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Performative hybrid interaction: Understanding planned events across collocated and mediated interaction spheres

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Performative hybrid interaction: Understanding planned events across collocated and mediated interaction spheres

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Abstract

There is a division among computer-supported collaboration tools by location (collocated/distributed) and by time (synchronous/asynchronous). Collocated synchronous tools were once given focus in research through studies of group support systems. Today, ubiquitous computing has led to collocated synchronous computing becoming a part of day-to-day life. The practices involved take place in *hybrid space* – a mixture of face-to-face and computer-mediated communication. This very real, concrete phenomenon has been subject to study in the human–computer interaction domain; however, theories examining social interaction in the hybrid space, or *hybrid interaction*, are rare. Such theories may help to advance the design and utilization of tools for hybrid interaction.

Aimed at helping practitioners understand and benefit from hybrid interaction, a study of one form of it was undertaken, with the emphasis on cases wherein the event is organized as a performance and there are spectators and performers. Hence, the focus is on *performative hybrid interaction*: hybrid interaction that is used as part of a performance. The work builds on 14 instances of hybrid interaction examined through mixed-methods approaches. The following observations about social practices were made on the basis of the empirical research:

(i) Hybrid interaction has *social rules* that govern how interaction takes place. In this respect, hybrid interaction is like any social interaction. However, the social rules of hybrid interaction emerge from the rules of both computer-mediated and face-to-face interaction. These two communication channels are interlinked and, therefore, influence one another.

(ii) In performer-oriented settings, it is important to establish social rules that support the performance. Performative hybrid interaction benefits from *active guidance by performers*. This active guidance establishes the social rules and communicates them to spectators. Performers establish these rules in several ways, both onstage and offstage. Yet the technical systems employed do not scaffold and support the active guidance.

(iii) The choices surrounding social rules are *normative decisions*. Therefore, frameworks that account for and reflect these decisions can be helpful for designers and researchers. Frameworks of this nature might be adapted, for example, from political science. They benefit research and design in two ways. Firstly, they often provide a set of validated

empirical methods that make the research more solid. Secondly, they support the design of systems: they justify the design goals and provide a backdrop against which the design ideas evolve.

Discussion proceeding from these findings considers how to improve practices of performative hybrid interaction. The thesis project investigated the importance of accounting for these social practices. Also, I propose further tools for supporting these social practices, such as the script. Furthermore, the thesis contributes to the use of social theories for human–computer interaction, with a synthesis of elements from several fields of research: political science, performance studies, event studies, and sociology. This combination offers insights related to the difficulties and potential problems in performative hybrid interaction. It also provides insight into the role of normative decisions that ought to inform designers and researchers working on performative hybrid interaction.

Computing Reviews (1998) Categories and Subject Descriptors:
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H.5.2 User Interfaces
J.4 Social and Behavioral Sciences

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human-centered computing, collaborative and social computing, computer-supported cooperative work

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hybrid interaction, performative hybrid interaction, performance, Presemo

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It is well known that *it takes a village to raise a PhD.* I have been surrounded by a community of friends with whom I have worked on various projects, learning how to "do science." The Network Society Research Program at Helsinki Institute for Information Technology HIIT was a valuable meeting place for social scientists interested in technology. I am happy to say I have worked with some of the brilliant minds of Helsinki there, including Airi Lampinen, Andrea Vianello, Antti Jylhä, Antti Oulasvirta, Antti Poikela, Antti Ukkonen, Arto Kekkonen, Asko Lehmuskallio, Eeva Raita, Eve Hoggan, Herkko Hietanen, Ilkka Kosunen, Imtiaj Ahmed, Jani Turunen, Jesper Hjorth, Jesse Haapoja, Joanna Bergström-Lehtovirta, Jouni A. Ojala, Jouni Vepsäläinen, Juho Hamari, Juho Pääkkönen, Jukka Reitmaa, Kai Huotari, Kai Kuikkaniemi, Kumaripaba Athukorala, Lassi Liikkanen, Mari Marttila, Mari Tuokko, Martti Mäntylä, Mats Sjöberg, Max Vilkki, Mika Honkanen, Mikael Johnson, Olli Pitkänen, Oswald Barral, Petri Lievonen, Suvi Uski, Tanel Mällo, Tuomas Husu, Tuukka Lehtiniemi, Veikko Eranti, Vesa Kantola, Vili Lehdonvirta, Ville Harjunen, Vilma Lehtinen, Yi-Ta Hsieh, and, Yki Kortesniemi. The newly founded scientific association Rajapinta has kept the relationship with the social sciences strong and also introduced me to other fabulous people, among them Arho Toikka, Laura Kohonen-Aho, Marjoriikka Ylisiurua, Mika Pantzar, Mikko Vili, Minna Ruckenstein, Pertti Ahonen, Salla-Maaria Laaksonen, Thomas Olsson, Tuukka Ylä-Anttila, and, Veikko Isotalo. Furthermore, over the years I have had the pleasure to work with colleagues and friends such as Arto Hellas, Brandie Nonnecke, Bryan Semaan, Emilia Hjelm, Eva Durall, Janne Saarikko, Jay Patel, Jenni Hokka, Juuso Karikoski, Kaarina Nikunen, Ken Goldberg, Kimmo Vehkalahti, Mervi Pantti, Patrik Floreen, Petri Savolainen, Reijo Sund, Riitta Smeds, Sanjay Krishnan, Tanja Aitamurto, Tarmo Toikka, and, Teemu Leinonen. Finally, my work at Nokia Corporation – at Nokia Research Centre, Nokia's Office of the Chief Technology Officer, and the Toijala Student Innovation Laboratory – helped me to develop various skills that were helpful for academic research as well: I am grateful to Erkki Ormala, Juha Arrasvuori, Juha Kaario, Karl Ots, Marko Mahkonen, Paul V. Brown, Riku Suomela, Timo Ali-Vehmas, Timo Sorsa, and, Vik Nuckchady. All of them[1] have helped me to learn more about *being a researcher* and what *research means.*

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[1]Including also those who I have forgotten to mention here.

Software Enablers for Real-World Deployments, and, Revolution of Knowledge Work), the Academy of Finland (work on racism and public communications in the hybrid media environment), the Nokia Foundation, and, the Sanoma Foundation (Digivaalit 2015). These projects have not only supported the development of various ideas presented in the thesis but also allowed me to learn many hands-on skills of academic life beyond writing funding applications. I also wish to thank the Doctoral Program for Computer Science at the University of Helsinki for picking up the bill for my various conference trips. In addition, the staff of the various support services, ranging from human resources and information technology to financial and travel support services of both Aalto University and the University of Helsinki, deserve an apology for all the times I have bugged them, usually with urgent needs.

Lastly, I must thank the University of Helsinki's Department for Computer Science for a forward-looking position on multidisciplinary research. I know that this has not been the easiest journey for the department either, but the continuous support and willingness to accommodate differences have enabled me – with academic roots in social sciences and industry experience in software and service development – to create a contribution of this nature.

Otaniemi, December 2017
Matti Nelimarkka

Contents

Chapter 1

Introduction

The focus of this thesis, performative hybrid interaction, is an emerging application domain for social computing technologies. In performative hybrid interaction, computer-mediated communication is used when people are collocated at a planned event. Performers and spectators use it in these planned events to enhance their interaction and engagement. Here, I will explore how the use context of planned events influences emerging practices: social rules, roles and practices of the performers, and normative standing. Before tackling this theme, I will briefly position my work in the history of human–computer interaction studies, computer-supported cooperative work, and social computing. I will show that the questions I ask have been examined with several other social computing systems (e.g., Grudin, 1994b) and that the context of collocated computing dates back to the early days of human–computer interaction research (Johansen et al., 1991; Ellis et al., 1991). This contextualizes my work in the larger narrative of research into computer-supported cooperative work: the combined study of social settings and new technologies. Because scientific work is not ahistorical, I believe that this brief review of the identity of the field is warranted. After the historical review, I will describe what I mean by performative hybrid interaction and summarize the findings presented in this thesis.

The early work in human–computer interaction pertained to individual-level use. Studies in the workplace addressed how computers support interaction between individuals. This led to research in an area known as "computer-supported cooperative work." As access to computers increased, they started becoming used outside the work context. Today, the term "social computing" is used together with "computer-supported cooperative work." Before continuing, I wish to acknowledge that extensive work has already been conducted on the identification of computer-supported collaborative work (e.g., Schmidt and Bannon, 2013; Grudin, 1994a; Ellis et al., 1991). These discussions emerged as the field has grown to appreciate various forms of contributions. Holsapple and Luo (2003) separated contributions to study of the design and use of technology from those works developing policies and strategies; they also observed that contributions were focused on either group- or organization-level problems. These ideas have been documented by academics in the field as well. Grudin (1994a) too categorized work in the field on the basis of organizational or small-group focus, and Schmidt and Bannon (2013) discussed the methodological differences between the practice-oriented ethnographic study of workplaces and problem-directed study of computer-supported coordination. Given the interdisciplinary nature of the field, I faced the question of how I should approach my research topic. I could focus on key conceptual findings and aim to extend to them (e.g., Schmidt and Bannon, 2013), but my quest is to understand particular use cases and the emerging application space, which I call "performative hybrid interaction" in this thesis (see Section 1.1, below). The focus of my contribution is, therefore, on the design and use of technology and more specifically on the problem-directed study agenda.

	same time	different time
same place	I	II
different place	III	IV

Table 1.1: Space–Time Matrix.

Work focused on any application space is naturally hindered by the constant flux of technologies within the field that, for example, Schmidt and Bannon (2013) posited to be a challenge for computer-supported cooperative work research. To address this, I ground my work against established understandings of technologies for cooperative work. Ellis et al. (1991) described several distinct classifications of systems: application-level taxonomies, degree of shared environment, and the space–time matrix. The space–time matrix (Johansen et al., 1991; Ellis et al., 1991) separates among pieces of collaborative software on the basis of the physical setup (place) and temporal setup (time) (see Table 1.1). Even today, existing tools can be, and often are, grouped in accordance with this model (see Fischer et al., 2016, for a timely example). In an illustration of this framework, email and wikis are designed to be used in a different time and different space (quadrant IV in Table 1.1), whereas chat and other synchronous distributed tools are used at the same time in different spaces (quadrant III). The space–time matrix has been able to guide system development for over 25 years, indicating that it is a rather stable way to categorize technologies. Therefore, it is a suitable grounding from which to proceed with further work.

Lately, active research in social computing has been focused on distributed tools (quadrants III and IV). The primary emphasis has been on the Internet, which has significantly transformed society. For example, in *The Rise of the Network Society*, Castells (1998) claimed that the Internet creates "timeless time" and a "space of flows." The former refers to how the global information networks challenge the concept of time in interaction. For example, the interaction from Helsinki to Berkeley is as fast as the interaction from Helsinki to Espoo. The idea of space of flows highlights how collaboration that takes place in multiple locations yet in a synchronous manner (quadrant III) becomes easy and the concept of place is, therefore, no longer needed. Studies of chat, email, blogs, social-networking sites, Wikipedia, and virtual worlds, among others, have been widely published in this domain.

There has also been a steady output, even if in lower quantity, of articles that focus on tools for collocated interaction. In quadrant I, research has focused on tools such as interactive surfaces for collaboration (among others, Rogers and Rodden, 2003) and tools for awareness support for collocated work (among others, Bergstrom and Karahalios, 2007). A significant subdomain has involved the focus on computer-mediated communication in cases of collocation (further examined in Chapter 2) – for example, using backchannels and audience response systems.

I have studied technologies in collocated synchronous communication (quadrant I), since it is the only quadrant in this matrix in which communication channels naturally coexist. Collocation entails people being able to interact in a face-to-face manner and at the same time maintain a digital interaction channel. Although the volume of research activity in this field is small, it represents a significant part of today's media environment. For example, in the United Kingdom, 26% of all Internet users have communicated with another person via a mediated tool even when they were collocated while at home; for teens, this number increases to 49%. Further, 32% of teens have communicated with someone through mediated communication while collocated on a school site (Office of Communications, 2016). Given its frequency, we must ask how such communication takes place. Section 1.1 offers a suggestion for addressing this challenge through the concept of hybrid interaction.

1.1 Hybrid Interaction

The space–time matrix has been applied in research into social applications. However, instead of "same time, same space," several researchers have used the concept of *hybrid* to elaborate on the forms of interaction emerging in quadrant I (e.g., de Souza e Silva, 2006; Harrison and Dourish, 1996; Crabtree and Rodden, 2008). While my research spans quadrant I, I will align myself further with the "hybrid" concept, for I find it a more suitable lens with which to examine the social interaction. To that end, I will, in this section, elaborate on the meanings of "hybrid" in the literature.

Hybrid space reflects the changes in a physical space as digital technologies are used to support it. For example, in media scholarship, de Souza e Silva (2006) defined hybrid space in the following way:

> [Hybrid space forms when] virtual communities (chats, multi-user domains, and massively multi-player online role-playing games), previously enacted in what was conceptualized as cyberspace, migrate to physical spaces because of the use of mobile technologies as interfaces.

They explain that the hybrid space is defined not through the technologies used to bring the "virtual" interaction into the physical space but rather on the basis of the social connections created through the interaction. The same term was used earlier by Harrison and Dourish (1996), who defined the hybrid space in a manner similar to de Souza e Silva (2006)'s, stating that it

> comprises both physical and virtual space, and in action is framed simultaneously by the physical space, the virtual space and the relationship between the two.

However, in their examples, they claimed this to extend beyond collocated interaction and aimed to reflect how, for example, video conferencing tools link physical and virtual spaces together and highlight the role of space and place in those systems (e.g., Dourish, 2006). In a similar fashion, Crabtree and Rodden (2008) presented the idea of *hybrid ecology* that

> combine[s] and exploit[s] the affordances of mixed reality and ubiquitous computing environments to extend the purchase of computing across multiple environments, physical and digital.

All of these authors show a distinctive emphasis in their formulations. Harrison and Dourish (1996) extended the term towards wider collaboration and did not cover the critical collocation aspect. Crabtree and Rodden (2008), on the other hand, have focused largely on the technical configuration and less on social settings seen as vital in computer-supported cooperation literature. Both of these challenges can be dealt with by referring to de Souza e Silva (2006) for the baseline notation for the hybrid space.

The second domain of human–computer interaction that has used the term "hybrid" has been centered on *hybrid artifacts* (Bannon et al., 2005): tools that support manipulating the interfaces through physical means. However, the emphasis with this tangible interaction has been on making the physical artifacts input devices or even manipulatable objects connecting the physical and digital (Ishii, 2008). Even though these artifacts connect the two, they do not address the role of several of the communication channels. Rather, the hybrid artifacts address the opportunities to use the physical as an input "device" for digital content. Therefore, this area of research (and its formulations in similar areas, such as embodied interaction, wherein the body is used as the input device) is beyond the scope of the thesis.

Figure 1.1: An example of performative hybrid interaction at an academic conference.

The third area in which the term is applied within human–computer interaction is that of *hybrid media consumption*, wherein an additional medium is followed to support television-broadcast consumption (Maruyama et al., 2014). The phenomenon is also known as "live tweeting" (e.g., Kim et al., 2015b; Hawthorne et al., 2013; Bentivegna and Marchetti, 2015; McPherson et al., 2012) or "second screening" (e.g., Feltwell et al., 2017; Trilling, 2014; Larsson and Christensen, 2016). Maruyama et al. (2014) has argued that this scenario creates

> a hybrid media environment in which anyone with an Internet connection can watch the conversation unfold or join the discussion.

This opportunity makes the television-watching experience more social (Hawthorne et al., 2013) and affects how people perceive the broadcast (Maruyama et al., 2014). The main difference from the notion of hybrid space discussed above is that study of physical space is not required for understanding this activity and it has not been a mainstream topic of research. Hybrid media consumption demonstrates the benefits of the "space of flows" idea, since the activity can occur in any place.

The focus in this thesis is on something else that can be considered a form of consumption of hybrid media. Planned events are examples of collocated situations. With these, spectators can consume both physical and digital activities. Therefore, they are engaged in hybrid media consumption. Figure 1.1 shows an example in which both digital and physical (verbal) interaction take place at the same time. As panelists manage what is shown in the digital space, they are performing in the digital sphere and inviting listeners to participate. Therefore, we must extend the ideas of hybrid space and hybrid media consumption to account for such roles and activities. *Performative hybrid interaction is a subset of hybrid interactions (in which interactions occur in a collocated situation) wherein a planned performance is ongoing.* I will now briefly engage with the concepts of performance, planned event, hybrid, sphere, and interaction, to justify the use of the concept of performative hybrid interaction.

The situation is *performative*;[1] the participants are not equal. They have social roles that put some of them in charge of the performance and make others spectators. For example, in the case of an educational event, teachers plan activities beforehand and are in charge of those activities even if (and when) students are asked to take part in the

[1] There are several meanings for this word. As Marshall et al. (2017b) and Marshall et al. (2017a) have suggested, it has many articulations in human–computer interaction literature and these may not do full justice to findings from the social sciences and performance scholarship.

performing. No matter how they take part in performing, students are not engaged in the planning of the pedagogy; while they may contribute to the learning activities or the exercises, they do not design them. Similarly, at a panel or seminar presentation, the presenters and panelists are in charge of the performance even if they invite questions from the audience. Therefore, the performance[2] emerges clearly when, to put a working definition to the term, we understand all social interaction as a performance (e.g., Goffman, 1978). In this case, even a casual discussion is viewed as a performance. However, when the interaction takes place at a *planned event* (Getz and Page, 2016), the performers have a role; they are "acting" even when they do not have a character whose lines and stage directions they are acting out (Kirby, 1987). The social situation is constructed, and the performing takes place in this constructed context. Therefore, the participants are not equal, through their roles in this constructed context.

However, recent media scholarship provides another view on hybridity. The transformation of the media space due to the increased role of social media in journalistic processes has led to creation of a *hybrid media system*. Chadwick et al. (2016) have argued that the current media environment mashes up the logic of newer and older media; that is to say that traditional media organizations (such as newspapers and television news entities) adapt their way of operating in reaction to social media organizations, and the social media organizations adapt their manner of operation to match those of traditional media organizations. I argue that an understanding of the adaptation of media logic is critical if we are to understand collocated interaction. I admit that the relationship is less clear than that with hybrid space and hybrid media consumption. However, as various media environments (or spaces, to remain with the terminology of hybrid space and hybrid media consumption) mesh together, what type of interaction emerges? The work outlined by Chadwick et al. (2016) focuses on the rules and practices that emerge when adoptions from traditional and new media spaces take place. Let us present that in terms of the hybrid interaction: the question raised in this scholarship would be "how do digital activities influence the rules and practices of physical activities, and, vice versa, how do physical activities influence the rules and practices of digital activities?" These questions are not addressed in the traditional description of hybrid space and considered only to a small extent in hybrid media consumption literature, because the focus there is on the existence of both digital and physical communication channels.

With the term "hybrid," I aim to indicate that the focus is in both digital and physical spaces. The conception builds mostly on those of hybrid space and hybrid media consumption, the idea that even collocated users have many spaces and communication channels employed. Various examples of this can be found in prior work. When a bar is augmented with public screens, visitors can not only engage in face-to-face discussion of the content but also share photos and thereby express themselves further (e.g., Lucero et al., 2012a). Similarly, backchannel tools have been used at conferences to allow people to share thoughts and ask questions by using digital tools even when they are collocated (e.g., McCarthy and {b}oyd, 2005; Harry et al., 2009). The perspective gained from hybrid media systems is related not to the existence of a second space for communication but, rather, to the *dual-sphere* communication opportunity. I use the term "sphere" to indicate the range of communication affordances that both the digital sphere and the physical sphere have. Therefore, I use the word "hybrid" to suggest that the focus is on digital sphere, physical sphere, and any interaction between the two.

Finally, with the concept of hybrid *interaction* I aim to reflect the fact that the hybrid space is more than a social "space." People use the hybrid space to communicate with others and express themselves when collocated. They can respond to questions issued by

[2] Since the topic of performance is further addressed in sections 5.1 and 5.2, I will not extend the discussion of a performance further here or relate it to the literature in greater detail.

the performer, as in polls or open-ended items, or react to a remark made by the performer. However, they also can use the hybrid space to respond to comments made by others. The interaction emerges, therefore, from participants' social actions. They are reacting to each other and commenting – the activity is beyond media consumption and is focused on media creation in both communication spaces in collocated settings.

1.2 Summary of Findings

I argue in this thesis that *performers can use performative hybrid interaction to shape the social interaction.* This argument is made by way of three research questions (1–3). Furthermore, Research Question 0 addresses cultural settings of my research site. To help the reader follow the discussion, I also provide a summary of my findings for each of the research questions below.

Research Question 1 The collocated computer-mediated communication system creates an additional "sphere" (i.e., layer or channel) for communication. However, we do not know how social interaction is regulated in the dual-sphere communication environment. *Are social rules different between the digital and physical sphere at a planned event?*

Finding 1 *The physical and digital spheres can differ in their social rules and, therefore, each can create an opportunity for particular behavior.* Furthermore, the social rules in the spheres are not separated but rather integrated, influencing each other. Hence, the social rules of the situation emerge as an aggregation of the rules and practices in both of the spheres and the spillovers mixing the spheres. Finally, the social rules in these spheres are not different from established interaction rules. They indicate that the hybrid interaction must account for rules of different spheres. This should be borne in mind when one explores the interaction.

Research Question 2 I have studied cases wherein hybrid interaction is used to support performance – cases of performative hybrid interaction. As is argued above, the performers have roles in these performances that they act out. From Research Question 1, the focus proceeds to the social rules in performative hybrid interaction. To understand performances in hybrid interaction, I ask "*what roles do performers have?*" and "*what actions are used to establish and maintain these roles?*"

Finding 2 There are spectators and performers in performative hybrid interaction. There are *four distinct roles for performers, based on their location ("onstage"/"offstage") and whether they can influence the flow of the performance.* Furthermore, *performers can use both physical ("onstage") and digital ("offstage") actions* to interact with spectators. These activities are not necessarily undertaken only to direct the participation; they may also add value for the digital sphere at planned events, because they communicate what type of participation the performer expects. Finally, the guidance can extend beyond the content and include directing the social rules in the hybrid interaction.

Research Question 3 Research Question 1 is focused on the social rules, and Research Question 2 highlights performers' work in this. In response to Research Question 2, I show that performers can determine and even enforce what takes place in the performance. This leads to the question of a normative setup for these systems and, thereby, this question: *does performative hybrid interaction support some normative positions more strongly than face-to-face interaction does?*

Finding 3 The results show that *the normative qualities of participation experienced* differ between face-to-face and hybrid interaction. Accordingly, I suggest that *the normative values of participation support the evaluation work*. Furthermore, a normative framework can be used for comprehending the social rules and their management. Finally, this opens significant questions with regard to how these values are chosen, particularly since the social rules can change in response to hybrid interaction. This reveals new opportunities to drive research into hybrid interaction on the basis of values and the role that technologies have in connection with values.

Research Question 0 Every social application reflects surrounding society – i.e., the socio-cultural context. Much of the prior research on performative hybrid interaction has been conducted in the United States. To aid in understanding what the socio-cultural differences are, I ask "*how does this study compare with studies from the United States?*"

Finding 0 Conducting a rigorous replication is difficult, given that previous work has not shared enough detail to elaborate the findings. A reading of the existing findings indicates that the only concept used in several works was the amount of unrelated content posted by the spectators. Even here, various terms, such as "spam," have been used, though all of those terms indicate that the content was not expected by the performers. I found that *the amount of unrelated content in my initial case study was similar to that in previous work* and hence allows further examination of this topic in this socio-cultural context.

The secondary aim in my research has been to demonstrate the utilization of *social theories for the design and evaluation of hybrid space applications*. Although a call for theories of social interaction may sound rather trivial, a survey has shown that 70% of communication technology papers published in social science journals did not present a clear theoretical background for the study (Borah, 2015). Borah (2015) has suggested that this is due partly to the exploratory nature of the research but still concluded that this impairs ability to further develop scholarship. Since social science publications often require a strong theory contribution also, the 70% figure is surprisingly large. Also in the realm of computer-supported collaborative work, calls for stronger theory have been made (e.g., Schmidt and Bannon, 2013; Wagenknecht et al., 2017). All the answers I offer to research questions 1–3 are backed by strong conceptualization from the social sciences, and I do my part to try to answer the calls made in human–computer interaction research.[3]

Using social theories, I will show the following:

- The social theories of interaction provide insights related to ways to improve the tools and practices applied for performative hybrid interaction.
- The social theories offer insights for further research, for both computer-supported collaboration and social sciences.

Furthermore, the theories used – addressing norms, social rules, performances, and values in design – provide insights on the main argument about performers' role in the performative hybrid interaction.

[3] However, this does not mean that the epistemological position is different from "bottom-up" research. Even a theory-driven framework does not mean that a deductive approach must be used. Theories can be used in an inductive manner too, wherein a theory-based hypothesis is not set first and the data are analyzed for initial understanding of the phenomena, before theories are used to conceptualize the findings.

1.3 The Author's Contribution

The work is based on four peer-reviewed and published articles (papers I, II, III, and IV) and one article in preparation for publication (Paper V). Since all articles have been written in collaboration, I will review the contributions of each author here.

Paper I The research idea emerged from collaboration among all authors. Matti Nelimarkka was responsible for data collection, analysis, and the writing of the first version of the manuscript. Kai Kuikkaniemi, Giulio Jacucci, and Matti Nelimarkka collaboratively revised the manuscript for publication.

Paper II The final formulation of the research idea emerged in collaboration with all authors, originating from an initial idea by Vilma Lehtinen. Kai Kuikkaniemi was responsible for data collection. Vilma Lehtinen conducted the initial data analysis (content classification) and the theory framing. Matti Nelimarkka conducted the further data analysis (statistical analysis) and revised the theory in keeping with the output from the statistical analysis. Antti Ukkonen provided support during the data analysis phase and contributed to the theory's revision. Giulio Jacucci reviewed and commented on the manuscript and engaged in discussions on the contribution of the article. All authors wrote the article, in collaboration.

Paper III The research idea was developed in collaboration by all authors. Kai Kuikkaniemi was responsible for the data collection and discussed the approaches to data analysis and the findings. Matti Nelimarkka helped with the data collection, especially for the in-depth case study. Matti Nelimarkka conducted the data analysis and wrote the first manuscript on the basis of the findings. Giulio Jacucci and Antti Salovaara reviewed and commented upon the manuscript and engaged in discussions about the contribution of the article.

Paper IV Matti Nelimarkka developed the research idea in collaboration with Antti Salovaara. Matti Nelimarkka conducted the data collection and analysis and wrote the first version of the manuscript. Antti Salovaara, Bryan Semaan, and Giulio Jacucci reviewed and commented on the manuscript and engaged in discussions on the contribution of the article.

Paper V Matti Nelimarkka conducted the data collection and the coding of the data. Matti Nelimarkka and Antti Salovaara analyzed the data with respect to publication. Matti Nelimarkka wrote the early drafts, which were revised with Antti Salovaara and Giulio Jacucci.

1.4 Structure of the Thesis

I have already presented the basic definitions employed for this thesis: I discussed the identity of the field and showed how my work continues the research approach therein. I moved beyond "same time, same place" by discussing hybridity and presenting two concepts, hybrid interaction and performative hybrid interaction. Through these terms, social settings – which are at the core of computer-supported cooperative work research – were brought to the fore.

Now that I have summarized the contributions of the thesis (the findings) and presented the individual papers, I can examine the subject matter in greater detail. In Chapter 2, I will review the existing tools that were used to create performative hybrid applications and the corresponding findings in the academic community. The purpose is to identify

Section 1.1	hybrid space		(de Souza e Silva, 2006)
	hybrid media consumption		(Maruyama et al., 2014)
	hybrid interaction	⋆	(Section 1.1)
	hybrid media system		(Chadwick et al., 2016)
	performative hybrid interaction	⋆	(Section 1.1)
Chapter 2	backchannel		(e.g., Du et al., 2009; Harry et al., 2009)
	audience response system		(e.g., Kay and Road, 2011; Caldwell, 2007)
	group support system		(e.g., Nunamaker et al., 1987, 1996)
	peer interaction		(e.g., Yardi, 2006)
	teacher–student interaction		(e.g., Kay and Road, 2011)
	public display of opinions		(e.g., Du et al., 2009; Harry et al., 2009)
Chapter 4	social rules		(Burns and Flam, 1987)
	social norms		(Lapinski, 2005)
	norm violation spillover	⋆	(Paper V)
Chapter 5	performer, as-performance		(Schechner, 2013; Kirby, 1987)
	integration work	⋆	(Paper III)
	extended performance	⋆	(Paper III)
	norm management	⋆	(Paper V)
Chapter 6	various models of democracy		(Dahlberg, 2011; Held, 2006)
	values and technology		(Nissenbaum, 2005)
	normative-theory-driven research	⋆	(Paper IV)

Table 1.2: The core concepts used in this thesis, where concepts contributed by this synopsis or the papers are marked with a ⋆ and concepts that originate from others' work are cited accordingly.

questions that remain unanswered by this literature (in Section 2.4) and provide a short overview of the existing work.

Then, I will articulate the research strategy I used. Although each paper presents the exact methods that were applied, at this juncture I can address the importance of conducting the research in situ and the challenges of such an environment. Furthermore, I will briefly elaborate upon the reasons my work uses mixed methods and the approaches that were employed for most of the papers. With these topics, not addressed in any of the papers, I provide an introduction to the methodological choices I and my co-authors made. Following this introduction, the research apparatus (Presemo) and the cases are discussed. I conclude the chapter by comparing the prior research to work in a different social setting (Finding 0).

Chapters 4, 5, and 6 each address one of the research questions, Research Question 1 in Chapter 4 and so on. They have been structured to address the related work on hybrid interaction in terms of the relevant research question. After the discussion, I elaborate on the social science concepts necessary for continuation of the narrative. With the groundwork laid in these two sections of each chapter, I reflect upon the empirical findings in the papers that support the answer I present for the research question and lead to the corresponding "Finding." Finally, each of these chapters ends with a discussion that examines the findings for human–computer interaction and social computing.

As outlined in Table 1.2, each of chapters 4, 5, and 6 makes its own distinct contribution to the thesis. This includes both using existing terms and relating them to the research context (cited in the table regarding the key literature that I discuss) and also applying

the novel terminology that I and my colleagues have introduced in our work to address the phenomena.

The conclusion (Chapter 7) summarizes the implications of the answers to the three main research questions for practices related to performative hybrid interaction. It also addresses topics that further systems could address and potential for research into performative hybrid interaction. I reflect on the potential to engage with the social science literature further and on contributions it could make. Also, I address the limitations of my work and then offer a final summary of the main contributions.

Chapter 2

Previous work on performative hybrid interaction

In this chapter, I will review the existing work on performative hybrid interaction. I provide an overview of research based applications that are performative and used in the "same time, same place" quadrant of the space–time matrix. Furthermore, I briefly review findings discussed with regard to these applications. The chapter provides an overview and motivation for the research questions by presenting possible gaps in the research. Chapters 4, 5, and 6 review the related work again, but they present it in a more detailed manner from the perspective of the respective chapter.

2.1 Prior Systems: An Overview

An early work from 1998 titled "Adding another communication channel to reality" (Rekimoto et al., 1998) explicitly calls out the technological opportunities to create hybrid spaces within a single space. This motivation continued with use of existing technologies, such as Internet Relay Chat (IRC), at conferences and in classrooms (McCarthy and {b}oyd, 2005; Yardi, 2006) and with development of new technologies for such purposes (Davis, 2007; Du et al., 2012b, 2009, 2012a). The systems also moved beyond a simple "communication space" as their developers sought to support tasks such as choosing and managing questions in collocation situations (Harry et al., 2009; Bergstrom et al., 2011) and further scaffolding participation (Baumgart and Pohl, 2011; Harry et al., 2012).

Although the aforementioned research addressed opportunities to use computer-mediated systems to share open-entry text and multimedia content, the focus in learning science has been on simple audience response tools. Unlike systems discussed above, the goal with audience response systems is to allow the audience to vote on a given set of options and show those responses to participants. Because audience response systems have been used extensively in education, reviews of them exist (e.g., Kay and LeSage, 2009; Caldwell, 2007). These reviews highlight several ways to configure the system in line with the needs of the performers (Caldwell, 2007).

Finally, performative hybrid interaction is one domain in the larger domain of hybrid interaction. For example, group support systems have been focused to improve collaboration via using both computer-mediated and physical interaction. Therefore, this is hybrid use (e.g., Nunamaker et al., 1996). Similarly, supporting social interaction in collocated entertainment-focused activities, such as events at bars (e.g., Lucero et al., 2012b) and concerts (e.g., Jacucci et al., 2007), demonstrates use of hybrid interaction. Both of these efforts include the core component of hybrid interaction: merging physical and digital activities.

The difference between performative hybrid interactions systems (studied in this work) and the wider domain of hybrid interaction applications is related to the distribution of power and roles. I study cases in which the participants are not equal but have roles and – therefore – expectations related to behavior (I will extend this line of thought further in Chapter 5). The roles make performative hybrid interaction different from a group support system and social interaction support applications, in which participants are more equal.

2.2 Current Hybrid Interaction Tools' Aims and Users

The majority of these systems have been used for educational purposes, to support interaction within classrooms. These include systems that are intended to support solely peer interaction (Yardi, 2006) and teacher–student interaction (Bergstrom et al., 2011; Kay and LeSage, 2009), as well as applications supporting shared display of opinions and viewpoints within the classroom (Du et al., 2012b, 2009, 2012a; Harry et al., 2012). Another use case has been supporting interaction at conferences or other types of organized gatherings. Again, the focus is on the peer interaction (McCarthy and {b}oyd, 2005), or allowing the public display of opinions (Harry et al., 2009; Rekimoto et al., 1998).

Based on qualitative observations, systems with open-text input (e.g., chat-type interfaces) are used to make comments about the ongoing activities (Du et al., 2012b; McCarthy and {b}oyd, 2005), ask questions and request clarifications about the content (Du et al., 2012b; McCarthy and {b}oyd, 2005), provide information additional to that given by the presenter (Du et al., 2012b; McCarthy and {b}oyd, 2005), suggest improvements on the organization of the event (Du et al., 2012b) or coordinate these activities (McCarthy and {b}oyd, 2005), engage in discussion of topical issues (Du et al., 2012b), or pursue social purposes (Du et al., 2012b).

Although the aims behind using systems with open-text input have been less explicitly stated (these are addressed in our work in Paper III), audience response systems are used in education environments to increase interaction within the classroom, guide students' thinking and review key content, assess students, gain more information about students, and make classes more engaging to attend (according to a review by Caldwell, 2007).

Finally, previous research has discussed the use of roles and it is evident already from the review discussed above. It can be stated explicitly: there are two user roles within these systems, those who use them to participate, comment, and react to the performance and those performing. The former are *spectators*, those not having a responsibility for the performance, such as the students in the classroom or the audience of a panel discussion. The latter are *performers*, who are responsible for creating and maintaining the performance, such as the teachers or the panelists. However, the distinction is not naturally this clear. Researchers have spoken also about technical personnel who are there to ensure that the mediated communication behaves correctly (e.g., Harry et al., 2009). Taking these developments into account, we have shown that performers can also be offstage and focus solely on managing the mediated communication system. I will further elaborate upon the notation related to roles and performances in Chapter 5.

2.3 The Impact of Hybrid Interaction in Events

Performative hybrid interaction has been shown to transform inactive spectators into active contributors during events (Du et al., 2009; Kay and LeSage, 2009), increase participation in events because it affords (among other elements) anonymity (Harry et al., 2012), support the event flow by providing a non-interruptive avenue for contributions (Harry et al., 2009; McCarthy and {b}oyd, 2005), and support peer interaction and learning (Yardi, 2006). Furthermore, the use of performative hybrid interaction tools – audience response systems

in particular – has been shown to increase attendance, attention, and engagement (Kay and LeSage, 2009; Caldwell, 2007). These benefits lead to higher-quality learning (Kay and LeSage, 2009).

Although the presentation above seems rather positive, it is clear that performative hybrid interaction tools can also create disruptions to the performance. There can be various unexpected and even antisocial behaviors, including spamming and even bullying (Harry et al., 2009; Bergstrom et al., 2011; Du et al., 2009), as are further examined in Section 3.8. Furthermore, users might find it difficult to share their attention between digital communication and verbal communication (McCarthy and {b}oyd, 2005). Surprisingly, this literature has not directed any attention to performers' experiences in this regard.

2.4 Open Questions

As shown above, previous systems have had static functionality: they only allow members of the audience to ask questions (Harry et al., 2009; Bergstrom et al., 2011), answer predefined questions (Kay and LeSage, 2009; Caldwell, 2007), or engage in peer interaction (Yardi, 2006; McCarthy and {b}oyd, 2005). However, our research group (particularly, in the work by Kai Kuikkaniemi and me) has examined whether it is possible to extend them. Developers of performative hybrid interaction seek opportunities to develop these systems from one static form of participation into a dynamic multipurpose system. My colleagues and I challenge this position and provide an alternative view of hybrid interaction.

My second observations is related to case-study-driven research and the scattered nature of the research it entails. Even the research on audience response systems – which has higher volume and more reviews – lacks systematic observations (Caldwell, 2007). This is not surprising, since even more social-science-oriented research on new communication technologies lacks a proper theoretical framing (Borah, 2015). Through research questions 1–3, this thesis is an attempt to develop a more theoretically grounded perspective on performative hybrid interaction. Proceeding from these two observations and the review presented above, I argue that there are the following three open questions that can help us shed light on the social dimensions and practices emerging in hybrid interaction.

The first open question has to do with *behavior in hybrid interaction*. What governs the interaction? The existing research can, to some degree, tell us how participants interact via the computer-mediated communication channel. I showed this above by reviewing classifications of messages in previous work. However, these classifications do not help us to further understand why particular patterns emerge in the interaction. This type of understanding would aid significantly with efforts such as reducing antisocial behavior in hybrid interaction situations. Through Research Question 1, I contribute to extending the state of the art by providing insight into the social rules in hybrid interaction.

The second open question is related to the lack of understanding of *how these systems can be used to guide participation towards given goals*. As indicated above, previous work on open-ended systems has shown a fairly good understanding of what type of participation emerges during the event, yet that work does not address what the goal behind the system setup was. More focus is on audience response systems. Via Research Question 2, I will develop the performative conceptualization of hybrid interaction and examine what factors ensure hybrid interaction that is directed as desired.

Finally, the biggest challenge with the existing work is connected with lack of evaluation of these systems. In most cases, the question of "success" has not been addressed at all. In papers where evaluation is provided, the authors do not present more extensive elaboration. They confine themselves to partial-level insights into the phenomena. Via Research Question 3, I highlight the potential of normative frameworks from political science to support the evaluation and extend work on the use of normative frameworks, with the aim of taking the field further.

Chapter 3

Research strategy

The research I have conducted used a mixed set of data sources: (a) observations, (b) video recordings, (c) interviews, (d) surveys, and (e) digital-trace data. On account of the versatility of the data and methods, the work for the papers connected with this thesis applied *mixed-methods* research. That means that throughout the papers we report on combinations of quantitative and qualitative approaches. The work is situated within a *data-driven research paradigm* (Kitchin, 2014). With this paradigm, exploratory methods and confirmatory methods are used together to answer the research questions, and the research process is iterative. Each paper presents the methods that are used in the particular work reported upon more explicitly. I will also provide a short summary of the data sources and methods, in Table 3.3.

In this chapter, I address research strategy – that is, higher-level methodological considerations driving the work as a whole. I first discuss why I have chosen to use in-situ setups (Section 3.1); outline my steps from classical observation studies towards experimenting with the social groups (Section 3.2); and, finally, comment on why I have used a mixed-methods approach (Section 3.3). After this, I present the system that is used in these studies (Presemo), in Section 3.4, and the cases the work builds on, in Section 3.5, and I address the ethics aspects of my work in Section 3.6. Finally, I discuss the impact of cultural factors with regard to this research, in Section 3.8.

3.1 Studying *In-Situ* Activities

A highly significant decision for my research was the choice to study the application in its natural use context, such as that of panels or education events (see Table 3.1 for description of these). Studies of this type, which are known as *field studies*,[1] have been widely debated within HCI and from a methodological standpoint (among others, see these works: Brown et al., 2011; Rogers, 2011; Johnson et al., 2012). Rogers (2011) has gone so far as to argue for the development of "wild theories." For her, wild theories are abstracted from field studies in combination with existing theories and via development of further theoretical insights. She characterized the aim of this research agenda as being to move beyond usability laboratories and understand use beyond the desktop. The wild theories describe technology use and interaction in a "natural environment," among people and in their day-to-day life – with all the interruptions this entails. While wild theories, therefore, are different from, for example, traditional predictive theories, they provide insights that aid in designing for the messy reality. The thesis overall and the findings presented here are focused on this call: I have aimed for several papers that develop new perspectives to

[1] I have chosen to use this articulation instead of *action research* because none of the studies follow the formal process of action research. In particular, we do not have feedback loops within the case studies; the research has always taken place after the empirical data collection.

help us understand; evaluate; and, ultimately, design for collocated interaction in planned events hybrid setups.

However, "wild methods" have raised methodological and reporting concerns. Brown et al. (2011) have called for more honest reporting of field studies' outcomes and encouraging, for example, more explicit reporting of failures. Furthermore, they suggested that replication is not a crucial part of in-the-wild studies, and they would rather embrace the importance of researchers' involvement and other situational factors in studies. Although I agree with Brown et al. (2011) on the complex social setup that exists when applications are studied in the wild, I do think replication of in-the-wild studies is vital too. Only through replication can the concepts be evaluated in a critical manner. This does, however, require the findings to be evolved to a suitable level of abstraction for wild theories and demands emphasis, for example, on concepts that assist in describing the phenomenon. Replications, therefore, should focus not on exact findings but on success related to these abstracted observations in contexts beyond the initial study. In this thesis, I will articulate such concepts and frame the research through theory's lenses to support the appropriate level of abstraction.

The call for study of in-situ activities has been made beyond the in-the-wild movement. Kurvinen et al. (2008) argued that social applications combining humans and technology ought to be studied in social situations. That is why computer-supported collaboration systems have a long history of using field methods. As Schmidt (2009) argued, this is the essence of traditional work in the computer-supported collaborative work domain; he stated that "in-depth studies of cooperative work 'in the wild' were considered a prerequisite for developing computer technologies for human interaction." This observation is still valid today. Many modern studies have examined social interaction through a field-trial setup. The studies we examined in Chapter 2, by Yardi (2006); Bergstrom et al. (2011); Du et al. (2012b, 2009, 2012a); Harry et al. (2012); McCarthy and {b}oyd (2005); Harry et al. (2009); Rekimoto et al. (1998), employ setups of this type. Following this tradition of computer-supported cooperative work and the call for wild theories, all research presented in this thesis is based on field studies and is, therefore, in-situ.

3.2 Conducting Experiments with Social Applications

Methodologically, the main challenge of in-situ studies is lack of control. There have been calls to conduct *field trials* to increase the control in traditional in-situ studies (Oulasvirta, 2012). For example, in group situations, it is hard to separate the effects of the technology from social and contextual factors. To illustrate these challenges, we consider the study by Du et al. (2012a), who claimed that their technology increased the sense of community among the students who used it in the classroom. They presented evidence of the sense-of-community measurements (Rovai, 2002; Peterson et al., 2008) before, during, and after the classes where the technology was used. Seeing an increase in these measurements, they attributed this to the technology. Naturally, it might be plausible that a sense of community in any class increases with the number of times the group gathers. The researchers would have needed to compare these effects to those seen with a class not using the technology if wishing to evaluate its true success in terms of increasing the feeling of community.

After this criticism of a single case, I must acknowledge that experiments with social groups are difficult. For example, formal field studies are rarely used in political science, because of the unclear causality structures, coupled with general unfamiliarity with experimental setups and the practicalities of running such experiments (Green and Gerber, 2003). However, when successful, they provide information which can be applied and has high value for practitioners (e.g., used for policy development; see, Green and Gerber, 2003; Stoker, 2010), thereby creating more need for such experimental setups. In my view,

the challenges are related to several contextual and social factors that make a proper experimental setup difficult to achieve. Naturally, with large user populations, such effects are reduced by randomization, so causal claims are possible (Green and Gerber, 2003), but when our unit of analysis is a group, the number of groups needed for ensuring such randomization is large. Although there are interesting examples of research-at-large studies (e.g., McMillan et al., 2010), wherein a system is deployed to a large number of users in settings "in the wild," our mixed analysis approaches (see Section 3.3) did not allow for this scale of procedures.

To illustrate the challenges of experimental research, I will describe a failure of pilot studies during my work. I tried a setup in which two distinct interfaces were served to users; half were served interface A and half received interface B. This followed the common approach for conducting an A/B study but did not work as I had hoped. The participants saw that others had a different interface and, therefore, assumed the system to be broken. Such forms of between-subjects designs that would still factor in most of the interesting social settings seemed difficult to implement. Accordingly, the experimental setups were focused on within-subjects designs instead. In these settings, we subjected the same participants to multiple experimental conditions. Of the works presented in this thesis, papers V and IV present such experimental variation. For Paper IV, students discussed the assigned homework, alternating between using hybrid interaction tools for this and using traditional face-to-face interaction. Through this procedure, we examined the difference between hybrid and face-to-face interaction. For Paper V, switching between anonymous and non-anonymous conditions was performed at one-month intervals. Our study focused on the assumed differences between anonymous and non-anonymous conditions, but we did not actually find any. These setups respond to the calls that were made to have some controls in place to examine the field setups. They also provided access to previously understudied questions surrounding the impacts of hybrid interaction in the context of group work.

3.3 The Mixed-Methods Approach

The aforementioned list of data sources shows that the work used a variety of data sources and analysis methods to consider the research questions. Instead of using methods separately, I have used mixed methods to answer the research questions. I chose to use *triangulation* to ensure correct interpretation of the data. This motivation has been behind many calls for more triangulation in research (for example, on audience response systems; see Kay and LeSage, 2009) In triangulation, the research question is answered by using several data sources and methods that either provide additional support or challenge one's findings. For example, in the work presented in Paper V, analysis based on reviews of video recordings suggested that a teacher moved about in the classroom to monitor students. Our additional interviews with the pupils gave additional support to this interpretation, but the interviews with the teachers called this analysis into question. This anecdotal demonstration shows the benefits of using several data sources if one is to understand social interaction correctly. Similarly, scholars such as Jordan and Henderson (1995) recommend that video-based interaction analysis take place in "video review sessions" where study participants talk and explain what happens in the video. The interviews served a similar purpose. The high number of participants and length of the video recordings made use of the interviews a more suitable approach.

Although mixed methods and triangulation are widely promoted, less is said about how such triangulation is conducted. For example, "big-data-augmented ethnography" (see Laaksonen et al., 2017, co-authored by me) suggests an iterative research process. In this form of iterative process, the researchers can change the methodological approach to

gain additional insights and inform further inquiries on that basis, although the reporting on the research is often more explicit and narrow. Even in demonstration work (Laaksonen et al., 2017) that separates between the ethnographic and computational observations, the research process has had this type of iterative nature. For example, in the case of Paper IV, the finding that, while similar levels of respect were shown according to the survey conducted, students' open-ended responses did not explicitly support the survey responses, which led to further examination of the discussion content via quantitative and qualitative measurements. This research was driven by qualitative analysis and supported through further quantitative analysis, which then also allowed the qualitative work to home in on particular aspects. Using this process, we were able to show the forms in which respect was indicated and, thereby, uncover and work with students' qualitative observations that were not fully captured through the survey.

3.4 The Presemo System

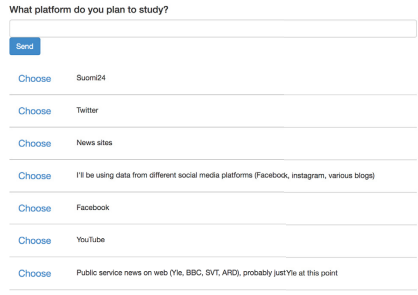
The Presemo system – which we used in the studies – supports performative hybrid interaction. It is used by the performers and spectators at planned events and improves their interaction by providing a computer-mediated communication channel to support the performance. It allows various modes of interaction, such as free-form text interaction and polls, and permits changing the interaction mode during the performance.

The Presemo system is used via a Web browser (including those on smartphones and other high-end mobile devices with a modern mobile browser). The Presemo system contains one or more interactive blocks and has four interfaces to show these blocks to spectators and performers. The choice to use a Web browser also allows each of these interfaces to have more than one device connected to it, thus making it possible to, for example, distribute control of the performance via the performer interfaces.

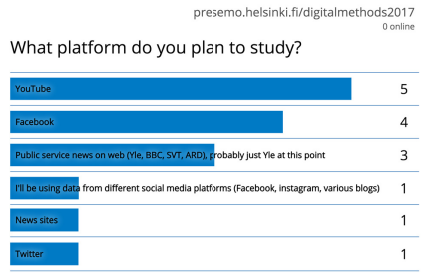
The four interfaces reflect the diverse needs that events have – in particular, to support performer and audience roles (Kuikkaniemi, 2017). The spectators use the participant interface (see Figure 3.1a) to view and participate in the digital activities, the public interface (see Figure 3.1b) is used to show the Presemo content to everyone in the space (e.g., via a data projector or television screen) and limits the display to only one block at a time, and the performers use their interfaces (see Figure 3.1c and Figure 3.1d) to manage the content shown via the other interfaces. The two separate performer interfaces provide various abilities to conduct this management; in particular, the first one can be used to create, show, and hide interactive blocks, whereas the second does not allow for such functionality.

The Presemo system has three individual interaction modes, allowing for various levels of spectator participation and engagement. The simplest form of interaction is the poll interface (see Figure 3.2a), in which the spectators choose from a preset list of options and votes are shown in a bar chart on the public displays. A variation of this is the voting interface (see Figure 3.2b), where the spectators can propose alternatives for voting and vote from among them. The most advanced form of interaction is enabled via the chat interface (in Figure 3.2c), where the spectators have an opportunity to provide any textual response they would like and the interaction is not limited to voting. Since the chat interface allows the most free-form participation, it is the component of primary interest for my research.

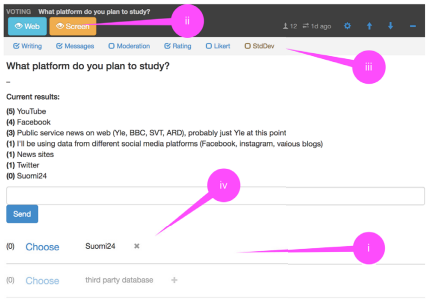
Each of these interfaces can be initialized to one or more blocks. Each block is a separate instance of the interface and can have its own title and content shown. Also, each block can be shown to and hidden from the spectators by means of the management interface, and the content within the block can be managed. For example, in the chat blocks, a particular message can be deleted or be highlighted (shown more prominently in



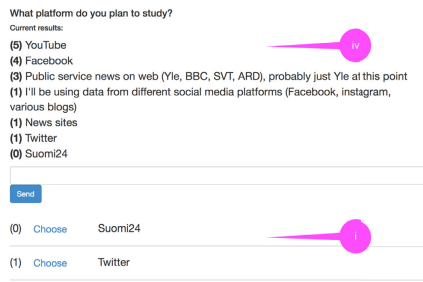
(a) Spectator interface, outlined in more detail in Figure 3.2.



(b) Public interface, which shows one block at a time.



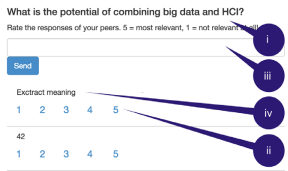
(c) Control interface: showing user-created content (i) and managing block visibility (ii), actions (iii) and user-created content management (iv).



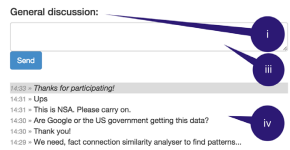
(d) Control interface: showing user-created content (i) and addressing user-created content (iv).

Figure 3.1: Presemo user interfaces and their role-specific interfaces.

(a) Poll block.



(b) Voting block.



(c) Chat block.

Figure 3.2: Presemo user interfaces' interactive blocks.

the public interface). The system lets more than one block be used at a time, allowing for the creation of two or more distinct blocks for participation that are available for spectators simultaneously.

The Presemo system was developed by the Digital Content Communities research group at Helsinki Institute for Information Technology. It has been released under the GNU Affero GPL and is available on GitHub, at `https://github.com/HIIT/presemo`. I have used the system as-is or implemented minor modifications to the interface (such as to allow the threading of messages) and discussed the designs and opportunities with the lead designer, also conducting research with him (for details, see his thesis: Kuikkaniemi, 2017). My main contribution is not to development of the system but to studies of its use.

3.5 The Instances Studied

The work is based on studies of 14 instances, mostly from various types of gatherings, with presentations or panel discussions and in the field of education (see Table 3.1). These instances originate from various sources, which explains the methodological differences between them.

I set up four instances (I, Va and Vb, and IV) to conduct research. With some instances, we had more control and agreement from the participants, and instances Va and Vb and IV used an experimental setup to conduct comparative studies. The initial study (I), in contrast, was an ordinary field study. The research group was involved in designing and implementing instances IIIa, IIId, and IIIf. I was involved in the planning and implementation of these instances.

Finally, seven instances emerged without extensive involvement from our research team. Instances IIc, IIIh, and IIIe were available to us because Presemo was in commercial use at the University of Helsinki and Aalto University and some teachers and presenters allowed us to examine how they used it. We did not participate extensively in the design of these instances. Instances IIa and IIb, IIIb, and IIIc were available to us since the Presemo technology was commercialized and employed by the company in these instances. The company was involved also in the designing of these instances in line with its best practices at the time.

Not only was the researchers' participation varied, but also the level of freedom and open-endedness differed among the instances in which the researchers participated. Instances I, Va, and Vb were open-ended, focusing on making technology available to the group and examining how it is used. In contrast, instances IIIa and IV were more closed-ended: the research had pre-articulated assumptions or goals and could be claimed to "verify" a theory. Instances IIId and IIIf were used to examine various patterns of use, but in our work, they were used to demonstrate several orchestration opportunities. Finally, I must stress that even the instances in which the researchers brought in the technology and designed the setups themselves were within an existing social context and, therefore, were in situ and in the wild.

ID	Description	Domain
I	An elementary school class (students were 12–13 years old) used Presemo for one month as instructed by the teacher. The teacher chose to use topics such as puberty and changes in one's body, opinions on energy consumption and renewable energy, and experiences and opinions from a book author's visit, all of which reflected the curriculum for that age band.	Education
IIa	Discussion centered on the development of immigration policy, especially the possibilities and challenges related to it. This included experts' and policy presentations followed by a discussion.	Presentations and discussion
IIb	A panel discussed how the city could support entrepreneurship and examine trends in the future of entrepreneurship. The event included a panel discussion with short introductory presentations examining these topics.	Panel discussion
IIc	Future challenges facing education development at the university were discussed and explored. Participants involved teachers and staff members from several departments at the university.	Presentations and panel discussion
IIIa	An academic panel discussion was held on big data in HCI research. Panelists presented their work on the topic, after which audience members and panelists (and, through Presemo, the whole audience) discussed the opportunities and challenges together.	Panel and other discussion
IIIb	The case involved a marketing festival for sharing the latest news related to trends in information technology and marketing with corporations' representatives.	Presentation
IIIc	A strategy meeting was held to discuss current and future trends in mobility with the organization's staff and external stakeholders, in connection with the organization's strategy work.	Presentation and discussion
IIId	At a state-of-the-art presentation and industry gathering, the latest information on industrial Internet development was shared. One aim was to understand how various members of the relevant association discussed how they apply industrial Internet thinking in their organization. Presemo questions were used extensively to collect facts from participants, which were then examined during the event and after it.	Presentation and discussion
IIIe	At an annual meeting of academic personnel, the future of the research institute and of university support services were presented. The first presenter asked to be interrupted during his presentation, but the second and third presenters preferred to answer questions at the end of their presentations.	Presentations and meeting
IIIf	A panel discussion and other discussion examined the future of work. The participants were a group of lead users taking part in a seminar on the future of work. The presenters asked questions and commented on the results as their performance.	Presentations
IIIg	A single class was observed during the semester via the instance Va.	Education
IIIh	A university lecture focused on techniques for promoting good oral hygiene.	Education

Continues on next page

Table 3.1 – continued from previous page

ID	Description	Domain
IV	In six university classes, Presemo was used to supplement and partially replace face-to-face interaction in discussion of academic papers and to understand their core messages.	Education
Va	elementary school classes used Presemo for one semester to supplement interaction during teaching. The teacher chose the topics for which Presemo was used and set up Presemo interaction blocks based on those settings.	Education
Vb	elementary school classes used Presemo for one semester to supplement interaction during teaching. The teacher chose the topics for which Presemo was used and set up Presemo interaction blocks based on those settings.	Education

Table 3.1: Description of the instances studied.

3.6 Research Ethics

Currently, questions of research ethics of social computing are being debated in big data research. The ethics debates have focused, for example, on the lack of consent and awareness of participating in research as well as data availability in big data research (among others, boyd and Crawford, 2012). However, these issues highlight the importance of ethical research conduct in all studies. In my research, the ethics questions are less ambiguous, mostly since the data collection is less extensive than that with automated data collection. Therefore, applying the principles of informed consent is sufficient. We do not cause physical harm to the subjects, cause long-term mental harm, or do anything of that sort; the research is of minimal risk and follows established practices (National Advisory Board on Research Ethics, 2009). Accordingly, whenever the group of participants could be identified, written informed consent was used as the primary ethical approach. When we studied minors, this was part of school activities, where informed consent is sufficient for study (National Advisory Board on Research Ethics, 2009). Since some participants were minors, informed consent was requested from both the participating children and their parents, in keeping with international best practices (e.g., Robinson and Schulz, 2013; Byrne et al., 2013).

Instances I, IIIh, IV, Va, and Vb used explicit informed consent. In instances IIIa, IIId, IIIe, and IIIf, the participants were informed about the data collection verbally and via other means. Explicit informed consent was not possible, since the participant pool was not fixed and could, for example, change during the course of the event.

The rest of the instances did not involve explicit or implicit informed consent from the participants. In these instances (IIa, IIb, IIc, IIIb, and IIIc), we asked permission to analyze the data and limited the use of personally identifying information from our analysis. Therefore, we analyzed only content that was visible to all participants at these public events.

Finally, ethics is more than consent and can be considered as a process (e.g., Markham and Buchanan, 2012; Brown et al., 2016). It is focused on harming neither the research subjects nor their communities or events that protect them (e.g., Markham and Buchanan, 2012). In consideration of these factors, in my research and the papers presented here, we have aimed not to identify participants. Instead, we have used anonymous contributions only. The system and users' interaction were designed to be non-coercive and not used against those participating – e.g., in terms of evaluating each pupil's contributions during

Research Question 0	Paper I
Research Question 1	Papers II, III, and V
Research Question 2	Papers III and V
Research Question 3	Paper IV

Table 3.2: Research questions and the contributing papers.

educational uses. Therefore, I believe the participation to have posed minimal risk to participants, and I am not aware of any harm caused by this research.

3.7 Summary of the Publications

As Table 3.2 shows, some publications address more than one research question. Therefore, I have chosen not to summarize the work done in each of the publications in the thesis itself accordingly; the papers are appended and form a holistic entity. However, at this juncture, I will summarize the data collection and analysis strategies used (see Table 3.3), along with the core findings presented in each of the papers, to help the reader situate the work further.

Paper I reports on a small, one-class field trial of the Presemo system at an elementary school. The focus of this study was on open-ended understanding of what happens when Presemo is used in the classroom context and what is done there. In more precise terms, the paper discusses the impact of anonymity on message content and how pupils experienced the Presemo system. The main finding was that anonymity should not be considered harmful; rather, it supported self-expression in a tight and small social group. Furthermore, the level of harmful effects of anonymity – i.e., of spam-like content – was on par with that found in prior research.

Paper II covers a three-instance study of the messaging patterns in Presemo chats and focuses on understanding any patterns that might emerge. We conducted Interaction Process Analysis (IPA, see Bales, 1950) to examine the forms of interaction in conversation threads. After that, we analyzed how the message sequences are built and observed that there are clear state transitions; a message from a given IPA category is most likely to be followed by a response of the same type. We concluded, therefore, that participants followed some patterns in these conversations or that there are certain overall social rules that govern this interaction.

Paper III considers eight Presemo instances and how performers decided to use the tools involved. One of the instances was chosen for detailed analysis (IIIa): detailed video analysis and interviews with performers and spectators were conducted. This revealed integration work, activities that performers conduct to ensure that Presemo is part of the physical performance and extended performance, with the idea that Presemo was used to support the physical performance. The studies of all eight instances focused on episodes: the various types of means of using Presemo and how performers often chose to present via one means for only a limited period of time. The analysis of the means showed how Presemo afforded different configurations of performers' and spectators' roles in control and initiations.

Paper IV explores how Presemo participation differed from face-to-face participation in the classroom. To this end, we carried out an experimental study wherein a class used both Presemo and face-to-face approaches to discuss a paper. The analysis applied the theory of the public sphere (Dahlberg, 2001; Dryzek, 2002; Habermas,

Research Question Paper(s)	0 I	1 II III V	2 III V	3 IV
Spectator interviews	✓	✓	✓	
Performer interviews		✓	✓	
Presemo data	✓	✓	✓	✓
Surveys	✓			✓
Video recordings		✓	✓	✓
Thematic classification	✓	✓	✓	
Codebook classification	✓	✓		✓
Descriptive statistics	✓			
Statistical analysis		✓		✓
Experimental setup				✓
Log analysis	✓	✓	✓	

Table 3.3: Data and methods, research questions, and papers.

1989; Held, 2006) for understanding how the communication spaces are different in classroom discussion. Presemo was found to be more inclusive for participation, no differences were found in the respectfulness of the discussion, and face-to-face interaction was found to be supported by claims and arguments. Furthermore, the paper discusses the normative aspects of using Presemo and the values that are encoded – by the performer – in the system.

Paper V examines the norm violations and norm management in an elementary school class. The setting was a field experiment in which the impact of anonymity was studied in terms of norm violations. The findings reveal that the norms with Presemo-supported communication settings are different from those of pure computer-mediated communications (since the anonymity did not have an impact on the number of norm violations). Therefore, the focus shifted to examining the norm violations and how they are created, and a conceptual model was developed. The conceptual model informed us about norm violation spillovers, showing how norm violations travel from one channel to another channel. Similarly, the study of teachers' norm management showed how an imbalance of presence in these channels emerged. This might explain the existence of norm violations.

As Table 3.3 summarizes and as discussed in Section 3.3, the insights described above were gained via both quantitative and qualitative methods. For me, the contributions of the papers lie in the ability to engage with existing theories and frameworks through the papers. The resulting engagement work is done mainly in this thesis, not the papers. The brief characterizations of the papers above suffice to provide overall context and explication of how the ideas have emerged and the way they are backed by evidence. I will continue making explicit references to the papers below as I discuss specific evidence or ideas presented in them.

3.8 Impact of the Research Context: A Replication

In response to the replication crisis, scientists have called for more replication research. This includes the human–computer interaction field (e.g., Wilson et al., 2012). This is particularly critical for examining social applications, since there can be various cultural

and other contextual factors that affect the use of the application (e.g., Sassen, 2002; Sturm et al., 2015; Reinecke et al., 2013).

In our case, the differences may stem from the participants and the Finnish cultural context. Some of the studies entail experiments with children, who are still learning the skills and practices of technology use (Livingstone et al., 2011). Therefore, they might not have full experience related to, for example, the social rules in mediated interactions. Finally, Finnish society (as is society in other Nordic countries) is characterized by high social trust and social capital and by equality (Castells and Himanen, 2002). This might create increased trust between people and promote pro-social behavior.

As Chapter 2 discussed, the work within this domain has been scattered across various themes. However, the one aspect dealt with in several works – even while operationalized in various, inconsistent ways – is that observation has focused on off-task messaging, or "spamming" the system with irrelevant content. Du et al. (2009) studied college students in the United States and reported that unrelated content constituted 19% of messages in the system. Similarly, Bergstrom et al. (2011) studied US college students, observing that 43% of messages were off-topic. While the two studies show a difference of 24 percentage points – most likely attributable to different ways to classify content as irrelevant – they offer some baseline of what might be seen.

Paper I examines how Finnish elementary students used Presemo over a one-month period under the guidance of their teacher (see Table 3.1's Instance I for further details). We classified the content by using definitions similar to those in previous work and found unrelated, off-topic content in the case of 26% of messages. This figure is marginally higher than the lowest observed (19%, by Du et al., 2009) but is clearly below the highest seen (the 43% of Bergstrom et al., 2011).

I find that this evidence indicates that the study context – even with elementary school students – does not produce results different from United States counterparts'. However, this replication study did not extensively explore variations in, for instance, the social settings of the study. Additionally, other indicators could also be used in replication studies beyond the measurement of unrelated content. Yet this was the only measurement reported in more than a single paper in the body of literature. Therefore, this is the best that can be done with the existing body of literature.

The work presented in Paper I was an early attempt to reflect on the social and contextual factors related to hybrid interaction. It seems that indicative evidence allows us to say that there are no obvious social and contextual factors that might bias the findings, for our study came to conclusions similar to those in earlier work in this domain. Hence, I argue that our work here can tie in with the previous literature and, thereby, allow us to move forward with theoretical work.

Chapter 4

Social rules in the hybrid space

With Finding 1, I argue that hybrid spaces create interaction layers with different social rules. To support this claim here, I must first present the social rules – the customs, codes, norms, and so on that are socially produced and regulate social interaction (Burns and Flam, 1987), in both spheres. I do so by examining social norms (Paper V) and interaction patterns in hybrid space (see Paper II). I will first review earlier observations on hybrid spaces; I will then conduct a sociological exploration of social rules and end by presenting the empirical work on this topic.

4.1 Related Work

Many authors within the field of human–computer interaction have aimed to study collocated settings — those settings where digital and other communication layers are used together (e.g., Harry et al., 2009; Du et al., 2009; Lee and Tatar, 2014; Rodríguez-Triana et al., 2016). In Section 1.1, I discussed hybrid spaces to frame the context of this work. Although the link to the hybrid space and to prior literature on it is a novel contribution, I am not the first to argue that physical and digital communication have merged.

To understand the merging of physical and digital communication, Lee and Tatar (2014) examined collaborative problem-solving using digital tools in collocated settings to understand merger of physical and digital communication. They distinguished among the social space (face-to-face interaction), the digital space (problem-solving and mediated interaction), and each individual's cognitive space (mental processing). Therefore, the problem-solving takes place in *triple space* as the three distinct spaces merge. Lee and Tatar then demonstrated that the social space was used to supplement interaction (i.e., the participants engaged in verbal discussions while aiming to perform the task that was given to them).

Unlike Lee and Tatar (2014), Rodríguez-Triana et al. (2016) identified two channels when examining the use of social media in collocated classrooms. Their focus was on the type of interactions that both the face-to-face and social media interaction afforded, counting the interactions between the performers (teachers) and the spectators (students) and within each of these groups. Their analysis revealed that face-to-face interaction was dominated by performer-to-spectator communication (90.4% of the time) and that the social media channel was focused on spectator-to-spectator communication (94.1% of the messages). Therefore, they concluded that the social media interaction complemented the face-to-face interaction.

Regrettably, the two works discussed above used slightly different terms to explain the use of multiple interaction spheres. The two works nonetheless establish ideas related to the same phenomenon – interactions that take place both in a computer-mediated manner and in a face-to-face manner in collocated settings. In this thesis, I have called

this *hybrid interaction* that takes place in *hybrid space*. The above-cited authors are not the only ones to have used other terms to describe such phenomena. Even our work has used several concepts – dual-sphere interaction (see Paper V) and the performance and extended performance (see Paper III) – to address this phenomenon. This fragmentation of the terms used poses challenges for the further elaboration of these settings. For example, it becomes more difficult to identify factors related to the context of use. To illustrate, the idea of triple space may be most suitable for explorations of dyadic communication, whereas the performance and extended performance may be best suited to presentation situations. The dual-sphere interaction in the hybrid space seems to be the most generalized form; although it does not include all the functions in this literature, it does capture the essence of the interaction.

Researchers have acknowledged the existence of several communication channels layers (or *spheres*, as we call them in this thesis). So the creation of a hybrid space – an interaction situation that utilizes more than one sphere – leads to a natural question with respect to the types of interaction in these spheres. As presented in Section 2, prior research describes what kind of communication takes place in the digital sphere and how it occurs. To understand the interaction in the physical sphere, for Paper III we explored how presenters interacted with the digital sphere – that is, how they used verbal remarks about the digital sphere and looked at the public display that was showing the digital sphere. This allowed us to go beyond the digital sphere in our research into communication and interaction in the hybrid space. However, when examining these findings, we observed that the social rules in the hybrid spaces have not been further described.

4.2 Theoretical Background

Social rules theory and group norms combine to provide a framework through which one can explore the rules of interaction in the hybrid space and thus provide the supportive theoretical apparatus for Research Question 1. Here, a group is "two or more people [who] define themselves as members of [the group] when the existence [of the group] is recognized by at least one other" (Brown, 2000, 3). Furthermore, each group has some norms (or social rules) "governing transactions among agents"; that is, these rules condition – but do not determine – the emerging interaction in a social situation. In fact, these rules formulate the grammar that allows the interaction to emerge (Burns and Flam, 1987, 8, 13–14). These rules are present also in small-group interactions, but they are less studied within mainstream social rules theory, for which researchers have focused on the societal level of rules (Burns and Flam, 1987, 31–32). Therefore, to understand the social rules in the hybrid space, we apply the idea of social rules theory but link it with the group processes to relate it to smaller entities, such as classrooms.

Group processes focus on, for instance, group membership, interaction within the group, the group norms, the roles and statuses, and social influence in groups (e.g., Brown, 2000). In our case, the establishment of the group is clear (people being together is often due to some other context); the roles have been elaborated on (see Section 2.2); and the ways that interaction takes place have been described, as seen in Section 2.2 and in the work of Rodríguez-Triana et al. (2016). However, the rules that are used in these cases are less known. Still, the idea of rules has been used within human–computer interaction for examining organizations and information technology. For example, March (1991) noted that the decisions in an organization are based on social rules rather than on pure rationality. He argued that the challenge therefore is often related to finding these social rules. We face a similar type of challenge in our work, since we do not know which types of norms, conventions, and so on regulate human behavior in these hybrid spaces.

		Onset in...	
		digital sphere	physical sphere
Continuation in...	digital sphere	A user posts off-task content that encourages others to do the same (Harry et al., 2009).	Pupils are restless and contribute with off-task content (Paper V).
	physical sphere	Pupils react to Presemo content by laughing (Paper V).	Pupils talk during class and distract others (Behnke et al., 1981).

Table 4.1: Norm violations, by their onset and continuation in various spheres, adapted from Paper V.

Although the *theory of social rules* (among other institutional approaches) has gained some currency in the social sciences, no clear paradigm seems to exist with regard to how to apply this theory (Burns and Flam, 1987, 31–32). We aimed to conduct our study empirically to explore patterns of social behaviors and thereby determine which types of rules can be formulated. For example, the patterns of interaction can be classified and examined as action–reaction pairs. Through interaction process analysis (Bales, 1950), a researcher can classify interactions as acts (such as the act of giving orientation or the act of asking for orientation) and can then examine what these interaction acts demonstrate (e.g., the use of orientation patterns indicates problems with communication). When examining these acts, we also can determine which types of interaction take place and identify them by means of rules or even a grammar of interaction. Social norms are also a clear example of social rules, because they define the acceptable group conduct (Lapinski, 2005) and since breaking them often leads to sanctions (Ehrlich and Levin, 2005). Social norms can be categorized by how they are understood. Lapinski (2005) discussed collective norms (implicit norms within a group), perceived norms (individuals' perspectives on collective norms), injunctive norms (what the norms ought to be), and descriptive norms (those that are defined by actual sanctioning practice). In particular, the sanctioned activities – and, therefore, the descriptive norms – are interesting to study in hybrid settings. By understanding which kinds of behaviors the group sanctions, we can learn what limits the group's interactions and set up some rules for social interaction. In Paper V, we have described what violations of the descriptive norms can take place and shared insights about the norms in hybrid spaces. Since norms are only one component of social rules, in Paper II we continued to examine the patterns of interaction, to demonstrate the sustainability of the social rules in the investigation of hybrid interaction.

4.3 Findings

In Paper V, we explored how elementary school classes use Presemo. We observed various forms of unexpected uses that violated teachers' assumptions (or, more broadly, those of the school's contexts) about the proper uses of such systems. We referenced these as norm violations. Upon further examination of these types of norm violations, we chose to classify them on the basis of the spheres of onset (where the norm violations begin) and continuation (where the norm violations resume). The outcomes of this classification effort are summarized in Table 4.1.

As Table 4.1 demonstrates, we separated out the cases in which the norm violation began in the digital sphere and continued in the digital sphere. These norm violations include off-task messages, such as the sending of humorous, antisocial, or spam-like content (Harry et al., 2009). Cases in which the norm violation began in the digital sphere and

continued in the digital sphere also existed in hybrid space. The prime example of this is spamming a system with off-task messages, which we discussed in Section 3.8.

Furthermore, our analysis revealed cases in which the onset and continuation took place in different spheres, thus demonstrating the hybrid nature of the technology. In a simple example of norm violation beginning in the physical sphere and continuing in the digital sphere, a restless audience engaged in off-task activities by creating humorous content in the digital sphere. Similarly, in various cases, digital norm violations led to continuations in the physical sphere. The most prominent example of this was when the audience started to laugh (a discouraged action) in response to the spam content posted in the system. Additional examples of these norm violations can be found in Paper V.

We used this theoretical lens to characterize the norm violations as onset-and-continuation pairs between the spheres, letting us describe the *spillover* between these spheres. In these cases, an activity in one of the spheres affects the other sphere. This supports our claim that there are additional communication spheres and also highlights that these spheres are not isolated, as interactions occur between them and as content moves across them.

Furthermore, the study presented in Paper V elaborated on how participants experienced the difference in norms between the spheres. Clearly, the digital sphere was novel to its users. Therefore, the guiding social norms of digital interaction were less clearly articulated than were those in the physical sphere. This allowed participants to behave rather differently in the hybrid interaction than in purely physical interactions. In the hybrid space, the existence of dual norms created additional challenges for behavior management (further explored in Chapter 5).

However, both my findings and others' results demonstrate that dual norms can have positive effects on interaction. For example, researchers examining group support systems have focused on the benefits such systems have for collaboration, including independence from others' opinions (e.g., Nunamaker et al., 1987; DeSanctis and Gallupe, 1987). Paper IV shows how the level of participation was higher when computer-mediated technology was used to support communication. Paper I describes how participants experienced that they could express themselves more freely when they did not need to follow the social norms. Therefore, a change in social norms clearly can have both positive and negative effects. However, these findings all point toward a difference in the social rules that is caused by the additional communication space.

Thus far, we have demonstrated that social rules differ between the spheres and, more importantly, that these spheres are not separated but instead are joined as a shared hybrid space for social interaction. These observations already provide evidence for Finding 1, since we showed that the norms in the situation were a hybrid of those for physical interaction and digital-interaction norms. To further support what is expressed as Finding 1, I addressed the social rules that guide behavior in the digital sphere. Paper II examines three distinct Presemo instances' use and focuses on how interaction took place in the digital environment. We used Interaction Process Analysis (IPA; see Bales, 1950) and classified the content that was produced in Presemo by using its 12 coding categories. Furthermore, we determined which messages were replies (i.e., looked at conversation threads). Because these instances demonstrated a high number of threaded conversations (65%), we were able to further examine how participants behaved in these conversations, including which types of interaction rules – if any – participants used.

Our first finding was related to the overall existence of interaction rules. We observed at a statistically sufficient level ($\chi^2 = 18.214$, $df = 9$, $p = 0.033$) that the response categories were not randomly distributed; instead, they followed patterns (see Table 4.2). For example, a question led to a higher probability of attempted answers among its responses. Socio-emotional communication had a high chance of having similar types of responses; in other words, a positive initial message was followed by positive responses. We called this

state robustness; if a message had a particular tone, the responses seemed to follow that tone.

This approach extends the analysis of patterns, for which previous researchers have found long conversations to have been caused by open-ended initial questions or by controversial topics (Du et al., 2012b, 133–134). The patterns we observed are not striking in themselves. Our research question has to do more with the overall existence of these patterns in the mediated sphere as well. These patterns indicate that the conversations, when they exist, follow certain rules of social interaction, even in constructed communication channels that do not support such interactions via technical affordances.

4.4 Discussion

Above, we have acknowledged the existence of various interaction spheres in hybrid spaces and provided evidence of the existence of various social rules in these spheres. The strongest support for what I express as Finding 1 emerged as we examined the social norms and discussed the existence of various norms in the digital and physical spheres. I want to emphasize that the spheres' differences in social rules have both positive and negative implications. Furthermore, when examining the social rules, we observed that these interaction spheres can collide via spillovers of norm violations. We also showed that patterns direct interactions within the digital sphere.

With Paper V, we argue that there is no need to develop new conceptualizations of core social rules, such as norms or interactions. Rather, I hope we have articulated that, in these types of hybrid spaces, the social rules in all spheres must be accounted for in the analysis of a given social situation. These spheres are particularly important because various types of spillovers may take place between them; our analysis focused on norms and norm violations, but a similar idea can be applied to various other social rules.

Secondly, throughout the work, we aimed to inform system designers and those who manage these events about the potential implications of social rules in the hybrid spaces. Here I want to highlight three observations (these will be further discussed in Section 7.1): The first is that state robustness led us to recommend that moderation could drive messages by initializing them with a certain tone in the mediated space. The second is our proposal that, if this is possible, all actors should be present in both spheres. For example, the presenters' presence in the mediated space could be supported through simplified reactions that they could quickly trigger by using a mobile device. Furthermore, the difficulty of presenters being present in the digital sphere (due to the challenges of asymmetries, further considered in Chapter 5) could require automation of the digital system – for example, displaying only significant content or indicating when social rules have been broken. Similarly, a large interactive screen might provide opportunities to further integrate physical and digital spheres. The third observation is that, because the interaction spheres are linked together, one must observe behavior in the physical sphere (e.g., signs of restlessness) and adapt the interactions within the digital sphere accordingly.

	Initial message category			
Responses' categories	Positive reactions	Attempted answers	Questions	Negative reactions
Positive reactions	10	28	10	8
Attempted answers	9	71	64	14
Questions	5	35	21	7
Negative reactions	10	61	29	12

Table 4.2: Classification of the initial message and responses to it, adapted from Paper II.

Finally, although our analysis focused on interaction situations in which both digital and physical spheres are used, the idea of social rules existing within a communication sphere can be adapted to other contexts. For example, in communications using both email and online chat – two forms of remote collaboration – these two channels might foster different types of interactions. In the terminology we have presented here, several interaction spheres, each with social rules of its own, exist, and the users either behave in accordance with the corresponding practices in a given sphere or engage in spillover practices. Because interaction is now mediated via several tools, hybrid spaces also exist in non-collocated computer-mediated interactions.

Chapter 5

Directing hybrid interaction

With Finding 2, I argue that spectators and their participation can (and ought to) be directed to ensure that the digital sphere does not become isolated, thereby ensuring that the interaction spheres lead to a single performance in both spheres. This directing can take various forms, including technical modification of the digital sphere and its affordances as well as changes to the content in the physical sphere in reaction to actions in the digital sphere (and vice versa).

With Finding 2, I continue the argument from Finding 1, with which I established the importance of the various social rules in the hybrid space. The importance of active management becomes apparent in acknowledging that the hybrid space has particular social rules, as Finding 1 shows. Thus, there is a potential for spillovers, which could undermine the interaction in both spheres.

To answer Research Question 2, related to directing hybrid interaction, I must describe what active management means in hybrid space and demonstrate active management's importance for the overall performance. I will also examine active management practices (dealt with in papers III and V) and offer a proposition as to how active management is established in the hybrid space.

5.1 Related Work

Proceeding from earlier work (see Section 2.2), I identified two distinct user roles: spectators and performers. The spectators primarily followed the presentation taking place at the event – and were activated via technology. The performers were involved in the planning and execution of the event process. As I acknowledged in Chapter 4, I reiterate here that this is hardly the first project to observe the performers as they conduct management to ensure that the digital and the physical spheres are in sync. For example, Harry et al. (2009) described situations in which the facilitators were present at the event and marking certain questions (which the audience had sent via the digital sphere) as having been answered so that they could be hidden. In this way, the facilitators ensured that the digital sphere represented the activities in the physical sphere. Similarly, although not using the term "facilitators," McCarthy and {b}oyd (2005) showed how panel organizers joined the digital sphere to directly address concerns arising from the digital sphere, including the logistics of an event and clarifications regarding the activities in the physical sphere. Again, the spectators could see the reactions to their activities, making it clear that the digital channel is interactive not only for peers but also for the people in the conference audience. Finally, Kuikkaniemi (2017) argued that there is a need for various types of performers and organizers. Support can be provided through each type having a distinct interface for the same content, and a single content interface can be used for management of all the interfaces. Therefore, it seems obvious that performers should be present in or

at least aware of the digital sphere, to ensure that the hybrid space is created rather than there being two separate spaces (to my knowledge, only Kuikkaniemi, 2017, has explicitly argued this).

Although the discussion above focused on what performers can do to ensure that the digital and physical spheres are in sync, this work is related to planning the content in the digital sphere. Audience response system literature has addressed these aspects further with regard to education. To illustrate, Beatty et al. (2005, 2006) suggested particular patterns (which they called tactics) for directing attention, raising awareness, stimulating cognitive processes or promoting articulatory discussion, and evaluating matters in an educational context. This indicates an important aspect: the digital tools can be used to support various aims (which we too have addressed, in Paper III). For each of these aims, Beatty et al. indicated the qualifications the question might be given for purposes of driving the students' participation accordingly. For example, they stated that questions promoting articulation and discussion can be formulated in seven ways. Questions promoting articulation and discussion can be formulated for concepts and ideas but nor for specifics (such as formulae), thereby requiring decision-making and reasoning on the students' part. These questions can have several defensible answers, depending on students' interpretations. They can be designed to generate disagreement between students, by being deliberately ambiguous. Alternatively, they can force students to formulate the unstated assumptions, trap them in unjustified assumptions, or help to identify common misconceptions. In highlighting the design space for question formulation, Beatty et al. (2006) presented 23 individual ideas on how to formulate questions for particular aims. Although this type of discussion has taken place in the educational domain, there has been little clear articulation of the opportunities that drive certain aims behind using the digital sphere.

To summarize the related work, I can state that, while interaction requires proper processes and proper functionality to be in place (Stromer-Galley, 2004), the existing research that has focused on hybrid space applications has not clearly articulated how this takes place or how it should be conceptualized. Informed by studies of interactive tools used for or as performances (e.g., Reeves et al., 2005; Reeves, 2011; Dix et al., 2006; Sheridan et al., 2005), we explored these hybrid spaces with performers and spectators as the performances' groups.

5.2 Theoretical Background

Above, we used the term *performance* to explain our insights about events in the hybrid space. Broadly speaking, performances can as-performances or is-performances. The is-performances are actions that everyone considers to be performances, such as theater plays. These are limited to particular cases only and are therefore too limited to broaden our understanding of the interaction direction in the hybrid interaction. Instead, we focus on as-performances, which are part of day-to-day life; these include rituals (Schechner, 2013). The understanding of various social gatherings and activities as performance is referenced as a performative turn, which has directed social research to focus on performances (for a review, see, for example, Dirksmeier and Helbrecht, 2008). The perspective of as-performance has also led to studies in human–computer interaction, particularly within research on ubiquitous computing and performative interactions (Spence et al., 2013). For example, when using performance as a frame to examine the use of large touch displays, researchers have demonstrated, among other things, how users orient themselves to positions in accordance with their roles in the performances (Kuikkaniemi et al., 2013).

Thus far, I have not articulated what a performance is. In my efforts to define the term for this thesis, I agree with Spence et al. (2013) that performances also take place outside

the theater and other staged settings. This is clear when one considers the performative turn, in which social occasions are also seen as performances (Schechner, 2013). Although Spence et al. (2013, 99) claimed that Goffman (1978) took a more theatrical approach to performances, with the separation of front-stage and backstage, this is not the case. Rather, Schechner (2013)'s reading of Goffman (1978, 15–16) suggests that performance is a social interaction in which a participant aims to influence other participants. That is to say, the performer aims to give particular impressions to the spectators. With this framework, all social interactions in all situations are seen as a performance. For example, in hybrid interaction, a spectator may perform as a spectator and, therefore, take on tasks assumed fitting for a spectator, such as taking notes.

Such a broad view of performances seems problematic since it does not restrict the performance to important actions. I have studied certain planned events at which participants gathered with clear role expectations as either performers or spectators (as reviewed in Section 2.2). However, I emphasized the nature of the event, which gives the participants a clear social frame and context for how to behave. The social context also frames how the performance is supposed to be engaged in (Getz and Page, 2016). Therefore, I aim to focus on performances in which socio-spatial positions such as the front-stage exist (e.g., Reeves, 2011). Furthermore, these performances have the critical characteristic that they can change. Even when the performance may be scripted beforehand, acting out the performance can change its execution. This means that the performances are live (Meyer-Dinkgräfe, 2015; Schechner, 2013; Auslander, 2012).

I acknowledge that the focus on this type of performances means that only a small subset of as-performances is studied. Even though these roles take a step toward theoretical performances, reflecting the terms created by Spence et al. (2013, 99), it is important to note that the performers are not acting. Rather, they are non-acting – not engaged in impersonating someone else – and the audience sees them via a particular role within the event (Kirby, 1987). Therefore, it is appropriate to consider the event as a performance and, on account of the interesting role of the performers in maintaining the performance, focus on their actions. In Section 5.3, I illustrate how performers do so.

However, understanding performers' roles in such a way highlights their power. Most significantly, in the area of performance studies, Gonquergood (1989, 84) asked, "How does performance reproduce, legitimate, uphold, or challenge, critique, and subvert ideology?" This linked the performances to the establishment of power rather directly and called to mind critical studies aimed at demonstrating how performances (both as-performances and is-performances) can recreate gender and sexuality (cf. Reinelt and Roach, 1992, 311-316) and cultural positions (cf. Conquergood, 1992). The conceptualizations have also advanced other fields. In education scholarship – which is the context for many of the instances I have studied – Pineau (1994) argued that power has been reflected upon well in the critical pedagogy literature. She promoted a performance-centered approach to education because this, according to her, balances the roles of teachers and students to some degree. More significantly, she used the existing literature to present, on one hand, the relationship between power and education, and on the other hand, the relationship between performances and education. Therefore, the literature also supports the argument that performers and performances are related to power and its use.

5.3 Findings

We answered Research Question 2 with two papers (III and V). In Paper III, we examined the utilization of the digital sphere during events and showed that (i) the systems were adapted to support performers' needs and were included in the performance through hiding and showing blocks, (ii) active work was conducted to bridge the digital sphere and physical

sphere, (iii) various performers could have larger or smaller roles in the overall direction, and (iv) the digital sphere supported particular modes of interaction. In Paper V, we examined (v) how performers both proactively and reactively manage violations of the social rules.

Our first findings were focused on the practices of active management. Firstly, we observed that the digital sphere was used as an extension to the performance. The existence of an extended performance required that the performers modify the digital sphere to be part of the performance in the physical sphere. The first step in this process was to change the content in the digital sphere to constantly support the activities in the physical sphere. For example, the Presemo blocks were made visible or hidden such that each presenter had a personal block for his or her questions.

The second step was *integration work*, referring to what the performers did to bridge the gap between the physical sphere and the digital sphere. As in articulation work – with the focus on outlining goals and processes in group work (Schmidt and Bannon, 1992; Strauss, 1985) – integration work in the hybrid interactions refers to meta-work that the performer must do to make the performances in both spheres successful. For example, the performers can raise the audience's awareness of the digital stage and encourage participation through it, and they can take the audience's contributions on board as part of the onstage performance. The interview detailed in Paper III indicate that the audience did follow how the performers interacted with the content in the digital sphere (e.g., the performers highlighted the audience contributions that they were currently discussing). Even more importantly, the performers also verbally made observations that they attributed to the digital sphere, explaining this as an approach to making the digital sphere a worthwhile channel for participants.

These two observations already respond to Research Question 2's core idea. Hybrid space can be actively managed so as to ensure that it supports the performance as in points i and ii above. However, Paper III makes two additional contributions related to this research question, addressing points iii and iv.

The third contribution to answering this research question is a fleshed-out typology of the performers. Although this typology was more extensively analyzed by Kuikkaniemi (2017), we used the simplified categorization from Paper III to answer Research Question 2. The performers can be distinguished by their socio-spatial location (onstage or offstage) as well as by their ability to influence the overall management of the event (see Table 5.1). The existence of performers – both on the stage and off the stage – who can manage the execution of the performance in both spheres indicates that these hybrid spaces can indeed be directed to support the performances.

The fourth contribution of this paper is related to the ability to choose the mediated system's formats to support the aims of the performances. This continues the line of thought related to audience response systems (Beatty et al., 2005, 2006) and shows how the systems can support the versatility of various aims. In Paper III, we identified seven social functions that hybrid space can have at events. For example, audience activation was shown to use closed-ended questions that the performers created (often beforehand): the responses were often used as an input in the physical-sphere performance. This is rather different from audience engagement, which was open-ended and, accordingly, allowed more elaborate thinking by the audience. Furthermore, we observed how these individual functions can be used to direct the digital sphere toward the performers' goals by showing and hiding blocks in a particular order. This created *episodes* of participation in line with the particular functions used. Therefore, it is clear that in these performance situations, the hybrid space is under performers' control and power – which is also the assumption for that social context. We will elaborate on this observation further in Chapter 6 on the basis of Paper IV. All four findings presented in Paper III indicate that the hybrid space can be

	Onstage	Offstage
Managing the performance	The *chairperson* is onstage and allowed to control the overall performance. Especially for panels, these people often are the chairs, but this role could also be held by a teacher in a classroom.	The *orchestrator* manages and coordinates the flow of the performance but is offstage, in front-of-stage position (Kuikkaniemi, 2017). These people not only manage the Presemo system but have a more holistic role in the event and its functions.
Not managing the performance	The *host* is onstage to conduct integration work and ensure that Presemo is part of the performance and not left as a separate channel. Often the host, for instance, reads questions to other performers.	The *moderator* is offstage and mostly manages the content (removes irrelevant content, suggests highlights to other performers, etc.) or the Presemo system (shows or hides blocks). Moderators do not, however, add new content.

Table 5.1: Roles of performers in the hybrid space for events, with special terms to identify various types of roles (details are presented in Paper III).

directed and that active management can be utilized to ensure that it follows performers' ideas.

Finally, we investigated management practices, as investigated in Paper V. In this work, we also studied what happens when the social rules – in this case, social norms – are broken and how the performers attempt to reestablish the social norms. We observed how verbal guidelines and physical presence were used together to guide spectators in using the digital sphere. The directing also took place through performers' choices of when and how the digital sphere was used, even as the performers' overall presence was, as noted in the paper, limited. Furthermore, we drew distinctions between proactive and reactive directing and between public and private directing. Proactive norm management often took place before the digital sphere was even brought into use, and it emphasized articulating how participants ought to behave in the digital sphere. Reactive norm management took place after the rules were broken and directed the participants back towards the intended uses. Reactive norm management had both public and private forms: the public form's norm management was aimed at all spectators, while the private form focused only on particular individuals in the audience. However, the private norm management was also public, in that all spectators could see the performers' action, even when those actions stressed a particular individual. In Paper V we focused on the management of norms, with regard to their relationship to the social rules that were the focus of the previous chapter. However, the work also demonstrated various other management practices. For example, the performers conducted integration work by articulating how the digital sphere was used and how it related to the physical performance. Therefore, the work reestablished the direction taken during the performative hybrid interaction.

5.4 Discussion

I have aimed to show that active directing of both the digital and the physical sphere is possible for events during performative hybrid interaction. The concept of the extended sphere distinguishes the hybrid space examined here from various other forms of hybrid

spaces. For example, some forms of backchannels (e.g., Yardi, 2006) existed in a hybrid space – with digital and physical spheres at the same time – but with no aim to integrate these spheres with each other. The two spheres coexisted, but the performers did not use the digital sphere as an extension of the physical sphere, so the digital sphere was not an extended performance. Although these hybrid spaces can have various beneficial outcomes, such as enhanced peer learning (Yardi, 2006), they lack the potential for conducting performances by adapting the system to performer needs. In these hybrid spaces, the onstage activities are not live in relation to the digital sphere; the performance hence cannot adapt to actions in the digital sphere.

Extended performance depends on the ability to conduct integration work. In the research presented in papers III and V, we observed integration work taking place in both the digital and the physical sphere. It took place before and during the digital episodes, in the form of verbal remarks, digital actions, and nonverbal actions (such as glances). We observed how, via actions of these types, the performers acted in the digital sphere. Furthermore, the integration work itself showed that the performance was live in relation to the digital sphere.

Once we understood the importance of performers' integration work in the hybrid spaces, we sought to understand how this work could be further supported. This might include enhancing the digital interaction between the onstage performers and spectators by such means as allowing performers to indicate when audience comments have been read. This might make the importance of the digital sphere more prominent to the audience. In addition, both automated content classification and human computing can support this integration work. For example, a burst of content could be automatically sorted into buckets, perhaps via the topic modeling process (e.g., Blei, 2012). This would help the onstage performers to summarize the content and to address its core aspects. Furthermore, audience input regarding the content (human computation), such as votes or reposts, could be utilized to indicate the relevant content more prominently. Computational tools can be further applied also to bridge the digital and physical spheres – for instance, by automatically reacting to the verbal remarks made (via speech-to-text) and by highlighting the digital content in relation to the physical activities (Andolina et al., 2015). Naturally, all forms of automated tools must adhere to the human performer's goals and rhythms.

The second observation we addressed in this chapter is that, no matter what type of proactive work is done, the performances – by their very nature – can create unexpected turns. These can be both positive and negative; for example, a new direction could be taken by a panel, thus requiring unplanned activities to support the new direction in the digital sphere. Likewise, spectators may not always utilize the digital sphere as intended, which could, in an extreme case, lead to behavior that breaks the social rules. Flexibility in both performances is needed to facilitate handling of these types of unintended items.

We speculate that flexible scripts are needed to allow the performers to plan alternative types of episodes and to adapt those episodes in line with the performance. This would help the performers react to any alternative (off-script) performances and to, even more importantly, plan for these types of what-if scenarios.

My final remark is more general and considers the hybrid space in general. We focused on a particular form of hybrid space where participants can be separated into groups: onstage and offstage performers and spectators, who together made up the performative hybrid interaction. These two groups had different roles in the performance itself, particularly with regard to the ability to direct the performance. However, I argue that various social configurations are possible in the hybrid space. For example, the group support systems were aimed at creating places where everyone was an equal participant (e.g., Nunamaker et al., 1996), and backchannels were aimed at producing a communication channel in which the performers were not participating (e.g., Yardi, 2006). For me, the only doubt exists in

those hybrid spaces that some participants are not a part of. As boyd (2009) expounds on in connection with her personal experience, an exclusion from the hybrid space – though present at the event where the hybrid space is set up – can make it challenging to interpret the physical sphere reactions. In her case, the spectators are laughing at jokes in the digital sphere and this is not visible to her, the presenter, and make it a challenging position to perform. Even in the instances we studied, we found reaction types similar to those identified by boyd, such as laughing together (see Paper V), but the outcomes were not similar to those that boyd (2009) documented. The performers could interpret why such reactions took place and determine how to mitigate them appropriately. Therefore, hybrid interaction should always be designed to be inclusive.

Chapter 6

Evaluating the hybrid interaction

Addressing the social rules (Research Question 1) and the opportunities to direct the social interaction (Research Question 2) led to identifying a need to consider how to evaluate the success of the hybrid interaction for purposes of improving tools for it in the future.

With Finding 3, I suggest that evaluation of hybrid interaction as participation is related to general questions of values and matters of political science, which can help us to reflect on the interaction further. The goals for hybrid interaction tools are often to enhance communication and participation (e.g., Du et al., 2009; Harry et al., 2012; Yardi, 2006), so fields that examine participation – such as political science – can inform about the success of such events. The evidence related to Research Question 3 is presented in Paper IV, wherein Habermas's framework is applied to evaluate the success of hybrid interaction.

6.1 Related Work

Sadly, the previous work addressed in Chapter 2 has not been theory-driven but, rather, focused on system-building (e.g., Harry et al., 2012, 2009) or described a new phenomenon of hybrid interaction (e.g., Du et al., 2009; Yardi, 2006). Because of this lack of more theory-oriented work (common within technology research, as observed in Chapter 1), academics have not fully articulated the underlying normative frameworks – as a part of many social science theories – that are involved with these systems. Extrapolating from what authors highlight in their findings, we can argue these systems to emerge from the need to promote active participation (e.g., Du et al., 2009; Harry et al., 2012; Yardi, 2006). However, the framing leaves open the type of participation sought with these systems. For example, Kelty et al. (2015) claimed that participation within an information system has seven dimensions, among them the amount of learning expected and the opportunity to voluntarily leave the system. More details on the type of participation, even a theory of participation, should be framed to make this argument stronger.

These aims have been much better articulated within group support systems literature, for which the particular needs of the group have been taken into account as a baseline for development of the systems (e.g., DeSanctis and Gallupe, 1987). In his review, Fjermestad (2004) identified outcome factors (and, therefore, evaluation criteria), such as reaching of consensus, efficiency measurements, effectiveness measurements, satisfaction measurements, and usability measurements related to these systems. He then continues to review findings from both face-to-face and computer-mediated (through a group support system) group work, using these measurements. As a result, his summary of the literature claimed that 28.2% showed computer-mediated to be better than face-to-face, 30.5% showed that face-to-face communication was better than computer-mediated, and 41.4% of observed measurements showed no difference between the systems. Based on these findings, he

claimed the benefits of group support systems lay in improved structures of the discussion and gains in productivity.

6.2 Theoretical Background

My aim with this chapter is to examine how participation should be considered. Discussing the quality of participation and decision-making is always normative. Therefore, there is no single correct approach, though several distinct models exist for how to make decisions, each of which is considered acceptable by those involved in the decision-making (for one review, see Held, 2006). Similar tools and environments can support several approaches as well, as shown in Dahlberg (2011)'s work on online tools and democracy, in which four separate approaches were identified in all:

- The liberal-individualist approach emphasizes the majority in decision-making and, thereby, an expression of opinions and finally the aggregation of those opinions.
- The deliberative approach is aimed at supporting rational and reasoned discussion in inclusive spaces.
- The counter-publics approach is intended to use the digital tools to include those voices or individuals excluded from the mainstream discussion.
- The autonomous Marxist approach emphasizes the role of the commons, a new system of policymaking that challenges liberal politics.

Choosing to apply just one of these is indeed a normative question, for it includes values. These questions pertaining to values are at the core of the third wave of human–computer interaction, where the focus shifts away from information processing (the second wave) and ergonomics (the first wave) and towards the humans and their values (Harrison et al., 2007; Bødker, 2006). Furthermore, classic literature in science and technology studies has firmly established how technical artifacts – such as hybrid interaction tools – can encode values in them. Winner (1985) examined how technology is shaped by its designers such that it articulates politics and designers' values. A famous example is the Long Island bridges (also known as Winner's bridges) that are claimed to be so low that a public-transportation bus cannot drive under them, thus restricting access to some parts of the city to high-income citizens only. Nissenbaum (2005) has provided a more recent contribution to classic literature about values and technologies. Claiming that technologies promote the values of the surrounding society, as those values are encoded in the development of technology, she sought to identify how various values can be embodied in the technical system. These two works addressed the designing and implementing of technical systems, which indeed has been the focus in value-sensitive approaches in design (Borning and Muller, 2012; Sellen et al., 2009; Friedman, 1996). Hence, it might seem unclear why I have addressed values and technical designs in such great detail within this work. Any evaluation is not neutral but a "political creature," because power is used to establish the evaluation criteria (Weiss, 1993). Therefore, our choice of evaluation framework within human–computer interaction too is influenced by political and power questions.

For this chapter (and Paper IV), I applied Habermas (1989)'s approach, which is focused on an ideal communication space where participants engage in deliberation. In summation, the core values of an ideal communication space are considered to be these (Dahlberg, 2001; Dryzek, 2002; Habermas, 1989; Held, 2006):

inclusive participation to allow all stakeholders to present their views

civil and respectful discussion that shows respect towards other participants and their claims

rational argumentation wherein claims are backed by factual or personal-experience-based argumentation

Given the importance of values, as discussed above, I must justify why this particular framework was used for evaluation. The first – and driving – motivation for my choice was to follow previous research within the field of political science: over the past 25 years, a deliberative turn has taken place, and many approaches have focused on supporting the deliberative interaction of citizen engagement (e.g., Smith, 2009). Therefore, there is a body of well-established literature behind applying these approaches and documented cases. Within human–computer interaction, this framework has also been used to study political and civic behavior further. Specifically, the framework has been used to motivate the design of novel systems for policymaking (e.g., Disalvo, 2009; Klein, 2012; Kriplean et al., 2012; Le Dantec, 2012; Semaan et al., 2015) and frame observations (e.g., Asad and Le Dantec, 2015; Semaan et al., 2014). Secondly, although a call to use Habermas's framework to study computer-supported group work has been made Ngwenyama and Lyytinen (1997), to my knowledge there has not been any previous work on those topics outside political and civic contexts. Finally, although the empirical evidence is mixed, there are positive outcomes related to deliberation. In their reviews, scholars such as Carpini et al. (2004), Ryfe (2005), and Mutz (2008) have argued that deliberative approaches support, for instance, the inclusion of minority opinions and that they render the decision-making more accountable. These positive outcomes are a worthy goal of interaction. Therefore, the empirical work presented here focuses on work with a Habermasian foundation.

6.3 Findings

Using the Habermasian framework described in Paper IV, we identified the opportunities and challenges of the digital-sphere interaction as compared with traditional non-mediated face-to-face interaction in terms of the opportunities to support the creation of an ideal communication space. In this work, three empirical observations were made:

- The digital sphere is better suited to supporting participation, since more of the spectators are active and the distribution of participation among the spectators is more balanced.
- The two methods were equally supportive in demonstrating that respect was held for other participants, even though the methods employed were different.
- The activity in the digital sphere was less rationally backed than that in the non-mediated space, thereby suggesting that the affordances of the mediated communication limited the quality of argumentation.

Therefore, one can argue that the findings presented in the paper were inconclusive.

However, the emphasis in Research Question 3 is not on the results but rather on the process: how they were studied. The significant contribution of Paper IV is to apply the Habermasian framework, which was originally used to describe (the ideal state of) political and civic discourse of large populations with small-group interaction that is not directed at civic concerns. The paper makes two cases for utilizing the normative framework within human–computer interaction: Firstly, it can support empirical investigations of a phenomenon, for purposes of designing systems by using a normative framework.

	Inclusive participation	Civil discussion	Rational argumentation
Participants' experience		Questionnaire (Black et al., 2011)	Questionnaire (Black et al., 2011)
Researchers' observations	Count of speech turns (e.g., Albrecht, 2006; Graham and Wright, 2014)	Qualitative observations	Content classification (Graham, 2008, 2012; Steenbergen et al., 2003)

Table 6.1: The Habermasian evaluation framework used for Paper IV.

The main benefit of normative frameworks is that *empirical research can apply the methods related to the relevant framework*. In the case of the Habermasian stance, various approaches – including surveys, interviews, and observations (Black et al., 2011) – have been proposed for measurements. For Paper IV, a full framework of the Habermasian approach was used to triangulate the participation further, as shown in Table 6.1. The triangulation was used to examine three dimensions of participation and included both researchers' observations and participants' experience. As shown above, the application was successful. We could then compare between groups with digital and face-to-face interaction and also observe how both methods of communication support the creation of an ideal communication space. Furthermore, established methods described in the literature can be used to support the various operationalizations In addition, the normative framework guides the focus of the research and simultaneously aids in identifying which elements should not be focused on.

The primary benefit of constructive research emerges from the *design challenges unveiled through the application of the framework*. In the case of Paper IV, we identified the challenges related to showing respect to other participants and supported the claims with argumentation. We thus proposed that a further mechanism could be used to show respect for other participants, one similar to the reactions used on Facebook. However, their meanings could be articulated via the value of the framework itself – for example, via reactions such as "I appreciate you sharing this point of view." The second benefit for constructive research emerges from the existing design explorations and design work conducted within this framework. Although the context may be different, it could also yield insights into how to address problems in the creation of new information systems. Accordingly, designers can apply solutions that have already been examined and hence focus in their design work on the approaches that are most critical for the specific service at hand.

Lastly, the work in the field of human–computer interaction can inform the work of Habermasian theory and evaluation also. For example, although the participants were collocated, we did not focus on their physical presence, which was observed to be significant in Paper V. Rather, guided by the research framework, we examined primarily the content of the contributions to identify how well the ideal communication space was represented in each of the contributions. Informed by research in the computer-supported collaborative work and computer-mediated communication domains, one can revise the Habermasian framework to address various elements of nonverbal communication as well.

6.4 Discussion

I hope I have demonstrated the benefits of using normative value frameworks to evaluate hybrid interaction by choosing the Habermasian framework as a guide for the research. In

this capacity, the Habermasian framework provides a grounding to prior literature, which aids in both establishing the research aims and formulating the research methodology. The state of the overall body of scholarship on performance-oriented hybrid spaces (reviewed in Chapter 2) suggests that shared objectives, such as clear articulation of the values in these systems, may significantly support research efforts.

However, the work on Habermasian values begs for this question: why was this particular value system used? In Section 6.2, I articulated our rationales for using the Habermasian value system as the basis for an evaluation. In Chapter 5, I established that hybrid interactions taking place in performances are directed, or even led, by the performers. The performance is conducted not only by using integration work but also by choosing the blocks and interaction modes to be used. Although these blocks can be appropriated in various ways (e.g., Harry et al., 2009), the indications of correct use and their ability to establish social rules (see Chapter 4) make the performers powerful. They choose the way in which people interact and influence what is discussed and what is not discussed (cf. the third face of power; see Lukes, 2005). Accordingly, returning to the topic of values in technical systems (Winner, 1985; Nissenbaum, 2005), we observed the value decisions relative to performers' (and system developers') ideas about how the system ought to be used.

However, one should be careful when deciding which normative framework "should" be used. Firstly, criticism of the value system choice is valid for any normative framework, as shown with the brief elaboration focused on participation informed by the field of political science. There are always several normative frameworks in the social sciences that could be used for a particular phenomenon, as indicated by the work of Dahlberg (2011). Each of them carries particular values that it promotes, since they are not neutral. Secondly, we ought to consider whether such a normative framework should be imposed on the spectators. For example, our decision to apply the Habermasian framework was not discussed with the participants. Since I was the teacher organizing the class where this was studied, the choice reflected my values related to "good" classroom participation. Another option, which many may argue is more sustainable, would be to seek to identify and respect the normative beliefs and values of all stakeholders, following the guidelines of a value-sensitive design (Borning and Muller, 2012; Sellen et al., 2009; Friedman, 1996). This indeed would decrease the risk of imposing values on spectators (i.e., using the technical artifact as a vehicle for imposing values). It might, however, be somewhat unnatural, since the principal aim with these tools ought to be to support the performers' activities in the hybrid space and aid in extending the performance. Furthermore, the process of stakeholder interviews before the system is used, particularly in event contexts, may be troublesome. Therefore, instead, researchers using a normative framework as an evaluation metric should aim to validate not only the participants' experience with the phenomena but also participants' standing on the various normative stances. This allows the researchers not merely to consider whether the values they had hoped to promote via the intervention were ultimately actualized but also to examine whether the stakeholders agreed with the researchers' goals. Furthermore, the assumed values and related normative frameworks must be outlined clearly in the work to make them explicit to the readers, something that those studying hybrid space do not currently do (see Section 6.1).

Chapter 7

Conclusions

With this work I have engaged with the broad topic of performative hybrid interaction. In the introduction, through analysis of prior work, I established this novel concept. The concept extended the idea of collocated computer-mediated communication (hybrid space or hybrid media consumption) to encompass consideration of how digital and physical logic shape each other in this interaction space (hybrid media system). To further engage with this concept, I asked three questions:

Research Question 1) Do social rules differ between the digital and physical sphere at a planned event?

Research Question 2) What roles do performers have, and what actions are used to establish and maintain these roles?

Research Question 3) Does performative hybrid interaction support normative positions more strongly than face-to-face interaction?

With chapters 4, 5, and 6, I answered each of these questions in turn. Before asking what implications the answers have for practices and research, I recap the findings.

Finding 1) I observed the potential of the differences in social rules between the digital and physical spheres. This was seen in interviews with teachers and the conceptualization of norm violations (see Paper V). Papers V and III demonstrate that these spheres are not separate. They become integrated (or hybrid). The hybrid nature was evidenced through norm violation spillovers; norm violations travel across the spheres. These also show how the differing of social rules created challenges to maintaining the performance. Teachers needed to maintain the social rules not only in the physical classroom but also in the digital sphere – which seemed to have different social rules for pupils than their classroom interactions did. Thus the findings highlight challenges of creating a performative hybrid environment, connected largely to differences in the social rules, such as norms, between these spheres.

Finding 2) In total, four distinct roles for performers were seen in the project: performers work both onstage and offstage and either have or do not have an opportunity to influence the flow of the planned event. I made a strong case for enhancing the active performer role (see Paper III). I considered the digital space as an extension of performance that is directed and managed. This means that performers shape the digital sphere to suit the particular aims of the performance. For example, they choose the structure of digital interaction and formulate the titles for the interactive blocks. Furthermore, the performers guide and acknowledge contributions made in the digital sphere and react to the same. These observations reflect how integration work was actively done to ensure that both the digital and the physical performance aspects were involved.

Finding 3) In relation to evaluation, I made a case for applying normative theories for participation to evaluate hybrid interaction. This approach would force authors to lay out their assumptions about the benefits of the technology in a clear manner. Furthermore,

normative theories have been widely applied in fields such as political science, which therefore provide background literature and methods that may be of use for conducting the study. For example, in the work reported on in Paper IV we used existing survey items, content classification schemata, and measurement tools to ask how present the ideas of a public sphere are in hybrid interaction. Furthermore, having acknowledged that the theories are normative, we highlight the importance of values within system development and use.

Now that each of the main findings has been discussed in detail, I will present conclusions on these aspects. I will first address the implications of this work that I have identified for performative hybrid interaction. I will discuss how practitioners and system designers can benefit from this research (in Section 7.1). Also, I will present some indicators related to potentially fruitful research areas not covered in this work (in Section 7.2). After this, I will discuss the role of social theories in supporting research on performative hybrid interaction (in Section 7.3), before summarizing the limitations of this work and offering concluding remarks.

7.1 Implications for Performative Hybrid Interactions

What do these findings tell us about the use of performative hybrid interaction or hybrid interaction in general? The findings reflect the complexity of performative hybrid interaction and address it in a manner not represented in the existing body of literature. The performer has a significant role in making the mediated communication meaningful (Finding 2) and guiding social rules, norms, and even values (Findings 1 and 3). Furthermore, the performers conduct work beyond just integration; the aspects of norm management (Findings 1 and 2) demonstrate that additional work is required to maintain the hybrid interaction in planned events.

Performers' work takes place both before and during the event. Before the event, planning work for performative hybrid interaction is conducted. This planning work includes tasks such as

- choosing the content for interactive blocks (e.g., titles, poll options, and the format for the interaction),
- scripting the event and planning the role of participation interaction, and
- considering the overall time spent on the activities.

During the event, efforts are made to bridge the digital and physical sphere, which we called integration. Integration can be supported partly via the digital tools, through means such as

- highlighting content instead of pointing it out,
- changing interactive blocks' titles to show audience members how they should participate, and
- hiding and showing interactive blocks.

However, the research highlighted that the physical sphere is used to conduct integration work, with

- verbal remarks,
- glancing and pointing out the public displays representing the digital sphere, and

- even moving in the space.

Overall, we conclude that these observations are not exhaustive. It is easy to imagine items not listed above for each of these lists. The observations show that more support is needed for the performers' practices for integration work.

Regrettably, today's technical tools for performative hybrid interaction – including the one we studied specifically (Presemo) and also commercial tools such as Sli.do (`http://www.sli.do/`) – do not provide guidance through the complex tasks of managing and performing in hybrid interaction environments. Therefore, even when the technology is already available and can enter application in easy-to-use online forms,[1] known practices for bringing this technology into use successfully do not yet exist. In the worst case, these technologies are brought to an event and into use but become separated from the event activities and, in consequence, do not add to the event's value or may even lessen it.

The work described in Paper III revealed that, along with adding value to the event, the integration seems to increase the value performative hybrid interaction has to the audience. Audience members say that they value the highlights the performers give. Peer interaction has been found to be beneficial in education (e.g., Biggs, 2011). Therefore, during successful performative hybrid interaction, the performers, audience, and performance are in a symbiotic relationship (Jacucci et al., 2014) wherein reciprocity of actions and independent agency exist. Proceeding from the work presented in this thesis, I propose the following:

- Before the event, the performers should consider the *aims for the use*, to ensure that the utilization of the system will be meaningful and to take into account any *values* that the system could manifest and configure the system to support them. To aid in this planning, tools such as *scripts* can be developed to offer support.

- During the event, the performers should aim to bring the audience-generated content into the performance. These actions can take the form of mediated interaction or direct interaction with the audience. The degree of action can range from mild (e.g., glances) to explicit (e.g., verbatim reference).

- It is vital to ensure that the system is aligned with the goals of the performance, in order to add value to it and, simultaneously, for the audience.

These practices can be further supported by the system design. However, additional research is required if we are to understand the complex relationships among the system, the performers, the performance, and the audience. In the next section, I will address those areas for exploration that I feel could contribute most prominently to the development of further systems that better support performative hybrid interaction.

7.2 Avenues for Future Research

The future research for performative hybrid interaction can focus on how to further support practitioners' performance in hybrid spaces. The thesis project points to three areas that merit further inquiry.

Firstly, the tools should further *support the planning stages*. Planning can take the form of a script in which the individual episodes of the performance and the role of physical and digital activities for those episodes are presented. Kuikkaniemi (2017) suggested a state-control matrix for Presemo, from which the activity for role-specific screens can be

[1] For example, at the 2017 ACM CHI Conference on Human Factors in Computing Systems, Sli.do was used in keynote speeches, panel discussions, and town hall meetings.

coordinated (see Figure 3.1c for an idea of what these could look like). However, this interface does not account for aspects such as timings for the episodes or nondigital activities. It is my belief that the performative hybrid interaction would benefit from planning support since that might further encourage integration of digital and physical stages. Many of the possible implementations were discussed in Section 7.1 as considerations for performers, but they could also be taken up as tasks to be supported with the help of design. How could the design aid in discussion of the aims and values of use, development of a script, and consideration of the time spend in various activities?

Secondly, further steps should be taken with regard to *testing and sharing various forms of scripts*. For these purposes, predictive models accounting for social, cultural, contextual, and technological factors and usage practices are a clear open research area for the future. This would help performers to plan their hybrid interactions in a more efficient manner. For example, this exploratory work has not been directed to understanding issues such as

- the effects of the public screen being used (Finding 2),
- the effects of good or poor integration work (Finding 2),
- the impact of the title and questions on audience participation (Finding 2),
- the impact of social factors such as sense of community or hierarchy on audience participation (Finding 1), or
- any interaction between these factors.

If these questions could be addressed in greater detail, this might afford designing for an optimal participation rate, via options for the possible combinations of public screen use, block configuration, and integration work (which are controlled by the performer), for a particular social context. This work would require extensive (quasi-)experimental study comparing various combinations of these settings.

However, any experimental research also requires a detailed conceptual development of the phenomenon, a third open research area. For example, how could the quality of integration work be measured? These questions clearly represent opportunities for development in this research field. My work shows only examples around these concepts, such as integration work, extended performance, and social rules. These concepts can be further *explained through more extensive taxonomies or measurement tools*. Furthermore, only by measuring these aspects can we take steps to *develop predictive models*. The work's contribution lies in the ability to reflect on these concepts through existing theories. Since I have not taken steps to further measure particular aspects and have steered clear of attempting to evaluate the performative hybrid interaction, since clearly established baselines for evaluation do not exist (Finding 3), plenty of room remains for further work. Researchers could, for example, present potential measurement tools connected with concepts presented in this thesis.

7.3 Performative Hybrid Interaction and Theories of Social Interaction

Beyond understanding the practices and improving the use and systems for performative interaction, in this thesis I have advocated also more theory-oriented research into hybrid interaction. The analysis has used concepts (see Table 1.2) such as *social rules* (Chapter 4), *norms* (Chapter 4), *performance and performing* (Chapter 5), *values* (Chapter 6), and *the models of democracy* (Chapter 6). Indeed, various perspectives can be used to guide the analysis of performative hybrid interaction. This focus on existing frameworks is in stark

contrast to what was discussed in previous work (see Chapter 2), where social theories were not extensively used to conceptualize the research problem or to articulate the findings. I argue that the theories presented have already provided opportunities to further reflect on and discuss the performative hybrid interaction and its challenges. These social theories have provided a vocabulary to discuss the phenomena.

For me, the second benefit of being informed by social theories emerges in the opportunity to rediscover existing knowledge and even solutions to problems we were able to identify via our work. In Paper IV we have noted the lack of rational-claim-based discourse. The problem is not new and has already been addressed in several works (e.g., Kriplean et al., 2012; Kim et al., 2015a). This means that a design addressing this challenge could be motivated by these works and address the issues found in the hybrid interaction environment. These design ideas could be adapted to support performative hybrid interaction and solve the problem identified.

However, the application of theories should be bidirectional. The research on performative hybrid interaction can and should also be aimed at giving back to the social theories it applies. Our study of hybrid interaction using the deliberative framework (see Paper IV) demonstrated the inability of that framework to address various nonverbal actions. This is a clear issue, since our study of performers' interaction (see papers III and V) showed the significance of nonverbal interaction. Therefore, research into deliberation and the measurements used therein should similarly account for the collocated nature of the interaction and focus on glances, sighs, and other forms of nonverbal communication. In light of the recent findings related to differences in online deliberation that stem from media richness (Brinker et al., 2015), this observation may indeed be valuable. This shows that the hybrid interaction study setting not only should apply social theories but can be used as a particular lens or perspective for study of the phenomena or even as a case to validate these – in particular, if the system design has been based on recommendations rooted in a theory.

Though the research has focused on performative hybrid interaction wherein computer-mediated and face-to-face interaction coexist, the idea of communication taking place in multiple spheres can also be applied to support the analysis of other communication types. As hinted at in the discussion in Chapter 4, for example, multilayered communication via social media (e.g., Facebook Messenger, Slack, or email) can demonstrate challenges similar to those we discussed in relation to hybrid interaction. Similarly, the observations on normative theories and values (Finding 3) can guide the analysis of various forms of mediated communication as design decisions (and, therefore, value-presenting decisions) are made. Even the observations made about performances (Finding 2) can be used to propose alternative ways to organize multilayered communication in events where performance and audience-generated content play a central role. For example, the concepts of integration work and extended performance can inform how television hosts address live tweeting during television broadcasts; the host should reflect the audience participation during the broadcast but direct it in line with the narrative of the broadcast to help the audience benefit from it. The scope of the work possible is so extensive that I have not delved into it in this thesis. However, with earlier work, I sought to understand the multilayered nature of social communication (Karikoski and Nelimarkka, 2010; Nelimarkka and Karikoski, 2012). That work presented observations that the social networks computed from phone call logs, text message logs, and social-networking service logs are structurally different. Working with the ideas of social rules and communication channels (Finding 1), we could elaborate on these differences (e.g., do people have different rules or perceive different norms in each of these communication channels?) and also undertake to examine how the interfaces build and support these type of rules and communication channels.

Lastly, the three perspectives addressed in chapters 4, 5, and 6 are all related to social interaction and the structures of such interaction. However, these three perspectives have not been integrated into one explicit research or design framework. The goal with such a framework would be to position the three findings in relationship with each other and unravel their potential interaction. One perspective that might be of use for understanding all these findings is to elaborate on how they are linked to power relations within the hybrid performance. In the social sciences, power is understood through its various forms (e.g., Lukes, 2005; Dahl, 1957; Bachrach and Baratz, 1962). For instance, Lukes (2005) argued that power can be seen through three distinct forms: the direct, the indirect and, the invisible. Direct power refers to the ability to force someone to do something he or she would not otherwise do (Dahl, 1957), and indirect power refers to the ability to change decision-making processes (Bachrach and Baratz, 1962). The invisible use of power reflects the ability to cause subtle changes to the surrounding environment, changing opinions accordingly (Lukes, 2005). The framing of the situation as a performance (Finding 2) points to the performers' capabilities to use power in the hybrid interaction as being critical and, for me, makes the event a performance – the performer conceives of a certain framing of the event. My work suggests that this power is established by using a social mechanism (establishing rules, Finding 1; choosing what content is integrated, Finding 2; and suggesting contributions, Finding 2) as well as through the implementation of technical apparatus (choosing the form of interaction, Finding 2, and applying interface design that supports particular values, Finding 3). However, this relationship is not sufficient; integrated theory should aim towards conceptualizations such as the audience funnel (Michelis and Müller, 2011) or the spectator interface (Reeves, 2011). As integrated theories, these help researchers to conceptualize the phenomenon and benefit from advances in the various fields that have informed conceptualizations. Details of such theory development are left to research questions for future work.

7.4 Limitations

Any study of social computing is bounded by the cultural and other contextual factors embedded in the social situation wherein it is conducted. We aimed to address some of these challenges through our initial study used to answer Research Question 0 (see Section 3.8), but, naturally, one exploratory study cannot address all potentially influential cultural factors. Similarly, our within-subjects experimental methods approach (see Section 3.2) was intended to take these contextual factors into account but not extend their analysis. Other studies in which I have been involved – for instance, on political social media use (Tuokko et al., view) – indicate that there are differences in user behavior between platforms. Furthermore, the instances I have studied represent particular types of events, such as the educational situations or large events that allowed us to conduct research. These aspects, however, mostly limit the empirical findings reported in each paper, not the general conclusions one can draw. Since the thesis, research questions, and findings provide more conceptual contributions, I do not foresee major challenges due to research context becoming apparent.

The social and cultural factors, however, do have implications related to the design suggestions made throughout the articles and elaborated on in my work. These interventions were designed within a Finnish context, wherein, for example, hierarchies are rather low and trust in strangers is high (e.g., Castells and Himanen, 2002). The interventions emerged from this ethos and can be seen as reflecting Nordic participatory traditions. For example, the proposal to engage pupils in defining the norms (in Paper V) is clearly rooted in this cultural context and linked with the goal of giving agency to those who do not normally have it; this is also reflected in the Finnish school system itself. Furthermore,

each social situation is a complex assemblage of factors. For example, the work conducted around social norms (represented by Research Question 1 and Paper V) revealed how students' restlessness influenced the hybrid interaction. Therefore, caution is advised if these design implications are taken on board for consideration of the various social, cultural, and contextual factors of the situation.

Likewise, the Presemo system's design and usability may have contributed to the outcomes in our analysis. The experiences I and Kai Kuikkaniemi have had suggest that spectator interface uptake is fairly easy while the performer interfaces are more complex. To address this, tutoring in system use was given in all cases to performers to ensure that they felt comfortable with the system. While this could not eliminate the potential for impact of the artifact itself on the findings, it shows that efforts were undertaken to limit that impact. Also, the findings are focused on levels of aiming to generalize beyond the results surrounding the technology, which I argue makes the system design and usability a less limiting factor than the overall cultural context.

The second limitation of the study's findings emerges from the methodological strategies applied. Firstly, research work is always an interpretation of the data. The findings emerged from our reading of interviews, our observations made while we watched the video recordings, and our analysis of survey responses. In this thesis, I have given the findings – presented in each of the papers – an additional interpretation. This means that I have made selections throughout the thesis-writing process on where to direct focus. These selections were guided through existing literature and our emerging understanding of the phenomena. I have aimed to provide examples that offer rationale for our reasoning.

The final limitation is related to the exploratory nature of the research described in this thesis. With my colleagues, I set out to understand an emerging phenomenon. However, I do not make claims about any laws or another form of predictive models emerging from these cases. In the long term, such predictive models would be useful for understanding what type of integration work is most likely to succeed or what contextual factors cause spillover norm violations. I have not addressed critical questions about success in performative hybrid interaction. Paper IV leads in this direction by outlining the role of normative frameworks and discussing aspects such as values. However, even in that work, we did not engage in examination of causes for deliberation.

7.5 Concluding Remarks

This work has examined the social aspects of "same time, same place" interaction. To study them, I developed the concepts of *hybrid interaction* and *performative hybrid interaction* to discuss what takes place in "same time, same place" interaction. As with hybrid media space, the focus in consideration of hybrid interaction is on understanding how the various media channels are interwoven. The brief reflection presented on existing knowledge of performative hybrid interaction and various tools offered previously to support hybrid interaction, such as backchan.nl (Harry et al., 2009) and Fragmented Social Mirror (Bergstrom et al., 2011), represents the background for our identification of a set of open challenges for performative hybrid interaction.

Hybrid interaction can have two sets of *social rules*, such as norms. The social rules of computer-mediated sphere are different from those of face-to-face sphere. This can cause problems, such as norm spillovers, but can also support valued outcomes, such as self-expression. Hence, there is a clear challenge for practitioners of establishing the social rules such that they support the aim behind using the technology.

The "correct" social rules can be established in several ways when performative hybrid interaction tools are in use. To approach the establishment of these rules, I consider these situations to be events. As events, they have performers responsible for maintaining and

performing within the event. The performers can integrate the computer-mediated content into the performance. They can use verbal remarks or glances to do this. Through its display, the system is also a tool for performance, since it allows, for example, for the hiding and showing of content or choosing the title of a block. The computer-mediated system becomes an *extended performance* that can, and should, support the main performance.

Given the significant role of the performers, we sought to understand how a system manifests values. The key contribution was to examine the performative hybrid interaction as participation. On this basis, we linked the system to political science and the study of democracy. We strove to understand the *normative values* of participation. The computer-mediated discussion, for example, seemed to support more inclusive participation.

Proceeding from these findings, we outlined potential topics for future research. At practical level, the performative hybrid interaction tools should support performances better. We have discussed the opportunity to focus on the scripting of performances. A script allows the performers to think about the interaction with the audience and tools for it prior to the event. Also, understanding of the various social phenomena could be further modeled. This would allow the research community to find the best practices, which could then be proposed for practitioners. This said, the work should engage with the normative theories and values further, because they help one understand what "better" and "best" as used above mean. Finally, the hybrid interaction context allows us to examine and extend the existing social theories. In addition, they have the ability to contribute to social research and foster more refined system design and evaluation.

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