

Collaboration and Meetings

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1 COLLABORATION AND MEETINGS

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1.1 Introduction

Perhaps the most obvious change that information workers experienced when moving to remote work as a result of COVID-19 was that the meetings they had previously attended in-person shifted to being remote, resulting in many new kinds of ‘meetings’ and other collaborative practices that attempted to make up for the loss of the full range of social interaction people had previously relied on at work. Thus, we begin by looking at the way collaboration and meeting practices evolved over the course of the pandemic. In addition to how meetings and other forms of collaboration have changed, we also discuss how remote work affected inclusion and the collaborative connections people form, and what changes people hope or expect will continue post-COVID.

1.2 Impact on Working Patterns and the Nature of Collaboration

1.2.1 The shift to remote work increased meeting and IM loads, while stretching workdays.

An ordinary day at a physical workplace includes a mix of pre-planned and spontaneous interaction that supports collaboration, productivity, and connection. With the move to remote work, both task-focused and informal communication moved to online platforms. Results from many studies, both of Microsoft employees and information workers external to the company, show that people had a higher meeting load during the pandemic than they did pre-COVID. In one survey of over a hundred information workers across a variety of industries, 57% said their meeting load had increased [160]. In an internal company-wide survey, more than half of respondents reported more meeting time [128]. Relatedly, a study of the working patterns of Microsoft China employees found that voice and video calls doubled from 7 to 14 hours a week after the transition to remote working [131]. Other studies suggest that scheduled meetings were also running longer. One internal study found that meetings were less likely to end on time, due in part to the lack of physical reminders that a meeting was done (e.g., the next group walking into your conference room, people shuffling papers, people standing up, etc.) [26]. Increased meeting load may not be special to the conditions of the pandemic: a study of 800 employees in a Microsoft subsidiary in the Netherlands, who underwent a 10 week remote working experience in 2018, found a 10% increase in meeting time [149].

Internal studies show that people were also holding more short meetings, those lasting 30 minutes or less, such as quick check-ins and 1:1s with team members and managers [26,91,138,163]. Analysis of telemetry data from the Modern Workplace Transformation team [91] found that 1:1s increased by 18%, and check-ins and team social meetings grew by 10% – half of these new meetings were recurring. Further telemetry data from Microsoft US employees show unscheduled calls in Teams more than doubled [182].

Instant message (IM) chats also substantially increased during this period of remote working [91,130,181]. Studies show IM traffic increased for different Microsoft teams by 65% to 72% [91,130], this being most dramatic amongst managers, with a 115% increase from pre-COVID figures. This finding is buttressed by an external study of information workers across a range of industries, where quick one-off and in-person conversations were being replaced with instant messaging via Teams, G-Chat and Slack [160].

All these meetings and messages were spread out over a longer workday. Research with one Microsoft team in the US found that the share of IMs sent between 6 pm and midnight increased by 52%, and that people who previously did not work much on weekends saw their weekend collaboration triple [66]. One participant in this study suggested that flexible working hours contribute to the problem: “If a colleague working flex hours sends a message at 9 pm, I feel like I need to respond.” It appears that working outside of normal working hours results in more IMs being sent, but also that sending (and others’ receiving) IMs can result in people working at unusual times of the day [66].

These changes in meeting hours differ depending on role, whether one is a manager, and how experienced one is in remote work. For example, Workplace Analytics data comparing metrics pre and post pandemic show that people in marketing, IT, sales, and program manager roles experienced a larger increase in collaboration time (as measured by amount of meetings, email and message time) than data center workers, applied scientists, software engineers and researchers [182]. After-hours collaboration time significantly increased for applied scientists, software engineers, and data center workers, and significantly decreased for people in marketing and sales. After-hours collaboration time remained steady for researchers, program managers, and IT professionals.

Managers experienced more pronounced changes in meeting patterns than independent contributors. Company-wide managers were more likely than individual to import an increase in meetings [128]. In a 3,500-person org, telemetry

data showed a 25% increase in managers' afterhours meetings [69]. At the same time, in a study of external customers, almost a third of participants reported fewer meetings with their manager [29], suggesting that some managers were facing more time demands than they could accommodate. For more on the importance of managers in adapting to change, see the following chapter on [Personal Productivity and Well-being](#).

Finally, because remote work entails a learning curve, experience helps. A study of collaboration patterns of Microsoft employees found differences between people who were new to remote working and those who had previously worked remotely [182]. The same study also suggests that recent hires experienced a larger drop in collaboration than established employees. While time in Teams meetings increased for both "always remote" workers and "new remote workers" (compared to pre-pandemic metrics), new remote workers saw a 47% point larger increase. New remote workers also made more 1:1 connections via Teams than always remote workers (13 connections per week compared to 9). In a separate survey of Microsoft employees, those with remote work experience were less likely to report a drop in productivity at the start of the pandemic [46].

1.2.2 The move to remote work was particularly hard on some kinds of collaboration, such as creative work, "thinking big," and decision-making.

The movement of work to entirely digital communication platforms had mixed results for collaboration. Some teams found it more efficient to be remote, such as one of our Beijing teams [176] who reported meetings were generally more efficient and focused. This same study found a substantial increase in use of all communication tools (online documents, Teams, email, phone calls and WeChat). Outside Microsoft, one of study of information workers shows that people worked through an initial remote work learning curve (e.g., learning how to use many of the capabilities of Teams [156]), to quickly ramp up their skills with online collaboration tools. And research that studied freelancing in small and medium businesses found that remote work made them more incline to work with freelancers [104,180], suggesting that collaborating with people who normally work remotely was easier once teams have gained the experience needed for effective remote work [104,180].

However, there are many indications that different kinds of teams struggled with the transition from in-person to remote for certain types of teamwork. A survey of thousands of software developers found that 46% were experiencing difficulty communicating with their team members, affecting their ability to collaborate and reach milestones [46,156]; similar patterns were seen in external surveys [142]. In one internal study focused on developers (see the chapter on [Software Engineering Experiences](#) for more), people reported difficulties conducting the kinds of technical discussions they would normally have had around a whiteboard: "We don't yet have an awesome replacement for getting the right nerds in a room at the same time, with a whiteboard" [69] (see the chapter on [Devices and Physical Ecosystems](#) for more about the use of physical devices in remote work.) A large external study of information workers [156] found that teams often lacked clear systems for communication and integration of working sets of information, resulting in challenges finding files, tracking the status of an element of a project, and other coordination tasks.

The challenges appear to run deeper than access to seamless, shared, collaborative working spaces, however. In one study of external information workers [15], an emerging theme was that remote work favors "solo work" over the collaborative generation of new ideas, finding clarity and alignment within a team, bonding emotionally, and the ability to change direction as a team. This qualitative study tracked a set of people over time and found that the emphasis on solo work meant that collaborators often fell out of rhythm with one another leading to unnecessary re-dos of work. A more quantitative survey of external information workers [156] added further weight to this claim; they found that 30% of respondents said that brainstorming and generating new ideas was the most challenging type of collaboration to do while working remotely. Also problematic were: planning (17%), sharing information (17%), and solving problems (16%).

Studies of Microsoft employees generate similar findings. An internal study of Office Experience Organization (OXO) teams reports that the ability to do work that involves new ideas, goals and big picture thinking was diminished when working remotely [26]. Another internal survey at the beginning of the pandemic had 57% of respondents reporting a decrease in their ability to brainstorm with their colleagues [114]. Similarly, a study focused specifically on the remote-meetings experiences during COVID-19 of over 800 Microsoft employees found that brainstorming, workshops, and meetings that require social interaction were amongst the most challenging types of meetings to carry out remotely [139]. One proviso, however: in this same study, employees in business and sales roles were over 2.5 times as likely to report that brainstorming had become *more* effective during mandatory working from home, in comparison to those in development roles. Why might this be the case? We know that those in business and sales roles are much more likely to have distributed teams, and thus have developed established

practices with remote or hybrid brainstorming meetings. Thus, the transition to all-remote work levels the playing field and may well have created a net improvement for brainstorming in these roles.

A study of Microsoft employees' experiences in remote meetings during COVID-19 [138] also looked specifically at teams' ability to pivot or change direction. When asked specifically about decision-making in meetings, most respondents agreed that they felt able to influence decision-making in meetings, and that dissenting opinions were discussed in meetings. However, significant proportions felt that both their influence, and the discussion of dissenting opinions (32% and 26% respectively), had lessened during mandatory work from home (11% and 12% respectively felt they had increased). Further, those with some prior remote work experience felt substantially more able to influence decision making in meetings than those without prior experience: this was the case before the pandemic, and even more so after. Those with prior remote work experience were over twice as likely to 'strongly agree' to feeling influential when asked to work from home than those without prior experience.

To understand why decision-making may be difficult, it is interesting to examine some of the participants' comments in this study [138]. Here we found that lack of physical cues, body language, and ability to gauge emotions were said to be significant hurdles to productive disagreement and decision making. A troubling pattern was for debate to be deferred ("let's take this offline") in the name of efficiency and to make use of limited time, but people often did not follow up. Another factor here was that, while some found online meetings more inclusive, due to the 'level playing field' of all-remoteness, it was also reported that those who were less likely to speak up in physical meetings were also less likely to contribute to online meetings. And without space constraints, it is easier to have online meetings of larger groups, which might seem more inclusive, but where fewer people will have a chance for their voices to be heard.

1.2.3 Informal and spontaneous interaction particularly suffered in remote work, affecting collaboration.

In addition to the task-focused work of collaboration, the ties that spark creative ideas and foster productive collaboration are built through interpersonal connection, informal communication, and spontaneous interaction, all of which can be harder to achieve remotely. Friendship at work positively affects both task accomplishment and job satisfaction [80,178]. Prior research on remote work has found evidence that the quality of relationships with coworkers tends to go down [1,116,150] and feelings of social isolation tend to increase [135]. An internal-facing survey of engineers with a focus on teams, found that "66% of respondents reported a decrease in social connection with their team members, and 78% and 65% cited a decrease in impromptu and scheduled social activities, respectively. Across the board, we saw a dramatic decrease in feelings of social connection and team cohesion" [114]. Importantly, they show that this lack of informal communication and cohesion was seen as negatively impacting productivity. Two Microsoft studies of information workers [156,160] found that they struggled with isolation from coworkers and friends. One internal study of engineers and program managers [46] found that among the most frequent challenges faced were "missing social interactions" and being "less awareness of what colleagues are working on." A similar finding is reported by a Microsoft team in Beijing, where social interaction in the physical workplace was reported to be one of the aspects of working life missed the most in working from home [176].

The concept of a 'meeting' has always been a fluid category in terms of the work accomplished, but in this period where remote work was required, it increasingly included encounters related to the fabric of collegiality. Many of the short hallway conversations, or dropping by someone's desk, were taking place through short video or audio calls. Hallway and casual interaction, some of which is related to coordination of work or sharing of status, was also moved to meetings [149] or accomplished through IMs. People made deliberate efforts to schedule regular touchpoints and virtual social rituals such as lunches or happy hours [91,138,156,160]. A study of Xbox console gamers who said they gamed with co-workers found that while they were split as to whether they talked about work while gaming, and that those who did reported higher quality gaming experiences [15].

At the beginning of the pandemic, Microsoft employees reported that in-meeting social talk increased at the start of many meetings, centering primarily around sharing experiences of the current pandemic [138]. These same participants mentioned the mood was frequently lightened by talking about people's backgrounds (actual or replaced with images) or the invasion of children, spouses, and pets [138] during ongoing meetings (although others report that such invasions were embarrassing [156]). However, as meetings became more focused on productivity within the context of increased meetings (see later in this chapter), there is evidence that this social interaction over time was squeezed out, which, paradoxically may have relieved some of the burnout from meetings while increasing the stress of isolation [138]. (See also the following chapter on [Personal Productivity and Well-being](#)).

Social talk is one aspect of the fabric of collegiality, but another is the serendipity of social connection in the physical workspace. It is perhaps no surprise, then, that while existing tools may help facilitate deliberate social connections and quick check-ins with known colleagues, studies report that people are struggling to replace the casual, spontaneous “watercooler” conversations that they are missing [26,69]. Note that these are a different kind of casual conversation from those discussed so far because they involve meeting and connecting with people whom one would not normally set out to connect with, to check-in with, or to arrange any kind of deliberate meeting with. We need, therefore, to distinguish between social talk amongst colleagues one plans to see, and conversations that are unplanned, including the awareness of others that comes from this kind of social activity. It is also important to remember that not all workplace interactions are pleasant. One external study found employees reported fewer interpersonal conflicts as they were better able to avoid some people [72].

Our study of Microsoft employees’ experiences in remote meetings during COVID-19 [138] confirms the importance of spontaneous interaction. Most people said spontaneous interaction mattered to them, though they were polarized over whether it had become more or less important to them over the pandemic. However, 67% of participants said their needs for spontaneous interaction were not met, regardless of how much they said it mattered to them. Some evidence suggests that many whose needs were not met were reliant on informal and unplanned conversations in social spaces at their workplace. For others, social interactions at home were at least partially fulfilling their needs for spontaneous interaction.

1.3 The Impact of Remote Meetings

1.3.1 Video conferences are fatiguing.

The idea of meeting fatigue rose to prominence during the pandemic, and our research supports the notion that constraints of video conferencing technology, when combined with increased cadence in meetings, contribute to perceptions of fatigue. Numerous studies have identified reasons that video conference meetings may cause fatigue, including reduced nonverbal cues that inhibit the ability to “read people” in a conversation, the need for sustained attention, the pressure to perform paying attention for others, low media quality, and the fact that crowded remote meetings require cognitive multitasking [49,153,172].

One study from the Human Factors team found that brainwave indicators of mental effort were higher when two people performed a collaborative task remotely, than when they shared the same space [19]. In another study, the same team measured EEG and heart rate of 12 Microsoft employees and found that brainwave markers showed significantly higher levels of stress in video meetings as compared to typical non-meeting work [19]. Further, fatigue due to concentration began to increase 30-40 minutes into video meetings. Looking at days filled with video meetings, dramatic changes in brainwave patterns, consistent with being over-worked or stressed, began to set in after about two hours. More recent, but preliminary results from this same team found that brainwave measures showed lower levels of stress and concentration when Teams “Together” mode was used compared to the more usual “Gallery” mode [19]. We conjecture in the traditional “Gallery” mode, the brain must override the sensory perception that all participants are in different places to treat them as gathered in one conversation. “Together” mode removes the different backgrounds of participants and the artificial separation of a grid, instead showing their cut-out images in a single naturalistic virtual arrangement (such as an image of an auditorium with each person in their own seat), reducing the workload necessary to perceive everyone as together. A related contributing factor to video conferencing fatigue is the lack of variety of what is shown on the screen – endless views of either talking heads or screensharing and presentations with very limited views of people [138].

1.3.2 Fatigue was also increased by meeting load and the challenges of coordinating meeting tools.

However, it was not just the dynamics of individual meetings that made them tiring during the pandemic. Their sheer quantity and the way they played out over time may have damaged productivity and increased burnout. As one study of external information workers found [156], the lack of a break between meetings in itself can be exhausting. As one participant said, the schedule of remote meetings led to “alot of stacked meetings...mentally you have to context switch.... I take a deep breath before, go click on the next and remind myself who is going to be in the meeting and what is it about before I joined because it really is that difficult when it’s all stacked one the other”. This points to a need for what these researchers refer to as “micro mental breaks” in order to do context or task switching. Two studies of employees [149] suggest that the increased number of meetings coupled with the lack of natural transitions between meetings in the office, such as walking between meeting locations, also reduced the overall physical movement of employees, contributing to fatigue.

Meetings, of course, need to be considered within the broader picture of collaboration workload. Many external information workers reported feeling “overwhelmed by the significant increase in the number of chats, channels, and documents they need to reply to, be aware of, and contribute to for collaborative projects” [156]. In a different study of external information workers, many also reported feeling “overwhelmed” by the sheer volume of incoming messages and being “tied to their desks” since IMs can come in any time of day [160]. An internal study focused on OXO Engineering teams, identified “too many meetings” as one of the most frequently cited pain points [26]. This is a sentiment echoed in a study focusing on Microsoft engineers [69], which found that, despite output measures for collaborative practices being either stable or increasing over time, the need to collaborate and to be seen to be productive, may well have contributed to burn-out and reports of perceived decreases in productivity. (See the chapter on [Software Engineering Experiences](#) for more detail.)

Several ongoing studies found that the diversity of tools in use also presented challenges. One study of external information workers [160] found that the diversity of communication media contributed to the stress of collaboration. They moved between email, video calls, phone calls and chat, and the products used varied depending on their colleagues. In a later set of findings [160], the extra overhead of moving between different tools, and constantly checking different places for communication during the workday, was a catalyst causing teams to settle on one collaboration tool, although this was not always entirely possible when work had both internal and external stakeholders [138]. An external study of information workers also found that information workers felt overwhelmed and that the “which tool when” problem has been highlighted by the pandemic [156]. It is no wonder that participants in one study mention that remote methods seemed more effortful than simply stopping by a colleague’s desk with a quick question [160]. Ultimately, differentiating the fatigue attributable to video conferencing and other qualities of remote work from that which is attributable to living through a pandemic will be important to tease apart over time.

1.3.3 Interaction in remote meetings is challenging in ways that are fundamentally different from in-person meetings.

Video conferences are comprised of multiple channels of cues – auditory, visual, and textual – which happen simultaneously and differently than they do when in-person. Evidence suggests that voice is the most important channel. In internal study of online meetings, 51% of the participants ranked the ability to “hear people” as the most important communicative feature of meetings [138]. This is in line with prior research that has found that voice is the central communicative mode and should be optimized for, even in video meetings [124,137].

However, video is important in terms of “social presence” – the sense of intimacy and immediacy with others. The importance of presence (and the consequences of its absence) recurs frequently in research across internal and external studies. In multiple studies of Microsoft employees’ experiences during COVID-19, participants reported that small group or one-on-one meetings with video turned on can be engaging and interactive, especially if people in these small meetings know each other well [26,138]. As group size grows, however, people reported feeling increasingly invisible. Independent of the number of people, social presence is difficult to attain when the meeting is primarily focused on screensharing or presentations. In those cases, Microsoft employees who were presenting reported that they were “speaking into the void”, with no sense of audience and thus no way to adjust how to proceed. Similarly, attendees became largely invisible, especially if they muted their microphones and cameras to ensure that the presenter could speak without distraction, which led in turn, to increased disengagement [138].

However, this same study also found changes over time. Video was turned on more initially during the pandemic, but as time passed, this was reported to happen less often due to bandwidth problems and the fatigue caused by people feeling like they always had to be presentable [138]. At the same time, the study found that the use of video (choosing to turn it on or not) did not correlate strongly with other factors measured, such as feeling effective, feeling tired, being able to engage, feeling comfortable, feeling that meetings are well-managed, and multitasking. This response appears to be at odds with the finding that visual presence is important. It is likely that this complicated issue is pointing to multiple factors at play which need further disentangling.

Even without a presentation, “reading the room,” – knowing what people are attending to, what activities are taking place, and being able to perceive non-verbal interaction – is difficult in remote meetings, especially as group size increases. A study of Microsoft employees’ experiences in remote meetings during COVID-19 [138] showed that “knowing who is speaking” was one of the three most important features of video conference quality, yet that could be difficult to discern. While current speakers might be heard, not knowing where to locate that speaker’s visual representation (video or an audio placeholder) was reported to make it more difficult to judge when to take a turn.

In fact, turn-taking (the prediction and management of which person should take the next turn to talk [144]) was the most frequently reported issue when asking about interactivity challenges in a study of Microsoft employees' experiences in remote meetings during COVID-19 [138]. Users reported uncertainty about the best way to deal with overlapping and interruptive talk [138]. This is also an aspect of remote meetings that research has explored for decades [146]. Even with video on, audio latency makes it more difficult to take turns and to separate meaningful and non-meaningful delays in responses [142]. The limited field of view and flattened view from webcams, as well as the arbitrary ordering of video rectangles also make it difficult to notice both the subtle visual cues that someone wants a turn at talk and the associated subtle visual cues that other group members are attending to a potential bid to talk [173]. The hand-raising feature in Teams was reported as helpful for overcoming at least the issue of bidding for a turn, but it was new and its use was only beginning to be ingrained [138].

Some of these challenges are caused by social cues we would normally use in-person not being present, others are caused by limitations of internet connections, especially shared domestic connections. It is important to note, however, that research has shown that even with no perceptible audio or video lag, conversations that are mediated by audio or video technology are significantly less interactive than in-person meetings. Mediated conversations have less overlapping speech and may be perceived as more formal [146]. Problems with internet connections, such as choppy audio and video, can have lead people to turn off their microphones and video, limiting everyone's ability to perceive one another [138], further reducing everyone's sense of togetherness, and hence undermining the kind of mutual social joys and obligations that are central to the experience of meeting in person. (For more about bandwidth and latency problems, see Chapter 5 on [Devices and Physical Ecosystems](#).)

1.3.4 The use of video in meetings is both a personal and group affair.

One study of Microsoft employees' experiences in remote meetings during COVID-19 [138] also found that there are many reasons why people choose to keep their video off, or not to turn it on in a remote meeting. As we have already noted, technical performance issues were rated as amongst the most important. However, the other major factors cited were: other people turning their video off, people wanting to multitask, and people feeling self-conscious about their appearance. "Not actively participating" and "The effort of being seen" were also rated as highly important by many participants, but this was less clear-cut. In general, there were no differences by gender, role or prior remote work experience.

Examining the comments from participants, the study found peer-mimicry to be ubiquitous: people looked to others in the meeting for cues as to whether to turn video on or not, especially looking to a meeting leader or customer establishing the norm. Many people also mentioned (and conflated) the effort of appearing presentable, appearing attentive by looking at the camera, managing their background, managing family interruptions, and feelings of self-consciousness. Non-standard meeting hours were commonly to blame for video off in early mornings, late nights, and after workouts or showers. However, some mentioned this perception of effort and self-consciousness was decreasing, greatly influenced by team culture. Video in general was seen as adding more social and engagement value—it was rarely spoken about in terms of improving work efficiency or output.

A second set of questions explored the value of video in different kinds of meetings: small group discussions, small group collaboration around shared documents or presentations, and large presentations. In small group discussions (with no shared documents), most people reported benefits to video, indicating that video for the most part was not distracting, that it boosted engagement, and provided important information for the collaboration. This situation changed, however, when there was a shared document or presentation in a small group. Whereas the video for this scenario was still not found to be distracting for most, it was also not always seen to boost engagement. Half of respondents in this case also said they wanted more information about others in this situation (53%), but a sizable minority did not (21%). People were divided when it came to seeing video of audience members during large presentations. When presenting, 27% of people said they found video of the audience distracting while 55% did not; 53% wished for more information about the audience while 25% did not. When in the audience, sizeable groups did and did not find video of the audience distracting (50% and 39% respectively), and did and did not wish for more information about the audience (34% and 53%).

On the whole then, people were more likely to find video of others distracting in large group presentation scenarios (whether presenting or audience) than in small-group scenarios. People were less likely to want more information about people who had their video off in the audience scenario, than in any other scenario (presenting, discussion, or collaboration). This was borne out in free text entries where it was generally judged that video was a net positive for small meetings, and a net detractor in big meetings. In big meetings, audiences liked to see video of the presenter,

and active question-askers, but not the audience, whereas presenters felt like the lack of audience video left them speaking into a void (as noted above).

Examining people's comments in relation to these questions reveals that the use of video in meetings presents a conundrum: on the one hand, the video of others can be irrelevant or even distracting (e.g., when others are clearly multitasking or not paying attention). On the other hand, visual information we normally glean from in-person meetings is clearly important for interaction and engagement, but difficult to convey in video conferences. As one participant put it, "[...] it's not information that's readily distilled, nor is it information that comes across well with a bunch of little video boxes. It's information that's often not even possible: who's sitting with who, who's having a side conversation when [...] Who's smiling and who's nodding is something you might get on camera...but people do behave differently when there's a camera on their face than when they're just in a room. [...]"

The modern video meeting attendee thus sits at the intersection of three phenomena: 1) the diminished utility of video since people cannot produce the interactional information they would have in person; 2) the need, as a speaker, to understand people's engagement (attention, emotion, etc.); and 3) the pressure, as a listener, to return the courtesy of relaying engagement information to the speaker. The result is that the provision of engagement information, which is universally acknowledged as valuable, is forcibly coupled to the consumption of irrelevant video information and a constant, unnatural physical configuration.

1.3.5 Parallel chat became a pervasive component of meetings.

Although the audio and visual channels are primary when video conferencing, most platforms also enable attendees to simultaneously post text, images, files, links etc. into a parallel chat area. A study of Microsoft employees' experiences in remote meetings during COVID-19 [128,138] found that over two-thirds (69.7%) reported using parallel chat in meetings, 26.6% reported using parallel chat in every meeting or almost every meeting, and 24.1% using parallel chat at least once a week. Thus people are splitting their attention across modalities. We know from previous studies [136,155] that attendees engage in backchannel chat because they want clarification on meeting contents, or want to participate, and/or influence others in the meeting when it is difficult to get a word in edgewise. This parallel conversation may augment the main discussion by allowing more people to contribute their ideas and share resources and can hence increase inclusion. But parallel chat can also create new challenges for meeting organizers and participants: chat can distract attendees from the main agenda, and organizers may have trouble integrating chat conversation with the overall meeting discourse. It is further unclear how meeting chat and the meeting proper are integrated into a holistic understanding for all participants.

One study of Microsoft employees' experiences in remote meetings during COVID-19 [138] also found that people were using chat more, some people found it more distracting than others, but most agreed it was a net positive. The top perceived positive uses of chat were allowing communication without interrupting the speaker and making large meetings more inclusive where it was tough for everyone to speak. The top reason for chat being distracting was when the chat conversation diverged from the audio-visual discussion, making it difficult for attendees to allocate attention. Respondents who were most positive about chat tended to list specific uses, suggesting that people who were successful at chat formed strong models of what chat is good for and when to ignore it or not use it, in order to mitigate its distractive effects.

It seems then that in-meeting parallel chat is one way that people can make their voices heard and their presence felt in an all-remote world. This appears to be a new habit that has gained strength and a feature that we are beginning to rely on and learn to use in this new world of work, and a way to compensate for some of the shortcomings of current, collaborative tools.

1.4 Inclusion and Forming Connections

1.4.1 Remote work affected inclusion both negatively and positively.

Difficulties in having a sense of presence and in having all voices heard point to some of the downsides of remote collaboration tools and their impact on inclusion. For example, when it comes to online meetings, it appears that junior (career level as self-reported in verbatims) Microsoft employees found it especially difficult to gain turns at talk or have their presence noticed, making hierarchies more conspicuous [138]. A recent study comparing the first 90 days of new hires in Azure Edge [69] to those of new hires the previous year found that new hires had a difficult time connecting with others, impacting their productivity. For that group, new hire meeting hours, meetings attended, emails and IMs sent, collaboration hours, internal and external network size were all down relative to 2019. Consistent with pre-pandemic research [86,87], new hires interviewed felt more positive when they had "formalized, consistent and sustained 1:1 interactions with onboarding buddies, mentors and their managers."

Furthermore, over-reliance on the visual channel in remote meetings can make telework especially challenging for people who are blind or low vision, and the assumption that everyone can hear the audio channel equally well can be difficult for the deaf. More specifically, our research shows that people who rely on screen readers for compute output (those who are low vision or have dyslexia) encountered were especially challenged when other people shared their screens with them, putting the screen reader voice of the shared screen and the speaker's voice in competition [163]. Another interesting finding is that those who are deaf and speak through ASL interpreters are disadvantaged by systems that use active speaker detection to choose which video streams to display. Such systems highlight the interpreter rather than the person who is signing leading these users to feel unintentionally digitally “erased” from the interaction [163].

At the same time, we are finding evidence of many benefits of all-remote work when it comes to inclusivity. As an example, some participants who previously felt excluded reported that their social presence increased during the pandemic. One study, designed to explore telework with and for people with disabilities [163], suggests that the shift to remote work has been a social leveler in some respects. People who under normal circumstances had to work from home were now ‘experts’ in teleworking, and some said that they preferred this new normal because they were no longer at a disadvantage simply by virtue of being the only one ‘not in the room.’ This same study found that some deaf participants who lip read said that all-remote meetings were much better for them because the frontal views of each participant were captured: this made it much easier to lip read, compared to calling into a conference room where the camera captures side views of people in a meeting [163]. These results show that who is included and who is excluded by which configurations of technologies and social practices is a complex issue, but one that deserves to be put front and center of our research, design and development efforts.

Another important point is that this “social levelling” effect is in fact of more general significance: in a study of Microsoft employees’ experiences in remote meetings during COVID-19 [138], the equalizing effect of everyone being remote was a major theme in the journal study. For example, one participant said, “When we’re meeting in a conference room, it’s easy for people who are remote and on Teams to be overlooked or marginalized. [...] Having everyone on Teams means everyone has the same opportunities to speak and has the same challenges in terms of hearing/presenting.” This is confirmed by other studies: Several participants in an external study of decision makers commented on senior leadership being more accessible online as opposed to being largely unavailable when working from a big corner office [62]. An important point here is that this effect will likely disappear when some people return to the office and we are then experiencing more hybrid meetings situations where some people are co-present and others are remote. Designing for the hybrid meeting situation raises a whole new set of challenges to make sure interaction is inclusive.

1.4.2 Many people not only maintained their existing networks post-COVID but made new connections.

Given the challenges of collaborating remotely, we might surmise that people’s collaborative networks would suffer. Some internal studies showed that many people’s professional networks were either maintained or even grew at the start of the pandemic. This was not universal, however.

Early in the pandemic, for example, a study of Microsoft employees in China [131] found that people’s networks did not change substantially after enforced working from home. After shifting to remote work, a quarter of employees experienced no significant change, and two thirds of employees maintained a network within 30% of their original size.

A different internal study analyzed the connections made by over 92,000 Microsoft employees [148] in order to explore the “meaningful connections” they made (emails, instant messages, and calls) pre and post enforced working from home, with a focus was on outbound connections to 4 or fewer recipients. The data show that most employees did not drop their meaningful connections in the transition to remote work and in fact increased contact with their prior connections by 3%. More than this, they were also found to increase the size of their networks, making 24% more than in the month prior to the shift to remote work. Most surprising, perhaps, was that 22% of these were outside of people’s usual working groups. The researchers suggest that this is the sign of a resilient organization where deliberate efforts are made to adapt working patterns to the new conditions.

An additional source of data comes from a study of Microsoft employees’ experiences in remote meetings during COVID-19 [138]. This found that the strength of people’s indirect connections (people they do not normally work with but are otherwise aware of) was generally perceived to be getting weaker, with the lack of spontaneous interaction cited as a significant factor here. People were also having variable success in maintaining their connections with their direct network (the colleagues they work with on a day-to-day basis), with a bimodal

distribution here of 36% participants who felt this was weaker, and 42% who felt it was stronger (22% reported no change). The majority of people in the study reported making new connections while working remotely, or forming new working relationships with existing connections. However, success with new connections appears to depend on role and experience. Some of our evidence shows that people in non-developer roles were more likely to form new connections, and people with previous remote work experience also fared better in this regard [138].

An external LinkedIn study of event attendees [179], however, shows that the networking that would have happened at on-site events was substantially undermined when events went online. The people interviewed found two-way video chat most conducive to forming those new connections but also found such video conferencing fatiguing. The picture on networks is complex and involves a variety of factors. The kind of network matters, be it direct close colleagues, indirect connections, or new connections. In addition, we have seen that role matters, as well as experience in remote working. There is little doubt, however, that the “levelling effect” of everyone being remote is at play, with physical location receding into the background and thus everyone feeling “as close” to everyone else (at least for those in the same time zone). We also need to understand whether these findings generalize outside of Microsoft, and to organizations which are perhaps less resilient, and with less technical infrastructure to rely on.

1.5 Looking Forward

1.5.1 People are creative and resilient, and are developing new work practices to adapt to a changing world.

In the face of the challenges outlined above, people are developing innovative new work practices at individual, team, and institutional levels. These can be effective but can also have undesirable downstream effects.

For example, from early in the pandemic, teams in Microsoft were developing new strategies to address meeting challenges, being thoughtful and deliberate in how they manage their meetings while everyone is remote: for example, people were trying to be more inclusive in their scheduling [138,149], more intentional about how and why they hold meetings [29], more punctual [138], turning on video to signal engagement [149,163], recording meetings, and immediately distributing presentation content [149]. It turns out that these kinds of practices are important: evidence suggests that good quality meetings and effective communication were associated with better perceived productivity [149]. On the flipside, meetings without clear agendas contributed to increased frustration and meeting fatigue [149].

Looking a little closer at how both preparation for meetings and meeting follow-up might have changed during working from home, we turn again to an internal study of online meetings [138]. This study found that while a small majority (55%) experienced a change in preparation for meetings, a substantial cohort (45%) did not. For those who experienced a change, all types of preparatory work were cited as being more frequent (pre-reads, agendas, goals, async and sync discussion) leading to most (66%) feeling better prepared for meetings. However, the picture was very unclear as to the overall value of preparatory work, with split opinions on whether it made other people better prepared, made meetings run more smoothly, or whether it improved productivity. However, there was strong agreement that better meeting preparation did not reduce the number of meetings overall.

With regard to meeting follow-up, an overwhelming majority (94%) of participants said they experienced more of at least one type. Here, Teams personal chat was seen as a positive way to follow up (63% reported an increase), while additional meetings were viewed as negative (40% of people reported an increase). There were modest increases in the use of action items and document collaboration, and mixed results for the use of Teams channels, meeting chat threads, and email. There was no strong evidence for positive impact of increased follow-up from meetings, possibly because of the negative impact of more email and more meetings being seen to undermine productivity. Good action items were seen as positive, although some comments indicated that they were often not tracked. Other pain points included lack of time at the end of meetings devoted to confirming follow up actions, and the problem of post meeting-related discussion being fragmented across Teams chats, channels, meeting chats, etc.

Teams were also developing some norms around shorter meetings and no-meeting days, and there were reports of leaders developing new meeting habits for teams. To deal with some of the problematic interactional issues in remote meetings, Microsoft employees reported that meeting moderation was becoming increasingly common [138]: either people were being assigned this role officially or they were taking it on in a more ad hoc way. Many moderators felt that they were providing a crucial service for their team. Other groups were questioning whether meetings were always the best route, and recommended considering when a Teams meeting should be an email [9,181]. However, people had mixed success in trying to reduce meetings through more asynchronous means, such as Teams chat, email, Teams channels and document collaboration [138].

These emergent practices can also have unexpected downstream consequences. One study of external information workers found: “Everyone’s calendars look full,” so people often have to ping coworkers to determine their availability, which in turn “[takes] more time and [leads] to more distractions” [156]. Moderators in meetings find that their own ability to contribute effectively to the discussion is diminished. No-meeting Fridays also resulted in reports of even more meetings compressed into even longer workdays from Monday to Thursday. Which strategies will work best for which individuals and teams remains an object of further research. Developing more deliberate practices takes time, is hard work, new team members need to be taught, and it may not work outside one’s team, leading to some frustration [138].

It seems, then, that we are collectively taking this opportunity to learn new skills in managing and making the most of remote meetings. Capturing and learning from this experience will be a key issue when we do start to go back to the office, both for the benefit of remote workers and for those who can meet in person.

1.5.2 The best hybrid future will retain many new work practices and focus on flexibility.

To close out the study of Microsoft employees’ experiences in remote meetings during COVID-19 [138], a poll was sent out to dig deeper into participants’ opinions about a hybrid future, given their experiences over the course of working from home. One question asked which meeting practices developed during mandatory working from home should persist. These included: seeking to reduce meetings, uploading profile images, using active moderation, including time to confirm next actions, not scheduling meetings back-to-back, using chat to increase participation, having agendas, and turning video on. There was near-universal support for retaining almost all practices (<10% disagreement). The one major exception was ‘everyone should turn on video’: 31% disagreed or strongly disagreed this practice should be carried forward. This reflects previous earlier findings (above) exploring why people turn video off, which showed that video is not considered necessary for meeting effectiveness in most cases and comes with a host of negative costs.

Another question asked what types of activities should be prioritized in opportunities for *same-room meetings*. In a hybrid working world, opportunities for same-room meetings are scarce, so the aim was to understand the most effective use of that time together. It was near-universal (<6% disagreement) that we should: prioritize *hybrid meetings where remote attendees engage fully*; and prioritize *same room meetings which are well-planned*, so that meetings are efficient. There was also majority support (45-60%) for: building in 1:1 and group social time, and prioritizing meetings for which planning is difficult to facilitate creativity (but there was a reasonable minority opposition, 15-20%). Prioritizing ‘meetings for which planning is difficult’ saw substantially more support from those without prior remote work experience (62% for; 10% against), than those with prior experience (40% for, 23% against). It is possible that remote workers underestimate the value of co-location in resolving ill-defined tasks – and it is possible that office workers overestimate it.

The verbatim responses that accompanied the poll reveal just how uncertain the future of hybrid meetings is, and how much flexibility we will need to have. Many participants indicated that they felt that the default mode of work should change permanently to remote asynchronous work, predicting there will be little or no opportunity for entire teams to be physically co-present in the future. However, there was also a strong voice from those who appreciate the benefits of physical co-presence. These people cited creative and social meetings as good candidates for prioritizing if any time in the same room is possible. In general, responses overwhelmingly cited a need for flexibility in whatever happens in future—solved team by team, need by need, and not top down, while supported by flexible technologies.

While the above research considers what people think of hybrid working *in prospect*, Microsoft employees in China have already been experiencing hybrid working and two studies report early findings from a staggered schedule of returning to the office [176].

One study of three Microsoft offices in China used a survey and interview technique to explore people’s decisions to return to the office or not [176]. The study found that two of the main motivations at play in deciding to return to the office were the ability to have meetings in person and social engagements with colleagues, underscoring the importance of in-person connection in working life and the degree to which working from home can undermine it. One general finding was a perception of higher productivity and increased job satisfaction when in hybrid work mode compared to all remote working pointing to the success of this mode of working.

However, a key question is: as a result of prolonged working from home, are there permanent changes in how people work? What will persist when some people transition back to the office and what is temporary? To explore this, the Workplace Analytics team [131] examined telemetry data from Microsoft employees in China. Early trends

indicate that collaboration patterns established during working from home have so far largely persisted. Increased use of instant messaging has stayed at the same elevated level as during the work-from-home phase, remaining steady as a way of communicating both within meetings and outside of them. At the same time, Teams voice and video calls have fluctuated considerably and even increased as people began to return to the office, probably reflecting the fact that many people were still working from home.

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