Exploring Engagement in Distributed Meetings during COVID-19 Lock-down

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***Abstract*—Meetings are an important part of articulation work in cooperative groups. Thus, engagement in meetings influences cooperation. In the case of distributed cooperative meetings, engagement is influenced by the spatial distance among members. Building on the existing literature, we introduce a framework for analyzing engagement in distributed cooperative meetings and study the phenomenon specifically for the period of the nationwide lock-down due to COVID-19, where remote meetings were the only choice. We interviewed 11 professionals experiencing home office during the nationwide lockdown, documenting their experiences on engagement in distributed cooperative meetings, and conducted five participant observations in meetings with 8, 4, 6, 4, and 13 subjects as a direct investigation of engagement. Findings suggest that the use of social cues, meeting facilitator and personal interest are influential factors that regulate engagement in distributed meetings. The suggested framework has potential for detecting engagement, as we discuss the implications of our findings for digital meeting platforms. This paper contributes in the field of Computer supported cooperative work and Human Computer Interaction, with discussions and future research in how to detect, obtain, and sustain engagement in the context of cooperative work.**

Keywords–Engagement; CSCW; Digital Meeting Platforms; Distribued Cooperation Work; Distributed Meetings; Attention; COVID-19; HCI; Participation; Conversation roles.

I. INTRODUCTION

Meetings have become a standard arena to come together, discuss, and divide the labor for upcoming work in most workplaces, being those in organizations ranging from small to medium to large, or the public sector [1]. Until recent times, meetings have been associated with a physical location, where participants can coordinate and interact more fluently [2]. Due to the increase in Information and Communication Technologies, the perception of meetings has changed, as people participate in virtual meetings. Participation in virtual meetings is optimal when physical alternatives are exhausted [3].

"The need for group decision making has never been so important", as a single individual's perspective on their work is limited in isolation [4]. Due to a diverse specialization and demand for expertise, people are increasingly cooperating to achieve a common objective [5]. Despite the use of supportive technologies for cooperative work, meetings are the most popular and optimal way for group decision applications [6].

Recent developments in supporting meetings have worked exclusively on technologies that support access to meeting content to distributed participants. However, to the extent of our knowledge, there has been little research on technologies that support the activity of discussion and decision making in settings where participants in the meeting are involved in cooperative work, where they articulate, delegate, and coordinate tasks. We will refer to these meetings as cooperative meetings. Researchers within the field of Human-Computer Interaction (HCI) and Computer Supported Cooperative Work (CSCW) have been exploring strategies and tools to support group meetings through teleconferencing technology [7]–[10]. Engagement is deemed important in multi-party interactions as it operates as a key component and condition to assure that a participant is immersed and receptive to shared information [11]. Frank et al. [12] outlined engagement as a key factor for meeting success. Furthermore, one must understand what influences a user's engagement in meetings in order to operate cooperative sessions productively.

In the early months of 2020, multiple countries enforced nationwide shutdowns due to the ongoing COVID-19 pandemic, reducing physical interactions to a minimum. A significant number of workers around the world were immediately faced with technology as the only option to do work. Meetings are now operated using digital tools, such as Skype, Zoom, Microsoft teams, etc. Previously, these digital tools were considered to only be a secondary option. The co-located cooperative meetings were now moved into the digital realm, into what we define as distributed cooperative meetings. In this context, we do not include educational lectures, conferences, and informative meetings as they are not of direct relevance for our study.

Considering the immediate shift towards distributed cooperative meetings amid in the lock-down, and the relevance of engagement in these sessions, we investigate these research questions:

RQ1: What is influencing engagement in distributed cooperative meetings?

RQ2: How to enhance engagement in distributed cooperative meetings?

We have investigated engagement as a concept and how it has been defined in the relevant literature. Moreover, we have explored how previous research has discussed the factors that influence engagement in the context of physical and distributed meetings. Based on a critical reflection of the literature, we have conceptualized a two-dimensional framework of engagement in distributed cooperative work. Our data collection is based on 11 semi-structured interviews with professionals involved in cooperative work within different workplaces along with participant observations of five distributed cooperative meetings. The findings provide insight into engagement on two parallel dimensions. The first being on the interaction between humans in the cooperative space, and the second focuses on the interaction between the human and the digital platform that provides the distributed meeting, which affects engagement on the first level. The findings contribute to the fields of HCI and CSCW by discussing the elements of engagement that should be taken into consideration in the development of future technologies and research that can support distributed work. The research questions are aimed at distributed cooperative meetings as they are the only option for work for the time

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being, but they are also essential for organizations operating distributed cooperative work as part of an accelerated digital transformation.

The rest of the paper is structured as follows: In Section II, we review related work on the different perspectives of meetings and engagement. In Section III, we present a framework that will be used to analyze engagement in distributed cooperative work based on critical reflection from the previous section. In Section V, we present a qualitative evaluation from participant observations and interviews. This will lead to discussions about the effects of distributed meetings on one's engagement in Section VI, followed by implications for development with theoretical grounds in Section VII.

II. Background

In this section, we present a review of the literature related to our main concepts. As CSCW is the field concerned with cooperative work, we initially present how meetings have been studied in CSCW. We then present engagement as a concept and how it has been discussed in HCI. Furthermore, we outline how engagement in meetings has been previously studied.

A. Meetings and CSCW

Meetings take an important part of our workdays. They are used to coordinate with colleagues with whom we cooperate toward common goals either in the same sites or when we are distributed in different sites [13]. Computer Supported Cooperative Work (CSCW) according to Bannon and Schmidt is the endeavor to understand the nature and characteristics of cooperative work, with the aim of designing technology. Interdependence is an important topic within CSCW as people engage in cooperative work when they are mutually dependent and are required to cooperate in order to get the work done [5].

In the context of cooperative work, a distributed group is characterised by work activity where members' work is not co-located with the support of technology [14]. Distributed cooperative work concerns the support of people's interdependence of work with others as they aim to complete tasks in meetings [7]. Thus, we define distributed cooperative work as group activity characterized by spatial and temporal distance, supported by CSCW technology. The style and specifications of said technology depend on the nature of the cooperation between members. According to Mills [15], space and time are dimensions within CSCW that a system should adapt to, as they are uncontrollable constraints for remote, cooperative work.

Previous studies claim that CSCW can save resources while improving interaction [16]. In a cooperative work setting, meetings can be used to distribute labor and discuss progress. We will refer to these meetings where all participants contribute to discuss and divide labor as cooperative meetings.

Joris et al. [17] argued that physical attendance in face-to-face meetings aids in reaching a shared understanding during distributed meetings. Related work suggests that human interactions depend on physical presence as a mode of communication. Hence, thousands of people worldwide travel for business daily [18]. However, during the lock-down, the normal way of doing cooperative work has been compromised. Topics that have been discussed previously in last-minute meetings with colleagues become an invitation for a distributed meeting, with digital meeting platforms that use rich media to provide representations of participants in a virtual room [19]. In addition to video calls, there are options to send messages and files, along with screen sharing, which has been outlined to be important in the context of content sharing [15]. Zoom has gained a rise in popularity at the time this study was conducted, due to its simplicity in configurations [19]. Figure 1 illustrates how the interface operates in a distributed cooperative meeting for two people.

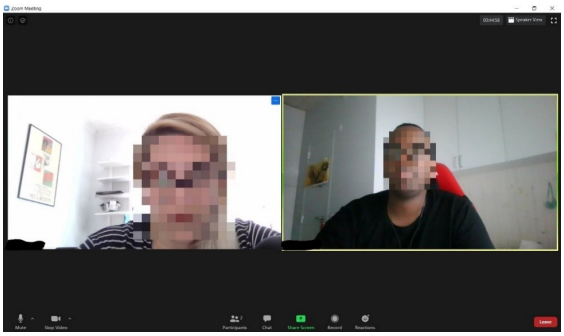

Figure 1. Zoom as the digital meeting platform to illustrate the interface for distributed cooperative work.

Rodden and Blair [20] claimed that the majority of CSCW applications are fundamentally distributed, stressing the importance of assessing the support these systems provide [21]. Previous work also shows the use of group support systems to empower cooperation, whether it be in co-located [22] or distributed applications [23].

Finally, in our study, we have focused on investigating engagement and its relevance in distributed cooperative meetings, where we explore aspects of engagement that are relevant to get work done.

B. Engagement

Engagement is derived from social and cognitive psychology. Doherty and Doherty's [24] review of engagement encountered 102 definitions used in HCI. The most-cited definition of engagement is that of Sidner et al. [25]: *"By engagement, we mean the process by which two (or more) participants establish, maintain and end their perceived connection."*

This framing implicitly places the definition within the context of a conversation between at least two agents, where both parties involved in the engagement are active and receptive participants in a continuous, synchronous process with a clearly defined beginning and end. This is relevant in the context of meetings where the underlying context is that of a multi-party conversation. Cooperation within group meetings requires participants to interact with each other by participation, especially in the context of the workplace.

In the analysis of conversation, Goffman [26] defined different roles in face-to-face conversations: the participant who makes the utterance is labeled a speaker, and the listener is referred to as an addressee. Sidner et al.'s definition of engagement in this context implies that the speaker and the addressee are actively engaged in the conversation. Dobrian et al. [27] claim that engagement is a reflection of user involvement and interaction. This is also supported by Glas and Pelachaud [28] who argue that involvement and engagement are closely related. The more involved the user is, the stronger the interaction with other participants. Based on this, we can argue that a participant that takes the role as a speaker exhibits involvement and is therefore engaged.

Goffman introduces side participants, who are not addressed

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by the speaker. Researchers have conceptualized a state of engagement without inheriting the role of the speaker or addressee, focusing on exhibiting attentive behavior in the conversation. While involvement in the context of engagement appeals to the speaker and addressee, passive participation in the conversation includes side participants as well. In cooperative work, a speaker would want to ensure that all participants are understanding the message directed towards an addressee [29]. Clark [30] emphasizes the importance of side participants as they shape how speakers and addressees act to one another. In order to achieve engagement for side participants, we look for factors that contribute to participation. Peters et al. [31] argues that selective attention is necessary to establish engagement, explaining further that the level of attention regulates the level of engagement, creating a lower threshold for involvement at a later point in the conversation. Turner [11] argues that engagement is the state in which one is immersed, accompanied by positive emotions. Findings from a study by O'Brien and Toms [32] show that participants lose their mental surroundings when concentrating in an activity, showing a form of engagement. Furthermore, personal interest, attention, control, motivation, and feedback are established attributes of engagement, which can lead to direct involvement at a later point [33]. These factors are suggested to establish a precedent for increased participation at a later point [34].

While we have presented engagement above in the context of a conversation, in the field of HCI, engagement has been discussed extensively on how users engage with the technology and the content provided to them. However, engagement has been addressed differently in HCI throughout the years, found mostly as "user engagement". Bouvier et al. [35] state that definitions of engagement are used broadly, and are dependent on context. This is also supported by Salam and Chetouani [36] as their findings suggest that the mental and/or emotional state of the user varies depending on the context of the interaction, meaning the definition of engagement varies as well. Within this field, engagement as a concept has multiple angles to consider as engagement has been defined in the context of the qualities of an interface [37], and as a state of captivation and immersion in social media [38]. In both cases, engagement has been interpreted as a state, where interest is captured, with control over an individual's attention, and keeping them in a state of immersion [39]. Doherty and Doherty [24] associate an engaged agent with commitment, intent, attention, immersion, and motivation. Meaning that engagement is not a state that occurs in isolation. Engaged agents that are labeled to be motivated are said to include reasons for action.

Engagement has also been studied in the context of gaming [40], education [41], [42], administration [43], creativity [44], and other applications using modern day technology [45].

C. Engagement in meetings (multiparty settings)

Related work has outlined that engagement can be boost using meeting structure accompanied by a facilitator. [46]. Sauer and Kauffeld [47] study suggested that meeting facilitators should ensure active interaction from all participants in the session. In addition, technology should be able to coordinate the interactions, by identifying the current speaker [48]. Frank et al.'s [12] study on engagement detection in meetings presented indicators of engagement using attributes, such as physical motions, facial expressions, and vocal responses.

Frank et al. associates disengagement with distractions and lack of attention [12]. Furthermore, the author presents a form of relaxed engagement with side participants, characterised by observant behavior, receptive to information shared without direct involvement. The study outlines apparent attributes of engagement, accompanied by a feeling of excitement and constant commitment to content. Furthermore, Frank et al.'s study outlined similar attributes of engagement to that of O'Brien and Toms [32].

Previous literature emphasized the importance of engagement in face-to-face settings. It is therefore essential to investigate elements that influence engagement in remote settings. Distributed meetings provide flexibility for participants in terms of saving resources and traveling time [49], and have been traditionally viewed as support for cooperation, in addition, these systems should be enabling when doing cooperative work [20]. The use of these systems has increased since their development as they save time and money, however, some researchers have focused on challenges and limitations to improve its usability in several applications [50] [51].

Mark et al. [51] considers engagement in addition to mental presence to be determining factors for remotely based teams to operate optimally.

Related work has highlighted the effects of the barriers and limitations of the technology used. For instance, poor audio quality(background noise, poor speakers) leads to disruptions in the flow of conversation [52]. It may also be challenging to know who is active in the room by just looking at the screen. Kuzminykh and Rintel's findings show that participants are attentive to social information such as facial expressions to confirm their engagement to what has been said, addressing also the challenges of finding them through a video feed [49]. Another underlying theme within studies concerning engagement in distributed engagement is trust. According to Jarvenpaa and Leidner [3], shared experiences and consistent social norms influence trust between group members in co-located settings. These are factors that are partially diminished in virtual meetings. The authors suggest that groups need to create norms and give feedback to invite interaction and reduce isolation.

Looking back at Kuzminykh and Rintel's study, lack of identifying non-verbal cues make it difficult to shift speakers naturally compared to a physical meeting, according to one of their interviewees, as they have to be addressed directly in remote meetings [49]. Based on their findings, Kuzminykh and Rintel argue that remote participation would contribute to a sense of engagement, as well as assessment to shared information by demonstrating purposeful attentive actions. Most participants in Mark et al.'s study relied on video feeds of their remote participants [2]. Cutler et al. suggests that technology must correctly visualize who is speaking and where they are located, so that meeting participants can get a sense of the current speaker [16].

Due to the freedom of using distributed systems, multitasking occurs in the current session. Multitasking has a significant impact in participating relationships in virtual as well as physical meetings [53]. It can enhance the meeting experience when it comes to distributed cooperative work, as it can provide benefits, such as effectiveness and efficacy [51]. However, this comes at the cost of participation, level of attention and thus, engagement [54].

Video feeds allow participants to express understanding by using gestures and nodding which do not disrupt the meeting, but rather enhance the experience. Isaacs and Tangs' findings show that in contrast to audio, video interactions make it easier for participants to come to an agreement [55].

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In addition, their findings show that turn-taking is easier to do with video compared to audio. Sharing documents live in distributed systems seemed to strengthen coordination and direct attention to relevant discussion areas and to some degree, increase participation [2].

III. A Framework to Analyze Engagement in Distributed Cooperative Work

Considering a lack of a definition for engagement and analysis of engagement in distributed work, we conducted a critical reflective analysis of the background literature presented above and propose a definition for engagement accompanied with a framework for analyzing engagement in distributed meetings.

We define engagement in distributed cooperative work as: *A process using technology as a medium where at least two parties involved are established as active and receptive participants in a continuous, synchronous process with a clearly defined beginning and end.*

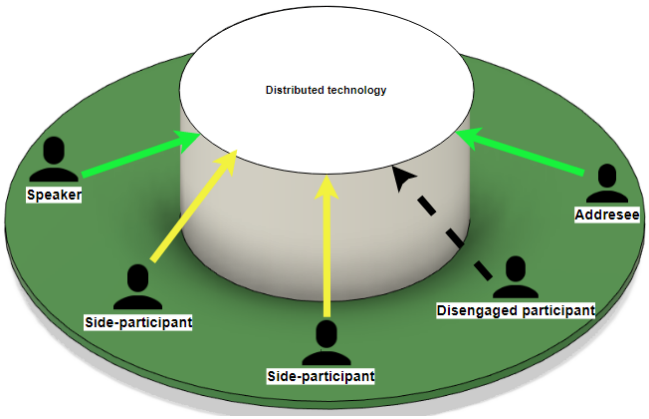

Figure 2. Illustration of the proposed engagement framework for analyzing engagement in distributed cooperative work

Figure 2 is an illustration of the framework for analyzing engagement in distributed cooperative work with the technology at the center of all interactions between participants. By active participants, we refer to participants that take the role of the speaker, who addresses participant(s) during a turn. Due to being addressed by the speaker, the addressee is active as well. Receptive agents operate as side participants, being immersed and attentive to the conversation between the speaker and the addressee(s). Furthermore, we adopt Frank et. al's [12] definition of relaxed engagement as passive engagement illustrated in figure 2 with yellow arrows from side participants. Involved engagement will be interpreted as direct engagement, illustrated by the green arrows which are exclusive to the speaker and addressee. A disengaged participant is illustrated with black dotted arrows as they are still be connected to the technology but not immersed in the meeting like the side participants. There are two dimensions within engagement in distributed cooperative work. Figure 2 is inspired by Goffman's [26] description of conversation roles, and illustrates the level of engagement between the user, their peers, and the technology. The first dimension is about the interaction between the participants themselves through the distributed system (green area), which is influenced by the content of the meeting, other participants' behavior, social norms, trust, and personal interest. The second dimension (white area) is about the influence of technology towards the user's engagement, which is influenced by factors such as video feed, microphone usage, and internet connection.

The speaker is initially engaged and will primarily use the digital meeting platform's inputs (web camera, microphone, or messages) as a medium to communicate with other users. The same applies when other functions within the system (written messages and screen sharing) are in use, regardless of context. A participant shows passive engagement by expressing non-verbal responses to the conversation (nodding, facial expression). On the other hand, one can be in a state of disengagement by late responses as a result of their mental absence or even possibly, technical disruptions.

IV. Methodology

This section begins with the process of how data was collected. The second part pertains to the analysis of the findings concerning to the research questions defined in section I.

A. Data Collection

Due to the exploratory nature of this study, we have taken a qualitative approach to investigate this matter during the nationwide lock-down for authenticity. We applied two data collection methods: semi-structured interviews and participant observations, which we will explain in detail below. Figure 3 summarizes the data collection process.

Method	Size	Description	Average time
Interview	11 participants	Semi-structed	18 minutes
Observation	Five sessions 4-8 participants	Participant Observation	2 hours

Figure 3. Summary of the data collection process using semi-structured interviews and participant observations.

Semi-structured interviews provide an in-depth understanding of exploratory topics [56]. We conducted 10 semi-structured interviews with professionals working in Norway and 1 interview with a subject working in the United States. All interviewees were working in national and global organizations and operated at a home office. The selection of the interviewees was made carefully to fit the target group of the research. We recruited interviewees through the personal contacts of both authors.

The interview guide we created was divided into main topics with a set of sub-questions and probes, with themes such as the frequency of cooperative sessions, nature of work, norms during meetings, the transition to operating cooperative work in remote settings, multitasking and it's implications on their engagement. In addition, we asked questions about the interviewee's experiences using digital meeting platforms and their level of involvement, and engagement from their peers as well as themselves. Furthermore, we asked interviewees about their use of multimedia extensions such as, video feed, screen sharing, and messages. Follow-up questions had been also planned to further investigate specific episodes. The structure of the interview was inspired by the theoretical ground above, investigating factors that influenced one's engagement in the two levels outlined from our suggested framework. During the interview, the first author adapted to the flow of the session based on the answers of the interviewee. We transcribed the interviews using verbatim transcription guidelines.

In order to capture the natural engagement of participants in distributed cooperative meetings, we used also participant

observations as a second method for collecting data. Participants observations is a technique in which the researcher enters the research setting and is involved with her/his user group activities as well [57]. The first author took the participant role in the observation of five online meetings, the structure of which resembles distributed cooperative work sessions, where a group of co-workers had to coordinate activities within a shared project. The first author was an active meeting participant. As the first authors was the one involved in the observations, we have chosen to write about the application of this method in a personal matter. We find the personal perspective to be helpful in the reflections and analysis on how the method was applied and what impact it had on engagement in cooperative work meetings. Thus, when referring to the observations, we will use the auto-ethnographic storytelling first person "I", to report on the process. In the next subsection, where we present the process of analyzing raw data, we return to the analytical "we".

The sessions that I participated in were groups and teams that had recently had a transition to digital, remote meetings due to social distancing. All of the groups would normally have cooperative work in co-located environments. Participants in the meetings were familiar with each other as they had been working for almost one year, and had already established social norms, which had been translated to the digital realm. I kept handwritten notes during the meetings, which were expanded furthermore after each session. In addition, for each meeting I drew a schema of each participant and kept the notes for the engagement of each of the specific participants in the meeting. This was done in analogy with the theoretical framework presented above. I chose to use traditional note taking to collect data because participants commented that they would not feel as comfortable participating while being recorded. Furthermore, the recording would increase the awareness of being monitored, which could significantly alter the level of engagement that would normally be in natural sessions.

The number of participants I observed were respectively 8, 4, 6, 4, and 13. Since I was an established and familiar member of these groups, the people involved did not alter their threshold to participate in the sessions due to my presence. I took notes in instances where one participant assumed the role as the main speaker, as well as how the addressee was receiving information. I documented the behavior of side participants that were reacting to the dialogue between the main speaker and the addressee and also made note of the time between dialogue exchanges. When the response time was relatively high, I identified the reason to why a member of the meeting was absent. The same was applied to immersive dialogue between multiple participants. In some cases, I evaluated my own engagement when multitasking between data collection and the content of the meeting itself.

The participant's eye gaze and head movement as an addressee, speaker, and side participant when using live video feed was also documented. On the other hand, I documented participants that did not use video feed, focusing on their vocal responses and interaction with the chat platform. Participating in the meetings and observing the others behavior and their engagement was challenging but helped me in achieving a more realistic scenario and build a critical self-reflection of my own engagement along with the others in the meetings.

In summary, the two selected data collection methods complemented each other and gave us a wider overview of the issues we investigate in this paper. The results of the data collection and analysis will be presented in the next section.

B. Data Analysis

After collecting data from interviews and observations, we used open coding and grounded theory as our analysis method. Grounded theory allows researchers to systematically break down raw data and conceptualize theories from findings that can be interesting for discussion or future work [58]. In addition, the method is beneficial in generalizing findings and ensures credibility in the emerging theory [59].

As the study had two research questions, the first step was to review the notes the from observations along with the transcripts from the interviews by looking for similarities and relevance towards our theoretical background. This was done by remarking codes on data from our observations and expressions made by our interviewees that were deemed relevant. On our first iteration, we created 13 codes covering aspects within participation, levels of engagement, and the use of technology. Using our established understanding of raw data, we continued expanding our analysis by reviewing the results in multiple iterations, ending up with 26 codes. We created five categories addressing the first research question and four categories aimed towards the second one. Our categories were grouped through continuous analysis and reflection to themes which are further presented in our findings below.

V. FINDINGS

In this section, we present the findings in an attempt to address our research questions from Section I. Firstly, we cover elements that influence engagement in meetings among participants (RQ1). Then we present elements of technology that influence the engagement (RQ2). We end this section with a set of strategies to encourage engagement retrieved from the data collection in Section IV.

A. Elements that influence meeting engagement

Here we address our first research question by presenting factors that affect an individual's interaction with other participants, and how that can stimulate or disrupt their respective meeting engagement.

1) Personal interests: Eight interviewees express that the content of the meeting has an influence on their participation in the meeting with varying degrees. They state that they are invested in topics and discussions that concern them by answering direct questions or waiting for a mediator to address them personally. Findings also show that a comprehension of what is being discussed contributes to more involvement. A priority for the meeting facilitator is for the topics to be relevant for all participants, specifically remote settings. It was noted in all five observations that the speaker tends to address a participant by announcing their name first, in order to gain their attention.

For two interviewees, if the interactions of the session do not reflect their expectations in terms of context, then there would be less engagement as a result. Remote participation requires incentive, compared to physical meetings, where social factors and norms can almost force a contribution according to one interviewee, noting that eye contact is an incentive to engage. The observations correlate with this when two participants directed their gaze towards the screen as the current speaker focused on the camera lens.

2) Turn Taking: Findings from the interviews show that involvement occurs when members provide a signal to take the role as the next speaker. This is done by either communicating it to others visually or by using the meeting facilitator. The latter

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being used the most in our observations, which is also verified by one interviewee that implied the importance of a meeting facilitator as their group depended on one person to lead the conversation. This varies based on the size of participants in the session, which was the case for four interviewees. Having too many participants in the session decreases the threshold for involvement. Turn taking helps coordinate speaker roles, and guides the discussion towards a goal, which also avoids derailing away from the current topic that can be a potential cause for disengagement.

3) Structure in the meeting: Agendas, systems, and norms make it easier to participate in meetings. This has been the case in four observations as participants notified each other on the order of the agenda when others start to derail from the current topic. There is also a set of constraints in terms of time per topic. The importance of a facilitator that moderates the meeting by keeping control of these rules has been essential for members. As one interviewee explained, the mediator sets the scene for the meeting. According to two interviewees, the facilitator is the most engaged person in the meeting, furthermore, seven interviewees expressed that one to one communication in such arenas provides comfort in involvement. For all interviewees, it is normal to use a mute function to ensure that one participant can speak at a time without disruptions. One interviewee explains that using the chat function to signalize that you want to speak is an alternative. This was also confirmed in the observations, when one participant forgot to mute their microphone, three other participants sent a message in the common chat, instructing them to activate the mute function. The chat was also used for turn taking, as the participants were required to write their names to provide a signal to not just the facilitator, but the rest of the participants. Clarification on who is to be given the role as the speaker provides convenience to anyone who wants to speak at any given time. In addition, the session's duration has an impact as longer discussions can disrupt the focus if a conclusion is not met, which leads to loss of interest, withheld progress, and disengagement.

B. Technology factors influencing engagement

This part of the analysis focuses on the technical aspects of digital meetings that influence the engagement in meetings, addressing the second research question from Section I. We have identified the use of video, messaging, and compatibility between participants through the digital meeting platform as factors.

1) Visibility: Nine interviewees claimed that the use of the camera feed in their meetings enhances engagement operating as an indicator of their mental presence. Findings also show that a majority of interviewees would prefer a video feed of all participants in the meeting in order to participate more, as it helps regulate their tone, observe their reaction, and response to what is being said.

One can tell that a participant is less engaged using eye gaze to interpret the direction of where the focus is. A video presentation creates presence, ensures that that participant is present, and establishes an incentive to engage as all attention will be locked to the one who is speaking at the time as explained by one of our interviewees.

On the other hand, two interviewees argued that the use of video can be inconvenient as what is being recorded in the background can turn into distractions themselves. Partial use of the camera or the digital platform's inability to visualize all participants on one display can lead to uncertainty for some participants, which discourages them to express their thoughts. In our interviews, we discovered that taking turns using video simplifies the process and creates more transparency to the meeting compared to physical meetings.

It seems easier to read people and change the setting of the meeting based on their reactions. However, for some, it seems that there is still a limitation to the use of video as poor visuals restricts small reactions. Furthermore, depending on the platform being used, the display of the speaker is scaled to be larger so that it becomes the focus of the display for all participants, making it clear who always has control.

It can seem difficult to engage naturally when there is no video feed as one interviewee pointed out if they were to not use audio as a backup. A simple nod from the head, hand gestures, and even facial expressions helped some continue speaking. In three of our observations, we notice multiple participants using gestures with their thumbs to confirm the tasks they have been articulated. Four interviewees have experienced live sharing of files with others, explaining that it helps other members look at relevant content at the same time.

2) Communication between members: There are a variety of exchanges between members during a meeting. Everything from vocal responses to messages in the chat area on the same platform. Writing a message to participants while another member is speaking does not seem to disrupt the flow, but rather create room for positive responses. Six interviewees have experienced that writing a short message builds on a discussion and clarifies misunderstandings so that the debate is still relevant to the topic.

However, most interviewees present the chat function only as a supplement in these sessions, primarily for turn taking and troubleshooting. Images, GIFS, and illustrations invite interaction, even in lenient moments during group meetings. This was also the case in three of our observations.

Three interviewees feel that there are limitations to adequately expressing themselves due to the fear of not being understood. A lack of confirmation from other participants in larger meetings led to shorter and more concise sentences.

Disruption of the conversation due to a problem with the internet effects the organic flow of the conversation greatly for some interviewees and repeated incidents discourage participation, which leads to disengagement. As conversations become stunted, members deviate from what has been said and resolve to do other activities. This has been the case in two of our observations.

3) Trust: The freedom of being able to do other things during a meeting has been expressed by most interviewees in the form of multitasking. In some cases, participants and interviewees used programs such as Microsoft Word to take notes of what is being said, which can disengage one from active participation, while others have been on social media and other irrelevant websites after being disengaged.

The duration of being mentally absent creates uncertainty and distrust according to three interviewees. Remote members rely on each other to be attentive to the topic at hand, however, in distributed meetings, trust may decrease as one cannot be certain of what others are doing. Members do not know if the reactions from others are genuine, which can lead to constraints in engagement on their part. Being a listener appears to be a heavier responsibility for speakers in digital meetings, as they require confirmation to maintain their level of engagement.

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C. Strategies to encourage engagement

This part of the analysis pertains to suggestions and strategies from participants based on experiences that contribute to enhancing and sustaining engagement in distributed meetings.

For most interviewees, being able to see all faces provides comfort and a lower threshold to participate in the meeting. In addition, the technology should minimize background noises or notify that one should be in a quiet location. Seven interviewees suggested that the digital platform should disable all notifications on the computer during the session. One interviewee suggested that the platform should show all participants on the same display, in order to encourage users to turn on their video feed. Indicating that some programs may not have this feature yet. Notifying participants of who is the next speaker can help enhance the flow in cooperative work. Technologies that enhance the conversation experience through virtual reality has also been suggested. One interviewee suggested measuring engagement from the meeting and provide oversight over which members need guidance or more encouragement after analyzing reports of retina graphs for instance.

Social norms in meetings can help reduce distrust among distributed groups. As mentioned earlier, a mediator can enhance engagement in meeting through constant interaction, good content, direct questions and turn taking. One interviewee created temporal constraints for tasks in an online session, informing them that one participant will present their work at random. Two interviewees suggested that the meeting duration could be shorter, which would give incentive to provide additional input and discourage derailing as there are constraints.

VI. DISCUSSION

In this section, we discuss our findings regarding elements that influence engagement in distributed cooperative meetings in relation to elements of engagement found in the literature.

Based on our findings, indicators of engagement from our suggested framework have an influence on the cooperative nature of meeting participants. Speakers show commitment to being involved as they become the center of the meeting. Most participants are engaged in the meeting when the topic concerns them personally. Personal interest, feedback, and motivation operate as incentives for engagement. This is compatible with the attributes of engagement outlined by O'Brien and Toms [32] and thus serve as mechanisms for the facilitator to sustain engagement with side participants. While the relationship between the meeting participant's involvement and engagement is not conclusive, Glas and Pelachaud argue that the concept of these two to be closely related [28]. Meeting participants inhabit direct engagement through involvement when initiating an utterance. Based on this reflection, involvement is an indicator of engagement in the context of meetings. In addition, speakers are sharing their resources with the rest of the group, which promotes productivity.

In our observations, side participants exhibit passive engagement using non-verbal cues from their video feed, which verifies Liu et al.'s [29] view on participation. This form of remote participation leads to engagement, which is compatible with Kuzminykh and Rintel's [49] findings on attentive actions in video meetings. We see that head nodding and non-verbal, reactive responses from the video feed foreshadow involvement, confirming Isaacs and Tang's claim on video interactions [55].

We find that there is a higher threshold for involvement when there are multiple parties in the digital room, specifically when there are challenges acquiring reactive information as a speaker. Furthermore, some groups that prefer to only use audio and chat over video, that still maintain a certain level of presence in the meeting, partially contradicting Tang and Isaacs's study [55].

The implications of being disengaged due to multitasking support the results from Lyons and Kim's study, implying that multitasking has a negative impact on engagement [53]. Another indicator of disengagement is the lack of visibility from video feed. Participants that do not use video lack the social presence required to interact with others, creating barriers for reaching shared understanding. Most attendants that used audio could not demonstrate engagement unless they were addressed by the facilitator. Op den Akker et al.'s [52] study emphasizes the need for feedback from participants in order to coordinate turn taking and topic management, two characteristics of meeting structure which have an impact on a participant's level of engagement in meetings [60].

We found that the facilitator has an influential role in prompting attendants in the meeting. This coincides to the recommendations and strategies for meeting facilitators to engage participants from Sauer and Kauffeld's study [47]. Four observations illustrated that the meeting facilitator was the one coordinating the meeting. One session in our observations show that there was no clear meeting facilitator, however, there were only four participants using video and established routines for turn taking. This may indicate that the need for a facilitator is dependent on the size of participants, however, this could also be due to the level of trust and social relationships between participants.

In our findings, interviewees expressed the need for feedback on their contribution from other participants. Jarvenpaa and Leidner's perception of shared experiences in this context indicates that social norms play an important role in enhancing engagement [3]. However, turn-taking norms in the meetings accompanied by a focused view of the current speaker as suggested by Bohus and Horvitz [48] and Cutler et al. [16] complies with the required meeting structure in disturbed meetings, which encourages participation. Based on this, we argue that if facilitators did not institute strategies of turn taking, then it would be difficult for them to control the floor [55].

The findings highlight conflicting opinions of participants deviating from the meeting platform due to multitasking. Some participants use other applications due to loss of interest in the meeting, while others have other tasks they would want to complete while attending the meeting. Mark et al.'s findings are closely related when it comes to these perspectives [51]. Lyon and Kim's results correlate with our observations, as the participants that seemed to be mentally absent were looking downwards, away from the screen. [53].

The findings indicate that distractions caused by audio problems disrupt the flow in the conversation, leading to frustration and a loss of engagement. Our observations confirm this as participants were less active after a series of audio problems occurred. This is listed as one common problem that people experience in Yankelovich et al.'s [50] study of telepresence. However, it seems that such problems can be solved relatively quickly by other participants who use the messaging function for troubleshooting.

A. Implications for engagement in distributed meetings

Our study presents a set of elements that can influence engagement in distributed cooperative work. Moreover, we

presented a framework, based on extensive theory for investigating engagement in distributed cooperative work. The findings and suggestions contribute as implications for developing future technology that aim to facilitate distributed cooperative meetings.

One implication for development is finding methods to conceptualize the context of the current speaker along with the topic. Ørebæk et al.'s [10] study developed a prototype that enhances the context of the current topic of the meeting with temporal constraints. This can appeal to a predictable and sustainable structure for those who need a sense of context to maintain engagement. Furthermore, there is potential for augmenting the meeting platforms by regulating turn-taking in an interactive matter.

Digital tools should also address multitasking, by handling notifications outside of the meeting. Alternatively, a facilitator can implement methods that allow groups to do work while maintaining the interdependence of cooperation. To the extent of our knowledge, there is a functionality within digital meeting platforms that creates breakout rooms. Using these rooms, the meeting participants are separated from each other, with the intention of returning to the meeting after a duration and thereafter continue doing cooperative work where they can provide feedback. We suggest that CSCW tools support meeting facilitators in order to keep track of when participants can work on their tasks during the session.

A study by Ståhl [61] explored experiences of VR(Virtual Reality) in project meetings. To the extent of our knowledge, there is no clear relationship between virtual reality and engagement. However, based on our findings, we see a need to visualize expressions so that speakers can adjust the dialogue to maintain engagement.

As for interaction between participants, trust between remote participants can contribute to an increase in participation, and thus engagement. Szewc [62] suggests that managers should maintain frequent contact with members. Our findings on the facilitators' role in cooperative work support this.

VII. Conclusion and future work

In this paper, we investigated the concept of engagement in the distributed cooperative work setting. We introduced a thorough review of the literature on engagement and engagement in meetings, followed by a proposed framework for analyzing engagement in distributed meetings. The framework was used later in gathering empirical data. From the findings, we can state that the framework is promising and can contribute as a conceptual ground for studying engagement in cooperative meetings. Moreover, the framework for investigating engagement in distributed meetings shows potential for adjusting today's digital meeting platforms. Engagement in meetings is an important factor for groups to be able to do cooperative work in a productive matter, especially when there are no alternatives during the lock-down. The list of factors that influence engagement in distributed cooperative meetings can be used to design future technology that can support these specific meetings, contributing in this way both in HCI and CSCW.

The aim was not to exhaust the issue of engagement in distributed cooperative meetings, but rather open discussions into developing and assessing digital meeting platforms that address the relevant issues within distributed cooperative work. The number of interviews and the observations can be considered as a limitation, but was adjusted due to the situation. In addition, it would be beneficial to explore engagement based on the nature of the meeting. Thus, in the future, we plan to investigate more on this issue and possibly observe a group meeting in both co-located and remote settings and comparing how engagement elements might differ in this setting.

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