public-facing website[63] (see Figure 4) and will continue to evolve and be expanded upon as the knowledge base grows.

The following three sections expand further on the design outcomes. Section 7.2 introduces the accessibility guidelines and protocol for organizing and running online sessions. Section 7.3 describes new accessibility features and plugins for existing and future meeting platforms to implement. Lastly, section 7.4 discusses an accessibility tool that could provide an alternate way for participants to contribute their responses (i.e., communicate and participate) for online sessions.

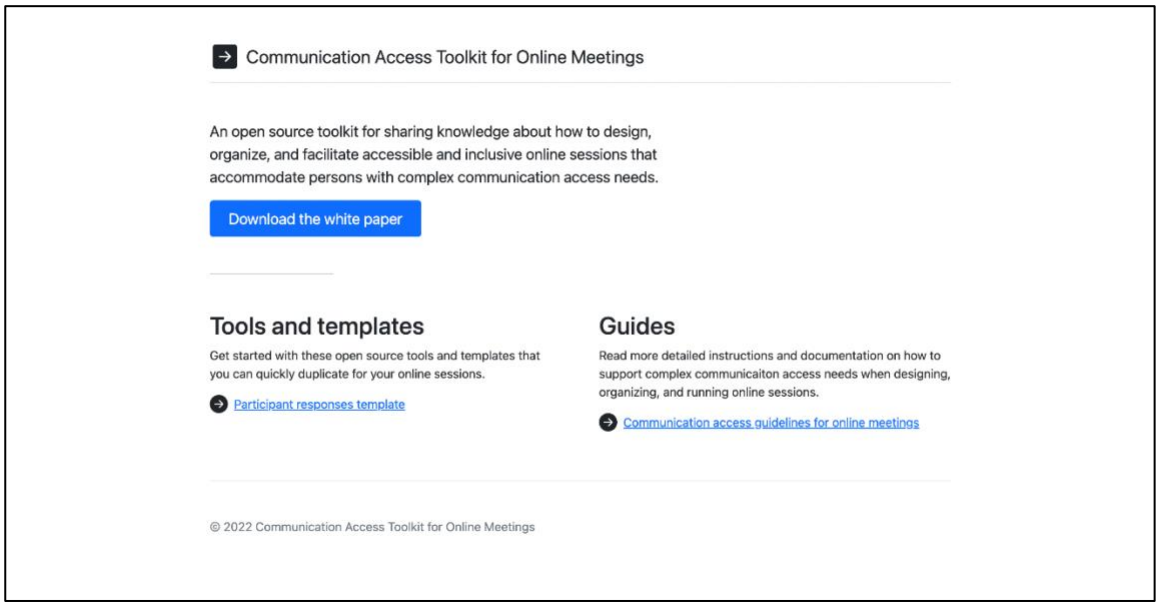


Figure 4. Communication access toolkit for online meetings (webpage)

[63] The Communication Access Toolkit for Online Meetings can be accessed with the following link: https://communication-access.github.io/online-meeting-accessibility-toolkit/

7.2 Guidance for accessible and inclusive online sessions

This guidance is for organizers, moderators, presenters, and chat box readers who participate in the efforts to make online meetings more accessible. This research found that for people with CCAN, there are various steps involved when accessing online meetings. Likewise, many of the steps overlap with the steps that meeting organizers take when designing and organizing these meetings.

The identified steps of an accessible and inclusive online meeting process can be grouped into 5 core phases and subphases:

1. Choosing an accessible platform
2. Before the event
    - Scheduling the meeting
    - Registering for the meeting
    - Preparing for the meeting
3. Joining (connecting to) the event
    - Entering the meeting
4. During the event
    - Participating in the meeting
    - Preparing to leave the meeting
5. After the event
    - Participating after the meeting
    - Sharing feedback about the meeting

These phases make up the online meeting process; however, more phases may exist. Within each of these phases, we identified a range of communication access needs and barriers among co-designers and different levels of accommodations and support that are needed in each phase. In addition, we identified their personal “setup” for attending a meeting which includes their communication devices and software, and any additional equipment and human support they may need to effectively communicate and participate.

Communication access support protocol for online sessions

Based on the collective contributions and feedback from co-designers with CCAN and community members who organize and lead online meetings, we co-created a protocol and checklist of suggested practices for supporting communication access and inclusion before, during, and after online meetings. The purpose of this community-designed protocol is to provide guidance to

meeting organizers, moderators, presenters, and chat box readers when meeting on a video conferencing platform. The protocol provides a roadmap on how to support diverse communication needs and help eliminate barriers for persons with CCAN at each of the 5 phases when accessing online meetings.

Phase 1. Choosing an accessible platform

This section provides a comparative breakdown of accessibility features that are important to people with CCAN, which meeting organizers should be mindful of when choosing an accessible platform. Table 14 below evaluates a range of accessibility features that people who use AAC may require, such as options for typing, captioning, chat box, raised hand and keyboard equivalents for mute and unmute (NAACA, n.d.). Co-designers and I identified these features across the multiple platforms and existing communication channels that we used.

Table 14. Accessibility features and meeting controls across platforms[64]

Accessibility features	Webex	MS Teams	Google Meet	Zoom	Jitsi Meet
Keyboard shortcut (End a call)	Yes	Yes	No	Yes	No
Host can mute/unmute participants	Yes	Yes	No	Yes[65]	No
Automatic captions	Yes	Yes	Yes	Yes/No[66]	No[67]
Live transcript and chat saved	Yes	Yes	No[68]	Yes	No

[64] The table highlights important accessibility features and meeting controls that platforms should have in order to support persons with complex communication needs. This table is available in Google Docs format. Anyone (e.g., software developers/designers) is free to comment on it in order to correct anything that is not accurate or needs clarification.

[65] This option is only available if the host enables pre-approved consent to be unmuted and the participant provides consent.

[66] Auto-captions are available for regular and corporate accounts, but have been removed for healthcare accounts.

[67] Auto captions are not provided within the Jitsi Meet platform, but they can be installed as part of a separate feature called Jigasi (Jitsi Gateway to SIP).

[68] Google Meet does not have built-in options to save live captions, and the only way to save the chat transcript is to record the video of the meeting as well. Meet Transcript, a free extension, can do this.

Real-time translations	Yes	Yes	Yes	Yes	No
Show/hide the menu/control bar	Yes	Yes	Yes	Yes	Yes
Enter meeting with another device	Yes	Yes	Yes	No	No
Share screen while seeing all meeting participants	No	No	No	Yes[69]	No
One-click sign-in (automatic entry)	Yes	Yes	Yes	Yes	Yes
Adjust size and layout of chat panel and text area	No	No	No	No	No[70]
Reply directly to a comment	Yes	Yes	No	No	No

[69] Zoom has a side-by-side mode for screen sharing

[70] Because Jitsi is open source, users can technically customize the meeting options/features to meet their needs, if they have coding knowledge.

Phase 2. Before the event

There are four steps for meeting organizers to keep in mind when designing an accessible invitation: scheduling, registering, and preparing. The toolkit provides organizers with the following guidelines and associated checklists to aid in this process.

Scheduling the meeting

Table 15. Accessibility considerations for scheduling online meetings

Accessibility barrier	Communication support need	Access suggestions and support strategies
Lack of time to schedule and plan for the meeting event	A person with CCAN may need time alone to rearrange their schedules when meetings are booked at the last minute; are on the same day as a pre-existing appointment; and/or conflict with personal care appointments. Otherwise, they may not be able to attend the meeting at all.	– Avoid scheduling last-minute meetings. Consider scheduling meetings in advance to avoid scheduling conflicts. – Choose an accessible platform. Consider choosing an accessible meeting platform with ample keyboard shortcuts, and ideally a platform with single-click access to the meeting space. You might also consider sharing the platform's list of keyboard shortcuts with participants ahead of the meeting.

Registering for the meeting

Table 16. Accessibility considerations for registering for online meetings

Accessibility barrier	Communication support need	Access suggestions and support strategies
Difficulty completing online registration questionnaires	A person with CCAN may need help from a communication support person to complete long, technical, and complicated registration forms. Others may require simpler questions on registration forms to support their understanding. In some cases, people with SLCDs, such as aphasia, may need certain terms and/or vocabulary in the form of pictures or symbols to understand and complete questionnaires.	– Simplify registration questionnaires. Consider simplifying the language, length, question format, and layout of your online registration forms and questionnaires. – Identify participants' communication support needs on the form. On the form, ask participants to identify any accommodations they need to participate fully in the meeting. – Provide instructions for completing forms with assistive technology. Consider providing detailed instructions for participants on how to fill out and navigate the online registration form when using a keyboard paired with assistive technology, such as switch scanning.

Additional considerations for supporting registration:

- On registration forms, use 'yes or no' questions, or Likert scales with only 3 values like high, medium, or low. In addition, provide communication support on questionnaires in the form of graphics and symbols for complex concepts and terms.

Preparing for the meeting

Table 17. Accessibility considerations for preparing for online meetings

Accessibility barrier	Communication support need	Access suggestions and support strategies
Information on what materials to bring to the meeting	A person with CCAN may need to know what materials they should plan to bring to the meeting ahead of time, as some people have mobility challenges and/or may require physical assistance to gather these items during the meeting.	– Share a list of required materials ahead of time. Consider informing participants about which materials (if any) they will need to bring with them to the meeting, well in advance, especially if they will need these materials to participate. Materials may include things like paper and pens or preparing their responses for discussion.
Preparing responses ahead of time	A person with CCAN may need to pre-program messages into their AAC device ahead of a meeting or event. This saves them time preparing longer-form responses during the meeting, and they can better participate and be more engaged in discussions.	– Share the meeting agenda and discussion questions ahead of time. Consider sharing the meeting agenda and discussion/activity questions in advance so participants who may use AAC have time to pre-program messages into their communication devices.

Additional considerations to support preparing for the meeting:

- Send out the questions or topics that will be presented or discussed at least a few days before the meetings if not earlier.

Phase 3. Joining the event

To support participants with CCAN when entering an event, we suggest that meeting organizers think about connection and troubleshooting strategies to help people get into the meeting easier. The following table provides organizers with an overview and associated checklists to aid in this process.

Entering the meeting

Table 18. Accessibility considerations for joining the online meeting

Accessibility barrier	Communication support need	Access suggestions and support strategies
Setting up assistive technology and AAC devices	A person with CCAN may need time to set up their communication devices and software just before entering the meeting. This may take a while in some cases, depending on the number of devices and additional hardware they use. For example, some people may use two devices in a meeting and separate speakers or microphones. Those who also have physical disabilities may need accommodations to set up and adjust their devices.	– Provide troubleshooting and technical support before the meeting. Provide technology support roughly 5 to 30 minutes before the meeting starts for anyone who needs help joining or logging into the meeting. – Provide trained communication assistants at meeting events. Find out if anyone needs a communication assistant to support them before, during, and after the meeting, and consider hiring them for the session.
Sharing meeting links and passwords	A person with CCAN may need support from someone to help them join a new meeting that requires a password or involves additional steps and clicks to join the meeting. If they do not have a support person around to help	– Support direct and/or quicker access to the meeting. Provide ways that help persons with CCAN access the meeting easier and, ideally, independently. Consider providing a

	them, they may not be able to join the meeting.	platform that supports one-click access to the meeting platform. In addition, consider using consistent meeting links and passcodes, where possible, for the different sessions and conference segments.

Additional considerations to support connecting to the meeting:

- Ask people what their communication signals are at the start of the meeting, such as how they communicate “yes” and “no”.
- Send out or reshare the meeting link via email 30-minutes to 1-hour before the meeting. This helps keep the meeting link at the top of people’s email inbox, so they do not need to search to find the original link.
- Some people have difficulty opening web links. Be mindful of this.

Phase 4. During the event

To support participants with CCAN during an event, we suggest that meeting organizers think about participation strategies as well as the ways in which they prepare to leave the meeting. The following tables provide organizers with an overview and associated checklists to aid in this process.

Participating in the meeting

Table 19. Accessibility considerations for participating in online meetings

Accessibility barrier	Communication support need	Access suggestions and support strategies
Technology limitations and meeting controls and features in platform	A person with CCAN may require technical support from a communication support person to help them access or control certain features of the video conferencing software, such as the chat box and muting/unmuting, or resolve technology failures so they can	– Support personal access needs and independent access. Be mindful of the fact that everyone’s access needs are different and unique, therefore their support needs may also differ. Allow everyone to participate and

	participate. In some cases, they may not have someone around, or others in the meeting may not understand their device's synthetic speech very well and may rely on other methods to participate like using the chat feature. A person with CCAN may also rely on key meeting controls or features such as captions (to understand and follow along during the meeting) and keyboard shortcuts (to access different functions of the platform independently).	communicate in the ways that are comfortable for them. – Do an accessibility check-in at the start of the meeting. Consider doing an access check-in at the start of the meeting or in advance. An access check-in allows people to share any access needs they might have, if they feel comfortable. – Do a technology check-in at the start of the meeting. Consider doing a tech-check at the start of the meeting to ensure that everyone can access important meeting controls like mute/unmute, raise-hand, and using the chat box. – Do a sound check-in at the start of the meeting. Consider doing a sound-check in the first 5 minutes of the meeting. Make sure everyone can hear and be heard.
Lack of time to respond, turn-taking, and fast conversation pace	A person with CCAN may need additional time to prepare their responses and respond during meetings. Especially in larger meetings where multiple people are talking quickly and/or at the same time, either in the chat box or through the microphone.	– Give people enough time to prepare their responses during meetings. Provide enough time for people to prepare and contribute their responses before moving on, especially for those who may use AAC.

Additional considerations to support participation during the meeting:

- At the start of the session, turn on captions for the entire meeting, and enable captions for all participants.
- Monitor the chat and any raised hands for when someone has something to say. Ideally, have someone assigned to this role.
- Write up key points from the meeting for participants with hearing impairments.

Preparing to leave the meeting

Table 20. Accessibility considerations for preparing to leave online meetings

Accessibility barrier	Communication support need	Access suggestions and support strategies
Lack of warning before meeting ends	A person with CCAN may not have a chance to say everything they wanted to say during the meeting, especially in larger meetings. They may need time to prepare final messages before the meeting ends. If the meeting ends without warning and they are in the process of preparing a message, they will be cut off.	– Give notice before ending the meeting. Consider giving a 5-to-10-minute warning before ending the meeting, so people can prepare and share any final thoughts they may have. It is important to have that time at the end.

Additional considerations for leaving the meeting:

- Consider using a platform that has a keyboard shortcut for leaving the meeting.

Phase 5. After the event

To support participants with CCAN after an event, we suggest that meeting organizers think about asynchronous participation and contribution strategies, as well as ways to capture specific communication access feedback about the meeting. The following table provides organizers with an overview and associated checklists to aid in this process.

Participating after the meeting

Table 21. Accessibility considerations for after the meeting

Accessibility barrier	Communication support need	Access suggestions and support strategies
Less active participation due to technology failing and harder questions asked during meetings	A person with CCAN may need to send their comments and/or responses to meeting organizers after the meeting due to their technology failing during the meeting or due to needing more time to answer harder questions which take longer to respond to with their communication technology during the live meeting. In cases like these, they may only be able to listen or tape the meeting and send their answers in an email after the meeting ends.	– Provide alternative strategies for people to participate in group discussions and activities. Provide or explore alternative methods, strategies, and tools to support their active participation during and after the meeting. – Collect feedback after the meeting. Provide an accessible feedback form to participants. Ensure that the feedback questions capture specific comments about how effectively their communication access needs were supported.

Additional considerations for after the meeting:

- Consider using a collaborative Google Doc that all participants have access to and can add responses to before, during, and after the meeting.
- Give people at least a week to respond and/or participate.
- After the meeting event, share the chat box and video transcripts, and video recordings.

7.3 Accessibility features and plugins for meeting platforms

Co-designers and I brainstormed and co-designed different concepts for new accessibility features and plugins[71] (e.g., being able to adjust meeting settings) that could be added to online meeting platforms to help improve communication accessibility within the platforms. Many of the design concepts are ones that we started prototyping and/or brainstorming but did not necessarily finish. Table 22 and Table 23 describe the design concepts for the new accessibility features and plugins. Because these designs apply to online meeting platforms, they are a bit more complex to implement and likely require the involvement of developers and software designers. As such, this section is primarily intended for software developers with an interest to develop accessible meeting platforms to accommodate people with CCAN.

The designs are a mix of existing features that we identified as useful in various meeting platforms that we used, and new features and plugins that were desired and imagined by the community. If implemented, the design features and plugins could greatly improve communication accessibility in online meetings as they are designed specifically to support AAC users and/or people with speech, language, and communication disabilities. There is also an opportunity for other meeting platforms that have not yet implemented these solutions to consider including them.

Design suggestions for developers and software designers

In this section, I 1) qualify the accessibility features that co-designers and I used to evaluate the different meeting platforms discussed in chapter 7.2; 2) present features that might matter to people with CCAN; and 3) present some design solutions to potential software developers and designers who are interested in creating new meeting platforms or plug-ins to add to existing platforms.

[71] In computing, a plug-in (or plugin) is a software component that adds a specific feature to an existing computer program. When a program supports plug-ins, it enables customization (Sterne, 2022).

Table 22. Accessibility Features and Plugins: Design suggestions from persons with CCAN

New accessible feature	Description
AAC typing awareness indicators	A feature for indicating when someone is: (1) preparing a message on their assistive communication software; and (2) finished typing and ready to speak/share their response.
Keyboard shortcut for leaving the meeting ("end call")	A keyboard shortcut for leaving a meeting. At the time of completing this study, the only platforms that had a keyboard shortcut for leaving a meeting (end a call) were Microsoft Teams, Zoom, and Webex. Both Jitsi and Google Meet are missing these shortcuts.
Flexible chat box	Designing a larger chat box with different width and height options to choose from based on accessibility needs.
See people in the meeting while also using an AAC device (Share screen to show message construction in AAC software)	In a session with Co-designer 2 and Co-designer 2B, they discovered that Google Meet's new feature Companion Mode[72] solves the issue of an AAC user being able to see others in a meeting while also using their AAC software, by allowing them to join the meeting with a second device. We expanded on this solution by co-designing ideas for enabling AAC users to share their screen for one of their devices to show their message being typed within their communication software.

[72] https://support.google.com/meet/answer/11295507?hl=en

Table 23. Accessibility Features and Plugins: Design suggestions from community organizers

New accessible feature	Description
Host can mute and unmute people	In separate sessions, community members from the Bliss i-Band and Breaking the ICE Canada Town Halls discussed having a built-in function for video conferencing platforms, where the host can mute and unmute participants: – if a meeting participant self-mutes, then the host cannot unmute them – if the host mutes them, then the host can also unmute them
Accessibility badge for mute/unmute feature	We discussed having an accessibility "badge" appear for security purposes when someone enters the virtual meeting room. The badge would notify all attendees upon entering the meeting with a message, like: "The host can mute and unmute you, and by entering the meeting you are consenting to that."
Built-in tutorials and guides	Built-in interactive tutorials so people can independently explore the meeting platform and features, as well as communication access guidance for supporting effective communication in the meeting environment.

The following section discusses in detail one of the co-designed accessibility features for meeting platforms. This design feature had particular significance to both groups of co-designers—those with CCAN and those who organize online meetings. The solution was based on a communication barrier that came up frequently with both groups, therefore, it felt like a good example to discuss.

AAC typing awareness indicators

In video-conferencing meeting platforms like Zoom and Google Meet, there is no simple, quick, and built-in way for a person who uses AAC to indicate to the meeting facilitator and group that they are preparing a message on their communication software. Due to their communication software being on a separate program or device outside of the meeting platform, they may also need extra time to prepare their responses if they were not prepared ahead of time. Having a

typing awareness indicator option built-in to the meeting platform could help facilitate independent participation among attendees who use AAC during online meetings, and support their communication with meeting moderators, organizers, hosts, and attendees.

> Co-designer 2B: “When we’re Zooming, the fact that you can’t tell whether [Co-designer 2] is actually typing a message is really frustrating.”

During a larger group meeting, for example, if there is a group discussion taking place and an individual who uses AAC wants to contribute to the conversation, they might first need to type out their message in their communication software, then copy and paste it into the chat box in the meeting platform. As was the case with several co-designers on the research project, this extra step could take several minutes. In these instances, by the time they add their response to the chat and share it with the rest of the meeting attendees, the conversation has sometimes moved on and their responses are out of place. This creates a barrier to participation as co-designers who use AAC stated they could not fully contribute to the group discussion. Additionally, co-designers noted the time-saving benefits of having a way to indicate whether they are constructing a message, especially in larger meetings, as meeting facilitators would not have to wait unnecessarily if a message is not actually being constructed.

> Co-designer 8: “We spend a lot of time waiting for someone to answer when they are not typing. And we ask them if they are trying to compose something. It kind of wastes time.”

To address this common challenge, co-designers and I prototyped a feature for a virtual meeting platform that would allow them to let people in the meeting, especially meeting facilitators, know when they are trying to say something, such as typing a message. In addition, they would need a way to let them know that they are done typing a message as well. Figure 4 and Figure 5 show early design concepts of this solution, which meeting organizers and leaders from the community also contributed to.

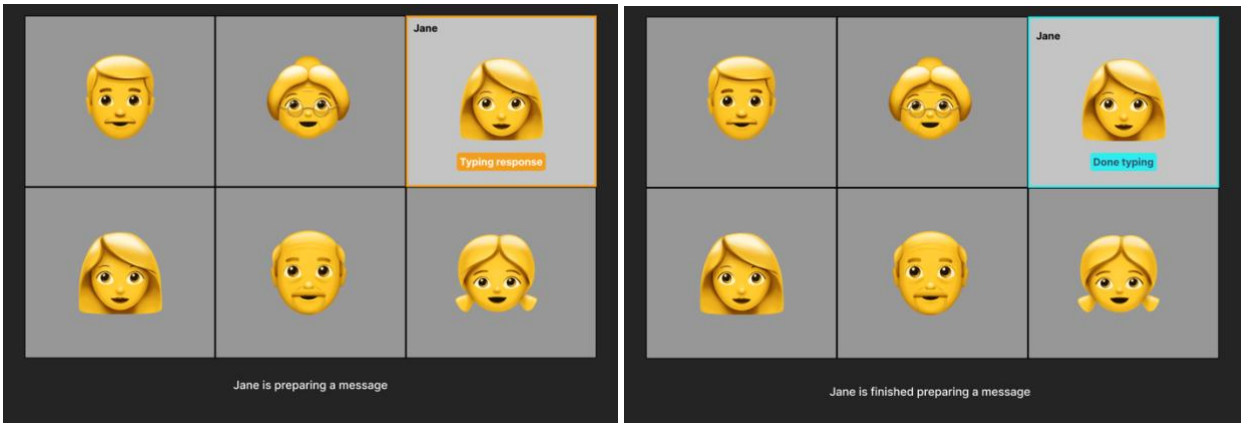


Figure 5. First iteration of "typing awareness indicators" design concepts (left: preparing a message, right: finished preparing a message)

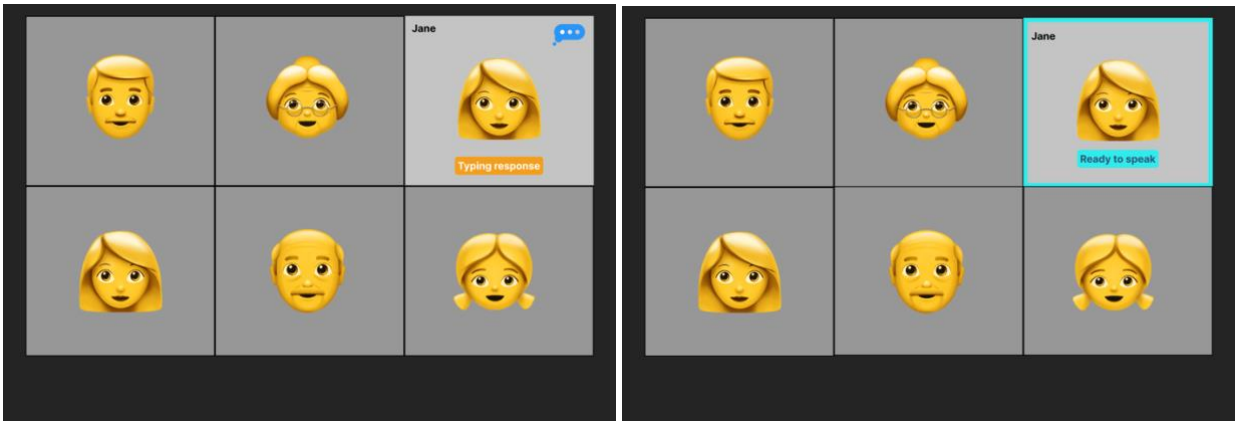


Figure 6. Second iteration of "typing awareness indicators" design concept (left: preparing a message, right: finished preparing a message)

Features of the AAC typing awareness indicator

1. An AAC user indicates that they are typing a response, by pressing a button or using a keyboard shortcut.
2. This will add a label as well as a speech bubble ellipses icon at the top of their thumbnail display.
3. When they are finished preparing their message, they will press a button or use a different keyboard shortcut to let the meeting know they are finished and ready to speak with their AAC device. The blue border around the name box indicates that someone is ready to share their message.

The addition of the “3-dots” speech bubble icon in the second iteration of the design concept was suggested by Co-designers 8, 9, and 10. This idea was inspired by Apple’s iMessage[73] and Meta’s

[73] https://support.apple.com/en-ca/messages

Messenger[74] platform, both of which use similar typing awareness indicators — those are the three dots that appear on your screen to show you when someone on the other end is typing a message (Tech Insider, 2016). Co-designers suggested adding the speech bubble ellipses icon, in addition to a word-based label (shown in Figure 5), for the people who have difficulty reading. The 3-dots are more universally recognized as they are used on many virtual platforms. Also, using both the text-based label and the speech bubble ellipses icon supports different accessibility needs.

7.4 Tools to support participation in online sessions

This section presents some design solutions to meeting organizers who design, organize, and lead online sessions, shown in Table 24. These solutions, or meeting tools, are intended to help meeting organizers better support persons with CCAN throughout their journey of accessing online meetings.

Design suggestions for meeting organizers

Table 24. Tools for meeting organizers supporting persons with CCAN

Support tool	Description
Collaborative online document template for sharing responses	Use a shared Google Doc for AAC users to add their responses to before, during, and/or after a meeting. Make this document open to all participants in advance.
Accessible online registration forms	Using descriptive language to explain how to complete forms with assistive devices.

The following section discusses in detail one of the co-designed accessibility tools that could provide an alternate way for participants to contribute their responses (i.e., communicate and participate) before, during, and after online sessions. This design feature had particular significance to co-designers with CCAN as it was felt that if such a tool was implemented in online meetings, it could support broader participation among people who use AAC; hence why we have chosen to detail this design solution.

[74] https://www.messenger.com/

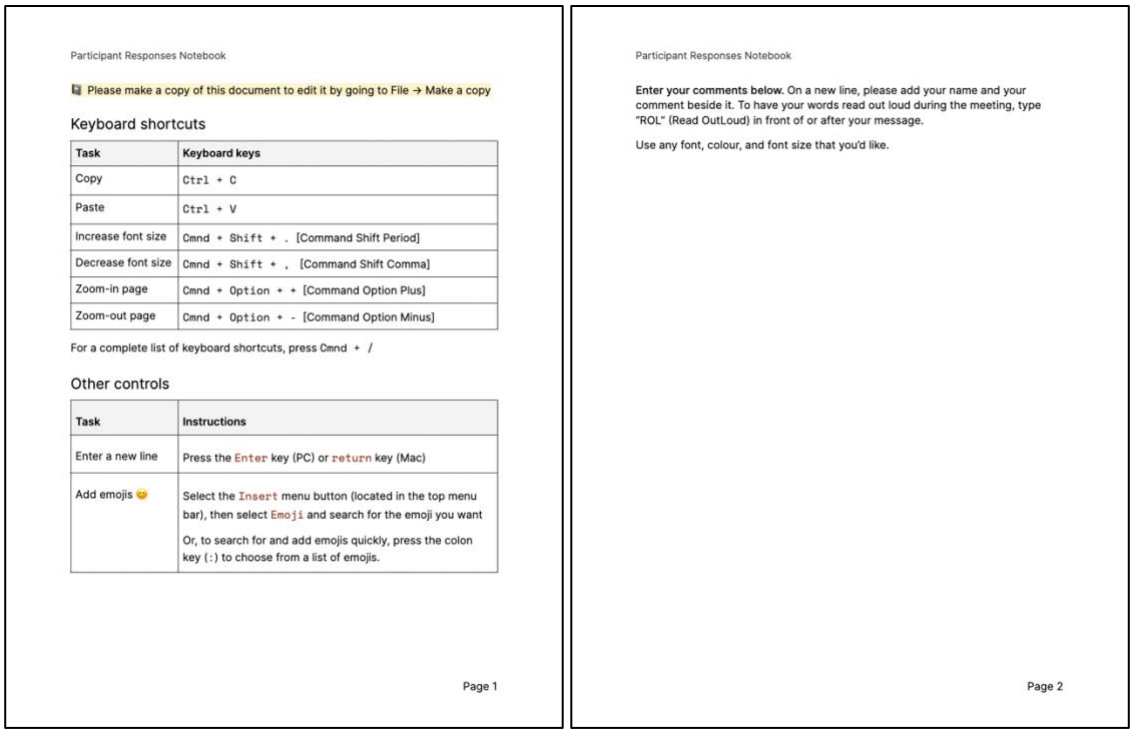
Collaborative document template for sharing responses

Co-designers with CCAN reported experiencing communication barriers that directly impact their ability to participate during online meetings, specifically when meeting over Zoom and larger group meetings. They noted facing challenges with the meeting platform such as the chat box, or the font in the chat box, being too small. They noted challenges resulting from the conversational structure of the meeting such as the pace of group discussions being too fast, and not being given enough time by moderators to prepare and share responses from their communication software. They expressed the desire to have other ways to participate and connect with others during online meetings, beyond the traditional and prescribed methods which are determined by the features of a given meeting platform (e.g., mute/unmute and the chat box).

> Co-designer 6: “Shared documents [to] type in words. Just like you're sharing a document now. I open a blank document and use a blank page to type my responses.”

To address this challenge, we co-designed a simple solution that enables people with CCAN, such as those who use AAC, to contribute their responses for a meeting (shown in Figure 6). We created a template for a shared online document using Google Docs for AAC users to put their responses in before, during, and/or after a meeting. This way, they can still actively participate and contribute what they want to say during the meeting. In the event they are unable to contribute their responses during the meeting, due to things like technology failures and insufficient time to compose and share their messages, they could still add their responses to the shared document after the meeting.

This is an adaptable template that meeting organizers can use and adapt to meet their specific needs for their meeting. The idea is for this document to be shared with all meeting attendees in advance of the meeting by email or through the meeting invitation so they can add their responses ahead of time if they want to.



Participant Responses Notebook

Please make a copy of this document to edit it by going to File → Make a copy

Keyboard shortcuts

Task	Keyboard keys
Copy	Ctrl + C
Paste	Ctrl + V
Increase font size	Cmnd + Shift + . [Command Shift Period]
Decrease font size	Cmnd + Shift + , [Command Shift Comma]
Zoom-in page	Cmnd + Option + + [Command Option Plus]
Zoom-out page	Cmnd + Option + - [Command Option Minus]

For a complete list of keyboard shortcuts, press Cmnd + /

Other controls

Task	Instructions
Enter a new line	Press the Enter key (PC) or return key (Mac)
Add emojis	Select the Insert menu button (located in the top menu bar), then select Emoji and search for the emoji you want Or, to search for and add emojis quickly, press the colon key (:) to choose from a list of emojis.

Page 1

Participant Responses Notebook

Enter your comments below. On a new line, please add your name and your comment beside it. To have your words read out loud during the meeting, type "ROL" (Read OutLoud) in front of or after your message.

Use any font, colour, and font size that you'd like.

Page 2

Figure 7. Keyboard shortcuts and instructions for participant responses notebook

Features of the shared participant notebook

1. Keyboard shortcut support
2. Navigation and editing are keyboard accessible.
3. Instructions for using other controls in the collaborative document
4. Pages for participants to enter their comments, ideas, feedback, and so on.

This solution provides alternative ways to participate in real-time as well as asynchronously. The benefits of this type of solution are that in the event that the chat box for a meeting platform is too small, for example, or the font is too small and there is no option to Zoom in or increase the font size, this collaborative notebook can be used to supplement the chat for people with CCAN who may find the chat box hard to use for these reasons. This sort of collaborative notebook also gives participants a bit more flexibility in terms of how they wish to communicate their responses to the rest of the group. For example, they can add emojis and change the color and font of their responses. They can also share links to helpful other resources and add pictures and videos. This solution also creates the possible need for an additional meeting role; where someone monitors this document during and after the meeting to see when new comments are added. This ensures that no one's comments get lost amongst the many other responses in the shared document. In addition, it is also possible to start a Google Meet call directly in the document (see Figure 7).

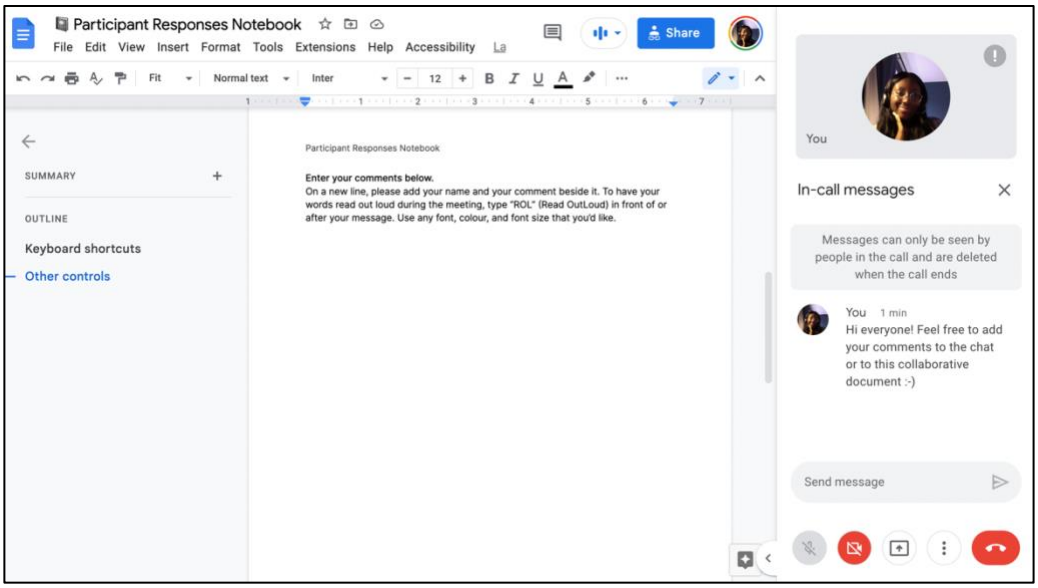


Figure 8. Google Meet integration in Google Docs

7.6 Further recommendations

This section provides further recommendations for meeting designers, organizers, and moderators, as well as for developers and software designers of meeting platforms on how they can help support and advance communication access when meeting online.

For meeting designers, organizers, and moderators

1. Support communication access needs before, during, and after online sessions

An access need can be something an individual has and resolves themselves when accessing a meeting, such as an individual who joins the meeting with their own AAC software; or sometimes an access need is also an accommodation, such as when an individual who uses AAC needs the meeting organizers to share the meeting agenda and discussion questions ahead of the meeting so they can pre-program their responses into their communication software. Being aware of different communication access needs among participants and the ways to support them, such as providing information in accessible formats, can help ensure that everyone can fully access and participate in online meetings in the ways that are most comfortable for them.

2. Share meeting roles and responsibilities

There is a lot to be mindful of when organizing and moderating online sessions. In these instances, it is best for the facilitator, or whoever is leading the meeting, not to assume all meeting roles and responsibilities on their own to better support effective communication. Assigning different people to do each of the core functions such as taking notes, running the technology, and monitoring and/or reading the chat, and any comments in separate collaborative documents, means that each person can focus on their dedicated role and help ensure that the meeting runs smoothly; everyone who wants to contribute has a chance to; and no one is being missed.

3. Create opportunities to socialize and build connections

Compared to in-person meetings, the challenge with two-dimensional (2D) online environments is that they do not offer an "authentic environment for communication" (Liou, 2012 as cited in Oh et al., 2021). Communication is more controlled and therefore, there are less opportunities for spontaneous social interactions. Something that meeting organizers could build into their meetings is informal chats at the beginning and end of their meetings to allow for more opportunities to build connections. Giving participants the opportunity to socialize and form meaningful connections is an important aspect of in-person meetings that could support how we meet in online sessions as well.

4. Support active participation and independence

> Co-designer 12 (Bliss i-Band): "The ideal would be that the individual who uses AAC has total control to say everything they want to say so that they have full functioning of their VOCA or they have the person who's their interpreter beside them doing what they want that person to do. And that the partner knows all of the rules about waiting and giving them the time that's needed."

The 'attendee vs. participant' distinction is more apparent in the online meeting context because the participant's contributions are more controlled. The role of an attendee or participant is more controlled in the context of online meetings that use video conferencing software. For example, to speak aloud during the meeting, you must physically unmute your virtual microphone. An attendee is there, but they may not be participating—they might be asleep, or otherwise uninvolved (i.e., showing a lack of emotional involvement).

Everyone in a meeting, regardless of their assigned role, is an attendee, but perhaps what makes them a participant is their active participation. Whereas attending a meeting suggests merely being present, participation suggests a more intimate and immediate form of presence, one where connections are established and the intentionality behind the action is to take part or share in something with others. Therefore, when discussing communication access in the context of online meetings, it is not enough to just support the attendance of individuals with CCAN (i.e., help them get to the meeting), but we also need to support their participation. Moreover, we must support their independent access. Providing more options to participants and individual control gives them more flexibility in terms of how they participate in the meeting. In addition, ensuring that the necessary communication supports are in place to make the meeting environment accessible, is essential to enable genuine and significant participation (Lewis, 2000).

5. Build capacity at the individual and community level

> Co-designer 18 (BTI): "When somebody is trying to indicate their answers and respond, I'm again thinking proactively how I can help support our families [at the clinics] to build those capacities at the pediatric level…at least there's a little bit more input that I can provide to build that capacity."

In some cases, co-designers mentioned not being able to access certain features in platforms, but upon closer examination, some of those features in fact do exist within the platforms. This led me to think there may be a possible literacy gap for meeting platforms. While some of the limitations stem from the meeting platform, there is also a need for organizers to familiarize themselves with the available features of the platforms so they can educate participants on how to use certain features that are important to supporting accessibility. These features can only be enabled by each participant, such as with real-time translations for Google Meet. So, the participant must first know about the feature and that they need to enable it themselves.

> "Alternative and augmentative communication gives voice to thousands of people who might not otherwise be heard. Supporting these communicators is a community effort, and requires collaboration between practitioners, family members, developers and…all of us" (CoughDrop, 2022, para. 3).

Building capacity involves not just the meeting organizers but also the family members and support staff who provide communication care and assistance to people with CCAN, and to especially support them to build those capacities at the pediatric level. Having a dedicated liaison

to support families and offer communication assistance in building capacity is important for adults and children with CCAN.

For developers and software designers

1. Standardize accessibility features across meeting platforms

> Co-designer 10: “People who work for Google and Zoom can help us if they understand what we need.”

The gaps and inconsistencies in accessibility support across platforms create further obstacles for individuals with CCAN. Meeting software companies like Zoom and Google, Microsoft, Jitsi, and many more, should consider standardizing key accessibility features across all their meeting platforms. There is a lot of variation across the meeting platforms in terms of their accessibility features. When it comes to the commonly used features such as keyboard shortcuts, chat box, and closed captions, those should be more consistent.

For example, co-designers with CCAN shared how they had different experiences across each platform which greatly impacted their ability to access communications in the online sessions. Some co-designers preferred Webex because it allows meeting moderators to mute and unmute participants; other co-designers mentioned they prefer Google Meet because it offers better keyboard shortcuts which enables them to access the platform easier and independently with their communication software.

Common keyboard shortcuts would be a worthwhile feature to standardize in online meeting platforms like Zoom and Google Meet. Similar to how Unicode standardizes most major writing systems, keyboard characters, and Emoji, which enables them to be recognized across all platforms. People who use communication software must add the keyboard shortcuts to their software for each individual platform. The common keyboard shortcuts, like copy, cut, and paste, should be standardized and consistent across meeting platforms to minimize the need to program these shortcuts into their software every time. It also helps ensure that they will be able to effectively use the platform. Co-designers also noted that because these platforms do not have keyboard shortcuts for everything, it makes it challenging as well because then they cannot even program the keyboard shortcut into their device at all. So, at the bare minimum, developers should include the keyboard shortcut within the platform. This applies not only to video conferencing platforms but different online meeting tools and spaces such as Google Docs and CryptPad. Having ample keyboard shortcuts is essential to how individuals with CCAN access and

participate in online sessions. In addition to standardized keyboard shortcuts, all chat boxes should provide alternate size options (e.g., width and height) for users to choose from based on their access needs. Another important feature that is worth implementing across meeting platforms would be a feature like Google Meet's Companion Mode which lets participants join a Google Meet video meeting on a second screen. Meeting organizers should let participants know that this feature is available to them before attending meetings and how to both enable and use it. In Google Meet, it is not enough to just join the meeting with another device because depending on the type of membership plan that a person has, if an extra person joins the meeting with a separate device, the meeting counts this as another person and caps the meeting at a certain time. Therefore, they need to use the actual Companion Mode feature to get around this.

2. Conduct accessibility testing with persons with CCAN

Software developers should engage persons with CCAN throughout the research and design process to ensure that their meeting platforms are supporting effective communication and meeting diverse accessibility requirements. For example, performing accessibility testing with AAC users and testing compatibility across different assistive technology configurations could greatly improve how persons with CCAN access online meetings. Other testing could include evaluating keyboard shortcut support in meeting platforms and different accessibility features; and testing and resolving things like inconsistencies in how auto-captions capture (or recognize) digital synthetic speech in Zoom. All video conference platforms, and any communication platforms that have a speech recognition component, need to design their speech recognition algorithm to recognize digital synthetic voices as speech, rather than filtering it out as background noise. Improvements to speech recognition performance in online meeting platforms are achievable by augmenting training data with synthesized material.

3. Open meeting platforms to enable user customization

Recent advancements in technology have expanded the customizability and convenience of AAC devices (Baldassari et al., 2014). Although these devices allow for some degree of customizability, it can be difficult to change them beyond simple settings. The mismatch between the fit of the device to the user's communication needs is a known factor in abandonment of assistive technology, which creates further communication access barriers. Researchers have concluded that one way to address the issue of abandonment is by implementing more consumer involvement (Hamidi et al., 2014).

The open source movement offers the possibility of increased communication access and community involvement, as AAC users can be directly involved in the design and creation of the technology they will be using. This approach has the potential added benefit of providing free access to highly modifiable software that can run on a mainstream computer and be customized

to a user's communication needs (DeRuyter et al., 2007). Additionally, as stated by Draffan et al., (2016), offering content and systems under creative commons and open licenses in accessible formats can encourage inclusive design through the participation of those in the community who need the personalization and localization of the intended communication resources.

The same is true for online meeting platforms. There is a need for more open meeting platforms[75] like Jitsi Meet. As stated by Kassabian (2021), "the open source software community is built on the idea that everyone can contribute, and that includes people living with disabilities" (para. 1). Platform owners, even if what they create is not open source software as such, could provide guidelines and resources on how to create add-ons or plugins to their software. Imagine if a person who uses communication software could edit the code of an open source meeting software to modify the keyboard shortcuts to whatever they wanted. This could support and advance communication accessibility for online meetings, because a community of users could customize the meeting software themselves, based on their individual priorities and accessibility needs.

7.5 Evaluation

The findings and resulting design outcomes represent the need for supporting effective communication access in the online meeting context. The toolkit provides contextual and individualized accessibility information about the entire online meeting context, such as the specific steps one might take when accessing an online meeting; accessibility barriers associated with online meeting platforms and communication tools, design suggestions for accessibility features within meeting spaces, specific communication methods used, and participation preferences. In addition, persons with SLCDs and people who use AAC and people with SLCDs brought forth and co-designed specific solutions to support their individual communication access needs. As the design solutions illustrate, people have different accessibility requirements, which re-emphasizes the importance of providing inclusive resources and strategies that support communication in alternative ways, across the online meeting context.

These findings and design outcomes highlight an important contribution to the research on supporting communication access and inclusion in online sessions for persons with CCAN. The findings further demonstrate that supporting and advancing communication access is a shared responsibility among meeting organizers and hosts, meeting platforms developers, and even AAC manufacturers.

[75] The meaning of "open" in "open meeting platforms" refers to: 1) open access (i.e., free content including metadata); 2) open licensed (i.e., liberal, free to share, re-use, adapt and combine with other content); 3) open format (i.e., easy to use and adapt); and 4) open software (i.e., open source licenses for systems developed and used) (Draffan et al., 2016).

Design dimensions of the online meeting context

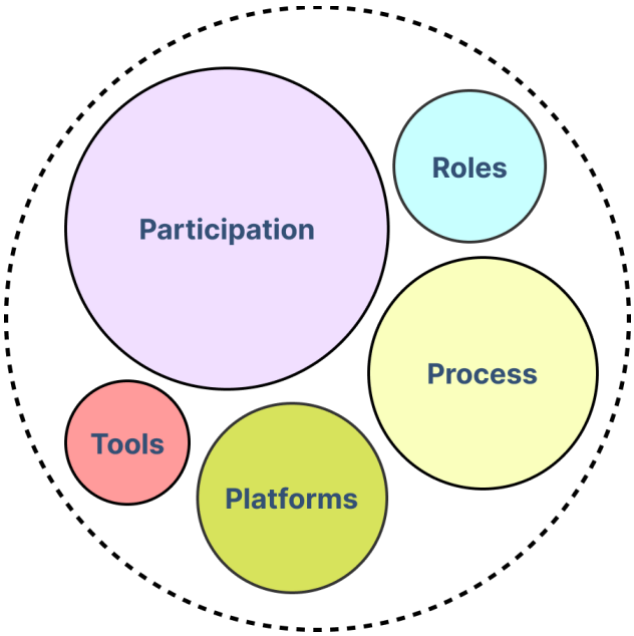


Figure 9. Design dimensions of the online meeting context

This research defines accessible and inclusive design dimensions of the online meeting context. When thinking of the online meeting context, it is helpful to understand how context is defined:

> Context most commonly refers to the environment or setting in which something (whether words or events) exists. When we say that something is contextualized, we mean that it is placed in an appropriate setting, one in which it may be properly considered. (Merriam-Webster, 2022-e)

Context is a container of possibilities. It provides the situational "wrapper" for things to happen or exist inside of. I like to think of the online meeting context as a circular frame with a dotted perimeter (see Figure 8). The dots that make up the perimeter do not form a solid line, because context is fluid in this way. It morphs and stretches to accommodate the many shapes and sizes of its changing internal mechanics. These include shared roles and responsibilities; accessible and inclusive processes; meeting platforms and tools; and alternate participation methods. Accessibility and inclusion are the intentionally interwoven threads and spatial matter that flow between and throughout each of the dimensions of the online meeting context.

Shared meeting roles and responsibilities

For the current research project, while organizing (designing and planning) and facilitating our online sessions, I took on the role of the meeting organizer, moderator, presenter, and chat box reader, while co-designers represented the participants (attendees). Ideally, in a non-research

setting, these roles would be shared between multiple people to maximize the effectiveness of accessible communication support provided. Clear meeting roles create an inclusive online experience and help foster collaboration among participants and organizers. Assigning specific people to monitor conversations, for example, ensures every voice and opinion is heard, as we learnt during our design sessions. In addition, roles should also be assigned to help facilitate the use of any collaborative tools during meetings. For example, one of the design outcomes for this research is a collaborative participant notebook where participants can enter their comments before, during and after online meetings. This is another way for them to participate in group discussions especially during a live meeting. With the introduction of new collaborative meeting tools comes potential new meeting roles, such as a Collaborative Document Moderator. This individual would primarily be responsible for monitoring any new comments that are added to the document by participants during the online session. This meeting role differs from existing roles as it is solely dedicated to supporting participation especially for persons with CCAN.

Accessible and inclusive process, platforms, and tools

As the research found, meeting online consists of considering more than the meeting platform and tools that will be used. It pertains to the process as well. Whereas the platform and tools focus on the meeting spaces, the process focuses on the stages or steps before, during, and after accessing the meeting.

> Co-designer 12 (Bliss i-Band): “AAC users need to be able to prepare in advance…Access means think about the time and the support around them, and that support is “people support.”

As we discovered, an accessible and inclusive meeting process includes designing and planning the meeting (i.e., the stages before the meeting) and running the meeting (i.e., the stages during and after). Within the stages before the meeting, participants with CCAN may have additional preparation to do as they may need to prepare their messages ahead of time and program their responses into their communication software. When joining the meeting, on top of their personal communication aids, they may need to set up additional hardware just to be able to participate. For example, they may require multiple devices to join the meeting, additional speakers, as well as a communication support person to assist them with troubleshooting and technology challenges.

Something I had not considered prior to this study, which the findings revealed, is that meeting online encompasses the steps after the meeting has ended once the virtual meeting room is closed and everyone has left. Although the meeting itself has ended, there are still opportunities for participation that need to be supported. For some of the co-designers who use AAC, both

during the research and in their personal lives, it is common for them to share their responses with the meeting organizer after the meeting due to issues with their technology failing or not being able to respond to difficult questions with their AAC devices due to time constraints. In these instances, as we found, participants with CCAN may prefer to participate asynchronously as they are unable to fully participate synchronously. In this view, the meeting process extends beyond the meeting space itself.

Accessible online spaces include choosing an accessible meeting platform and support tools that facilitate participation and collaboration. Consideration for the platforms and tools that we would use throughout our sessions proved to be an integral step in the process as the meeting platform and tools pre-determine the level of participant engagement and what they can do in the meeting environment. Online spaces that lack important accessibility features such as keyboard shortcuts like 'Ctrl + Z', options for typing, and captioning can pose many challenges for a person who uses AAC.

Independent access and asynchronous participation

This project explored meeting online in two different ways: through synchronous and asynchronous forms of meeting. Synchronous (live) sessions are the common among the two, in terms of how we meet online. It is what we are most familiar with, and it is from synchronous sessions which many guidance documents are based. However, as the findings revealed, accessible and inclusive online meetings should provide and support alternate options for communication and participation. Moreover, they should support independent access and asynchronous forms of meeting and participating wherever possible. Asynchronous participation provides alternate options and ways for how participants can choose to participate, and it is an important consideration which many guidelines for holding effective and/or accessible online meetings do not entirely account for nor draw attention to.

In the case of the current research project, in addition to the standard online sessions which we held over Zoom and Google Meet, we explored alternate, asynchronous forms of meeting and participating using collaborative documents and whiteboard tools like Google Docs and Figma which we used during and after our sessions. In addition, co-designers were encouraged to share their responses in the ways that felt most comfortable to them. Doing this gave co-designers the creative license to explore outside of the traditional confines of meeting in a live format. Through this lens, we explored communication accessibility and its impact on inclusion. For instance, in the co-writing session, Co-designer 2 sent her response in text and audio format through a Word document and a voice recording, respectively.

Sending emails was another asynchronous method that co-designers used to participate. It was also the primary channel through which co-designers, and I communicated together, whether it was through one-on-one emails or group emails. In light of this, it was important to consider the potential accessibility constraints surrounding the use of emails especially as a primary means to communicate in a study and online. It also reinforces the importance of considering accessibility pertaining to the communication channels that meeting organizers use to communicate with participants outside of and during the online sessions. These communication channels are just as much a part of how they access online meetings. This also touches on the use of communication materials pertaining to how we inform potential participants and attendees about an online meeting or event. For example, in the context of my online research project, I initially engaged and communicated with co-designers online over the internet through emails and my recruitment materials such as a recruitment poster, information letter, and consent form. One potential participant who was excited about participating could not take part in the research in the end due to an inability to open web links easily on their own. They did not have the necessary human support available to assist them, so they missed out on this research opportunity. Although I know that the Web is inaccessible to many persons with disabilities, I had not previously considered that some people may have difficulty opening web links and may need physical assistance from someone. In the case of this potential participant, short of meeting them in person, the only means through which they could have participated would require the internet in some form, which in turn requires the need to click and open links. It again reiterates the point that considerations for accessibility and inclusion within the online meeting context need to start long before the meeting takes place. Although it may take additional time to thoughtfully come up with alternate options for participation, it ensures that we are meeting the unique accessibility requirements of participants by utilizing a one-to-one design approach, which can also help support independent access.

In sum, through designing, organizing, and hosting online meetings with members from the AAC community, I am reminded of the importance of providing resources and strategies to support communication and participation in alternative ways. The use of the shared Google Docs and Figma board allowed co-designers with CCAN to see and contribute to the responses from other co-designers in different sessions. Having the option to participate both asynchronously and in live sessions, further enabled broader participation in all the activities as well as communication in the ways that were most comfortable for them. This facilitated cross-community collaboration, as these alternative meeting spaces provided new ways of connecting online together and sharing knowledge.

Throughout this community-based research project, I have come to appreciate that the online meeting context is vast. Much like the Web[76], it is forever changing and nothing within it is static. This presents innumerable opportunities to consider new ways of how we might interact, communicate, connect, and meet online. In doing so, we can expand the contextual boundaries of accessible and inclusive online meetings as they relate to the entire process of accessing online meetings. From registering for the meeting, to preparing to attend, to entering the meeting space, to participating during the meeting, to leaving the meeting, to what happens after you have left the meeting space. Communication access in the online meeting context encompasses the entirety of the meeting process including all the tools, methods, and strategies that are needed to design, organize, host, attend, communicate, and actively participate. It helps us consider the complexity of issues, diversity of experiences, and the broad range of communication support that people may need, with the aim to create online meeting spaces where all kinds of accessibility are centered and valued (Disability & Intersectionality Summit, 2022).

[76] See 'World Wide Web'

8. Conclusion and future work

The aim of this work was to address the gap in research on the impacts of meeting online on communication access and inclusion for persons with complex communication access needs (CCAN) and draw attention to their accessibility requirements when accessing online meetings. Co-designers and I approached this research with two objectives:

1. to gain a deeper understanding of the individual communication access and support needs, barriers, and lived experiences of persons with speech, language, and communication disabilities who may or may not use AAC when accessing online meeting spaces.
2. to apply our understanding toward developing suggested practices for supporting communication access and inclusion in online meetings for persons with CCAN, at an individual and community level.

Through a collaborative, community-led design process, we gained a deeper understanding of the online meeting context (i.e., the meeting roles, process, platform, tools, and participation options). During the process, I zoomed-out to gain perspective on the scope of the context—in other words, asking myself what the experiences, perspectives, and challenges at the community level are —and then I zoomed-in to understand the individual challenges and needs within the community and we designed solutions together to address each person's needs. The cumulative prototyping approach worked well not just for finding new solutions and developing the accessibility guidelines and toolkit, but also as a qualitative research method, as it provided rich opportunities for cross-community collaboration, knowledge-sharing, and forming meaningful connections across the AAC community.

Throughout the study, we uncovered that there are huge implications for communication access across the online meeting context, and its impacts on persons with CCAN are vastly diverse. Co-designers helped to create an initial draft of communication access guidance and designed concepts for supporting communication access and inclusion in online meetings for persons with complex communication needs. We found that alternative methods and tools for connecting online such as collaborative documents and whiteboards, and one-on-one and group email threads can be used to support communication access and inclusion in the online meeting context.

The design outcomes of our cross-community collaborative efforts are as follows:

– A community-designed model and guidelines for supporting CCAN when meeting online, featuring a support protocol for designing and facilitating accessible and inclusive online meetings. The model also outlines an accessible and inclusive process for designing, organizing, and running online meetings.

- Accessibility features for online meeting platforms and alternative communication support tools.
- Accessibility guidelines for meeting organizers, moderators, presenters, and chat box readers to follow when holding online meetings, webinars, and presentations.
- An open source communication access toolkit for online meetings. The toolkit is intended to live online and serve as an educational tool for the wider population on how to design accessible and inclusive online meetings that support CCAN. The toolkit was formed from the perspectives and insights of persons with speech, language, and communication disabilities, people who use AAC, as well as community organizers who chair online meetings in the AAC community.

We identified various communication barriers that co-designers with communication support needs face when accessing online meetings. In general, online meetings typically have a before, during, and after phase which meeting designers and organizers account for when planning their online sessions. As we learnt, co-designers who use AAC go through at least 5 phases when accessing online meetings which include: registering for the meeting; preparing to attend the meeting; joining/entering the meeting; participating in the meeting; and participating in and sharing feedback after the meeting. Within each of these phases, co-designers who use AAC experience many communication barriers and have a range of communication access needs. We found that many of the challenges they face when accessing online meetings stem from a combination of technology failures with their AAC devices, inaccessible features within online meeting platforms such as the chat box and lack of keyboard shortcuts, complicated forms when registering for meetings, and the overall meeting structure, organization, and facilitation. These findings reemphasize an earlier statement that supporting communication accessibility and inclusion for online meetings is a combined effort and shared responsibility between the meeting organizers, moderators, presenters, chat box readers, meeting platform developers, and even AAC manufacturers. Co-designers expanded on this view by including communication partners and other meeting participants as additional supporters of communication access in the online meeting context. This further highlights the notion that supporting and advancing communication access and inclusion within the context of an online meeting is a community effort. We all have a part to play in advancing communication access for online meetings, toward ensuring that everyone can participate and form meaningful connections both within and outside of the meeting space.

Overall, this research provides a foundation for further research and development of best practices in supporting communication access and inclusion in the online meeting context for persons with CCAN. It is my hope that this work will inspire meeting organizers, platform developers, AAC manufacturers, and other stakeholders to work collaboratively to improve the accessibility and inclusivity of online meetings for all individuals.

8.1 Contributions to accessibility guidelines for online meetings

In planning this study, I referred to existing accessibility guidelines on how to hold accessible online sessions which in turn helped me design the sessions for my study. I modeled the current study's online sessions off accessibility guidelines that are being used by the organizers of an online conference. As mentioned in an earlier section, these guidelines have not yet been evaluated by persons who use AAC and therefore it is unknown how the use of AAC impacts the ways a person may access online meetings. Based on the perspectives and communication access needs shared by persons who use AAC, we came up with 5 phases for accessing online meetings. I therefore evaluated and expanded existing accessibility guidelines for online sessions in accordance with the identified 5 phases for accessing online meetings. To support communication access and inclusion, accessibility guidelines for online sessions should be expanded to include the following list of considerations for meeting organizers, moderators, presenters, and chat box readers to follow when designing, planning, and running their sessions. These considerations can be applied to online sessions of all scales, from informal team meetings to larger conferences.

Choosing an accessible platform

- Meeting organizers should consider providing platforms that support one-click access to the meeting room to reduce the number of steps involved in joining or connecting to the meeting. In addition, consider using consistent meeting links and passcodes, where possible, for the different online sessions and conference segments. If a passcode is needed to access the virtual meeting room, consider using the same passcode everywhere, if possible. The reason being some co-designers mentioned having difficulty entering the meeting spaces when the passcode kept changing. In those cases, they would require assistance from someone. Limiting the number of passcodes and using consistent ones supports independent access and minimizes the need for some individuals to seek out external support.
- Provide a list (on a webpage preferably) of keyboard shortcuts for the meeting platform so people who use AAC devices can program the shortcuts into their communication software. Alternatively, direct participants to the meeting platform's website where the keyboard shortcuts are listed.

At registration

- Consider providing instructions that support individuals who are accessing and navigating the form using their keyboards and other assistive technology such as through scanning methods. For example, indicating in the instructions which keyboard key people need to press to select a Yes/No option on the form.

Before the event

- If time allows, consider pilot testing the design of each of the sessions and overall event (e.g., conference) with persons who use AAC and who have CCAN to identify and resolve any outstanding accessibility barriers.

Joining the event

Consider adding a section to accessibility guidelines for supporting communication access when joining (connecting to) the event.

- Provide troubleshooting and technology support roughly 5 to 30 minutes before the meeting starts for anyone who needs help joining or logging into the meeting.

During the event

Consider adding a section to accessibility guidelines for supporting communication access during the event.

- Do an access check at the start of the meeting.
- During the event, give participants enough time to respond, especially if a person uses AAC to prepare their responses. For example, after each discussion question is asked, before moving on to the next person or topic, make sure sufficient time is given to allow people to prepare and share their responses. Also, let them know at the start of the meeting and throughout the meeting that they have that extra time to respond, so they don't feel rushed.
- Turn on auto-captions and live transcriptions for the whole event.

After the event

Consider adding a section to accessibility guidelines for supporting communication access after the event.

- Consider providing an accessible feedback or evaluation tool to participants. Ensure that the feedback questions capture specific comments about how effectively the meeting platform, tools, and space. Ensure, as well, that the organization and facilitation of the meeting, support their communication access needs, rather than only asking general questions about what went well and what could have been better.
- After the meeting event, share the chat and video transcripts, and video recordings with attendees. This way, those who were not able to attend or could not follow everything during the meeting, will know what they missed.

In sum, this investigation contributes to an initial understanding of how to design online meetings that support CCAN, in online spaces and throughout the many phases of accessing online

meetings. These findings may inform meeting designers and organizers, disability advocates, software development companies, as well as the wider public on how we can better design online meetings and spaces to support communication access for people who have communication disabilities and may or may not use AAC. Moreover, this work lends itself to the development of accessibility regulations for information and communication technologies (ICT) as it could help inform how we can make ICT products and services accessible for persons with disabilities. Finally, it contributes to the growing knowledge base on conducting inclusive research online and remotely with persons with communication disabilities and with persons who use augmentative and alternative communication. As this study revealed, communication is at the center of every online setting, interaction, and meeting. Additionally, each person's communication access needs are unique. Therefore, the study underscores the importance of adaptations pertaining to the planning and designing of online sessions, as well as adapting the online sessions themselves according to individual needs, in order to maximize participation and communication (Dee-Price, 2020). Throughout the research process, openness, transparency, and collaboration remained central, all of which inclusive design is compelled to be (Pullin et al., 2017). Applying an inclusive design lens to communication access and AAC research underscores the importance of adopting a one-size-fits-one approach to addressing barriers at the individual level that have broader beneficial impacts on the wider community.

8.2 Limitations

It is worth noting the limitations of this work at this stage. The research encompasses the experiences and perspectives of eighteen adults across Canada and the United States. The research does not, however, claim to cover or address the experiences and perspectives of all individuals within Canada and the United States. The research process was condensed due to the requirement to complete the research within the required timeline of the Master's Major Research Project MRP. It would have been beneficial to hold more sessions so co-designers and I could have gotten further with refining and finalizing our prototypes and evaluating them. In addition, co-designers could have taken part in documenting our research and design outcomes. This would have made for an even greater inclusive and community-led process as co-designers would have been involved in all decision-making throughout the research project. In addition, except for the communication access guidance, the co-designed solutions were not formally tested and evaluated by all co-designers who use AAC to know how well these solutions would effectively support their communication and participation needs in an online meeting process and setting. Lastly, although I captured informal feedback from co-designers throughout the research process, I failed to collect feedback on the full research project, specifically on the accessibility and design of the meeting processes and tools. Doing so would have helped provide clarity on which

core elements of the study did not support communication access and thus, could be improved upon for future iterations of the current study.

8.3 Future work

In future research, it would be beneficial to explore the effectiveness of implementing the design outcomes produced from this work in various online meeting contexts. This could involve testing the accessibility guidelines, toolkit, and communication support tools in different settings and with diverse groups of communicators to assess their impact on communication access and inclusion. Additionally, future research could focus on further refining and developing the design outcomes based on feedback from users and incorporating emerging technologies and communication tools. Furthermore, it may be worthwhile to investigate the attitudes and awareness of meeting organizers, moderators, and presenters towards communication access and inclusion in online meetings, as well as the potential barriers they face in implementing these practices. Finally, there is a need for ongoing research to address the evolving needs and challenges faced by persons with complex communication access needs (CCAN) as online meeting platforms and tools continue to develop and evolve. Table 25 presents some additional paths that deserve further research, some of which are already being worked on.

Table 25. Directions for future work

Activity	Description of future work
1	Expand the scope of accessibility guidelines for online sessions – Future work will focus on expanding the scope of the communication access guidance to include hybrid meeting events and conferences. Accessibility guidelines should also include more guidance for presenters and communication partners/ support persons. – Hybrid meetings are becoming an increasingly prominent way of meeting in today's post-pandemic climate. Examining communication accessibility in relation to hybrid meetings is an identified gap of this MRP and could be the source of future studies. As we continue to move toward the future of online-hybrid meetings, communication access research that asks questions like "what is a hybrid meeting?", "who can access them?" and "what are the accessibility needs of those experiencing the greatest barriers?" will be essential to supporting accessible communication and inclusion in the online meeting context.

2	Explore accessibility features of different online meeting spaces – Future research will look at video chat meeting platforms and other popular web conferencing platforms like GoToMeeting[77]. – More work needs to be done on investigating the communication access needs and barriers pertaining to specific features within meeting platforms such as breakout rooms and sending private messages, as well as community-based social platforms and workspaces like Messenger, Slack, Reddit, and Discord. – An additional area that should be the focus of further research is continuing to explore alternative methods and tools that can support communication and participation in online meetings beyond the predetermined features in meeting platforms.
3	Refine and evaluate design solutions – Future work will involve continuing to iterate on the design concepts that were designed by co-designers, and potentially turning them into medium and high-fidelity artifacts that can be tested within various online meeting processes and formats, such as conferences, and one-to-one, small, medium, or large group meetings. – Future efforts may also involve exploring additional ideas that were sparked during and after the study but have not yet been explored in detail with participants with CCAN. For example, these ideas include expanding on what the roles and responsibilities for the Collaborative Document Moderators would entail; and adding a section to feedback forms that ask how well the meeting process supported participants' communication and co-designing the form questions with participants with CCAN.
4	Finalize the Toolkit and Guidance – The Communication Access Toolkit and Guidance for online meetings will continue to be worked on as a direction for future work. The Toolkit, along with the accessibility guidance and design solutions, will be made available on a public-facing website on GitHub[78].

[77] https://www.goto.com/meeting

[78] This work can be found at the following website: https://communication-access.github.io/online-meeting-accessibility-toolkit/

5	Sharing findings and recommendations with software companies – Future work will involve sharing the findings and recommendations about improved accessibility features for meeting platforms with software companies like Zoom Video Communications, Microsoft, and Google. – I also plan to email the software companies directly to ask specific questions that were raised during the study pertaining to the different accessibility features within their meeting platforms.
6	Contribute to ICT accessibility standards and communication access legislation – Future work may involve sharing the findings and guidelines from this work with regulators of ICT accessibility standards. – A more rigorous analysis is needed of the research results, in order to provide accessibility recommendations that could contribute to future communication access legislation on how we might better support CCAN within the online meeting context.
7	Investigate independent access and unique participation needs – Future work will explore independent access and unique participation needs and ways for making online sessions easier to take part in (e.g., not requiring use of web links, as an extreme example). How might we as meeting designers support and enable broad and diverse participation among persons with communication access needs, without the use of the internet at all? In addition, how mighty we support independent access so they can participate on their own, without any (or very little) support from someone.

8.4 Final thoughts

This research was undertaken with the aim of "practicing what I seek to understand" to the best of my ability. I carefully considered and differentiated[79] various elements of the research project such as tools, meeting environments, and content to meet the individual needs of co-designers. At the heart of this project, was the desire to understand and explore the many facets and faces of communication by examining the ways we meet and connect online. By addressing a practical communication access problem that impacts many in the communication disability community, the design outcomes of this work can be readily applied by the wider public. These outcomes serve as an initial step towards inspiring more conversations around communication access in the online meeting context and highlight the importance of providing alternative ways for individuals to express themselves, participate, and connect with others in online spaces. Ultimately, this work is intended to provide guidance to the general population on how we might ensure that online meetings of all forms are inclusive and accessible for diverse communicators, so they can communicate and participate with dignity in ways that they understand and are understood.

[79] Differentiation is a teaching technique used to tailor teaching instruction to meet individual needs by responding to variance among learners in the classroom (see Tomlinson, 2000).

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