Recurring Meetings: An Experiential Account of Repeating Meetings in a Large Organization

KARIN NIEMANTSVERDRIET, Eindhoven University of Technology
THOMAS ERICKSON, IBM T. J. Watson Research Center

Meetings are often seen solely as a site of collective work. However, as McGrath has noted, groups are concerned with much more than collective work. In this study we examine how individuals experience meetings, and ask what they do, why they do it, and how they feel about it. Our study focuses on recurring meetings, both because recurring meetings are an ordinary aspect of organization life, and because their routine nature lends them a casual character that distinguishes them from one-time, issue-focused meetings. This paper analyzes accounts of 19 meetings and examines how various peripheral activities – side-talk, side-tracking, multi-tasking, pre- and post-meeting talk – have positive effects, as well as negative ones. We argue that viewing recurring meetings as a confluence of individual and collective aims suggests new approaches for designing technology that supports both meetings and participants.

CCS Concepts: • **Human-centered computing → Empirical studies in HCI**; • **Human-centered computing → Empirical studies in collaborative and social computing**;

KEYWORDS

Recurring Meetings; Meeting support technology; Remote communication; Multi-tasking; Interruptions

ACM Reference format:

Karin Niemantsverdriet and Thomas Erickson. 2017. Recurring Meetings: An Experimental Account of Repeating Meetings in a Large Organization, PACMHCI, 1, CSCW, Article 84 (November 2017), 17 pages. https://doi.org/10.1145/3134719

1 INTRODUCTION

Meetings are a site for collective work. They are one of the primary ways in which organizations tap the diversity of their employees' individual experience and channel it into collective work. As a consequence, people spend significant amounts of time in meetings, and organizations devote considerable resources to supporting meetings.

HCI, recognizing the importance of meetings, has devoted a lot of research towards supporting meetings. However, much of that effort — particularly when directed towards designing meeting support technologies — seems driven by a view of meetings as an uncomplicated venue where people simply work together to pursue collective goals like solving problems, designing artifacts, and making decisions. However, as McGrath [36] and others have noted, groups are concerned with much more than the collective pursuit of instrumental goals. They are also concerned with maintaining their collective health, and supporting the individual well-being of their members. We suspect that some of this work occurs in meetings. Furthermore, HCI's examination of other spheres of work reveals many ways in which individuals' work practices are shaped by pressures such as overload and interruption. Should we expect meetings to be any different?

Because we are part of a group that has been chartered to design new meeting technologies, we wanted to take a close look at meetings from the inside, from the point of view of the participants. Our aim was to gain insight into how people experience meetings, describe their behaviors and motivations, and understand what sort of value there might be in seemingly 'non-optimal' activities.

We choose to focus on recurring meetings, an ordinary aspect of organization life that enables groups and teams to manage themselves and their work. Recurring meetings are pre-scheduled periodically repeating meetings with the same group of people. Recurring meetings are common — enough so that calendaring systems provide features to support them — and their recurrence makes them a good starting point for iterative development of meeting support technologies. Recurring meetings are also interesting because of their recurrence. Their repetition and regularity allows relationships, norms and roles to form and evolve, and their routine nature lends them a casual character that distinguishes them from one-time, issue-focused meetings. Finally, recurring meetings have received much less attention than ad-hoc or one-off meetings in the HCI literature.

This paper offers an account of recurring meetings based on 19 interviews, each examining a particular instance of a meeting. It begins by reviewing the literature around meeting technologies, meetings, and collocated interaction. Next, it describes its methodology, followed by an analysis of informants' accounts. Then the findings are presented and discussed, followed by a discussion of three directions for design.

2 PRIOR WORK

An interest in using technology to support meetings has been a staple of HCI research for at least three decades, and its quantity and diversity is a clear testament to the importance of meetings. Some of these meeting support technologies aim to ease the work of preparing for a meeting. For example, by letting participants vote for agenda topics [17]; by providing extra contextual information [16,51]; and meeting assistants [37,52] that help with scheduling, creating an agenda, or managing resources. Other technologies aim to support time management, either through peripheral light patterns that display the remaining meeting time [45,62], or through a haptic notification system between chair and presenter [55]. To allow for contribution of all members, alternative and parallel ways of gathering input from participants have been explored [23,24]; and since equality of conversational turn-taking is known to increase group performance [61], visualizations of the relative speaking times of attendees have been developed [5,14,30,58]. Capturing systems can record parts of meetings[12,18,19,33,41,51], and enable late-comers or people that cannot attend to catch up [2,57,59]. Efforts to support remote participation are also numerous, for example, by allowing access to a meeting using mobile devices [10], or by providing contextualized views and supporting remote or asynchronous whiteboard use [8,13,48]. To give remote participants more presence, telepresence devices give remote users local embodiments [6,32], and virtual meetings allow all attendees, represented by avatars, to interact at the same level [15,54].

We observe three tendencies in the literature that arise from its focus on developing or evaluating meeting technologies. First, meetings are often viewed as instrumental events that exist solely to produce a decision or other deliverable. As a consequence, studies often solely evaluate productivity-based criteria, such as performance and efficiency during decision-making. However, these instrumental goals are only one of three "contribution functions" that shape group interactions, according to McGrath [36] (well-explained in [22]). A group must also do work to maintain its identity and 'health' as a group (e.g., camaraderie), and to support the well-being of its individual members (e.g., personal status and recognition). McGrath argues that groups are typically engaged in all three functions at any one time, and we find that this perspective helps make sense of many of the phenomena we observe in meetings.

Second, meetings are often looked at prescriptively: they are viewed as collective activities aimed at achieving collective goals. Of course, that is their aim. But meeting participants may disagree with, or lack interest in the goals of a meeting, or may simply have other work that takes precedence. A number of ethnographically-inspired field studies of the workplace – including Bellotti and Bly's study on local mobility [4], González and Mark's investigation of multi-tasking [20], Hudson, et al.'s study of interruption [25], Olson et al.'s account of collocated teams [47], Mintzberg's investigation of manager's job descriptions [39]; and

Muller et al.'s study of request management [42] – have foregrounded ways in which individuals adapt their activities to accommodate the pressures of life under overload and deadlines. With regard to meetings, Green and Lazarus showed that the perceived productivity of meetings can be low (ranging between 33 to 47% [21]), because of free-riding of participants, conformance pressure, and information loss. The analysis of ten small ad-hoc design meetings by the Olson's, et al. [46] showed that only 40% of the time was spent on direct discussions of design. Iqbal, et al. [26] studied multi-tasking in seminars and colloquia: they found that about 40% sometimes multi-tasked — the majority on non-meeting related topics — and recognized both benefits and drawbacks to the practice. Two extended abstracts [31,43] that examine multi-tasking in business meetings also find that multi-tasking was common and Marlow and colleagues [35] found that the layout of a video conference system can influence the perception of this multi-tasking behavior. Carter et al. [10] show that by viewing meeting participants in distributed meetings as a less homogeneous group, new opportunities for distributed meeting technologies can surface. We anticipate that the same will hold true for differences between the goals of individuals and the meeting's aims.

Third, meetings are often seen as single and discrete events – with clear beginnings and endings – that stand apart from the life of the workplace. In part this is a consequence of doing lab-based studies to evaluate support technologies that focus on single instance meetings with aims defined by the researcher ([19,32,37,51] are notable exceptions); and in part it is a side effect of digital (teleconferencing) technologies that are either on or off. There are studies that examine pre- and after-meeting activities around a single meeting (e.g., [28]) but to our knowledge there is little attention to sequences of recurring meetings. Also, most research focuses on one or a few meeting-centered activities, such as note-taking and meeting recordings [29,60], sketching [56], whiteboard use and drawing habits [11], technology selection for remote meetings [49], or multimedia sharing [34]. As *The Cambridge Handbook of Meeting Science* [1] published in 2015, comments: *"Astonishingly, however, a scientific look at meetings as a focal topic remains largely elusive."* [1:1] While the Handbook's articles do address meetings as meetings, and situate them in their larger context (e.g., the examination of pre-meeting talk [63] and a study [53] that argues – in line with Boden [7] – that meetings not only reflect, but also constitute organizations), they in turn give little attention to design.

In summary, much work focuses on single meetings, and looks at how to supports their collective instrumental aims. In contrast, recurring meetings have received less attention, as has the question of how individuals experience such meetings and how that might impact design. This study contributes to the work on recurring meetings by looking at how individuals *experience* meetings, the *motivations* for their behaviors, and the *benefits* they obtain from being in meetings. This, we hope, will provide an enriched basis for new approaches to supporting meetings.

3 METHOD

In this research we examine the experience of individual meeting participants to get an insider's perspective on recurring meetings – that is, to understand subjective factors such as participants' experiences, motivations, and benefits. For this we used semi-structured interviews.

In designing this study, we faced the choice of conducting a breadth-first study where we examined a larger set of recurring meetings, each at one point in time; or a longitudinal study where we focused on a smaller set of recurring meetings, but looked at multiple instances of each recurring meeting over time. We opted for the breadth-first approach for several reasons. First, sampling a diverse array of meetings from the viewpoints of a diverse array of informants would give us more confidence in the generality of common phenomena we observed. Second, our interest in exploring design interventions also predisposes us towards examining a larger number of different meetings. Third, we hoped that our informants could draw upon their history in the recurring meetings they reported on to give us some insight about how various aspects of recurring meetings play out over time. That said, future studies of how recurring meetings are experienced over multiple occurrences would be of great interest.

3.1 Interview Setup

To address known shortcomings of interviews – memory limitations, over-generalization, and the tendency to focus on unusual incidents – we used two techniques. First, we requested that each informant report on *one* particular meeting they attended, and we tried to schedule the interview on the same day to ensure that the memory was still fresh. Second, during the interview we had informants sketch timelines of the meeting activities and graph their experience – their attention, meeting usefulness, excitement, etc. – over time. To help the participants in their sketches, they were given templates in which different activities and experience indicators were named. These sketches were not intended to serve as quantitative "data"; rather, they provided the ground for discussions of experience (e.g., of fluctuations in attention, multi-tasking, usefulness), and how those experiences related to events (e.g. social talk, interruptions) depicted in the timeline. By explaining that the sketches were not intended as data, but rather as triggers for discussion, we gave the participants more freedom to tell their stories and put less pressure on them to produce 'accurate' sketches.

The sketching technique was very useful for provoking explanations and critical reflection. For example, it was common for an informant who initially reported 'little difficulty' paying attention to nevertheless produce an attention graph with peaks and valleys, leading in turn to detailed accounts of rationales and reactions.

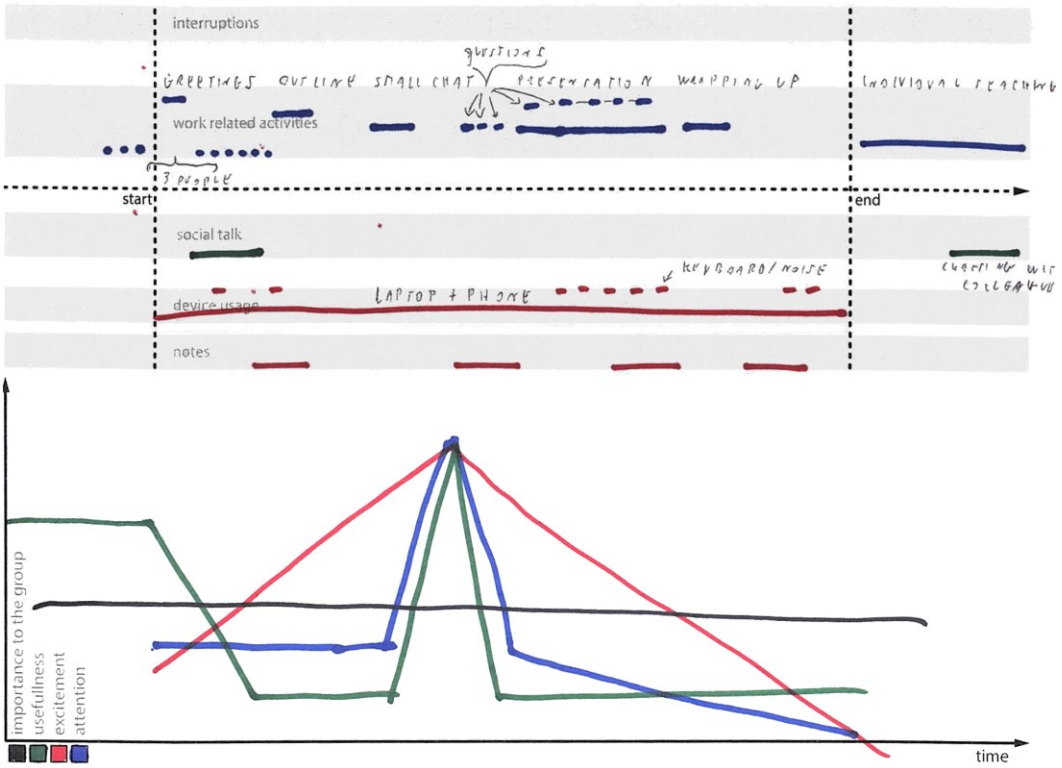

Fig. 1. An example of an informant's sketches. Informants filled in a timeline with lines indicating interruptions, work activities, social talk and note-taking episodes (above), and then drew a graph (below) of personal usefulness (green), importance to the group (black), attention (blue), and excitement (red) throughout the meeting. The sketches supported discussion of events, motivations and feelings.

The interview followed a semi-structured protocol, with one author leading the interview and the other taking notes and asking additional questions. It began by gathering background on the informant and the types of

meetings attended, and asked about the informant's conception of an ideal meeting. Next it focused in on the particular instance of the recurring meeting that the interview had been scheduled around. The informant was asked to describe the meeting, and then walked through the meeting activities from its beginning (including just before) to its ending (including just after). Asking about before and after the meeting allowed us to examine transitional activities and informal pre- and post-meeting activities [27]. As previously described, each informant was asked to draw a timeline of the meeting (e.g., Figure 1, top) and to sketch graphs of their experiences (e.g., Figure 1, bottom). The resulting sketches were used to structure the conversation and to draw out more detailed accounts of activities and experiences. At various points, informants were asked to contrast this instance of the meeting with other meetings, to discuss the experience of remote participants, to place the outcomes of the meeting in a larger work context, and to suggest improvements. The interview ended with a short Likert-scale questionnaire on the meeting's overall usefulness, attention, and atmosphere.

The interview protocol was developed over three pilot interviews, where one or both interviewers attended the meeting that the informant reported. Because only two minor changes were made to the protocol – adding the question about ideal meetings, and the Likert-scale questionnaire to compare the accounts of the participants quantitatively amongst each other – the pilot interviews are included in our results.

3.2 Participants and Meeting Types

Participants all worked in different departments of the same large research organization in the US. They were invited to participate by random face-to-face recruitment in the cafeteria. Email was used to confirm interest, to identify the meeting that each would report on and to schedule the interview. Informants were asked to select one of their regularly recurring pre-scheduled meetings with between 5 and 15 participants, on a day where we could schedule the interview afterwards.

Ultimately, 21 informants were interviewed with varied backgrounds, including software and hardware development, manufacturing, HCI, business and sales, and facility management. While only 3 of our informants were female, this is roughly in line with the proportion of woman in the studied organization (19%). 15 of the 21 interviews took place on the same day as the meeting they reported on, and 4 on the day after. In 2 cases the original meeting was cancelled, leading to an interview about the prior week's meeting. Two interviews were dropped – one reported on a non-recurring meeting; the other on a class that was deemed to be too different for comparison) – resulting in a total of 19 interviews. Each of the 19 interviews reported on a distinct meeting and together they cover 17 different meeting series (p1 and p3, and p5 and p8 talked about different instances of the same recurring meeting). See Table 1 for an overview of the participants and the meetings they reported on.

The recurring meetings differed in size, duration, and activities (see Table 1) but all fall into three categories:

- **Project updates (small).** Attendees all work closely together on the same project and are highly dependent on each other's work. The aim of the recurring meeting series is to keep everyone up-to-date on progress, and to identify and resolve problems promptly. Activities mainly consist of status updates and brainstorming/problem solving. These meetings all followed agile/scrum methodology [3]. The project update meetings of our participants (4 in total) averaged less than hour (average = 43 min), and had a small number of participants (4 to 6, median = 5).

- **Project updates (large).** Attendees work together on one overarching project, but are not all equally dependent on one-another. This type of meeting is meant to make sure that all subgroups, the manager, and other stakeholders are aware of the project's status. There is generally some information sharing, but the majority of time goes to status updates. These meetings (9 in total) all took place weekly, and ranged in duration from 40 to 150 minutes (average = 78 min). Their numbers of participants depend on the size of the project group and ranged between 5 and 25 (median = 8).
- **Group meetings.** Attendees are members of an organizationally defined group, and may work on various projects that are not closely related. The meetings generally consist of managerial updates (information sharing) and presentations of finished work of group members. These meetings (6 in all)

averaged one hour (between 40 and 80 minutes) and had the largest number of participants out of the three types (8 to 16, median = 12).

Table 1. Characteristics of the meetings types that were covered in the interview. PU stands for Project Update and GM for Group Meeting. The * indicate different instances of the same recurring meeting.

P#	Gender	Time in organization	Meeting type	Frequency	Attendees	Duration (min)	Main Purpose & activities
P1	M	<6 months	GM*	Weekly	~12	40	Info sharing & presentations
P2	M	> 5 years	PU (large)	Weekly	8	80	Status updates
P3	M	<6 months	GM*	Weekly	~15	70	Presentations
P4	M	<6 months	PU (large)	Weekly	5	150	Status updates
P5	M	> 5 years	PU (small)*	Bi-weekly	5	70	Status updates
P6	M	> 5 years	PU (large)	Weekly	> 7	45	Status updates & info sharing
P7	M	> 5 years	PU (large)	Weekly	17	105	Status updates
P8	M	> 3 years	PU (small)*	Bi-weekly	5	60	Status updates
P9	M	> 5 years	PU (large)	Weekly	6	60	Status updates & decisions
P10	M	<6 months	PU (large)	Weekly	11	50	Status updates & decisions
P11	M	> 5 years	GM	Weekly	12	60	Info sharing & presentations
P12	M	> 2 years	PU (large)	Weekly	25	40	Status updates
P13	M	> 5 years	PU (small)	Daily	4	**15**	Status updates
P14	M	<6 months	PU (small)	Daily	6	20	Status updates
P15	M	> 5 years	GM	Weekly	15	70	Presentations
P16	F	<6 months	GM	Weekly	16	60	Presentations
P17	F	> 5 years	PU (large)	Weekly	8	60	Status updates
P18	M	< 1 year	GM	Weekly	10	40	Presentations
P19	F	< 1 year	PU (large)	Weekly	15	60	Status updates

3.3 Analysis

The interviews were audio recorded, with permission, and transcribed. 698 quotes were extracted and used in an inductive thematic analysis [9]. The themes were formed iteratively and included: meeting structure and activities; meeting quality; experience of the meeting; attention and distractions; remote participation; and strategies and tools. In frequent discussions the authors looked for patterns within each theme.

As noted, the graphs and timelines were not analyzed as data; rather the information they elicited was integrated in analysis via the quotes resulting from participants' explanations of their sketches. The Likert-scale questionnaire data was used to compare accounts.

4 FINDINGS

Our findings are grouped in three sections: the purpose and usefulness of the meetings and meeting sequences; the structure of the meeting; and attention and distraction.

4.1 Meeting Purpose and Usefulness

Our participants generally liked meetings with clear goals: "An ideal meeting should have a very clear purpose and [...] then it should solve that problem. An example would be: We need to make a decision, we should meet for an hour, and by the end of the hour the decision has been finalized." (p14) However, in recurring meetings, this purpose is generally not that specific and participants mentioned that often the meetings occur more out of habit rather than necessity. "Sometimes we just talk to talk." (p8)

The main purposes of the project meetings (both small and large) are advancing work and alignment: "I believe running a meeting means [...] some type of project management. It spreads out like a tree [...] you know what your responsibilities are, but if you distribute work, to work together with people you need to make sure that they are all in one line." (p6) For group meetings, the main purpose is to provide group awareness – to know what the different members of the group are working on. This is less directly related to achieving work-related goals, although we saw examples where group awareness resulted in new work: "I'm working on a demo to tie all of that together. [...] It didn't exactly come out of the meeting but it does come from knowing what others are working on." (p1)

The perceived usefulness of the reported meetings differed considerably between participants, ranging between 2 and 5 out of 5. The small project update meetings were rated as most useful with an average of 4.3 out of 5, especially in the beginning of a project: *"In the beginning and middle of the lifecycle of development playback meetings are great. During the end when it is ramping down, people move onto other things, you have seen earlier versions before, you are transitioned to something else... you just want to avoid them."* (p13) In the larger project update meetings, relations between subgroups are not always as close and people are often already up-to-date on progress within their own subgroup, resulting in lower usefulness (average of 3.7 out of 5). *"In our weekly meeting with our team we are all pretty aware of what we are doing because we meet every day, so that one to me is pretty repetitive."* (p8)

The awareness information in the group meetings was more useful to new employees (< 1 year in the organization; see table 1) who used it to help understand the organization. Thus, while long-term employees rated usefulness of group meetings as 2 (out of 5), employees in the organization for less than a year rated them 4 or 5: *"Interactions at this point are very helpful to me.* [...] *Once I'm clear on what I really want to do here, my perspective might change. So if we'd have this same discussion a year from now, it will probably be very different."* (p18)

In all but 3 meetings, informants' graphs of 'personal usefulness' of the meeting and 'importance to the group' did not align. Of those, the majority (12) rated the importance to the group higher than personal usefulness. For some people this difference is anticipated – *"It's not so much the value that would get but more the possible value that I could provide should a question arise."* (p7) – but others expected a more useful meeting for themselves: *"A lot of times you in there and they are discussing things and you think: I could have just walked away. I didn't get any help; nobody got any help from me being there: I just wasted time."* (p8) However, when pressed as to whether they would skip the meeting if they could, only one participant said yes. This suggests that there is value in recurring meetings beyond their primary purpose. We identified other four functions of recurring meetings.

4.1.1 Collective Thinking and Subgroup Formation

One widely recognized function of meetings is that they create opportunities for building upon others' thinking. *"I'd say that your best ideas are inspired on someone else's comments instead of on individual thought."* (p10) Connections between projects can lead to new directions: *"Sometimes they give me ideas that I can apply to my topic. For example, the meeting of today, they talked about the classification problem on using particular datasets* [...] *a dataset that I can also use in another project."* (p16)

It is also the case that it was in meetings that one person would discover the need to have a detailed conversation with one or a few co-workers. Sometimes, as we shall see, this would occur within the meeting — causing it to be hijacked or side-tracked — and other times the group or chair would decide to take it offline: *"In the middle of that meeting we decided there were things we had to sort out after, so we spent some time after to talk through some of the things offline."* (p10) As one informant nicely summarized it: *"A meeting creates meetings."* (p8) However it occurred, the ability of the meeting to surface topics for discussion by a subgroup is valuable.

4.1.2 Recurrence for Clocking, Bonding, and Visibility

There were several cases of recurring meetings acting as a clocking mechanism. First, meetings function as a deadline: "*It might push me to finish some things before the meeting.*" (p8) Recurring meetings can structure the week and control the pace of the work: *"Right before the meeting, you work harder and faster* […] *You don't want to have the same story as last week."* (p4) Meetings bring people together regularly, which makes it easier to plan to ask questions – *"Without the meeting it is impossible to have this part. If I have a quick question I usually wait until the project meeting"* (p16) – and to plot encounters: *"Meetings are a place to waylay people without interrupting them."* (p17) They also create moments for collaboration: *"Right before the meeting I spent some time with one of the team members who is usually not here and we solved a technical problem that was holding both of us up.* […] *Because the meeting* [the colleague] *was in the building and we could sit together and work on it."* (p17)

A second function of recurring meetings is to provide an opportunity to strengthen relationships with colleagues: *"I went mostly to support* [colleague X] *who is in my group."* (p15) Just attending the meeting can be enough to show support to the team: *"I want to be there to at least say: I've attended and am a part of this team and am not indifferent towards what is happening here and I care about the other projects in the team."* (p11), *"You feel guilty if you don't go."* (p15) The beginnings and endings are especially valuable for teambuilding and provide an opportunity for chitchat and getting to know others better. *"I was walking along the hallway with the intern who was leaving. So I was asking about what his thesis was and how this fitted in and found out that he had done an internship here before."* (p17) This bonding is facilitated by the fact that opportunities for interactions with a co-worker continue to arise in future instances of the recurring meeting.

A third function of recurring meetings is to provide a platform for being visible to others. Even when not directly contributing to the meeting, visibility can be important: *"…to be honest, to be seen. In an ideal world I shouldn't have to attend* [the meeting]. *But* [by] *the end of the day we have evaluations and they are judging me on my presence, whether I was there, so that they think: 'oh this person has been working hard'. If I don't go there and they don't feel that I'm working hard, they would think '…and he wasn't even in the meetings!'. You need to be seen, even if you don't like it."* (p11)

Note that these secondary functions of meetings are less accessible to the remote attendees. Remote participation was common: in 16 out of 19 meetings some of the attendees were remote, and in one case the informant was remote (p11). Remote attendees are less visible in the meeting, and other people are less visible to them, which limits relationship building and connection effects: *"I don't know everyone well enough yet to recognize everyone's voice* […] *so there's at least a couple of times per meeting when I'm not sure who's talking."* (p14) Nor can they be "waylaid" before or after the meeting, and even during the meeting informants mentioned that it is more difficult for the remote participants to engage in discussion, which limits building upon each other's ideas: *"It doesn't become a discussion but just a remark now and then."* (p9)

4.2 Structure and Order in Recurring Meetings

Most of the meetings that were reported upon had a meeting chair. Usually, the chair is responsible for scheduling the meeting, inviting attendees, booking the meeting room, defining the purpose or agenda, and setting up the technologies. The role of the chair during the meeting itself varied from negligible in informal meetings, to large in highly structured meetings: "*I think the chair is the main point of setting the rules in the meeting.*" (p6) All larger meetings had active chairs who guided conversation, controlled turn taking, and managed time; but some smaller meetings were also more formal (e.g., the meeting of p13).

Just as people prefer a clear purpose, people like having a clear agenda in the meeting: "[An agenda] could be important so you don't waste time thinking of what to talk about and that you spend too much time on something although you have more important things to talk about." (p8) Of the 19 meetings, only one had an official agenda that was sent out beforehand, but the majority used something to provide structure. Six of the project update meetings used an ongoing progress document or to-do list: "The format of the meeting was to try to go through the spreadsheet and touch on all the important topics and to hear progress." (p17) In five meetings, presentations had been prepared. In some cases, people took advantage of having an agenda to accomplish personal goals, e.g., by deciding to attend based on the topic: "[It depends on] the topic being discussed; if it's something I'm interested in." (p15) Or by deciding when to multitask during the meeting. For

example, when a spreadsheet revealed the order of updates, one informant used that to prepare: "As we were going around, I was making notes about what I was going to say…" (p2)

As for the timeliness of the meetings, 6 out of 19 were shorter than planned (with an average of 16 minutes), 6 were longer than planned (with an average of 19 minutes), and 7 took exactly the planned duration. However, meetings that run on time are not necessarily more efficient: *"What happens a lot is that meetings get scheduled for an hour and somehow they have to fill the hour"* (p9); and they do not always accomplish their primary purpose: some meetings are cut off at the planned time, whether all topics are covered or not. This is appreciated by attendees who see time management as a form of respect: *"It is as important to arrive on time as to end on time. It shows respect of the meeting manager to the people, so they will take it more seriously."* (p6) Other meetings continue until all topics are addressed. While they take more time, they are on average more useful (4.25 out of 5; median = 5) than meetings that are shorter than planned or that stay on time (3.7 out of 5; median = 4). Going over time is not always possible, because attendees have to go to other meetings or the meeting room has been reserved by another group.

4.2.1 Balancing Order and Openness

As mentioned, an important function of meetings is collective thinking, where the group explores new topics and builds upon each other's ideas. Agendas serve as a focus for collective thinking: *"When you are in a formal meeting and you have an agenda, you would think of things you could possibly discuss for each agenda point. You would get your brain thinking along those lines. In an informal session, that might not happen that much."* (p7) For this to happen, the meeting needs to be open to exploring ideas: *"There is no way to take a straight path to something that is new and off the beaten path.* […] *There will be things discussed left and right and then we say: 'no that's a bad idea'. So it can never be efficient, but it has to be that way."* (p5) Meetings that are too efficient can undermine this function: *"The meeting didn't wander off into other topics* […] *this is my one and only time in the week to meet all my teammates* [and] *it would be more productive to allow a more freeform discussion."* (p18) At the same time, digression is a common frustration: *"Meetings often get side tracked or taken hostage by one or two people…"* (p7) While some digression is needed to explore new topics, it should not take up too much time of the meeting itself. *"What happens rather frequently is that two persons find something that is relevant to the two of them and go off on a tangent.* […] *And it is like five people are uninterested and two are highly interested."* (p5) There seems to be a delicate balance between order and openness.

The responsibility for controlling this balance usually lies with the chair. "The integrator [leader] has a dominating role. I can bring up a topic but if the [leader] doesn't want to go there they'll say, 'that's too complicated' or 'we don't have time'. […] if no one speaks up then the [leader] can basically drive it anywhere they want to. For good and for bad." (p12) Balancing order and openness is difficult. A topic can easily lose relevance for the majority, but there is the risk of cutting off interesting directions: "If someone is about to have an epiphany, the last thing you'd want to do is cut that off and then it is lost." (p7) Also, saying that something isn't interesting to the whole group can be a sensitive matter – and not everyone appreciates being called to order: "There are some people, if you interrupt them they will get back on track and others will double down. So you have to know which people to interrupt." (p13)

4.2.2 Beginnings and Endings

In most meetings, there are a couple minutes between entering the meeting room (or calling in for remote meetings) and the official start. During this time, attendees work on their laptops individually, or engage in social talk, or just wait silently. *"I'm checking my email, I may be chatting with people around me on whatever topic might come up. Usually not meeting related; it could be anything. Some social thing, the weather: social talk."* (p12) However, most of the social talk seemed to happen after the meetings had ended, because the time before the meeting is generally short. Also, it depends on the atmosphere in the room and the behavior of other people whether it feels appropriate to start a conversation. *"When I came in 4 or 5 people were already there and they were all just sitting. So I came in and didn't say much more than hello…* […] *Usually I will ask one of the people who arrives first some questions in that time when you are waiting for people to gather. But if I come into the meeting room when everyone is already sitting there and is silent, it is hard to start."* (p17)

In the large majority of meetings, participants engaged in after-meeting talk. After-meeting talk, like pre-meeting talk as described by [40], includes small talk, shop talk, and an especially large proportion of work talk and meeting related talk and we heard examples of each category. Also, the different types do not stand alone: social talk lowers the threshold to ask for work talk, and the other way around. *"But I had things, had there been more social time I would have asked one person about that and another about that one-on-one… I'm a very one to one communicator."* (p17) Much of the after-meeting talk involves the coordination of follow up interactions: *"With one person we were talking about work: 'this is it, that's what we need to do next', and OK. With that one: 'see you in the afternoon.' Another person: 'see you right after that this meeting.'"* (p8) This talk often continued as participants walked back to their offices: *"I'll get some questions related to several projects going on. If there is an issue with individuals that usually happens in the walk from the 40th corridor."* (p7)

Interestingly, after-meeting talk was often considered to be highly useful and in some cases followed into new meetings: "Most people went out, and some people were sitting there and I had something to discuss, and I asked: 'do you have few minutes?' and then she had something [to discuss] too… so we actually had two little meetings." (p12) In two cases, meetings were purposely scheduled to end earlier to ensure time for after-meeting talk and spontaneous follow-ups: "Having a short meeting helps because there is awkward piece at the end that you can use for some other purpose if needed […] we ended up spending doing design for half an hour afterwards. Because [these meetings] are 15 minutes long, nobody schedules anything afterwards." (p13)

There were no accounts of remote attendees being involved in pre-meeting or after-meeting talk; this is a significant drawback, as this seems to be an important period for following up on topics and for building relationships. *"There was some social talk with other folks ahead of time* [the remote participants] *have missed – which could be bad as a team aspect."* (p7) The formal meeting usually ends with disconnecting the teleconference, which excludes remote participants from after-talk: *"Almost every meeting we go to there are people hanging around chatting in the room, but pretty much people log of the phone as soon as the meeting has ended and then you cannot really talk to them."* (p12) The pre-meeting talk is restricted by the teleconferencing system: *"We couldn't talk while waiting because she was the host and we had to wait for her to arrive to start to the conversation."* (p11) This restriction is met with frustration and we heard that people bypassed this system: *"Everyone should be able to open them. People pass around the leader codes, which we are not supposed to…"* (p13)

4.3 Attention, Multi-tasking and Distraction

In ideal meetings every attendee would be attentive for the whole meeting – but in reality this is rare. Of the attention graphs that people drew, none showed steady high attention: *"It peaks when I get to the parts I'm involved with and then as we discus and I'm not engaged anymore, it kind of flat lines… and then there is an occasional random spike as I have to chime in on something."* (p12) Especially as the meeting continues, attention starts to drop, impacting usefulness: *"The first 20 minutes is most useful because that is when everyone is paying most attention, and then it drops off* […] *That is because attention is flagging, not because later topics are less important."* (p7) When attention lapses, participants are likely to engage in other activities, and vice versa. Multi-tasking is common: in 14 of 19 meetings informants noticed multi-tasking going on, and 11 informants reported multi-tasking themselves. Moreover, all informants reported that they sometimes multi-task during meetings.

4.3.1 Sources of Distraction

We found different reasons for people getting distracted and multi-tasking. Distractions can be external, related to the meeting, or internal. Common examples of external distractions are emails, messages, or phone calls that come in during the meeting. Since the distraction is coming from outside the meeting, the activities that are triggered are generally non-meeting related, and even non-work related: *"I got a notification on my* [smart] *watch from my wife who said: 'check this out' and I checked it out."* (p8)

Meeting-related triggers result from the meeting itself, and often result in meeting-related multi-tasking, such as searching for extra information (e.g., terminology that is being used), editing meeting-related files and preparing for an upcoming turn. *"The reason I multi-task is because in the meeting I realize that there is a gap between what I should know and what I actually know* […] *I worry that if I don't know it by the time I get to the next piece of the meeting then I might have missed out on something and then I cannot follow anything."* (p1) We

also saw examples where meeting-related distractions triggered non-meeting related activities, such as scheduling appointments, sending emails, and finishing work tasks: *"I made a little PowerPoint during the formal meeting* […] *just having the people together made me think that I had to set up a meeting for the next week and that I had to get a draft out to the people so they can review it."* (p12)

Self-distractions are a third common source. They often have to do with the attendee's state of mind: *"It's going to vary day to day, perhaps depending on how deadline driven that day is."* (p10) Stress, work pressure, and interruptions from other tasks or family affairs can cause distraction. *"Sometimes, depending on what I was doing before, I'm just itching to get back to the thing I was interrupted from* […] *and I'm thinking about that and I might do something related to that."* (p17) Self-distractions often result from boredom: *"The distraction doesn't matter because when I get bored I find some distractions, I promise."* (p11)

Note that these three sources of distraction are not mutually exclusive. In many cases, there is more than one factor at play. For example, non-meeting related multi-tasking can result from the combination of external work pressure, the meeting-related relevance of the topic, and attention lapsing. Remote participants experience more external and self-distractions: *"It is very easy for me to get distracted when I am remote* […] *I might get an IM and respond to it and it goes on for long, or my mind might wander off."* (p1)

4.3.2 Effects of Multi-tasking

Although they do it, our informants did not like multi-tasking. *"I don't think* [multi-tasking is] *useful and effective. But because I found the meeting ineffective, I went to something else."* (p11) All informants agree that being distracted influences the meeting negatively. When attention is low, the quality of the meeting drops: *"You might miss out on opportunities to engage, give feedback, information, discussions."* (p1) It also negatively influences order – *"I really hate when people don't focus, then they ask questions on something you just explained or don't follow where you want to go."* (p4) – and interaction becomes more difficult. *"Instead of thinking about things* […] *they are typing on their email and are not coming up with solutions."* (p10) But most informants see multi-tasking as unavoidable, because of its many sources and triggers.

There are also positive effects of multi-tasking. Meeting-related multi-tasking is often seen as necessary and valuable for the meeting: *"It's a choice: googling might turn out to be a distraction, but I think it enriches my experience."* (p1) Work-related multi-tasking allows meeting members to make better use of time: *"Email drives a lot of the business and it doesn't stop when the meeting happens. You either address it in spurts or fits through the meeting, or you address it at the end of the meeting where it takes half an hour."* (p7) Multi-tasking is also a way to handle the frustrations with inefficient meetings: *"We have some members that really like the sound of their own voice. So if they go off on a rant it is good to have something to look at to distract you. The polite thing to do is to ignore them because if you don't ignore them you'd get angry."* (p13) In a few cases, multi-tasking increased the awareness of work and even led to the resolution of problems, as this example nicely illustrates: *"Towards the end of the meeting* [my colleague] *probably got distracted and started working on this code and the person next to him saw that and got enthusiastic. So he asked me to open it on my browser. I gave him my computer and continued listening.* […] *But it didn't work, there was a bug in his code.* […] [After the meeting] *I walked back and I got to the office and I opened* [my laptop, with the code still open in the browser] *and I found the bug in his code."* (p1) Here multi-tasking and side talk led to a bug being fixed. Lastly, multi-tasking can be a method of communication: *"If you are giving your update and* [the manager] *is not looking at you and doing his email, that is kind of implicit feedback."* (p19)

4.3.3 Strategies to Handle Distraction

People have different perceptions of where the responsibility for staying attentive lies. Some informants place responsibility for keeping the attention with the meeting organizer or chair. *"Sometimes you go to a meeting because you are invited and you understand that you really shouldn't be there. So then I work on my laptop."* (p4) Others place responsibility mainly on the current presenter: *"It depends on the speaker.* […] *A good presenter can catch attention."* (p11) But most participants see it as their own responsibility: *"If the requirement is just to be aware, you're not really engaged. You are just there, and it is your job to remain attentive and on topic."* (p10)

Paying attention requires effort: "*It's sort of a self skill of sorts, a little bit of discipline. 'OK, I need to focus. I had that coffee earlier. I can do this.*'" (p10) A common strategy for paying attention is to avoid distractions like

phones and laptops: "*Most meetings I don't take the laptop because I know it is a hazard. I don't want to be distracted.*" (p6) Other strategies include writing notes, engaging in the discussion, and preparing questions. One interviewee mentioned that just keeping a pen in his hand served as a memory cue: "*I keep a pen in my hand.* […] *It is a reminder of what is going on and of being attentive.*" (p7)

Meeting related multi-tasking is generally accepted by other people, and work-related multi-tasking is understood, but non-work related multi-tasking is often not appreciated. Therefore, people try to keep up appearances: *"I want to pretend I am very focused but my mind isn't."* (p19) For example, phones are more likely to give the impression of non-meeting related multi-tasking, so some informants mentioned that they'd rather use a laptop for the same activity: *"You are more obviously not paying attention* […] *if you are on a phone, rather than the laptop responding to your email."* (p10) Inattention is less visible in remote meetings, which can be an advantage – one of the few advantages of remote meetings we've heard: *"It is easy to call into because you can do what you like and only pay attention to the part you care about in the meeting."* (p17)

5 DISCUSSION

In the interviews we observed a large discrepancy between ideal meetings and meeting practices, especially in recurring meetings. While this discrepancy is not unexpected [21], it should be noted that departures from the 'ideal meeting' – due to interruptions, side talk, getting distracted, and engaging in multi-tasking – were not necessarily problematic. Although our informants liked meetings that efficiently achieved their purposes, they acknowledged that digression was often necessary and sometimes useful. Furthermore, though informants often complained that the group meetings were not very relevant to their own work, only one would have skipped the meeting; the others gave reasons for staying such as supporting other group members, being available help others 'connect the dots,' and the value of general awareness of what others were up to. Informants also discussed ways in which they derived personal value from meetings unrelated to the primary purpose – ranging from using the meeting as a place to 'waylay' colleagues, to using it as a stage to be visible to their group and management.

5.1 Tensions between individual and collective goals

The *Time, Interaction, and Performance* (TIP) framework by McGrath [36] describes how groups simultaneously carry out three functions: (1) achieving the group's work-related goals, (2) maintaining the health of the group, and (3) supporting the needs of individual members. Viewing the accounts of informants through the lens of McGrath, we see all three functions in play. The primary functions – collective thinking, subgroup formation and meeting-related multi-tasking – support the group's work goals. Fostering group awareness, pre-meeting and after-meeting talk, and bonding all relate to maintaining group identity and well-being. Non-meeting related multi-tasking, using meetings for visibility, and digressions for personal interests are examples of individual member support. Interestingly, some of these functions seem to be in competition with one another; especially when it comes to *collective* versus *individual* goals.

During the meeting, attendees appear to be in a balancing act between attending to collective goals and pursuing personal utility. An imbalance between these collective and personal goals can lead to digression: the meeting might become more relevant to an individual by continuing an interesting discussion, for example, but if that discussion is only relevant to a few attendees collective usefulness drops. Or the meeting can become a valuable showcase for an individual's work but their presentation might have limited usefulness to the whole group. Ideally, personal usefulness and collective usefulness overlap, but as the sketching exercise showed, people perceived the two to be different in the great majority of meetings. When the time spent on a central activity is not proportional to its usefulness, participants often turn to personal activities with higher utility: work-related (email, coding, slides) or non-work related (finances, insurance, or messaging family). With less engagement in the meeting, its collective goals suffer.

This complex nest of tensions that we found to be part of the meeting setting is in line with the reviewed literature. For example, the Olson's and colleagues [46] found that even in small and focused design meetings, only about 40% of time is spent on the main purpose, and Green & Lazerus [21] found low perceived productivity in meetings in general. While our results do not lend themselves to quantification, we believe this

happens even more frequently in our larger recurring meetings. The balancing between individual and collective goals reminds us of the work by Hudson et al. [25] who describe a manager's tension, knowing that some interruptions can be disruptive, but some can be valuable. The combination of the value *and* frustrations of being a remote meeting participant is underwritten for remote collaboration in general by Nurmi and Hinds [44]. Because we found many external pressures on meetings (e.g., deadlines, email, full schedules) and because we saw meetings impacting other aspects of work life (spilling over into post-meeting time, and generating informal interactions with coworkers), meetings should be studied in a broader context, as also stressed by Post et. al. [50]. González and Mark [20] showed that even though people look at work as larger tasks with uninterrupted attention, people tend to work for only a few minutes on a single task. Interestingly, they depict meetings as an exception, averaging an uninterrupted 41 minutes – but our findings suggest that meetings are not uninterrupted either, but filled with interludes of personal work. This is again in line with the research on multi-tasking during video conferences by Marlow et al. [35], who found similar multitasking types as we did (*meeting* related, *other work* related, and *personal* multitasking activities).

In summary, research on different settings than ours shows that employees have multiple responsibilities, many interleaved tasks, and a constant flow of requests and other communications that fragment their workday. Our findings suggest that recurring meetings are not orderly sanctuaries where participants put aside their cares and focus on collective goals either; rather, within meetings, as without, workers struggle to balance their personal and collective responsibilities, and act accordingly.

5.2 Opportunities for meeting support technologies

Based on the understanding that recurring meetings are complex nests of tensions, we describe three directions for design that can both inform the new opportunities and that can be used to reevaluate the value of known meeting support technologies.

Our participants mentioned that perhaps the most important function of meetings is that they support the pursuit of collective thought – a function that is rare in meetings that are highly structured. As we have seen, the value of mutual awareness of work is difficult to predict and emerges in the longer run, and collective thinking can suffer if meetings are run too rigidly. At the same time, we have also seen that when a subset of meeting attendees discover that they need to have a deeper conversation, it can turn into an episode of side-talk, or even hijack the meeting, which can again negatively influence the meeting usefulness. Therefore, a challenge is to design meeting practices and tools in such a way that they strike a balance between order and disorder, so as to not undermine the function of meetings as a site for discovery.

One possible design direction is to make running meetings more of a collective responsibility. Currently, meeting chairs have the primary role in running the meeting. It is generally the chair that decides the meeting's topic, its level of formality, how long it will last, and when to cut off a side-track. This means that chairs have to be highly aware of what is being discussed, as well as of how meeting members react to what is being discussed – a challenging task, especially with remote participants. Also, chairs are often not aware of each attendee's individual goals, which leads to meetings that either focus solely on collective goals or that favor the chair's goals, as this example illustrates: *"[The meeting] was very driven by the spreadsheet which is OK if your goal is to update the spreadsheet, which for the manager was the goal, but in terms of 'this is my one and only time in the week to meet all my teammates' it would be more productive to allow a more freeform discussion."* (p17) We see opportunities to make running the meeting a more collective responsibility. By providing information that is related to the meeting's progress – timekeeping, topic discussed, the identified need for follow-ups, or equality of speaking time, to name just some examples – the group as a whole could be accountable for the meeting's order. The visualizations of relative speech time, as presented by [5,14,30,58], are one example of designs that follow this approach by publicizing information about the balance in participation among members. Similar designs have been proposed for timekeeping [45,55], but they are often solely directed by the chair. By enabling meeting members to collectively adjust the time that is given to agenda items, and displaying meeting progress in a central location, attendees might find it easier to intervene when too much time is spent on a topic; or they might realize that they are causing digression themselves. Of course, this approach requires sensitivity to privacy, power dynamics and other factors; interpretation should be left to the

members, since – as our results show – deviations from the agenda, and unbalanced discussions, can often be productive.

A second way to address discovery and subgroup formation, while keeping the meetings on track, would be to provide alternative communication channels, and to create space for follow-ups. For instance, a group might agree on the use of a text-based communication channel to allow potential side-trackers to non-disruptively continue their discussion, to schedule an 'offline' venue for further talk, or to 'bookmark' content for later exploration. Promising examples of this are the Tin Can platform [24] that provides a text-based communication platform to give meeting participants an alternative communication channel, and the in-meeting application MixMeetMate [10] that allows people to share key frames and photos in separate meeting chats. In addition to supporting subgroup interaction, alternative communication channels could be designed to support the other functions of recurring meetings that we observed. The clocking function could be supported by closer integration between meeting tools and virtual work environments. Similarly, providing more access to alternative media could give participants an alternate stage to increase their visibility in the group without disrupting the meeting too much.

Remote participants are currently not involved at all in pre- and post-meeting activities, nor do they become part of the spontaneous subgroups that emerge, for example, through after-meeting talk. The commonly used conference call system in the organization we investigated doesn't even allow people to start a meeting without the host being present; afterwards, it provides no means for participants to break up into subgroups. This means remote participants have little access to pre-meeting talk and after-meeting talk, and spontaneous subgroup follow-ups. Exploring ways to include remote participants in these interactions would be a valuable direction to pursue. For example, local participants might transfer the central audio connection to personal devices to 'take things off line'. Or distributed audio connections could allow remote participants to switch between centralized comments, smaller subgroup discussions, and 'whispered' comments to local attendees. One current example of a system that provides remote participants with this option is the SideBar application [16], which uses image analysis of conference video to identify remote participants in real time, and provides background information and thus the possibility for email or chat contact. A more radical approach is presented by Lee and Takayama [32], whose mobile 'robots' provide remote participants with "*more independence to initiate conversations with locals*" and access to *"continued conversations after the end of meetings,"* by giving them a local embodiment [32:37–38].

As a third direction, we see advantages in re-designing recurring meetings to be semi-synchronous. As we've seen, participants have individual goals as well as collective ones, and priorities shift based their states of mind, the meeting usefulness, and external interruptions. Instead of assuming full attention from all, designers might explore ways of working with this aspect of meetings. To support semi-synchronous meetings, design solutions could enlist attention when attention is required, and let people work on their own tasks at other moments. This approach has been suggested for multi-tasking in seminars and colloquia by [26] and we believe it could also be of value in smaller meetings. To support multi-tasking without disrupting the meeting, speech agents could – in addition to the opportunities identified by [37,38] – keep track of the meeting through analysis of audio recordings, and could remind attendees when items related to their role or contribution are coming up. Also, systems like Hypervideo [19] or Catchup [59] could be repurposed to help participants reestablish context by summarizing what happened while they were focused on other work, for example, by providing a summary of the missed portion.

Inspired by our participant p13 who mentioned scheduling short meetings to allow for after-talk, subgroup formation could be an integral part of how meetings work. Recurring meetings could be redesigned so that subgroups could form and disperse in tune with the agenda, or as dictated by ongoing discussion. Digital agents might monitor progress, and summon appropriate participants to the meeting as needed. Alternately, participants could multi-task when the current discussion is not relevant to them, preparing for future topics. The work on asynchronous meetings – e.g., [2,19,57]) – as well as some work on parallel design tools (including the TEAM STORM application [23]) could serve as a starting point in this regard. Rethinking the need for synchronized collective work might result in new forms of collective interaction that strike better balance between collective and individual needs.

6 CONCLUDING REMARKS

In this work we have taken an experiential approach in examining recurring meetings to inform the design of new meeting technologies. Our findings show that the explicit purposes of recurring meetings are not the only functions they serve: others are collective thinking, triggering subgroup formation and follow-up, clocking, bonding, and providing a platform for visibility. Overall, meetings embody a complex interplay of behaviors that address the work of the group, its well-being as social system, and the individual needs of its members.

While prior work on designing technologies for meeting support has largely focused on supporting the collective instrumental purposes of meetings, we argue for a broader approach to supporting meetings. Certainly there is nothing wrong with providing tools that support the collective work of the meeting, and that make it more efficient – indeed, our participants were quite enthusiastic when they talked about meetings and meeting behaviors that brought a meeting closer to their ideal, structured meeting. But at the same time there is no denying that people come to meetings with their own needs and priorities, and that those individual aims sometimes compete with the collective goals.

We believe that recognizing that meetings are a confluence of individual and collective needs and goals provides a more realistic basis for and perspective on meeting support technologies. We have offered lines of inquiry that suggest new foci for designers.

ACKNOWLEDGMENTS

We thank our participants for their open-hearted accounts and the anonymous reviewers for their constructive feedback. Special thanks to Berry Eggen and Elise van den Hoven. This work was made possible by the Aspasia grant related to STW VIDI Grant No. 016.128.303 of The Netherlands Organization for Scientific Research (NWO), awarded to Elise van den Hoven.

REFERENCES

[1] Joshep A. Allen, Nale Lehmann-Willenbrock, and Steven G. Rogelberg. 2015. *The Cambridge Handbook of Meeting Science*. Cambridge University Press.

[2] Jeremy T. Barksdale, Kori Inkpen, Mary Czerwinski, et al. 2012. Video Threads: Asynchronous Video Sharing for Temporally Distributed Teams. *Proceedings of the ACM 2012 conference on Computer Supported Cooperative Work (CSCW '12)*, ACM, 1101–1104.

[3] Kent Beck, James Grenning, Robert C. Martin, et al. 2001. Manifesto for Agile Software Development. Retrieved September 16, 2016 from http://agilemanifesto.org/

[4] Victoria Bellotti and Sara Bly. 1996. Walking Away from the Desktop Computer: Distributed Collaboration and Mobility in a Product Design Team. *Proceedings of the ACM conference on Computer Supported Cooperative Work (CSCW '96)*, ACM, 209–218. http://doi.org/10.1145/240080.240256

[5] Tony Bergstrom and Karrie Karahalios. 2009. Conversation Clusters: Grouping Conversation Topics through Human-Computer Dialog. *Proceedings of the 27th international conference on Human factors in computing systems (CHI 09)*, ACM, 2349–2352. http://doi.org/10.1145/1518701.1519060

[6] Jacob T. Biehl, Daniel Avrahami, and Anthony Dunnigan. 2015. Not really there: Understanding embodied communication affordances in team perception and participation. *Proceedings of the 18th ACM Conference on Computer Supported Cooperative Work & Social Computing (CSCW '15)*, ACM, 1567–1575. http://doi.org/10.1145/2675133.2675220

[7] Deirdre Boden. 1994. *The business of talk: Organizations in action*. Blackwell Publishers.

[8] Stacy Branham, Gene Golovchinsky, and Scott Carter. 2010. Let's go from the whiteboard: supporting transitions in work through whiteboard capture and reuse. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '10)*, 75–84. http://doi.org/10.1145/1753326.1753338

[9] Virginia Braun and Victoria Clarke. 2006. Using thematic analysis in psychology. *Qualitative Research in Psychology* 3, 2, 77–101. http://doi.org/10.1191/1478088706qp063oa

[10] Scott Carter, Jennifer Marlow, Aki Komori, and Ville Mäkelä. 2016. Bringing Mobile into Meetings: Enhancing Distributed Meeting Participation on Smartwatches and Mobile Phones. *Proceedings of the 18th International Conference on Human-Computer Interaction with Mobile Devices and Services (MobileHCI '16)*, 407–417. http://doi.org/10.1145/2935334.2935355

[11] Mauro Cherubini, Gina Venolia, Rob Deline, and Andrew J Ko. 2007. Let ' s Go to the Whiteboard: How and Why Software Developers Use Drawings. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '07)*, 557–566. http://doi.org/10.1145/1240624.1240714

[12] Patrick Chiu, Ashutosh Kapuskar, Sarah Reitmeier, and Lynn Wilcox. 1999. NoteLook: Taking Notes in Meetings with Digital Video and Ink. *Proceedings of the seventh ACM international conference on Multimedia (MM'99)*, ACM, 149–158. http://doi.org/10.1145/319463.319483

[13] Ross Cutler, Yong Rui, Anoop Gupta, et al. 2002. Distributed Meetings: A Meeting Capture and Broadcasting System. *Proceedings of the tenth ACM international conference on Multimedia (MM '02)*, ACM, 503–512. http://doi.org/10.1145/641007.641112

[14] Joan Morris DiMicco, Katherine J Hollenbach, Anna Pandolfo, and Walter Bender. 2007. The impact of increased awareness while face-to-face. *Human–Computer Interaction* 22, 47–96. http://doi.org/10.1080/07370020701307781

[15] Thomas Erickson, N. Sadat Shami, Wendy A. Kellogg, and David W. Levine. 2011. Synchronous Interaction Among Hundreds: An Evaluation of a Conference in an Avatar-based Virtual Environment. *CHI '11 Proceedings of the International Conference on Human Factors*

in Computing Systems, ACM, 503–512. http://doi.org/10.1145/1978942.1979013
[16] Morten Esbensen, Paolo Tell, and Jakob Bardram. 2014. SideBar: Videoconferencing System Supporting Social Engagement. *10th IEEE International Conference on Collaborative Computing: Networking, Applications and Worksharing (CollaborateCom 2014)*, 358–367. http://doi.org/10.4108/icst.collaboratecom.2014.257335
[17] Ana Cristina Bicharra Garcia, John Kunz, and Martin Fischer. 2004. Cutting to the Chase: Improving Meeting Effectiveness by Focusing on the Agenda. *Proceedings of the 2004 ACM conference on Computer Supported Cooperative Work (CSCW '04)*, ACM, 346–349. http://doi.org/10.1016/j.cub.2004.10.038
[18] Werner Geyer, Heather Richter, and Gregory D. Abowd. 2005. Towards a Smarter Meeting Record - Capture and Access of Meetings Revisited. *Multimedia Tools and Applications* 27, 3, 393–410. http://doi.org/10.1007/s11042-005-3815-0
[19] Andreas Girgensohn, Jennifer Marlow, Frank Shipman, and Lynn Wilcox. 2015. HyperMeeting: Supporting Asynchronous Meetings with Hypervideo. *Proceedings of the 23rd ACM international conference on Multimedia (MM'15)*, 611–620. http://doi.org/10.1145/2733373.2806258
[20] Victor M. González and Gloria Mark. 2004. Constant, Constant, Multi-tasking Craziness: Managing Multiple Working Spheres. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '04)*, 113–120. http://doi.org/10.1145/985692.985707
[21] Walter A. Green and Harold Lazarus. 1991. Are Today's Executives Meeting with Success? *Journal of Management Development* 10, 1, 14–25. http://doi.org/10.1108/02621719110139034
[22] Jonathan Grudin. 2008. McGrath and the Behaviors of Groups (BOGs). *HCI Remixed: Reflections on works that have influenced the HCI community*, 105–110.
[23] Joshua Hailpern, Erik Hinterbichler, Caryn Leppert, Damon Cook, and B.P. Bailey. 2007. TEAM STORM: Demonstrating an interaction model for working with multiple ideas during creative group work. *Proceedings of the Conference on Creativity & Cognition*, 193–202. http://doi.org/10.1145/1254960.1254987
[24] Drew Harry, Chris Schmandt, Eric Gordon, and Chris Schmandt. 2012. Setting the Stage for Interaction: A Tablet Application to Augment Group Discussion in a Seminar Class. *Proceedings of the 2012 ACM conference on Computer Supported Cooperative Work (CSCW '12)*, 1071–1080. http://doi.org/10.1145/2145204.2145364
[25] James M. Hudson, Jim Christensen, Wendy A. Kellogg, and Thomas Erickson. 2002. I'd Be Overwhelmed , But It's Just One More Thing to Do": Availability and Interruption in Research Management. *Proceedings of the SIGCHI conference on Human factors in Computing Systems (CHI '02)*, ACM, 97–104. http://doi.org/10.1145/503376.503394
[26] Shamsi T. Iqbal, Jonathan Grudin, and Eric Horvitz. 2011. Peripheral computing during presentations. *Proceedings of the 2011 annual conference on Human factors in Computing Systems (CHI '11)*, ACM, 891–894. http://doi.org/10.1145/1978942.1979073
[27] Brigitte Jordan and Austin Henderson. 1995. Interaction Analysis: Foundations and Practice. *Journal of the Learning Sciences* 4, 1, 39–103. http://doi.org/10.1207/s15327809jls0401_2
[28] Bridget Kane and Saturnino Luz. 2006. Multidisciplinary medical team meetings: An analysis of collaborative working with special attention to timing and teleconferencing. *Computer Supported Cooperative Work* 15, 501–535. http://doi.org/10.1007/s10606-006-9035-y
[29] Fawzia Khan. 1993. *A survey of note-taking practices*. Retrieved from http://www.hpl.hp.com/techreports/93/HPL-93-107.html
[30] Taemie Kim, Agnes Chang, Lindsey Holland, and Alex Sandy Pentland. 2008. Meeting Mediator: Enhancing Group Collaborationusing Sociometric Feedback. *Proceedings of the 2008 ACM conference on Computer Supported Cooperative Work (CSCW '08)*, ACM, 457–466. http://doi.org/10.1145/1460563.1460636
[31] Lisa Kleinman. 2009. Perceived productivity and the social rules for laptop use in work meetings. *Extended Abstracts of the 27th SIGCHI international conference on Human Factors in Computing Systems (CHI EA '09)*, 3895. http://doi.org/10.1145/1520340.1520590
[32] Min Kyung Lee and Leila Takayama. 2011. "Now, I Have a Body": Uses and Social Norms for Mobile Remote Presence in the Workplace Min. *Proceedings of the 2011 SIGCHI Conference on Human Factors in Computing Systems (CHI '11)*, 33–42. http://doi.org/10.1145/1978942.1978950
[33] Franz Lehner, Michael Langbauer, and Nadine Amende. 2014. Measuring success of Enterprise Social Software: The case of hypervideos. *Proceedings of the 14th International Conference on Knowledge Technologies and Data-driven Business (i-KNOW '14)*, ACM, Article no. 3, 9 pages. http://doi.org/10.1145/2637748.2638411
[34] Jennifer Marlow, Scott A Carter, Nathaniel Good, and Jung-Wei Chen. 2016. Beyond Talking Heads: Multimedia Artifact Creation, Use, and Sharing in Distributed Meetings. *Proceedings of the ACM conference on Computer Supported Cooperative Work (CSCW '16)*, 1701–1713. http://doi.org/10.1145/2818048.2819958
[35] Jennifer Marlow, Eveline van Everdingen, and Daniel Avrahami. 2016. Taking Notes or Playing Games? Understanding Multitasking in Video Communication. *Proceedings of the 19th ACM Conference on Computer-Supported Cooperative Work & Social Computing - CSCW '16*, ACM, 1726–1737. http://doi.org/10.1145/2818048.2819975
[36] Joseph E. McGrath. 1991. Time, Interaction, and Performance (TIP): A Theory of Groups. *Small Group Research* 22, 2, 147–174. http://doi.org/10.1177/1046496491222001
[37] Moira McGregor and John Tang. 2017. More to Meetings: Challenges in Using Speech-Based Technology to Support Meetings CSCW 2017, Portland, Oregon, USA. *Proceedings of the 2017 ACM Conference on Computer Supported Cooperative Work and Social Computing (CSCW '17)*, 2208–2220. http://doi.org/10.1145/2998181.2998335
[38] Donald McMillan, Antoine Loriette, and Barry Brown. 2015. Repurposing Conversation: Experiments with the Continuous Speech Stream. *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems (CHI'15)*, ACM, 3953–3962. http://doi.org/10.1145/2702123.2702532
[39] Henry Mintzberg. 1990. The Manager ' s Job: Folklore and Facts. *The Harvard Business Review* March-Apri, 1–14.
[40] Julien C. Mirivel and Karen Tracy. 2005. Premeeting Talk: An Organizationally Crucial Form of Talk. *Language and Social Interaction* 38, 1, 1–34. http://doi.org/10.1207/s15327973rlsi3801
[41] Thomas P. Moran, Leysia Palen, Steve Harrison, et al. 1997. "I'll Get That Off the Audio'': A Case Study of Salvaging Multimedia Meeting Records. *Proceegings of the Conference on Human Factors in Computing Systems (CHI '97)*, ACM, 202–209. http://doi.org/10.1145/258549.258704
[42] Michael Muller, Casey Dugan, Michael Brenndoerfer, Megan Monroe, and Werner Geyer. 2016. What Did I ask You to Do, by When, and for Whom? Passion and Compassion in Request Management. *Proceedings of the ACM 2016 conference on Computer Supported Cooperative Work (CSCW '16)*, ACM, Forthcoming.
[43] William Newman and Ethan L. Smith. 2006. Disruption of meetings by laptop use: Is there a 10-second solution? *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems Extended Abstracts (CHI EA '06)*, ACM, 1145–1150.... http://doi.org/10.1145/1125451.1125667

[44] Niina Nurmi and Pamela J. Hinds. 2016. Job complexity and learning opportunities: A silver lining in the design of global virtual work. *Journal of International Business Studies* 47, 6, 631–654. http://doi.org/10.1057/jibs.2016.11
[45] Valentina Occhialini, Harm Van Essen, and Berry Eggen. 2011. Design and Evaluation of an Ambient Display to Support Time Management during Meetings. *INTERACT 2011*, IFIP International Federation for Information Processing, 263–280. http://doi.org/10.1007/978-3-642-23771-3_20
[46] Gary M. Olson, Judith S. Olson, Mark R. Carter, and Marianne Storrosten. 1992. Small Group Design Meetings: An Analysis of Collaboration. *Human-Computer Interaction* 7, 4, 28. http://doi.org/10.1207/s15327051hci0704_1
[47] Judith S. Olson, Stephanie Teasley, Lisa Covi, and Gary Olson. 2002. The (currently) unique advantages of collocated work. In *Distributed work*, Pamela Hinds and Sara Kiesler (eds.). The MIT Press, 113–135.
[48] Fabrizio Pece, William Steptoe, Fabian Wanner, et al. 2013. Panoinserts: mobile spatial teleconferencing. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '13)*, 1319–1328. http://doi.org/doi: 10.1145/2470654.2466173
[49] Malin Pongolini, Johan Lundin, and Lars Svensson. 2011. Global online meetings in virtual teams. *Proceedings of the 5th International Conference on Communities and Technologies (C&T '11)*, 108. http://doi.org/10.1145/2103354.2103369
[50] Wilfried M. Post, Mirjam A. A. Huis in 't Veld, and Sylvia A. A. van den Boogaard. 2008. Evaluating meeting support tools. *Personal and Ubiquitous Computing* 12, 3, 223–235. http://doi.org/10.1007/s00779-007-0148-1
[51] Heather Richter, Gregory D. Abowd, Werner Geyer, Ludwin Fuchs, Shahrokh Daijavad, and Steven Poltrock. 2001. Integrating Meeting Capture within a Collaborative Team Environment. *Proceedings of the International Conference on Ubiquitous Computing*, 123–138. http://doi.org/10.1007/3-540-45427-6
[52] Rutger Rienks, Anton Nijholt, and Paulo Barthelmess. 2009. Pro-active meeting assistants: Attention please! *AI and Society* 23, 213–231. http://doi.org/10.1007/s00146-007-0135-0
[53] Cliff Scott, Joseph A. Allen, Steven G. Rogelberg, and Alex Kello. 2015. Five Theoretical Lenses for Conceptualising the Role of Meetings in Organisational Life. In *The Cambridge Handbook of Meeting Science*, Joseph A. Allen, Nale Lehmann-Willenbrock and Steven G. Rogelberg (eds.). Cambridge University Press.
[54] Mel Slater and Anthony Steed. 2002. Meeting People Virtually: Experiments in Shared Virtual Environments. In *The Social Life of Avatars*, R. Schroeder (ed.). Springer-Verlag London, UK, 146–171. http://doi.org/10.1007/978-1-4471-0277-9_9
[55] Diane Tam, Karon E. MacLean, Joanna McGrenere, and Katherine J. Kuchenbecker. 2013. The Design and Field Observation of a Haptic Notification System for Timing Awareness During Oral Presentations. *Proceedings of the 2013 ACM internation conference on Human Factors in Computing Systems (CHI '13)*, ACM, 1689–1698. http://doi.org/10.1145/2470654.2466223
[56] John C. Tang. 1989. Listing, drawing and gesturing in design: A study of the use of shared workspaces by design teams.
[57] John Tang, Jennifer Marlow, Aaron Hoff, et al. 2012. Time Travel Proxy: Using Lightweight Video Recordings to Create Asynchronous, Interactive Meetings. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, 3111–3120. http://doi.org/10.1145/2207676.2208725
[58] Jacques Terken and Janienke Sturm. 2010. Multimodal support for social dynamics in co-located meetings. *Personal and Ubiquitous Computing* 14, 8, 703–714. http://doi.org/10.1007/s00779-010-0284-x
[59] Simon Tucker, Ofer Bergman, Anand Ramamoorthy, and Steve Whittaker. 2010. Catchup: A Useful Application of Time-Travel in Meetings. *Proceedings of the 2010 ACM conference on Computer Supported Cooperative Work (CSCW '10)*, ACM, 99–102. http://doi.org/http://doi.acm.org/10.1145/1718918.1718937
[60] Steve Whittaker, Rachel Laban, and Simon Tucker. 2006. Analysing meeting records: An ethnographic study and technological implications. In *Lecture Notes in Computer Science* (Machine Le), S. Renals and S. Bengio (eds.). Springer, Berlin, Heidelberg, 101–113. http://doi.org/10.1007/11677482_9
[61] Anita Williams Woolley, Christopher F Chabris, Alex Pentland, Nada Hashmi, and Thomas W Malone. 2010. Evidence for a collective intelligence factor in the performance of human groups. *Science* 330, 6004, 686–688. http://doi.org/10.1126/science.1193147
[62] Jiang Wu, Harm van Essen, and Berry Eggen. 2016. Designing Sculpting Light Systems for Information Decoration. *Proceedings of the TEI '16: Tenth International Conference on Tangible, Embedded, and Embodied Interaction - TEI '16*, 609–614. http://doi.org/10.1145/2839462.2856547
[63] Michael A. Yoerger, Kyle Francis, and Joseph A. Allen. 2015. So Much More than "Chit Chat": A Closer Look at Premeeting Talk. In *The Cambridge Handbook of Meeting Science*, Joseph A. Allen, Nale Lehmann-Willenbrock and Steven G. Rogelberg (eds.). Cambridge University Press.

Received April 2017; revised July 2017; accepted November 2017