

Global Online Meetings in Virtual Teams –from Media Choice to Interaction Negotiation

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ABSTRACT

This paper draws on an ethnographical study of a community of technology experts within a global automotive manufacturing company that uses information technology to communicate and collaborate in global virtual teams. Our findings show that discussions, negotiations, compromises and joint problem solving characterize media choices made in virtual teamwork. Practitioners are adding new media to ongoing interactions, rather than using media in sequence. Furthermore, one medium is not used exclusively, rather a number of media can be used in parallel. This shows that some of the fundamental assumptions built into the concept of media choice theories, are somewhat problematic as an analytical perspective when virtual teams are researched in real settings outside of laboratories and hypothetical scenarios.

Keywords

Virtual team, virtual community, media choice, media richness, media synchronicity, online meeting

INTRODUCTION

The automotive industry is often used as an example of how the globalization of industries brings changes in the organizational structures [1, 23, 19, 33]. We have conducted ethnographic [14] studies of technology experts within a global automotive manufacturing company. Most of their work consists of communicating and collaborating with peers in bordering practices located in different parts of the organization, and in the world, and commonly they attend to, what can be termed, global virtual online meetings.

The studies pay specific interest in the choice of communication media in different real online meeting situations and what factors affect the selection of media. The study of computer-mediated communication (CMC), and computer supported collaborative work (CSCW) provide foundations for studies within this area, theoretically as well as methodologically. In line with the interest presented here, CSCW focuses on collaboration rather than on individual behaviour, on social aspects of use [26], rather than on interface design, and on studying and

intervening in real practices rather than experimenting in the lab [2]. Still, the design-oriented strands of CSCW often focus on finding implications for design of a “grand system” for distributed communication. Whereas in the boundary of different practices a multitude of tools and media for collaboration are available in order to meet the needs of the collaborators. Interaction is likely to rely on constantly ongoing tinkering and adaptations.

Research on virtual teams has a long tradition. (See [22], [15] and [25] for overviews). Virtual teams are here defined as geographically distributed work teams whose members primarily communicate and collaborate using IT-tools. The concept of a “team” is described by Zenun et al. [35] as “...a small number of people with complementary skills who are equally committed to a common purpose, goals, and working approach for which they hold themselves mutually accountable.” (p 701). According to Ebrahim et al. [12] the more widespread use of the term work teams was used in the 1980s in the US, and in the late 1990s companies had begun exporting the team concept to their global affiliates around the world. The advances of information and communication technology and continued globalization have facilitated the expansion of virtual teams worldwide [18]. Martins et al. [22], in a literature review on virtual teams, conclude that “*VTs are increasingly prevalent in organizations and, with rare exceptions, all organizational teams are virtual to some extent.*” (p 823). “*We have moved away from working with people who are in our visual proximity to working with people around the globe*” [17, p. 29].

Early research on how inter-professional communication is managed focused on understanding how users choose between available technologies based on the affordances and limitations of the media. Daft & Lengel [5] suggested that the choice of media could be understood as a rational process where the uncertainty and the equivocality of a message could prescribe a suitable media, i.e. that there could be a perfect fit. Even though their study did not focus on IT in particular it still has had great impact on research on how IT media is chosen. “Although this research did not incorporate new media, the findings help explain why managers do not fully utilize information systems and electronic media” [7, p. 363]. The quote suggests that there is a best way to use a media, a full potential, which is something that can be discussed. More interestingly, given

the context of this paper, it also downplays the importance of the specifics of the media chosen – their hypotheses are applicable to all media, whether digital or any other form.

Given the variety of information and communication tools that are available, as well as the specifics of being engaged in virtual team activities the following research question is raised in this paper:

What characterizes the use and choice of information and communication technology in global online meetings of virtual teams?

Our findings indicate that some of the claims made in existing media theories can be contested. Both Media Choice Theory [32] that draws on Media Richness Theory [4, 5, 6] and the competing Media Synchronicity Theory [9, 10], attempt to explain the underlying principle of what medium is best suited, from a managerial point of view, for processing communication. Here, the recommended medium (or combination of media) is chosen to achieve a certain communication performance to accomplish a given task. But these theories among many other studies of virtual teams and the choice of media for communication are mainly based from studies of groups in laboratory settings or assembled groups of students [29] where a pre-defined and often rather poor set of tools are made available to choose from. These studies do not take in consideration what happens in real situations when different geographically dispersed peers have to find ways to communicate and collaborate with each other. The communication in global virtual teams is often performed in contexts where the conditions surrounding the communication are not always predictable.

We have conducted empirical studies of communities of engineers within a large global company, active in the automotive industry. To improve the planning and control of the development of new cars they have assigned 400 engineers the strategic responsibility of subsystems within the car. Our study has focused the work of this novel role and organization, here referred to as Subsystem manager (SSM). The car has been divided, conceptually, into 400 partly interrelated subsystems e.g. backseat, seatbelts or steering wheel. The corporation design cars at 13 R&D-centres around the world. The R&D centres have long experience of arranging work in virtual teams of engineers. The SSM arrange continuous global online meetings, in different team-settings, with other experts within the subsystem or with other SSMs for closely related (integrated) subsystems and with project teams working with new models. The members in these project teams were located in the different R&D-centres around the world. Our study concerns the way these communities of engineers utilize information and communication technology in their meetings. In the studied organization there is a long tradition of collaborating across geographical distance in virtual teams.

The remainder of this paper is organized as follows: The next section provides an overview of research on virtual

teams and their use of information and communication technologies. This is followed by a description of current research on media choice. Thereafter we present our research method and setting of the studied teams and online meetings in an automotive company. Finally we present results and a discussion of findings from our observations of these meetings followed by conclusions about use and choice of information and communication technologies.

VIRTUAL TEAMS

According to Vaccaro et al. [33], no explicit definition on virtuality in team or project work exists: “*Although the literature lacks a unique definition, the idea of virtualization is always associated with the introduction and extensive use of ICTs*” [33, p 1]. In a recent review of virtual team research Ebrahim et al. [12] states that the literature related to virtual teams have a lack of depth in the definitions. They conclude by the following definition of virtual teams: “*small temporary groups of geographically, organizationally and/or time dispersed knowledge workers who coordinate their work predominantly with electronic information and communication technologies in order to accomplish one or more organization tasks.*” [12, p. 2655].

Research on virtual teams is often addressing issues of task performance and efficiency in work giving guidance to managers and team leaders for best use and adaptation of technology [31]. Ebrahim et al [12], suggest, in their review, that, different communication technologies are more suitable for different meeting purposes, depending on the information richness in the communication between team members. Thomas & Bostrom [31] also concludes that “*Studies and current theories on the role of ICTs in the effective execution of computer-mediated work emphasize the importance of media choices (e.g., Dennis and Garfield 2003; Dennis and Valacich 1999; Zigurs and Buckland 1998). Several of these latter studies treat ICT choice as an initial problem rather than an on-going concern because ICT selections are based on their fit with functional needs, which may be predetermined from work tasks.*” [31, p 116]

Within the automotive industry tasks can range from conducting project meetings [21, 33], where geographically dispersed engineers need to discuss project deadlines and deliveries and share technical drawings, to solving a specific design-task in a software development team [7] where designers and developers need to collaborate in specific online applications.

Bal & Gundry [1] studied virtual teams in an inter-organizational concurrent-engineering project. This research was conducted during a period when the automotive industry was starting to recognize the need for more agile working processes, replacing recurring time-consuming face-to-face meetings. Studying managers and virtual teams in the automotive manufacturing sector they analyzed the use of different communication and collaboration tools like “*...video and audio links, shared whiteboard and product libraries*” [1, p 190]. The authors

identified a number of factors affecting the performance of the virtual teams connected to the information and communication tools used like the *selection* of appropriate IT-system (based on the task, the organizational capability and the user skills), *security* issues related to the organization, the physical *location* of the IT-system and team members and how much *training* the users had in using the different tools [1]. They concluded that successful virtual teams were hard to find. And that “*Our empirical research highlighted that introduction of VTs should not be considered as or implemented as an IT project, as then usually insufficient attention is paid to human and process factors*”. [1, p 192].

Contrasting this research, some studies in the automotive industry shows that virtual teams communicate more effectively using collaboration tools and that such tools increase the quality of work and reduces product development time [23, 21]. Today, teams can choose from a broad range of technologies to supplement or replace face-to-face interaction [22, 12].

The research on virtual teams is shifting from a focus on technology and task to a focus on the understanding of relations and social processes (i.e., shared understanding, communication, and trust). This is illustrated in Duarte & Tennant-Snyder [11] where focus is set on group-processes and how to manage virtual teams where the IT-infrastructure is subordinate to the processes and roles that are at the centre of attention [16, 12]. Ebrahim et al. [12] state that: “*success in implementing virtual team working is more about processes and people than about technology*” [12, p 2663].

Studies of the use of collaboration technologies in communities have a long tradition in the field of CSCW. Here the concept of communities of practice, introduced by Lave and Wenger [20] has been widely used. In a community of practice, meaning, negotiation, participation and reification [34] are important processes for community members in their shift from peripheral participation to full participation [20].

Huysman et al. [16] compares perspectives in technology view within the research field of CSCW and within virtual teams: “*Virtual team researchers are mainly focused on problems of interaction faced by such teams, and less on the way teams appropriate communication tools. CSCW researchers on the other hand, are more interested in tool usage and less on the contextual or organizational aspects that might influence the process of appropriation of communication tools.*” (p 412). They attempt to bridge these differences in an exploratory study of the evolving use of communication tools by six global virtual teams composed of students from engineering departments in the Netherlands and in the US. One of their findings in this, semi experimental setting, is that all of the virtual teams tended to stick to the particular mode of communication they developed early in the project. The teams also showed a tendency to collectively stick to one type or style of

media use and not to switch to another. The authors refer to this phenomenon as “media stickiness”.

CHOOSING MEDIA

In media richness theory, whenever a message is to be communicated, the inherent equivocality and uncertainty of that message can be used to prescribe the media, depending on the richness of the medium. Uncertainty is here understood as the gap between the available information and the amount of information judged necessary to perform a particular task. Equivocality is the “... *existence of multiple and conflicting interpretations about an organizational situation.*” [5, p. 556]. Different communication media is then placed along a continuum depending on their capacity to reduce uncertainty and resolve equivocality. Rules and regulations are the lowest in richness, and face to face meetings are the highest. The richness is also described as ability to facilitate understanding, or even support shared meaning. The richness of different media channels are decided depending of their ability to: (i) allow feedback, (ii) allow multiple cues, (iii) facilitate language variety, (iv) full personal focus.

Media richness theory has received critique both concerning its theoretical foundation and the quality of the empirical studies providing support. Framing work as a sequence of rational decisions supported by tailored information technology has been questioned, and more or less all empirical evidence of how managers go about choosing a medium for communication is based on hypothetical scenarios (see [8] for an exception), in which managers are asked about their media preferences in a given situation. Methodologically this approach inherently focuses on the medium as the dependent variable, and rests on the (somewhat simplistic) assumption that managerial communication is principally about transmitting information to the employees.

Dennis et al. [8] expands and refines the Media synchronicity theory (MST) originally presented in Dennis & Valacich [9]. They argue for a broader view of how media is used in different communication settings instead of remain with trying to further elaborate upon the Media Richness Theory that has been proved insufficient for the explanation of media choice and communication performance [8, 9]. Münzer & Holmer [24] confirms in their study the strengths of MST proposing that, “*existing media contain a bundle of interrelated dimensions on which they differ, and current media choice theories do not adequately characterize these differences*”. Other researchers have also concluded that factors beyond media richness affect media choice (see [13, 27] for reviews of media choice research). As increasingly sophisticated applications supporting distributed collaboration became available, research on IT-supported communication and collaboration directed growing attention to the social aspects of work. Here improvisation, bricolage and the

dynamics of the organizational life are central processes [3]. Furthermore, the central consequences of communication technologies are often far-reaching, are to a large extent unintentional [30], and have a significant impact on how work is articulated and organized [26].

Theories of media choice and media synchronicity are also criticized by Riemer & Filius [28]. They state in their communication analysis that media choice theories exhibit several shortcomings for guiding practice. *“The rational media choice theories are based on the principle of rationale choice behaviour. They assume that users base their media selection on cognitive evaluations of the media and their appropriateness to the task at hand”* [28, p. 165]. Media synchronicity theory also includes this rational relationship between task and media. Riemer & Filius [28] claims that a range of social factors influences media choice and that different media characteristic can be viewed in different ways in different social contexts. In conclusion we note that previous research on the choice of medium is based on an idea that there is a most rational, efficient and ideal medium, fitted for different communication purposes.

These theories of how technology should be chosen or used in different work situation do not fit well in the constant changing environment that characterizes the boundaries between different practices. Most of the studies presented above regarding media richness and other media choice theories derive from semi experimental settings. When studying virtual teams “in action” we believe that the picture of which communication tool to choose is less simplistic and differs from what is prescribed by these theories.

METHOD

The research design of the study responds to a call for studies of virtual teams in real-life settings [e.g. 22, 31]. For instance, Martins et al. [22] state that: *“Another methodological concern with the current state of the literature on VTs is that much of the empirical research has been conducted in laboratory settings, using student teams working on short-term tasks...”* [22, p 822]. Studying real-life settings gives us the opportunity to observe the use of media in situations where parameters like technical/digital infrastructure and availability, team members prior experience and knowledge, common understanding of task and technology are not controlled and pre-designed by researchers as they are in experimental settings.

Sivunen & Valu [29] criticizes the methodological bias for laboratory experiments: *“These procedures cannot answer questions of what influences communication technology choice, because often only a few tools are actually tested in laboratory settings and no real choice between different kinds of media can occur in those circumstances”*. [29.. p 57-58].

The meetings we have studied involved a multitude of different communication technologies and our goal was to

explore how information and communication technology was used in global virtual teams and in the practice of the SSMs. This comprised their everyday work in general and when participating in online meetings in particular, as well as covering the tasks they had to complete, the obstacles they had to deal with, which technology was chosen during meetings, when and for what purpose.

To reach a better understanding about the SSM:s daily work and their main activities and to get access to the workplace we started our study with four group interviews in autumn 2008 with three SSM:s. Data from the group interviews were collected as notes and on one occasion also recorded with an audio recorder. This data was thereafter discussed by the researchers where activities connected to the global online meetings were more thoroughly analyzed. The information from the group interviews served to enrich the picture about how the meetings were carried out, what topics were discussed, the average duration of a meeting and the typical information and communication technologies used. Based on this information, field studies combined with interviews were then conducted. In the field observations, one researcher, during an agreed time space of 4-8 hours, followed a SSM in his daily work and participated in all the work-related activities during the determined time. The observations included mainly interactive activities like participating in online meetings and, in some cases, face-to-face meetings, phone-conversations, computer-work etc. Focus on these observations was set on the use of information and communication technologies. The observations were made during December 2008 to May 2009 and comprised four different online global meetings utilizing a variety of different media. Since we were not authorized to collect video or audio data, field notes combined with interviews and discussions with the SSMs were our main data sources.

After every observation the field notes were more thoroughly transcribed and each one of the researchers analyzed the excerpts in search of patterns in the choice and use of information and communication technology during the online meetings. Potential patterns and themes of use and choice of technology were then discussed and the data yet again analyzed in relation to these themes. To complement the observations the excerpts from the field notes were also discussed with the SSM, providing further and more detailed descriptions and clarifications.

To avoid identification with the actual company, the names of subsystems and countries in the excerpts presented in this paper are rendered anonymous.

SETTING FOR SSM WORKPLACE AND ONLINE MEETINGS

In this section we present an overview of the workplace and communication technologies made available by the corporation for the SSMs and the different virtual teams. We also present typical work tasks and responsibilities for SSMs and the teams.

Workplace

The SSMs were all sitting in open-plan offices at the R&D-centre located at a plant in a North European country. They were co-located with other colleagues at the same division although the team-members they had to collaborate with were located in other countries in Europe, North America, South America and Asia at different R&D-centres. The physical workplaces at the plant looked all very alike, with screen walls, shelves, chairs and desks. The digital workplace with different information and communication tools was accessed mainly through the mobile phone and laptop. Most of the SSMs work was performed in the office space.

A SSM had to communicate with different project groups working with car-parts or subsystems within, or interrelated to, his/her car subsystem. This was usually performed in recurring online meetings with different team members and project groups. The teams typically consisted of engineers responsible for different car-parts or subsystems entirely or partially connected to the SSM's subsystem, and the participants could be located in different countries around the world. Some of these team members had therefore never met each other or the SSM face-to-face.

Due to differences in time zones, some participants had to participate in the meetings out of their office hours. Consequently they attended to the meetings from their home, or other office spaces than their usual workplaces. In some cases external suppliers, not co-located to the R&D-centres, were also included in the meetings. These circumstances meant that participants on a global online meeting could not always count on that they all had the same set of technologies available during the meeting.

Communication tools

Presented below (table 1) is a selection of information and communication technologies typically used by the SSMs. There was a range of systems available: File transfer and sharing, groupware, different web-meeting systems, e-mail, phone, instant messaging and application sharing tools.

TABLE 1. Systems used for information sharing and communication. (Fictive system names for anonymity)

<i>System</i>	<i>Description</i>
GroupWare	Groupware with different built in tools for group work. Used for e-mail, planning and scheduling in calendars and note-taking
WebMeet	Web meeting system, text chat, whiteboard, desktop sharing, and file transfer. Audio and video transfer is also available in the application.
Web Application Viewer	Used for web meeting like WebMet for sharing applications
WebEx	A communication system that is not part of the corporate Intranet. The software is delivered as a service by WebEx. A web meeting system with possibility to share documents, and applications.
Instant Messaging	Text chat-program. Sometimes referred to as messenger
Video-	A special audio/video-communication solution

conference	placed in a dedicated videoconference-room, allowing different locations with groups of people to interact via video and audio transmissions. Video-transmissions can also be made using a connected computer or a document-camera.
FindMe	A visual presentation with name, e-mail, messenger address, telephone number and photo of all staff in the global corporation that shows the "chain of command".
File repositories	Repositories for all kind of documents. Here project specific documents and official global and corporate documents like supplier agreements and contracts, statistics etc are stored. Also various documentation with constraints about how the different parts of the car subsystem should be used or assembled is stored here.
CAD-visualization	A visualization/presentation tool for 3D-drawings

Work task

The main role for the SSM in the meetings was to ensure that the different project teams followed the company recommendations for designing subsystems with parts from different suppliers. Also the SSM should ensure that knowledge of different car parts was disseminated to the team members in teams responsible to (sub)systems related to the specific part. Discussions in the online meetings could for example concern different restrictions of the dimensions for a specific part or quality issues and durability for parts from different suppliers. A SSM would also have to read, modify and create project documentation, specifications that were distributed in different file-areas and repositories in the global Intranet and/or distributed by e-mail. These documents could be anything from meeting-notes to formal technical documentations and specifications of specific parts of a car or e.g. 3D-drawings of parts. Some documents also described road maps for different projects with deadlines and deliveries.

Participating at different global team-meetings was a frequent and important activity and part of the SSM's work and also the centre of attention in our study. A typical working-week a SSM had to participate at 4-5 different global online meetings coordinating and managing activities with different project groups. The meetings served as checkpoints for the different parallel projects that the SSMs had to survey. These meetings were held according to predefined agendas, with deadlines and road-maps, which were recurrently revised and agreed upon by the global teams for different car platforms and programmes. These revisions were regularly documented and saved in the shared file areas in the corporate intranet by the team leaders, usually as a consequence of the discussions the teams held in the meetings. These file areas were available to all team members.

Normally, the meeting agenda was distributed by e-mail along with the basic data for decision making. The meetings were held using teleconference and a desktop or application sharing system. Video-communication was not allowed in the company, for secrecy reasons, except when

using videoconference equipment in dedicated videoconference-rooms. The SSM:s usually participated in these different project-meetings as a supervisor or adviser. In average 5-10 team members participated in an online meeting and the duration of a typical meeting was 1.5-2 h.

RESULTS AND DISCUSSION

In this section we describe and discuss the main result from observations of different online meetings. Excerpts from typical situations from these meetings are presented and discussed and summarized thematically after each subsection.

The presented data is taken from different global online meetings where a SSM, here referred to as Carl, attended. He was responsible for a specific subsystem, and was stationed in a European country. All meetings were conducted in English but involved mostly non native speakers. They were carried out as teleconference-meetings combined with desktop sharing. This means that Carl used his phone with headset to talk and listen to what was said, and his laptop to look at, work with and share digital documents. These documents usually involved facts and figures, technical specifications, drawings etc regarding the subsystem or part of the subsystem to be discussed. Generally Carl would have conducted these meetings at his ordinary office space. However, to be able to use speaker phone, and include the researcher, the meetings were organized in a conference room. In the excerpts the observer/researcher sometimes clarify different aspects or comments specific situations and these comments are marked with brackets, (). The results will be presented thematically. After each theme or excerpt we provide analytical comments.

Choice as a matter of convenience

The excerpt below is taken from a global project meeting held with project teams for subsystem-A. Participants were an Asian group, the SSM-leader for another subsystem, subsystem-B who participated from European country 2 and Carl from European country 1. The aim of the meeting was to determine if subsystem-B could meet the requirements needed for a specific part of subsystem-A. The meeting had recently started and Carl just managed, after some technical difficulties, to start a WebMeet session on the laptop and connect to the teleconference with the speakerphone. The microphone is turned off.

...You can see the Asian group in the shared window in WebMeet. It looks like they are sitting around a table in a conference room and probably using a videoconference system with special audio/video-equipment (I later asked Carl about it and he also thought it was some kind of videoconferencing system located in a special conference room –not the desktop-sharing system they normally used in their meetings). One Asian participant gives a brief background description to the meeting in English about the specific part of subsystem-A. One of the participants in Asia is conducting their part of the meeting but there is

about 7-10 other participants visible (on screen) in their group. It's difficult to distinguish the different people on the small screen on Carl's laptop. The person presenting says that he is trying to share a Power Point presentation in WebMeet. After a few seconds a presentation is displayed on Carl's desktop and the presenter announces that he encountered some kind of problem. He tries to change some settings and a discussion (in local language) starts between the participants in the Asian group. It's hard to distinguish who is speaking. Carl keeps the microphone turned off and says to me that it's probably their projector connected to the videoconferencing system that is not working properly. (Apparently, they were not able to see their own presentation on the screen). After a while the Asian group announces that "it's working again" and that they will look at a computer screen instead.

In this excerpt the videoconference, placed in the videoconference-room in the Asian country, was connected to the desktop-sharing system, WebMeet. The task was to present a PowerPoint presentation and discuss matters in the presentation. The Asian group encountered technical problems and were unable to display the PowerPoint presentation on their own screen. To solve the problem they connected a laptop to WebMeet and viewed the presentation from the shared desktop on their laptop instead. The videoconference system was still connected to WebMeet displaying the Asian conference room and to the teleconference for audio communication. Several parallel systems were used and partially integrated during the whole meeting.

The videoconference equipment is technically advanced, combining many different technologies; a computer, one or more video-cameras, the ISDN or IP-based audio-communication equipment and a large video screen. The choice to use videoconference was made by the Asian group before the meeting started and they had to combine this equipment with a combination of two other tools, teleconference and the desktop-sharing system, to be able to communicate with the other meeting participants. The Asian group were the only participant who displayed video from the conference room. All other participants were sitting at their laptops sending and viewing the screen captures.

When the Asian group encountered technical difficulties they had to come up with a solution "on the fly" to be able to continue to participate in the meeting and carry on with the task. After a short discussion they decided to stay attached to the audio-communication (teleconference through the videoconference system) but had to switch tools for presenting and viewing the PowerPoint presentation. The solution they came up with was to connect a laptop to the Internet and use the desktop-sharing system from the laptop instead of the computer connected to the videoconferencing system.

The choice of media seems not only to be a question of what is most suitable for the specific situation but it's also a matter of convenience. Here we can see the choice of medium is dependent on what tool is available at the moment and what kind of tools the other participants in the meeting are using. The Asian group chose videoconferencing because it was convenient to them as they were able to use a conference room where all the 5-7 co-located participants would be able to see the presentations on a larger screen. The extra video connection that was used in the communication tool was superfluous and really never useful to perform the task. When combining and adding different communication tools to each other some participants may experience richer media and some poorer media at the same meeting.

When something fails the participants have to find workarounds and reach an agreement on how to be able to keep on with the meeting activities. In this case they chose to add another communication tool to the one already used to solve the problem. The choice of media becomes more dependent of the situation and the overall context and just partially dependent on the task performance.

To summarize

In this section we have shown that choice of communication technique in an online meeting is not solely a matter of the most suitable media according to the task to perform but the choice of media is also a matter of convenience depending on the situation at the particular moment. The choice is not only an individual choice but the result of collective agreements.

Choice as a matter of adaptations

This observation is from a global project meeting with different project groups dealing with subsystem-A in North America and a European country. In North America one subsystem-A-supplier was present together with one of the project groups. Carl was participating from the European country. The meeting was held two hours later, the same day as the meeting with the Asian group and concerned security issues of the subsystem. Carl joined the teleconference and started a WebMeet session. All the other team members were already connected to WebMeet. One of the participants in North America is just going to present some 3D-drawings in CAD-visualization showing different, alternative positioning of a specific part of the subsystem.

...One can hear that the project group in North America is experiencing difficulties in displaying the drawings in the desktop sharing-session with WebMeet. The other participants discuss if the problem has something to do with different screen-resolutions on their computers. The sound is poor (It's difficult to hear some of the participants) and after a while Carl asks if they can use Web Application Sharing instead. The participant, at the moment chair of the meeting, replies that he does not have Web Application Sharing installed on his computer. Carl looks a bit frustrated and explains (to me) that WebMeet

cannot be used to present CAD-models and films and that is the reason why the participant cannot display the drawings he wanted.

Someone says that they now are copying the drawings to a PowerPoint-presentation instead so they can carry on with WebMeet. (It takes a while).

Since 3D-drawings cannot be presented in the tool previously agreed upon to use, the participants need to switch to another more suitable tool to perform the task, in this case, to present the drawings. One meeting participant therefore tries to solve the problem by suggesting another desktop sharing tool but the lack of this tool at the presenter's computer creates a new problem that the team has to overcome. They have to find a new solution and finally another participant volunteers to copy each drawing from the CAD-model to a PowerPoint presentation.

The excerpt illustrates how the choice of media is the result of several negotiation processes caused by unexpected problems or, in this case the "wrong choice" from the beginning of the meeting. Each member in the team does not have the overall picture of what tools are available at the other member's workplaces and what technical limitations there are in each tool. The different desktop sharing systems are more or less similar but when the task is to present 3D drawings just one of the systems has the technical capacity to perform the task. The "right choice" is in this case is based on the knowledge of the technical capacity of the communication tool in combination with technical knowledge of the task. When the team-members discovered that the presenter did not have the right tool available they instead agreed upon to adapt the task. Now the solution is not to choose another communication tool but to transform the 3D drawings into 2D drawings in the PPT-presentation. This workaround to overcome the obstacles by adapting the task was accomplished by joint discussions, compromises and problem-solving.

To summarize

The use and choice of communication technology in online meetings are here shown as a matter of negotiation not only about which tool or combination of tools to use but also about what the task really is about. The participants' knowledge and experience plays an important role in these collective negotiations where adaptations can be made on both technology and/or the task to get the job done.

Choice as a matter of parallel use

This theme is illustrated with two different excerpts. Each one is followed by comments regarding parallel communication.

The first excerpt is from the same meeting, referred to in the previous section, a few minutes before it ends. Carl just received a chat message and the microphone is turned off.

...Carl has a messenger-chat with a co-worker during the meeting. It's a subsystem manager for another system and Carl says to me "I have to give him a call later". The

meeting continues and there is a lot of talking going on between the participants in North America. The meeting is prolonged and Carl starts doing other thing on his laptop. He keeps the microphone turned off. He opens GroupWare and starts to read and answer e-mails. He also looks at his calendar and checks different appointments. He has multiple application windows open and swaps mostly between GroupWare and WebMeet, where the PowerPoint slides are shown. (My impression is that he is trying to keep track of what is going on in the meeting, now and then, even though he's doing something else on his laptop.) Sometimes he comments on something discussed in the meeting but the discussion is mostly going on between the participants from the different project groups in North America. Carl turns on the microphone and says to the other participants that he has to leave the meeting and sums up what has been said so far. The other participants thank him for his participation (this happens with some irregularity whereas greetings took place more or less simultaneously). He disconnects from the meeting (and I get the impression that the meeting continues without him...)

Here, Carl is attending the meeting, listening to the discussion. He does not, however, seem to have to keep up with what's going on at the shared desktop except for looking at the PowerPoint slides once in a while so he uses his laptop for other matters. The other participants know that he is still attending but they cannot see or hear (when the microphone is turned off) what's going on from his workplace. He starts a conversation with another co-worker using the instant messaging system and subsequently participates in two different "meetings" at the same time. He then switches to other applications and starts working on other tasks whilst listening to the discussion and checks the shared desktop now and then to keep updated.

This illustrates that the media choice is based on a collective agreement for the meeting itself but the meeting participants are also able to choose other communications tools in parallel discussions with other co-workers outside the meeting and on-the-fly. Here, a text based communication is added and used in parallel to an audio-conversation with shared desktop. Different tasks are performed at the same time using combination of tools with various degrees of richness and synchronicity. Carl saw the opportunity to complete other tasks during the online meeting while his participation was only needed in a more passive way. He could "stay tuned", listening at what was going on in the meeting while he also wrote some e-mails regarding other matters, without letting the other participants know about it. The richness and the synchronicity of the media is appropriate according to each one of the different task; a richer synchronous audio-communication with desktop sharing, demanding higher synchronicity in the online meeting where the participants need rapid transmission and a poorer asynchronous, text-

based correspondence, demanding low synchronicity where Carl needs to do an individual interpretation of the information. The media choice theories does, in this case, help us to explain the choice of each individual but says nothing about the overall situation where the context and changes in communication and task also demands for continuous adaptations in the choice of media.

In the next excerpt, the team has just finished discussing the first item on the agenda, and a new participant, David, has turned up in the conference room where Carl (and the researcher) are sitting. David is an engineer in charge of a specific part of the subsystem that is going to be discussed next.

... Carl looks for an e-mail in GroupWare and has multiple mail-windows open and Web Application Sharing at the same time. It looks like he is downloading a presentation to his computer. He opens the PowerPoint presentation and presents it to the rest of the participants using a menu in Web Application Sharing. (I now understand that Carl and David are going to lead the presentation). David reaches for the computer and starts to present the first PowerPoint slide...

(Now the meeting has moved to the next item on the agenda. The participants have commented on the fact that they now are short of time and have more topics on the programme to discuss, but they have all agreed upon continuing the meeting.)

...The previous picture with a table is still visible in Web Application Sharing but the discussion is now concerning other things. Some different cities in North America and Europe are mentioned. Suddenly Carl receives a chat message on Web Meet. One of the participants comments something on the chat regarding the previous topic in the meeting about a supplier. I ask Carl about it and he explains that the chat-discussion is about the connection with the supplier. It's a sensitive issue as they (the company) want to put some pressure on the supplier but, at the same time, they don't want to lose them. Carl and the meeting participant send some short messages to each other and then the chat session ends...

The excerpt shows that participants in the meetings can participate in different communication activities using different communication media simultaneously. Carl and other participants have parallel discussions on "the side" of the meeting e.g. through e-mail or chat when they need to discuss urgent matters more privately. Here other negotiations and activities take place that are not visible to the rest of the team members. These discussions often relate directly to the ongoing meeting and are used to reach agreements or check out other participant's standpoints that could be useful in the meeting (like in the issue with the supplier) but we can also see that these activities not always relate to the actual subject or agenda of the meeting. When a participant is not playing an active role in the meeting,

he/she can switch to other media during an online meeting in order to perform other tasks. Some of these tasks are directly related to the ongoing meeting and some are more connected to other activities.

To summarize

This section shows that individual choices of both task and technology can be made in an ongoing meeting where different technologies can be used in parallel to perform different activities sometimes not necessarily connected to the overall task. Also parallel communication channels can be used between meeting participants in the same meeting to smoothen differences in opinions or solve shared problems.

CONCLUSIONS

The research reported in this paper shows that communication in virtual teams encompasses complex use of communication technologies that cannot fully be understood based on prior theories of media use. Firstly, we can observe that only rarely work is “merely” about completing tasks. The work we have studied is characterized by negotiations, not only concerning how to solve a task, but also concerning what the task actually is.

Negotiations are here understood as negotiations of meaning [34], where the negotiation can be seen as reaching an agreement in an ongoing process that “...entails both interpretation and action” [34, p 54]

Secondly, the choice of media is in itself is a matter of negotiations. Therefore, choice of media is neither a matter of a single individual’s choice, nor is it an exclusive choice. One can participate in a videoconference, with the sound turned down, using a phone conference for the sound, sending IMs and checking e-mail, all at the same time – and as a meeting progress, new (unpredicted) events call for additional negotiations and media.

As a result of these negotiations and adaptations of new events, team members do not only communicate with each other through one channel. They may use different communication media in parallel where not all meeting participants are included. They can also communicate simultaneously with persons outside the meeting without letting the rest of the team members know about it. They use information technology during the meeting for retrieving information or, simply perform tasks outside the meeting. It all depends on the situation.

Media choice theories can, only to a limited extent explain the choice of communication media in the observed meetings. Their static view of how communication processes and media capabilities has to be matched to get the best “fit” fails to fully clarify the dynamic settings we have presented where media is used in situations that are constantly re-defined.

What this study of real meeting-situations reveals is that sometimes seemingly trivial aspects like what tool is available at the moment or what kind of tools the other

participants in the meeting are using affect the choice of media. Technical difficulties and breakdowns, which rarely occurs in laboratory experiments, forces team members to collaborate and negotiate to find alternative solutions or generate new combinations of media to get the job done. Team members experience and technical knowledge of different tools also influence the choice of medium. We have shown that social and contextual matters, in virtual teams, affect the use and choice of technology in online meetings, beyond the existing theories of task-media fit. What characterizes the use and choice of media in global online meetings in virtual teams is more about interaction negotiations and less about predetermined media selections.

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