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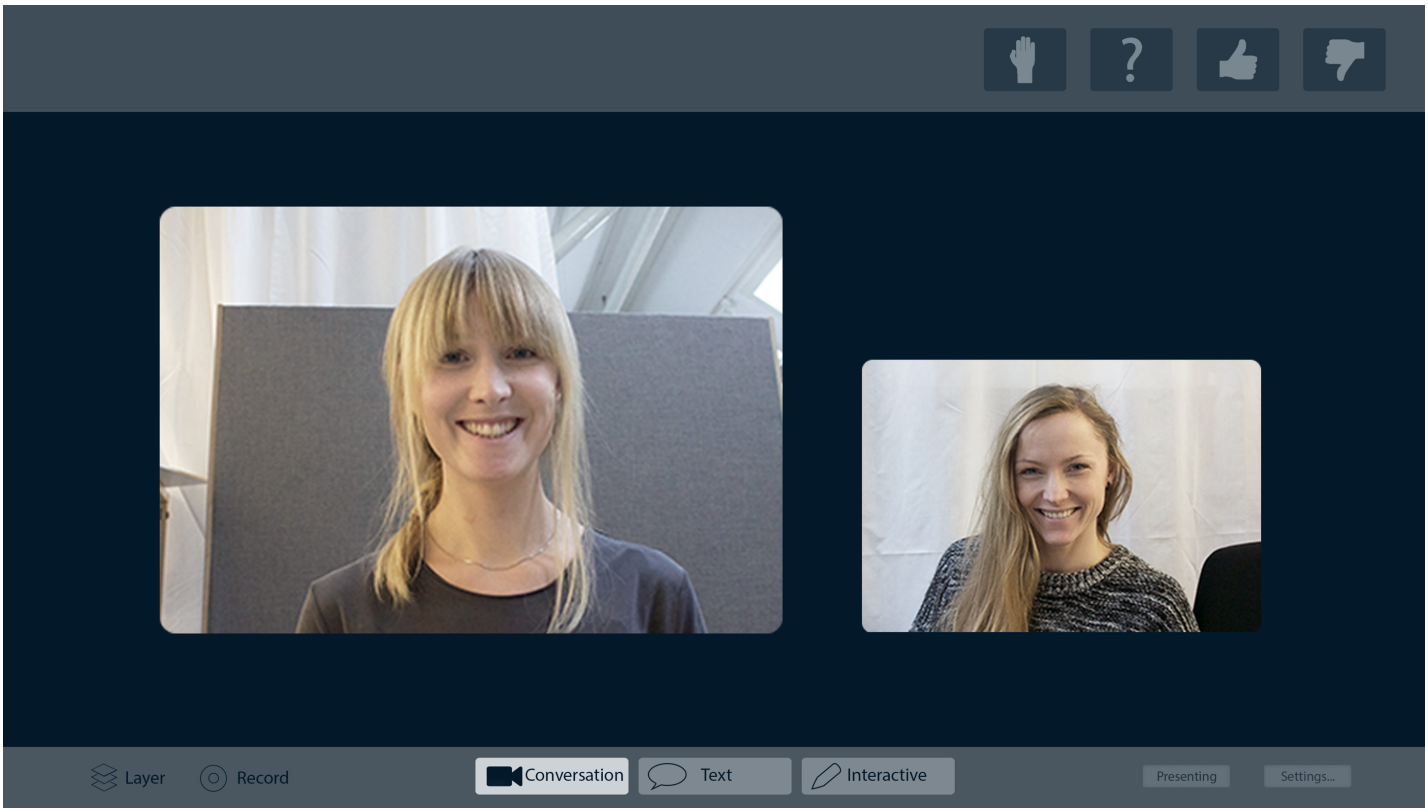

How to improve collaboration remotely
- from a user perspective

Master of Science Thesis in the Master Degree Program, Industrial Design Engineering

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Gothenburg, Sweden 2016

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Foreword

We would like to thank all the stakeholders in the MERCO project that have supported us in many ways with their competence, optimism and ideas. Another great big thanks to our examiner Oskar Rexfelt and our supervisors Anneli Selvefors, David Gillblom and Ulrica Cullen that always brought valuable input to any given discussion and created new ways of thinking to avoid narrow roads. Also, we would not have been able to conduct this study without being so welcomed at the researched companies by all the employees, so we would like to send a big thanks to all employees and user study participants that patiently supported us throughout our field work. An especially big thanks there to Magnus Thor for helping us with the prototype and all his wisdom. Finally, thank you to friends and family for always being the best of support in the process.

Abstract

Remote collaborations in companies are today more frequently used as a consequence of increasing cross-national business and the benefits of cost, time and environmental impact reductions as a consequence. Nevertheless, it has been shown that remote collaborative meetings do not live up to the alternative of meeting in person in matters of effectiveness. The aim of this master thesis project is to investigate the remote meeting situation at two multinational, development companies and by the found data create a solution that supports remote collaboration. The project focus has been to identify existing user needs in remote meeting situations and to translate these into either a physical or digital product. The project has been carried out on behalf of Ericsson AB and Semcon AB and supported by several other stakeholders, part of the external project MERCO.

The findings display the need for considering the social context and to challenge the existing meeting culture to facilitate collaboration and increase individual motivation within the meeting environment. The importance of facilitating and encouraging creativity and interaction throughout the meeting has been found as crucial when aiming for creating a collaborative environment remotely. Therefore, the final result of this master thesis project includes a framework with factors of how to enable informality within the meeting context, aiding designers and product developers how to work with informality as an important factor for facilitating communication.

The project process has been carried out through literature and user studies several concept ideas were created as a result of the found user needs. By consulting meeting participants related to the concepts intended users and the MERCO objectives could one final concept be taken further into developing an early digital prototype, aimed for supporting the collaborative process when meeting remotely.

The final developed concept is a software program that is supporting remote collaboration by including functions that supports increased interactivity and inclusiveness within the remote meeting. Functions to visually display participants even though the network connection is low, to capture important aspects within the meeting and allowing the participants to interact with the displayed artifacts during the meeting is some of the developed functions incorporated within the software. An early prototype was developed to test some of the functions during remote collaboration.

Further development will be required to design more of the software program functions and to test it thoroughly. The project findings means to support the following MERCO project to take the software program to new levels of development and market adaption.

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1 Introducing the project

This chapter introduces the framework and overall goal with the conducted master thesis project. The project process is described at the end of the chapter, which also is the process of how this report was written.

1.1 Background

Effective teamwork often requires different competencies frequently collaborating and interacting with each other. Successfully performing advanced group tasks such as complex decision making, group ideation and team building is something that is of great importance for an effective teamwork delivery. As for today does such complex tasks requires physical presence for the participants and even though there exist net-based communicational remote tools such as teleconferencing, face-to-face meetings are still frequently used. This result in an increased need for transportation, which ultimately is becoming an environmental issue when the fuel used for these transportations are adding to global Co2 emission[1].

One of the reasons for still having the need to meet in real life is that the available technology for teleconferencing does not capture the full spectra of elusive information flows that take place in natural conversation[2]. Gestures that occur in such conversations could be for instance hand movements, facial expressions and glances, which unfortunately could be filtered out through using net-based communication. Moreover could such a non-aligned system of information where elusive parts are left out lead to a lack of efficiency in communication, simply as these subtle movements play a substantial role in cognitive input whilst communicating[3].

In order to reach efficient results in remote communication, three layers of space are according to MERCO required in order to reach a transferable system of information that are similar to a live meeting context; task, work and communication space[4]. The *task* space refers to the artifacts generated by the collaborative team such as drawings; whereas the *work*space refers to the deictic gestures and references the speaker do to emphasize a meaning. The *communication* space concerns the verbal communication, the eye movements and more automatic body movements such as shrugging. By introducing technological components combined with adequate software that enables the transformation of these layers, the scope is to invent a product that can aid an interactive meeting context.

The MERCO project, or Mediated Effective Collaboration as it is short for, was initiated in 2014 and is expected to be finished in January 2017. The project aims to solve the described scope above with help of shared competence of several stakeholders. This

[1] Joireman et al, 2004
[2] t2i interaction laboratory, 2015
[3] Celtic-plus, 2015
[4] Celtic-plus, 2015

master thesis is the second one conducted within MERCO with more thesis projects to come before the project is due.

1.2 Employer

The employers for this thesis project are Semcon AB and Ericsson AB, being two of the collaborating parts in MERCO. One of the master thesis students is hired by Ericsson and one by Semcon. The MERCO project consists of several other parts as well, namely: Chalmers University of Technology, ETH Zürich, Intelliconcept AG, AVS Systeme AG and Touchtech AB.

1.3 Project description

This master thesis project will investigate the possibilities of improving remote collaboration in business meeting contexts with emphasize on enhancing interaction between colleagues, focusing on doing so from a user perspective. A pre-study will be conducted where literature is consulted and user studies performed to find the core user needs during the remote meeting situations. An idea generation phase will be initiated with aim to develop several concepts, focusing on reaching a high innovation level in combination with satisfying found user needs.

The developed concepts will be evaluated and one final concept will be chosen for further development. During this phase, the usability aspect will be of great importance and several user tests will be performed to evaluate the concepts based on factors such as user experience and user interaction. To be able to test and evaluate the different concepts, mock-ups and prototypes will be developed depending on the research need.

The final concept will be presented in an early state as a digital or physical representation, which depends on the findings throughout the project. Above this, the project delivery consists of a final concept presentation and this project report.

1.4 Aim

The aim of this master thesis project is to understand the phenomenon of real life meetings conducted at the researched companies and how they differ from meetings in a non-real life context and thereby identify the core needs when conducting remote meetings. Based on the user needs, the aim is to locate a concept solution to support the user during the remote meetings. The aim is also to realize the concept as a physical, digital or combined product to display how the needs can be met through a developed product.

Furthermore the overall aim is to support future work within MERCO to document the project findings in order to act as a foundation for further development.

1.5 Questions posed

The posed questions have been divided into research questions and driving questions. The later is the questions that has driven the project forward, to find the answer to the overall research questions.

1.5.1 Research questions

How can the important and substantial aspects of communication be captured in a physical and/or digital product to support a creative meeting environment remotely?

What core functions will such product contain and how could these be realized?

1.5.2 Driving questions

What aspects of a meeting are important to consider with regards to the existing literature and conducted user studies, related to the research question posed?

What type of business meetings is relevant to investigate with regards to the found aspects?

What user needs are central when conducting a remote meeting?

How is a creative, collaborative meeting environment created based on the findings above?

1.6 Definition of terms

- Real life meeting - a meeting where all the participants are physically present.
- Remote collaboration - when a group of two or more people is working for a common cause at the same time as real life meeting is impossible for at least one of the members.
- Artifact - an object in a virtual environment, i e. PowerPoint, PDF, word document etc.
- Site - the physical place from where the remote meeting is held. A remote meeting consists thereby, by definition, by least two sites)
- Interaction – the activity of being with and communicating with others, also covering the way people react to each other's behaviour.

1.7 Limitations

The external stakeholders initializing the MERCO project developed the frameworks of this project. Even though this master thesis project stands alone from the work of MERCO the problem description was limited to fit the overall project goal. Moreover the user group was limited to involve the employees at the researched companies. The project prerequisites have also lead to limiting the project not to include the perspective such as culture, gender or age differences.

The focus of this project has been to investigate remote meetings and therefore the limitations has been set to only include remote meetings within the user study and also to focus on the remote meetings during the literature study.

The use context of the remote collaboration is limited to in-house meetings, i.e. between different sites within the same company. Limitations regarding the user studies have also been done to focus on real-life meeting situation with 2-15 participants in a limited number of meeting sites (maximum 8 different sites).

1.8 Project process

The structure of this master thesis project is based on the product development process. Initially, a pre study has been conducted to locate user needs and theoretical background on the researched topic. Then the data has been analysed and structured to provide a ground for the ideation phase. During this phase several concepts were generated and then evaluated based on the findings of the pre study in combination with the result from user tests. Based on the evaluation, one final concept was chosen and taken further for development. One final prototype was created to evaluate the final concept and to suggest further development for future work.

The project plan can be viewed in figure 1.1 below.

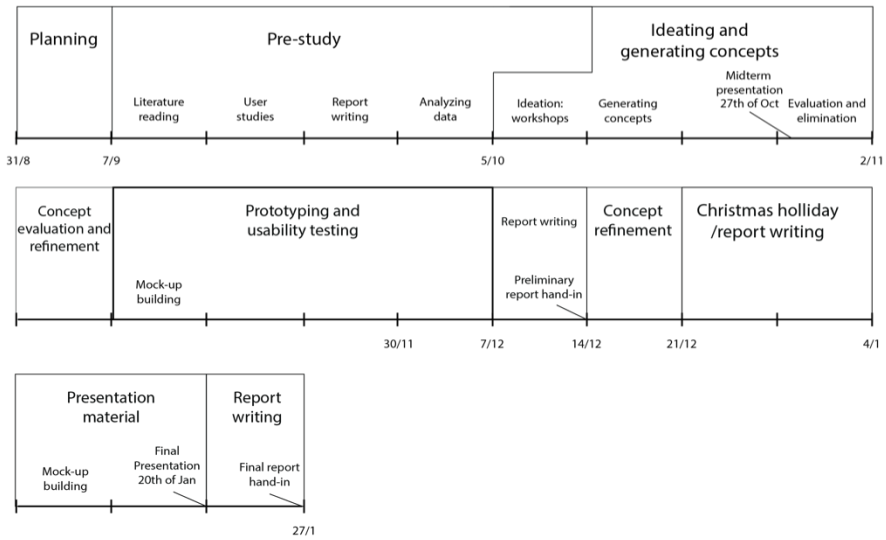


Figure 1.1 - The project process

2 How remote meetings work

The study of this project investigates the user needs through theory and practice by consulting related literature that touches upon the relevant aspects of remote collaboration and through investigating how the meetings are taking place at the companies through user studies. The chapter is introduced by investigating the methods that were used followed by the results and analysis from theory and practice in separate chapters.

2.1 Methods and implementation

During the pre study a great amount of data was gathered by the use of literature studies and user studies. The following section describes how the data was attained and sorted during this process in order to be analysed for future project steps.

2.1.1 Literature studies

An extensive literature study was initially performed to attain information on theories and previous studies on the investigated subject. During the reading sessions, summarized notes were taken continuously to store all the information input. The literature was mainly found by the search engine Google scholar and through Chalmers University's library.

Search phrases used:
Meeting and meeting structure, remote meeting, business meetings, behaviour science, communication theory, impact of body language and nonverbal cues, informality at workplaces, digitalization of workplaces, online gaming, commute environmental impact, group dynamics.

User experience, mental model, designing user experience for the web, online gaming culture, theory on creativity, innovation, curiosity, interaction design, collaborative environment design, user interaction, user testing.

2.1.2 User studies

The user studies have been conducted iteratively throughout this project. This chapter describes the initially conducted user studies that provided the foundation for further research.

Observations

Five real time observations and five recorded videos from observed meetings were included in the pre-study. All of the observations were of a non-participating matter. Observational research as a method means to observe on going behaviour at a designated place, in this case the two researched companies, to obtain insight in a certain user

situation[5]. The notes taken during the observations were based on the communicational interaction during the meeting and the technology used[6]. The real time observations were recorded and notes were taken by the use of pen and paper. In the case of observing the video recorded sessions were the procedure similar. The notes concerned user actions, behaviour (group and individual) and acknowledgments from user errors and problems.

Interviews

Eight semi-structured interviews and several structured conversations were conducted to obtain qualitative data from corporate representatives with different competence and backgrounds. The interview outline can be found in Appendix 3.2. Semi-structured interviews were used because it allows the interviewee to steer the interview and thereby revealing the interviewees' perspective[7].

The six of the interviews (interview 1, 2, 3, 6, 7 and 8) were conducted separately with persons working at one of the investigated companies in different departments. All interviewees had many years of experience regarding remote communication and were seen as expert users. The questions posted contained elements about the daily work, how they would like to work and what they saw as possibilities and obstacles when it comes to technology and early ideas for concept directions.

Interview 4 and 5 was conducted with employees at two external companies and the interviewees were described as experts in remote collaboration at the different companies.

As mentioned, above the semi-structured interviews were several structured conversations held with people within the user group. The reason for this was to gain valuable insight of the user need and perspective in an informal and iterative way.

Focus groups

During the ideation phase, three organized focus groups were conducted. The participants that took part in the focus groups was identified as *lead users* which is users that early has experienced needs for a solution and may have tried to work around the existing products to satisfy this need[8]. Focus group as a qualitative method is used to encourage unfiltered thoughts and opinions on a specific subject. The session is steered by a focus group leader, making sure the conversation is held within the investigated topic[9].

The first focus group (focus group 1) was carried out at another development company with four participants whereas one person of these was attending by teleconference. The aim for the session was to discuss how the participants experience the teleconferencing tools and aids that they work with in their everyday working life and to hear what they might or might not want to see in the future[10]. By receiving information from another

[5] Kawulich, 2005
[6] Appendix 2.1
[7] www.qualres.org, 15-12-09
[8] Ulrich and Eppinger, 2000
[9] Johannesson et al, 2004
[10] Appendix 2.2

company that could be compared to the previous companies' experiences as well as identify similarities that could lead to a potentially stronger concept foundation.

Last, two focus groups at one of the researched companies were conducted with a similar structure, both including four participants to discuss the developed ideas and early concept solutions and to investigate attitudes. At the beginning of the sessions, some of the solutions regarding the investigated subject was presented and the participants was allowed to discuss around these presented ideas

2.1.3 Affinity diagram

The data collected during the pre study was sorted and analysed with use of an affinity diagram. The method was developed by Kawakita Jiro in 1953 and is used to organize large amounts of written information, which in this case are all the notes of the attained data. The procedure is to print and organize all the information onto separate notes, group the notes that were handling the similar user issue or aspect of the meeting. Within each category were data then grouped into sub-groups dependent on what named user issues the data was relevant to[11].

The following categories emerged: *Meeting, meeting types and contexts, Communication, Innovation and creativity, The individual and group dynamics aspects and Available technology.*

These categories have been the foundation of the next chapter, were all the data is presented.

2.2 Remote meetings in theory and practice

In this chapter data from the literature study, observations, interviews and focus groups is presented. The categories of the literature study are the following; *meeting, meeting types and contexts, communication, innovation and creativity, the individual and group dynamics aspects* and *available technology.* Derived from the result of the affinity diagram. The data is analysed in relation to the relevant chapter in order to give an insight of what has been found for the following work.

2.2.1 Meeting, meeting types and contexts

The overall purpose of why persons meet, the benefits of the event and how meetings differ in context and type is in this chapter discussed. It is crucial for the designer to understand how the meeting incorporate a web of communicational acts, which thereby put requirements on technological development. The first section of this chapter, the meeting, investigates how these acts are related as a consequence of complex social patterns. This leads up to the second section of meeting types, categorizing commonly occurring meetings and their characteristics from theory and empiric results. Different meetings create unique needs that put requirements on technology, which here will be

[11] Cheng and Leu, 2011

investigated. This will likely also differ when you do the meeting on remote, which flowingly will be elaborated in terms of differences and similarities between physical and remote meetings. It is also likely that the quality of the meeting and how the actual effectiveness is perceived can be related to the organizational matters from a managerial level. The management's role as a meeting mediator and initiator as well as supporter in the collaborative process is here also brought up. Finally, the context of where the meeting takes place is suggestively having an impact on the quality of the meeting itself, which this section will aim to determine in ways of how and why.

The meeting

A meeting can be looked upon as a powerful tool to exchange information, solve problems, resolve conflicts and inspire others. The term *meeting* can be defined in many ways. One definition Alan Barker (2011) uses to describe a meeting is "*A meeting is a group of people purposefully thinking together*". The definition shows the different aspects to consider regarding a meeting; a *group* that is *thinking together*, with a *purpose*.

A meeting is a complex phenomenon and to fully understand it, one must consider the many aspects of the meeting context. Instead of looking at the meeting as a 'blank slate' one should consider the meeting as a gathering that beforehand is influenced and therefore the conditions for each meeting differ[12].

To attain a meaningful meeting one has to consider the *meeting structure*. Meeting structure is here referencing to a number of participants, purpose, agenda, place and time frame. The number of participants within a meeting is recommended by Barker (2011) not to include more than 12 people because the occurrence of sub-groups and the difficulty to manage many people at once. When starting up a meeting a clear agenda is crucial; the lack of one may prevent a systematic approach of capturing the meeting. This could lead to information loss, which could devastate a project due to the consequence of poor decision-making[13]. Another aspect is that it's important to know when *not* to have meetings, as the definition reads: meeting with a *purpose*. Thus during one-way communication it is typically not necessary to call for a meeting but instead use another type of communication method.

The observed meetings (1-10) had implemented the required meeting structure in various extents. An example of an unclear mediator was during observation 2, where no secretary or designated mediator was observed and instead an informal meeting leader guided the other participants. In observation (8) eleven persons participated on site, having side conversations appearing more frequent than throughout other observed meetings with a smaller quantity of participants. The meeting was however appearing as successful. The authoritarian mediator is suggested being the reason for why the meeting succeeded, as she was skilled in turn taking, fast decision-making and mediating between different parties. The importance of having a clear mediator role is here outlined in terms of having the responsibility of leading, act and division.

[12] Schwartzman, 1989
[13] Emmit and Gorse, 2009

The mentioned meeting (8) did also have a clear agenda, which was displayed for all the participants early on. Not all meetings that were observed had an agenda, but it could be considered useful in especially the bigger meetings where many different stakeholders would collaborate. It was often sent out beforehand but not always presented verbally, which consequently could be beneficial for the remote sites. One person in focus group (4) mentioned that occasionally would it be beneficial to know when a certain point on the agenda is presented due to the fact that not all participants always have an interest in the meeting as a whole. Something that suggests that the meeting should be better structured with inviting relevant competences at certain agenda points if their contribution is only desired there.

In some observations the objective of the meeting was stated at the beginning of the meeting. For example did this occur during observation (1) were the mediator stated: "*I called for this meeting with the aim to...*" while another observed meeting (observation 7) was cancelled because no one attended. One of the participants that waited for the meeting to start exclaimed: "*Why are we even having this meeting? I don't even have anything to say*". The fact that this occurs indicates how the purpose of the meeting is not always clear to the participants itself, and that some meetings are conducted habitual rather than when actually needed.

An example of how the meeting place and time frame was implemented in the researched companies was described in interview 2 as being insufficient. The interviewee stated: "*Often you book a full hour by standard, but it is rarely that an entire hour is required*". During focus group (2) the participants discussed how it was hard to get booked meeting rooms and that they often was unavailable. The inflexibility of the meeting administration is once again displayed by this section.

Two different interviewees (4 and 5) lifted their company trend of having more flexible meeting places, not being stationed at a specific meeting room but instead having alternative meeting places and also increasing the allowance for employees to work remotely. Interviewee 4 describes how they are implementing this within their company policy to introduce the term "DNA - Det nya arbetslivet" (translation: The new work life") and interviewee 5 describes the same phenomenon by using the term "Mobile worker". The first company is stating regarding the term DNA that work is no longer a *place* but something you *do*[14].

Above the failure of implementing structural aspects like a meeting structure, Barker (2011) states that the reasons to why meetings fails most often are that they are either unnecessary, possess unclear objectives, include the wrong participants, is held within a poor environment or with poor timing. Risto Puutio (2009) mentions another aspect of the meeting; the unarticulated targets of the meeting, namely hidden agendas. These two-sided tasks affect the way the participants behave and act and this is therefore an aspect to take into account then analysing the interaction during the meetings.

During interview 2, the interviewee described that the worst kind of meeting was the meetings that you were not suppose to attend to but you don't notice it until the meeting

[14] microsoft.com, 15-11-01

starts. Focus group participant (4) describes the occurrence when only wanting to participate during a certain point of a meeting, then not wanting to attend more. "*You practically just 'sit off the time' the rest of the meeting*". The frustration of not having an insight in how the meeting is related to ones owns competence is here apparent. It could through this be suggested that the purpose of the meeting itself is inflexible and that the relevance of the whole meeting is not always related to the individual contribution.

At the observation of meeting (7) the purpose of the meeting appeared as unclear to the persons and they were asking each other out loud: "*Why are we even having this meeting?*". A similar experience was later observed in meeting (10). This exemplifies the importance of having a clear pre defined structure of the meeting but in combination with previous findings; also a need for being able to change these structures throughout the meeting. The situation of meeting (7), as mentioned, even led to a cancelled meeting before it even got started. One participant in observation (7) commented that they must be more prepared for their meetings and pointed out: "*Last time was a disaster, everybody talked at the same time without structure*". Not only was the meeting not prepared with a dedicated purpose, it also became a negative event for the participants. Later on in the project, during observation (10) the same group met again and one participant stated: "*I don't want to cancel these meetings, even though you feel they are unnecessary, because it's so hard to book meeting times*". The statement implies that there is a need for arranging meetings in other ways than in the traditional sense but that the participants do not know how. The risk of not meeting at all is seen as worse than conducting an inefficient meeting. This section displays the need of providing easy means to meet within the business context, something that is considered being complex today. The meeting culture is set to habitual ways of working which are hard to change and especially through the solid culture that has been developed around it. Through facilitating the users with new ways of arranging and booking the meeting it is believed that the unnecessary meeting situations could be helped. Doing so would require both new ways on a managerial level to introduce other ways of working in combination with having an easier access to the tools for the arrangements.

Meeting types

There are various ways to categorize the different meetings, one categorization describes the six most common meeting types by looking at the goal of the meeting, which also is used within this research: (1) information sharing meetings, (2) status update meetings, (3) decision making meetings, (4) problem solving meetings, (5) innovation meetings and (6) team building meeting[15]. The ways to meet within an organization can according to Braun et. al. (2001) vary but more frequently applied meeting types have previously shown to be the informal, face-to-face meetings, the formal meeting and informal telephone conferences. This despite making it more cost efficient to have a telephone conference in combination with exchange documents.

During the observations the most common meeting type was the status update meeting (observations 2, 3, 4, 5, 6, 7 and 8) and second most common was information sharing meetings (1, 2, 10). Decision making meetings occurred during observation (8 and 10). Innovative/idea generation meetings were occurring during observation (2 and 9) and

[15] Meetingsift, 15-09-28

observation (1) showed an example of a problem-solving meeting. A majority of the observed meetings (observation 1, 2, 6, 8, 9 and 10) were having influences of other or switching totally between different meeting types. By acknowledging this it is believed that technology should also have the ability of doing this easy adaption between meeting scenarios and thereby aid the users better to make such shifts.

Informality

Above previously mentioned theories about meetings the type could vary in degree of formality. The factors that influence the degree of formality of a meeting have shown to be the agenda, the process, the location, time and duration but also the participants' social and organizational relationships[16]. However, the perceived degree of informality has a lot to do with how well acquainted the persons in the group are with each other beforehand and how well their social relations are grounded. According to Emmitt and Gorse (2009) do people that are aware of the social framework in a context and thereby are able to relate to the person they are talking to have a tendency to become more engaged in the groups' relation. Enabling the person to commit to the task in a better sense. If the persons have not established these connections messages would serve mainly as information providers, leading to the interpretation of connected behaviour as being acceptable or not in a whole different way. Mostly since the persons would have less knowledge of the other parts behaviour and personal traits and therefore have less understanding of them. When having an informal relation or creating an informal situation leading to such relation it could on a next level basis create a common ground of understanding of the other person. Consequently this would lead to achieving better communication and thereby faster and more effective results[17].

During both focus groups and interviews (focus group 1 and 2, interview 1 and 2) participants described that it was easier to collaborate when one was familiar with the other meeting participants. During focus group (1) the participants discussed how the collaboration and teamwork was affected negatively by not having met or seen the other team members. One of the focus group participants expressed communication issues due to as he describes: "*When you've never met a person, and only talking in the phone, it is very hard to anticipate what's coming next in the conversation. I don't have that problem if I've met the person because then I understand how that person acts*". Informal situations create a common ground of understanding each other and a better relation to other people. In a group this leads to a more easy-going communication, which could result in handling negative emotions in a better way. The literature states that to informally meet before and after the actual meeting could also enhance the ability to express emotions such as giving feedback that is either positive or negative. Through being able to repair and rebuild relationships in the meeting from having this open climate the efficiency of the meeting could be improved in a positive way[18].

Interviewee (2) states that he has no need for visual feedback of the other sites at all, he also explains that he has worked within the same project group during several years. Also, observation (1, 4 and 9) shows examples of interactive meetings without visual feed, during all of the three referenced observations the participants stated that they had

[16] Braun et. al., 2001
[17] Emmitt and Gorse 2009
[18] Emmitt and Gorse 2009

frequent contact and knew each other well. Communication was solved either by having one single speaker who addressed the turn or the speakers were few and knew each other well. When the participants knew each other they would seemingly connect faster and establish a common ground for continuous work. In observations (1 and 9) was this extra apparent. The working pace was fast and efficient and was brought further by a mediator. The already established relation was evident through mentioning each other's names, asking questions more directly and having a more relaxed body language. Despite some communication difficulties did the participants solve their tasks quickly and did not lose track of the agenda as well as having short communication loops between turns. Moreover, observation (2 and 5) shows examples of low interaction and trouble understanding communicational cues. The observed participants did not know each other well and the familiarity was seemingly non-existing. The audio transfer as communication channel could not cover all the communicational acts in the room, nor did it bring the participants closer together even after talking for a while. This displays how the social grounding generates a communicational interplay that is sufficient enough through audio and that this works as the only communication channel if persons get a chance to socialize informally as well. The understanding of the groups and individuals behaviour can be considered as a cause to this as the result has shown that the social understanding of that enables better understanding through visualizing the other person.

According to Anne-Laure Fayard and John Weeks (2007) can informal interactions not be planned for: they simply occur. However, the likeliness of their occurrence could be influenced through indirect means. Architectural factors have shown to impact how well an informal tie could be generated. This could further be divided into two different areas: the centrality of space and the enclosure/openness of space. Moreover has the flow through the space also an impact on how well informal ties can be created. When speaking of centrality this could for instance mean that the placement of a coffee room is centrally located in the office environment, which enables more people to access it with ease. It is thereby believed that the change of visual cues could impact the formal setting in the meeting room with subtle means.

Both open and enclosed spaces have shown in individually performed studies to provide more or less informality, indicating that the social setting plays a huge part as well as what the environment affords. Farad and Weeks (2007) speak of how different personalities prefer different environments. What the environment afford its users in matters of for instance visual objects therefore also consequently affects the informality. When entering a space the queues of that area might afford the person into certain behaviour. These queues could be unknown for the user until they are changed through re-designs, thereby emitting a new behaviour. Affordances are interpreted through the meaning they have to someone and how the use is related to that, this adds to the physical description of affordances as being a functional indication for our perception about the object[19].

In all of the observed meetings (1-10) the meeting environment and used technology were the same. It consisted of a traditional meeting room with a large table, chairs and often an external screen to view an artifact on. The used technology had no room for

[19] Farad and Weeks, 2007

individual changes or adding own character into the virtual meeting room except for inserting own profile picture in the used teleconference software. This was however seldom used. As most meetings were held on teleconference would therefor the visual feedback of the person get lost, making the visual space insipid in terms of social interplay.

Enclosed spaces architecture can be related to theories about privacy in a sense that persons prefer to communicate informally when they feel that they can control the boundaries of their conversation[20]. Privacy acts physically as a perceived result of the visual and auditory isolation of a space. This could be done architecturally through designing a room with surrounding walls, closed doors, windows and so on. Enabling the flow of persons through the overall environment to be kept out. When it comes to the design of private areas there is also a social dimension. Here would norms and social meanings of the actual space of course impact a lot in matters of how private it actually is perceived. On a cognitive level this could be described as privacy having a spatial and temporal dimension. Spatially, as when two persons talks in private which would require them to feel confident that there is someone listening whilst talking as well as not having others overhear the conversation. Simply as the conversation could lead into more sensitively oriented directions[21]. This might also be the case why the capture of informal meetings through video previously have failed, as persons did not want to feel observed when informally interacting. Focus group participants (3) describe the importance of having own space when using an interactive tool, one of them states: "*I don't want all my ugly drawings to be visual directly for everybody*". The same matter is stated regarding meeting notes: "*I want to be able to make notes for myself, they are probably stupid sometimes and that is not something I want to share"*. That the private feed was displayed led to that they did not feel comfortable with sharing their screen. The ability to still be private when the situation requires should of course not be taken away, even though communication opportunity could be facilitated through doing so. The interface could however better support users into being reminded of how the activated video actually aid them into receiving and giving a more truthful information flow in terms of communication. Facilitating that process for oneself and others.

The temporal dimension concerns when a person prefer to interact and is mentally ready for the informal interaction. Some persons are perhaps not desired to interact with whilst others are highly prioritized. When forced to interact when not being prepared would consequently lead to that the feeling of privacy is lost[22]. One participant in focus group (1) stated that: "*I am definitely having less contact with the team members on the other sites, you don't want to call and risk disturbing them*". Focus group (1) continued to discuss the importance of having quick dailies and another participant explains that he believe the project members are more efficient if having the opportunity to connect spontaneously. He stated that: "*In our project team we have frequent contact throughout the day because we sit next to each other, I believe that has been really helpful for our work*". Interviewee (4) also described the phenomenon of how the surrounding is affecting the meeting situations by stating: "*If you have a natural way of meeting with your team members it minimizes the thresholds to initiate contact.*" A politeness and modesty about the other remote sites

[20] Farad and Weeks, 2007
[21] Emmitt Gorse, 2009
[22] Farad and Weeks, 2007

activities is here displayed and suggests that with a more formal relation the threshold for initiating the spontaneous contact will become harder. It is also brought up how the closer and more informal contact with the colleagues improves the work for the employee and that the work situation should aid such communication in an easy manner.

Bound and Middleton (2003) states that informal networks contribute to a majority of the knowledge received at the workplace. It has through the same study been shown that lack of causal conversations within a company leads to less informal learning and less socializing. According to Hirsch-Kreinsen and Jacobsson (2008) is this especially applicable to how sticky information is shared; i.e. practical knowledge that could be described as explicit or implicit. Explicit practical knowledge could for instance be design drawing and specifying requirements whereas implicit could be experiences and routines on how to solve problems. Moreover have informal ties shown to contribute to the establishment of better formal outputs, meaning that the actual formal meetings could benefit in their effectiveness and output quality from having these relations[23]. So, if informality aids the formal work it therefore also should be seen as crucial how the effectiveness of the remote company is improved in this way. The now taken for granted social ease of informality should therefore through design be enhanced and supported in the remote collaboration context.

Open spaces architecture relates more to the theories about propinquity and thereby saying that informality is generated in spaces that bring people closer together, having a steady flow. Consequently this could also benefit from being a centrally located space, as this would be easier accessed. Spaces like these could be as mentioned a dedicated area such as the coffee room. Open space architecture is related to the theories about propinquity, which can be seen as a function of proximity and social frameworks. Propinquity concerns when persons are located at the same place with equal opportunity and social obligation. If this is modelled in a proper way there could be a socially beneficial situation where informality is generated and persons interact in that sense. However, when two people feel that they are forced to interact with each other it instead becomes an interaction obligation. As persons are physically close to each other with no easy escape it could be seen as an almost mandatory interaction. Interaction obligation have a highly cultural dimension to it which means that the feeling of obligation that you have to interact with someone when standing in an elevator for instance would differ with nationally, regionally and ethnically different traits[24].

Remote meetings

As mentioned above is the electronic meeting, also known as remote meetings, one of the most common meeting types in business contexts and is of course a central aspect in this project. All of the observed meetings (1-10) and focus group (1) included at least one remote site. The occurrence of this type of meeting is continuously increasing because of the resources it saves due to traveling time and costs as well as the environmental aspect. Technical aids are required to assist the meeting and the most common technology used is visual and audio transfer in form of instant message and/or video- and telephone

[23] Pavit, 2005
[24] Farad and Weeks, 2007

conference[25]. According to Cao and Östin (2015), most commonly, the remote meeting was held with several sites at once where all of the sites were using the same kind of equipment (a laptop computer and sometimes an external screen). Similar setups were used in the observations of this project where most meetings with a computer, microphone and often connected to an external screen. 7 out of 10 observations were held on teleconference without video.

Interviewee 5 states that there is an increased need for mobility and that today's meetings are insufficient. The company Cisco who is developing remote collaboration tools describes that 62 percentage of todays employees work in multiple locations and that it is crucial to ensure that these employers productivity by making sure that they always can connect, to each other or to gain information - at all times[26]. Interviewee (2) states: "*You practically must meet at the beginning of a project, otherwise the communicational aspects is really hard because you have no sense of who you are speaking with.*" Observation (5) confirms this through having one participant expressing the will to meet with the remote party 'to shake hands' after the meeting. This even though they were in fact meeting remote as she said it. The difference between remote and real-life meetings is here displayed and highlights that there is still some situations that require persons to meet in this way.

When managing a remote meeting the mentioned meeting structure becomes even more important. One basic four-part model on how a remote meeting should be managed includes: opening, subject introduction, interactivity and review. At the opening of the meeting, all the participants should be included and preferably be able to introduce one self because if doing so the barrier of interaction later on is lowered. To introduce the subject is mentioned by Barker (2011) to be necessary so that all the participants grasp the meaning of the meeting, which increases the success rate of the meeting. The interactivity is of great importance when conducting a remote meeting. When not being collocated it becomes more crucial that the participant is active during the meeting in order to not lose focus. And last, to review the meeting afterwards provides the participant an opportunity to follow up and affect the meeting situation, creating a more effective meeting environment.

The remote meeting context is affecting the participants as it makes them more aware of space and distractions but also of silence and participation during the conversation. It is also easier to 'tune out' during virtual distance meetings since the participants often don't meet on a regular basis. This might jeopardize the deliverables because the participants are not becoming as engaged in the meeting outcome as if they were set in the same location[27]. The following traits of the participants are described to facilitate the meeting situation:

- personality trait of social butterflies
- possess organizational skills
- be able to manage time across dimensions

[25] Barker, 2011
[26] cisco.com 15-11-01
[27] Settle-Murphy, 2013

- be able to use tech-tools with ease
- possess good listening skills
- be able to ignite their own spark

As mentioned, during some observations no clear person was designated as a mediator. Though during observation (2), one participant came forward as a meeting leader by introducing the meeting subject and managing turn-taking, which is behaviour connected to the personality trait of a social butterfly. The mentioned meeting was observed having short communication loops and high level of interaction.

Sellen (1992) states that when using technology for remote communicating, some information loss in various degrees appears which makes communication more difficult. To understand how this affects the meeting one must look into the phenomenon of communication.

Cao and Östin (2015) presented a framework for effective remote communication during meeting situations. The framework involves the following ten factors:

- perceive others' presence, roles and relations
- accessibility of use and adapt to workflows
- sufficient means to visually view the entire workspace
- sufficient means for participants to track where sounds originate from
- support explicit- as well as implicit verbal communication
- watching of other participants body movements and non-verbal cues
- facilitate use of deictic- and representational references
- provide feedback that communication has been perceived and understood
- should be able to make eye contact with each other
- facilitate full view and ability to manipulate artifacts

During observation (1) the meeting participants knew each other well and had met in real life. The participants had different technical equipment (one had video and one only audio), they used the interactive tool in the teleconference system that allowed them to map ideas like during a brainstorming activity. The meeting communication was observed to be highly interactive and the participants held short communication loops. One of the participants said: "*Why have we never done this before, this was really helpful*". During observation (9) the participants explained that they would want to start a brainstorming session but due to the remote sites presence they did not. This indicates a need for wanting to change between meetings that are hindered by having technical thresholds that makes the remote switch between meeting types inflexible.

One participant during focus group (3) stated that: "*You're more prone to do other things if you know nobody is watching*". Another aspect of visual feed that was lifted during the pre study was the ability to make eye contact. During observation (1) the participant did not have any visual feed on the remote site and was staring down at his keyboard the entire meeting. In focus group (1) one of the remote participants was on a remote site and only provided by audio sound, and when he talked all of the focus group participants were looking down at the table or started looking at their computers. Low monitoring

behaviour and habitual working patterns are here apparent and displays how the visual feed plays a role as both a communication channel and as a provider of information of paying attention at the remote sites. In order to understood that messages have been received and understood that working process is crucial.

To be able to attain fluent communication throughout the meeting, adding opinions and questions are valuable, strengthened by Emmitt and Gorse (2009). The social framework of the meeting must support the open interaction and discussion in order for this to be achieved. One can also draw the conclusion that if the participants is not aware of what is being communicated it decreases the focus to the other sites and instead draws one's attention to matters located near by, tempting the participants to start side-conversations. Therefore it is suggested that technology should help with increasing the ability to raise opinion, which consequently would make the user feel more encouraged and prone to interaction. If this can be achieved it is likely that the low monitoring behaviour could be helped.

Organizational aspects of meeting

There could be various ways of measuring the efficiency of a meeting held in an organization. According to Emmit and Gorse (2009) should the managerial concerns in a meeting context be the process (leading to an effective outcome), production (the qualitative result of the meeting) and perception (how the participants experience the previous mentioned concerns). In other words could this mean that the meeting is carried out in time and within budget with a perceivably desired result by the meeting parties. This is however not always the case. In order to reach a successful result in a meeting, certain communicational behaviour is mentioned. According to Emmit and Gorse (2009) who conducted a study with help of Bales IPA framework with over 1500 communicational interactions does successful groups use a broader spectrum of communicational acts.

Emmit and Gorse (2007) state that successful meetings have more socio-emotional exchange as seen in the descriptive chart. To clarify it could suggest that the team has the ability to create, support and recover relations efficiently throughout the meeting as well as being able to show disagreement, questioning and follow up on recovering from conflicts. This would consequently lead to better results within project time and within budget. Moreover is it suggested that successful teams do evaluate, question, express and acknowledge information more rather than just putting information to the table without any discussion[28]. This could be seen upon as an interplay within participants, which is formed through having a better internal relation to each other. The project teams that were observed and had a more dynamic discussion throughout the meeting would appear to reach consensus faster, having more agreement and include more parties in the overall process.

The managements' role when implementing new directives are described by interviewee (4) as: "*It is really important that the bosses starts with a certain behaviour if wanting to implement something within the employer's work, because then the employers follow that*

[28] Emmit and Gorse 2009

behaviour". This suggests a need for managerial concern when it comes to lead the way at a company in order for changes to occur.

2.2.1 Section summary

- When designing for remote meeting situations, one must consider the meeting structure: i.e. participants, agenda, objectives, place and time frame, to understand what type of meeting you are designing for.
- It has been found that different meeting types and needs occur throughout the same meeting session It is thereby suggested that technology should possess functions to favor easy adaption between meeting scenarios and needs.
- The social relations, the level of (in)formality, impact the meeting situation and the participant communication and is thereby suggested as an important factor to consider.
- The technology that connects the participants in a remote meeting impacts the ability to communicate and interact, today often negatively. At the same time, aspects like social butterflies are lifted as an aspect that helps communication through remote meetings. It is suggested that the technology should aid the user to raise opinions, express emotions and to communicate in a more nuanced way to support the meeting situation.
- Management possess an important role when implementing new technology or work patterns at a company. It is important to understand the company culture and management when wanting to develop a product that will be used at a certain company.

2.2.2 Communication - why is it so important?

How the meetings' participants communicates a message to the group is of course a very crucial matter, which has been shown to often be a root to misinterpretation on remote. This chapter investigates how the communicative traits of a group affect the overall contribution and ability to send and deliver messages. This is done through firstly describing communication as a phenomenon and what could be incorporated with that term in a broad spectrum. Aiming to give an insight in why communication can fail, and especially on remote. The other section describes ways of communication and how body language act as a part of that, digging deeper into the acts that provides a overall impression of what a person is aiming to communicate. Substantial parts that often are known to get disrupted on remote, more thoroughly described why in that specific section below.

Communicational theory and practice

Stated in the MERCO project description, one of the important contributors for enabling collaboration remotely is the *communication space*[29]. Communication is defined by Harrington and Lewis (2014) as "...an exchange of information and ideas between two parties. It can be exchanged verbally, nonverbally through body language or signage, or by written and electronic means." According to Harrington and Lewis (2014) is the

[29] Celtic-plus, 2015

communication facilitated if the communicating people are motivated to share and if they are part of an environment of integrity and trust. The conditions of communication to appear is that a message are sent, the message is received and then a response is given.

During all of the observed meetings (observation 1-10) verbal communication was mainly used to communicate, in some of this occasions the verbal communication was complemented or reinforced by sending video feed or textual information (observation 1, 6, 8 and 10). The camera was turned off as the participants were feeling that the video did not add anything or simply felt that they were not comfortable with sharing their picture remotely. This indicates how the virtual environment must be de-dramatized so that the users can feel safe in the remote meeting situation.

The conversation is the heart of the meeting. The way a verbal conversation is sent back and forward between the participants are called *communication loop* and include following eight steps:

1. Sender - The person who thinks something
2. Encoding - Thoughts are verbalised to spoken words
3. Medium - The word vibrations are sent through air
4. Receiver - Listener receives air vibrations
5. Decoding - Interpretation of the vibrations
6. Feedback - Provide input of message
7. Analysis - comparing the interpretation of feedback to original thoughts
8. New loop/end loop - Either the message is understood or the receiver needs more information[30]

The listener, receiver, of a conversation needs to be aware of the content, the unspoken content, the order of importance of the content and the degree of objectivity of listener towards conversation. It is also important for the listener to be able to decode the message and understand what type of factual (informative) and emotional (affective) content the message holds[31]. When communicating, the message must be clear and honest for interpretation and as a result the remote meeting is dependent on the technology used to transfer the messages.

Literature has shown that during remote communication the verbal communication message is enhanced: making a silence *more* silent and side-conversation *more* disturbing. During the user studies the meeting participants often solved this by quickly interrupting the silence with follow-up questions. Moreover, it feels much longer during a remote meeting when a person is talking for a long time, which leads to poor attention to the message. To keep short conversation loops is of great importance when wanting to avoid these occurrences[32]. The communication during observation (1, 2, 4, 6 and 9) mainly consisted of short communication loops while observation (3, 5, 8 and 10) had longer loops and also longer pauses between each loop. In the meetings with shorter loops the meeting participants would seemingly be more engaged and more interactive. This

[30] Barker, 2011
[31] Harrington and Lewis, 2014
[32] Wilson, 2009

highlights the importance of interaction in the meeting room and to keep conversation short. Technology is believed to have the possibility to aid the users with this in a more sufficient way.

Another aspect above the conversation of remote meetings is the need to share and receive artifacts. Like the conversation, it is important that the referenced artifact is clear to the receiver. Also Chastine et al (2007) describes the inter-referential awareness and the lack of such during remote communication.

The observed meetings would always have a secretary taking notes, which sometimes also included individual persons taking notes for own purposes. To document the meeting is of course important in order to remember and obtain certain important highlights. However, this did occasionally lead to making the secretary less focused on the communication part and being more silent. As theory describes, it is important with a steady flow of communication in especially remote meetings. It is thereby believed that the meeting itself in combination with technology could aid the participants to better enable them to interact in the meeting, making all included.

In one of the conducted focus groups (3) the participants stated that it was often that you referenced to something by a nod or a shrug, which is not perceived by the remote site. In observation (5) one meeting participant was trying to explain what area of the artifact he was describing but the remote site did not understand him. For the presenting part it becomes hard in this situation to know if the remote participants have heard and understood what has been presented. It is therefore believed that the technological aids should help the users with capturing and transfer non-verbal cues, gestures, references, indications and feedback so that this is displayed in a satisfying way. If video feed is available it is believed that it could help with transferring this important information.
Communication problems can be devastating for a project, the lack of communication or poor communication leads to misunderstandings and mistakes, which may lead to wrong decisions, loss in work force or lacking in motivation. According to Nancy Settle-Murphy (2012) certain communicational aspects would contribute to a desirable team achievement. The leader should therefore in matters of communicational contribution consider the following:

- To actively listen to the participants of the meeting and know how and when to step in intuitively
- To see the individual needs of every team member in order to provide appropriate communication vehicles and preferences
- To ask the right questions with the understanding of how posing the questions differently affect the outcome of the answer[33].

During one of the focus groups (1) the remote participant accidentally interrupted the other participants during the conversations. The focus group leaders asked several times if the remote participant had perceived the question. The confirmation questions to know if the other site had perceived the others occurred multiple times during some of the observations (observation 2, 4, 8 and 10). The problem of sensing the tone and timing

[33] Settle-Murphy, 2012

on remote is here illustrated and shown to be facilitated through asking frequent questions. It is believed that the technological tools could better aid the user in the situation to be able to enter the conversation through other means than verbally.

Several participants (focus group 1 and 2, interview 6) stated that the communication would be facilitated if one could express communication through more ways than verbalization. Interviewee (6) described how only using verbal communication was insufficient since it made it hard to understand underlying messages and it was also difficult to have a proper turn taking within the conversation: "*If only communicating by spoken words, you loose the information of non-verbal cues which makes it difficult to enter the conversation without interrupting the others*". The issue of not knowing when to speak was also observed during observation (1, 2 and 8) were the meeting participants interrupted each other several times. One focus group participant (3) describes how she avoids speaking when being on a remote site because it is difficult knowing when it is your turn. Moreover would it seemingly be hard to know who is speaking at certain points, especially noticeable in the larger meetings. This was observed in observation (3) but also brought up in focus group (1) and interview (2) as an issue. Further remarks would be the sensing of tone. Even though the persons knew each other the tone was occasionally misinterpreted. This suggests that it becomes harder to understand communication and messages and thereby misunderstand, if parts of the communicational transfer are missing.

During observation (4) the meeting leader started by saying: "*Let's go around the table as usual...*" and everybody got to speak shortly about their tasks. This made it easier for all of the participants to join the conversation later and it was observed that many participants talked more frequently. This kind of turn taking and introducing was therefore perceived to counteract the LMB that could occur when no direct task or assignment is given to the individual in the meeting situation. A further observation during observation (5) would be that the individual presentations were very long, which would suggest waiting time for the other participants without any, at the time given, task. Consequently this lead to inattentive behaviour in the situation such as going through mails, looking away or down in the table and playing with their hair. The division of the turn has a clear problem and could be solved through assigning the mediator with a more outlined role to lead the meeting in a more satisfying way which also observations (4 and 8) shows could be done even with more participants. Technology should here aid the meeting though providing the right tools for more efficient meeting division, which supports the individual to raise opinion when the situation requires it and actively take part in the meeting.

As previously described in the informality chapter do contextual barriers such as room décor and style of architecture also influence the communication by impacting the person's attitude. By observing these barriers one can develop the ultimate environment for communicating and by this create a climate for good communication[34].

One of the interviewees (8) explained that the main issue with not being on the same site as the rest of the meeting team did not perceive the same contextual environment as the

[34] Harrington, 2014

rest of the group, which made it hard to feel present. The interviewee said: "*I almost wanted to close my eyes and try to imagine the other meeting room"* when explaining the feeling of sitting on the remote site during a meeting. To attain focus to the meeting can according to mentioned theories be done through isolation from surrounding disturbances as well as having the same information sharing and communicational tools available at both sites. During the observations, sounds would occasionally appear from the remote site suggesting they were sitting in a lively environment. That the experience derived from the meeting should be perceived as equal is here of concern, simply as it is today perceivably different as described from two sites, one being the mediator and one being remote, covered in observation (10) also supports (appendix 4.7). In order to make all participants feel equally included this should be in mind when developing technology (interview 4 and 5). The new way of working with more activity-based environments has shown in the interviewed companies (4 and 5) organizations to contribute to an increased use of different meeting spots as well as becoming an important aid when developing technology for remote users. By their programs of DNA and Mobile Worker the aim is to support users with work, no matter what location, in order to achieve a fulfilling meeting situation. The importance of conducting meetings with the right technological aids that can be used with less regard to location is hereby acknowledged for further work. This in line with considering that the experience from the meeting through technology should aim for being perceived as similar at all sites.

Body language as a communicational act

So far the verbal communication has mainly been the subject for investigation but when looking into the collaboration phenomenon it is also important to understand the gesturing and non-verbal cues that are used when communicating[35]. There is the language, which is the *spoken words*, the paralanguage, which includes the way to communicate the language such as *tones* and lastly there is the kinetics that concerns the *facial expressions and body language*. All these layers must be included if the receiver should receive the sender's message correctly[36]. Observation (5) displays how one of the sites participants are pointing at the computer screen, referencing to a specific part of the artifact, and the remote sites exclaims "*Hold on, I'm not following what page you're at right now"* when not having any visual feed at hand. In observation (1) did the observed participant try to wrap up the meeting, which was not sensed by the remote site. The fact that communicational messages are sent out without being received in fully of course makes the interpretation of the message become limited and could lead to confusions and mistakes such as described. It is crucial that the remote collaboration tools can aid the communication process so that more than the spoken words can be captured and transferred in order for messages to be sent and received as intended.

A major part of communication is delivered and retained by a person's body language. Illustrators, which is when the body language is used to enhance a message, and adaptors, which is unknown body movements like scratching your nose or yawning, are constantly used when communicating and is facilitating the encoding of the sender message[37]. Above this, Burgoon et al (2014) describes the use of body language as a way to clarify

[35] Celtic-plus, 2015
[36] Poyatos, 2002
[37] Burgoon et al, 2014

speech, for instance to describe someone's length by using both words and hand gestures. Regulators is a way to control other people's' speech. To tell someone to stop talking for example by raising your hand is one example of a regulator. This is more of an intentional body language where a major of the described language is unknown for both the receiver and the sender but still impacting the communication message[38].

All of the participants during the remote meetings were sending a message by the use of their body language (observation 1-10). For example, in observation (1) one participant crossed his arms impatiently at the end of the meeting meaning to imply that he wanted to end the meeting, which the remote site didn't perceive because the lack of video feed. One focus group participant (1) described that the remote site sometimes is excluded from jokes or is mentioned by non-verbal communication, by using facial expression or gazing at each other. The participant states: "*Sometimes we look at each other if for instance we don't understand or disagree with the remote site, but it doesn't feel good doing so because the remote site doesn't perceive those signs*". This indicates how an internal mentality of communication, where the persons who can meet in person have more communicative channels, internally (and unintentionally) excludes them selves from the remote site. The social connection with all parties, naturally built up when meeting informally, is here highlighted in terms of how it is needed for creating a collaborative ground.

The influence of the informality of the meeting has been described. When studying the body language it becomes clear that the ability to use body language is affecting the degree of formality of the meeting. Unsatisfying use of body language and other non-verbal cues may result in a more formal meeting context[39]. When looking into the use of body language during remote communication gestures are often exaggerated and the movements are mostly turned towards microphones or cameras, as they are the input devices. Thereby some of the inter-personal interaction becomes impeded[40]. Moreover is establishing eye contact whilst communicating important in order to confirm when someone is attentive, ensuring that the message is received[41]. This is a natural feedback that takes place automatically in physical conversations. In comparison, cameras do often appear static and can therefore not be controlled by the observer on the other side of a remote meeting. Cameras are also often placed above the screen where the information is shared which leads to a display of the person as gazing slightly downwards. In focus group (3) it was mentioned that this could be enforced when not having any video on since persons felt less observed and then started multitasking. It is therefore important to acknowledge the role of the video feed as it provides awareness of when someone actually is there and attentive to the task as well as providing an attention point for the communicational acts.

It is suggested in theory that when conducting meetings remotely participants often exaggerate the languages (both bodily and verbally). When visual feed is not provided, this of course impacts the ability to show the bodily exaggerations of what is communicated. Therefor should this be considered from two sides: On a managerial encouragement level to spur participants to use the video feed in early group

[38] Hartley and Karinch, 2010
[39] Emmit and Gorse, 2009
[40] Settle-Murphy, 2013
[41] Cao and Östin, 2015

development phases as well as designing the video feed to better aid the user with a clear representation of the remote site.

2.2.2 Section summary

- Technology should support short communication loops to enable the user to transfer messages in an honest way and also to enable all participants to actively participate in conversations in order for attaining an interactive meeting climate.
- A major part of the communication is delivered and retained by body language and non-verbal cues, it is thereby important that the technology supports these non-verbal communication channels.

2.2.3 Individual and group dynamics aspects

The personal traits of persons might indeed affect the overall effectiveness of a team. The chapter of individual and group dynamics aims to investigate to what extent and in what sense this can be related to a remote meeting. Also looking at how the individual and group contribution as such can be optimized, starting off with the group and then moving on to the individual. The complexity of the social interplay that occurs in a team that work together is not easy to interpret, but theory and empiric studies have through this chapter shown that there is indeed a lot to be learned when it comes to developing collaborative tools.

Group dynamics aspects

As the definition of 'a meeting' states: a meeting is a *group* thinking together. Thus, to understand the phenomenon of the *meeting* the dynamic of the group must be understood. According to the group model by Tuckman there are four development stages a group goes through during a project. During each stage, different conditions for productivity and social relations are abled. The first stage, *forming*, is when the relations are tentative and to fit in within the group becomes of great importance. The next group stage is *storming*, which is characterized by conflicts and there are limited room to focus on the group task and productivity. If the group is able to manage through the storming phase they enter the next stage of *norming*. This is a phase where the group starts to focus on the task and performance instead of relations and individual impressions in the group. It leads up to the next phase of *performing*, which is the phase of high productivity and where the group members care about the group performance and task[42]. While evolving through these stages, the structure within the group is constantly developing and changing. The group structure is a complex, dynamic system that involves factors such as status, power, role, leadership and liking[43]. When looking at a group of remote collaboration the status and power within the group becomes of great importance. Research indicates that during remote collaboration status and hierarchy is exaggerated[44]. As often two or three persons would appear dominant in the remote meetings, clearly observed in (2 and 3), it could occasionally block out the more introverted. This effect

[42] Barker, 2011
[43] Barker, 2011
[44] France et al, 2001

becomes extra apparent when being on remote as it gets harder to interrupt from the remote site, as previously described. If the technology then could aid persons to enter the conversation it is believed that the threshold for communication would decrease.

The fact that formality may have an impact on the meeting, its members and their ability to be productive is apparent in the group behaviour in several ways. Looking at the group dynamic, one can see that implementing socio-emotional interaction during the early stage of the group development, during *forming*, provides a tool for the group to work effectively together[45]. Several focus groups (1, 2 and 3) discussed the importance of feeling a connection with the other meeting participants and how this could help to reach a common ground. This highlights the significant importance of socio-emotional interaction. Informality impacts in how people relate and interact with each other. If people feel that they actually know more of the person than just work related information it becomes easier to also be more open and relaxed, this is brought up earlier from the observations of already familiar groups compared to newly established teams. Several interviewees (1, 2 and 3) and focus group (1) would here highlight the need of spontaneity in the meeting situation, which was something they saw as helpful for the more informational acts. Theory highlights that informal interaction cannot be planned for but could however be helped with other means. Technology should therefore support the users into taking more spontaneous contact with their working team in a very intuitive manner. Similar to how they would encounter their colleagues at the office where you just go over and have a quick talk. The management of meetings also have an obligation here in order to create an inclusive climate for the involved participants so that this can be achieved.

In interview (1) the interviewee explains that he has no need for seeing the other meeting participants while a participant within focus group (1) describes missing the function of visual feed of the others. The interviewee has worked in the same team for several years and has continuous meetings with the team members. The mentioned focus group participant describes that he is new at work and has just started to collaborate with a remote team member. Another interviewee (interview 2) is also stating that he lacks the visual feed from the other sites, he has a position that he often starts up new projects and the participants of his meetings are rarely the same over a longer period of time.

However, having a more inclusive meeting climate can hopefully spur more feeling that their contribution is valuable. Inclusiveness is described by Hill (2014) as important when managing a creative work environment. In focus group (1) it was brought up that the meeting group should work more with combating exclusion of the remote sites as it occasionally tend to be a more open climate in the meeting room and that sometimes an internal ”we and them” mentality could occur. It was also brought up that it is important to feel trust and prepared for what the meeting is about, something that can be related to the theory about being in control. In line with this, the understanding of others and individual role in the meeting itself is, as previously mentioned, important to know if the meeting is relevant for one self to participate in. In focus group (1) the participants describes this as crucial when being on remote, as you need the information to be able to bring relevant information to the table.

[45] Emmit and Gorse, 2009

Individual aspects

When understanding the behaviour of a group, one must also see to the individuals within this group. Each individual is striving towards fulfilling the own well-being regarding; physical and mental health, emotional well-being, sense of belonging and sense of being in control and spiritual state. If the group satisfies these needs the individual will respond by strengthening it[46].

One theory that describes the difficulties with the behaviour that an individual may experience during remote collaboration is the *theory of self-monitoring behaviour*. The theory explains how some people within a group is more sensitive to how others perceive them and thereby has a high self-monitoring behaviour (here called HMB). These people incorporate trust in the meeting by asking many questions and showing participation, while the behaviour of low-monitoring people (here called LMB) is perceived as distant and hostile. Often, LMB is sprung out of multitasking such as for instance talking on the phone, texting or doing other work during the meeting. According to the theory it is especially important to counteract the LMB during remote meeting. By getting the participants involved early during the meeting i.e. introducing themselves, make necessary data and feedback available for all participants or encourage engaging communications, HMB is facilitated[47]. In all of the observed meetings the participants were at some point in the meeting engaging in non-meeting related activities. In observation (2, 3 and 8) it was unclear of how many participants that were present because of the high frequency of entering and exiting the meeting. During observation (2) one of the participants on the remote site took a call at his smart phone in the middle of the meeting, entered the door and did not come back until five minutes before the meeting was finished. This indicates how easy it is to tune out during the remote meetings and how this should preferably be prevented in order to achieve a sufficient interactive climate.

Another aspect of behavioural issues during remote meetings is highlighted by the *uncertainty reduction theory, URT*. The theory states that when we lose the ability to communicate nonverbally an uneasy atmosphere is occurring, which may increase the degree of participant uncertainty. URT suggests asking questions more frequently and using collaborative exercises will reduce uncertainty[48]. Several of the meeting participants are displaying uncertain behaviour during the observations. Observation (3) shows an example of when a participant is keeping a monologue and only one other participant out of seven speaks during the entire meeting. In observation (2) one of the participants was frequently asking "*Are everybody on board?",* "*Has everybody understood?*" and "*Any comments or questions?*" This contributed to a better meeting effectiveness and overall more interaction. It is here highlighted that the need for reducing uncertainty could in fact also be more apparent in the remote meeting situation as more obstacles of communicating are present. The fact that it becomes harder to interrupt when only having audio is also a matter to consider for later development stages.

[46] Barker, 2011
[47] Wilson, 2009
[48] Wilson, 2009

Above this, different personality traits and roles of the individual will always affect the meeting situation and group constellations. Some individuals are more comfortable and outgoing than others; some more talented in turn taking, making a point, interrupt respectfully while others may contribute little to none in these aspects. As well as the group dynamic and development affect the members; each member and the different dominances are affecting the group. Moreover, different individuals correspond differently to information through different senses. Some persons can be more pervious for visual information while others are more auditory or tactilely conditioned. That one individual could be reading carefully from a power point and observe the body language whilst another is listening directly and a third is looking into his papers. Simply as the visual feedback is what one is used to, another being a good listener and the third liking to feel what is presented[49]. Persons could also have more or less of these traits combined, including smell and taste. The different traits of the users set the conditions for the further work of the project. Therefor should important actors be identified and described to guide the development of the final product.

2.2.3 Section summary

- To enable all users to easier enter the conversation would favour the group dynamics and help the interactive behaviour.
- Different users have different individual characteristics, which must be taken into account when wanting to create an inclusive meeting climate.

2.2.4 Innovation through creativity

An important factor of collaborative work is innovation, being the aim for many project teams in terms of coming up with new ideas for how to solve problems and push technological limits. In this project, such teams are of most concern as they are the subjects of investigation through the MERCO stakeholders. Innovation has one important root out of several, and that is creativity. Without this very much taken for granted component in the collaborative sphere, it becomes very hard to come up with new ideas. Therefor, this section aims to investigate how creativity can be created in order to see how creative environments could be generated on remote.

What is creativity?

Richard Peterson (2001) describes creativity as occurring as "the first time a person has an original or novel solution. Peterson (2001) states that creativity must satisfy two conditions for being seen as creative; originality and purpose. If a product or a solution is seen to be both novel and to have great purpose for existing it is categorized as a creative idea. Peterson (2001) also describes several stages that are of great importance for facilitating creativity: preparation (to obtain information), incubation (to process that information), inspiration (finding a solution) and verification (evaluating the solution). Thereby, 'working creative' has much to do with the work process and how you behave on the journey towards a creative solution. In conclusion, it is important to facilitate the creative work process during the entire work process.

[49] Fexeus, 2007

The individual can be motivated to work and think creatively by many different ways. One factor that helps creativity is when feeling curious. True curiosity is described by John Adair (2007) as being the desire to learn and provide knowledge. When thinking creatively, curiosity is stated to be an important ingredient in motivation. To develop curiosity it's important to ask a lot of questions both when talking to others and yourself. By asking questions the individual becomes aware of what is known and unknown and is then triggered to investigate and learn about the unknown. But even though individual aspects as curiosity creates motivation and enjoyment during a task, there are more ingredients needed in order to achieve creative, innovative solutions. As stated in *Collective genius* do innovation not spring from nothing. The interaction and collaboration with others to create innovations is significant. 'The single genius' may exist in some rare cases but true innovation comes from a group of people that is provided with the right tools and conditions[50]. John Adair (2007) describes the importance of using *pen and paper* when being creative. Also providing the group with the right type of material for the task is here mentioned as being significant for the task outcome. Because the group members influence each other they need to be able to express themselves without limitation so others can interpret their ideas correctly.[51]

The participant at the remote site during observation (1) describes how he is interrupted in his work because he can't find the right tools: "*I want to find the pointer-tools to show you what I mean, but I can't find it!*" In observation (4) one of the participants was trying to explain which figure in the document he means to describe: "*No, not that one, I think you are on the wrong page*". When constantly facing user errors, technical problems and a formal meeting environment the individual participant is being obstructed in his or hers creative process. This aspect is implying that the actual use and experience with the product could directly be connected with the ability of creating a creative environment and an individual motivation for being creative. Observation (1) above shows one example of how the participants are interrupted in their work, trying to explain an idea but not finding the right tools instantly but instead must interrupt the ideation and instead focusing on finding the proper tool to explain his idea. According to Hill are these obstacles working counteractive regarding the creative process and inhibits the creative work environment. Therefore it is suggested that the technology should aid the user different needs of expressing themselves, allowing thoughts to be communicated unfiltered and without obstacles.

Creativity through management

So far, the state of the individual and the collaboration of the group have been described as being important factors for creativity. But when continuing looking at how innovative products are being developed, one must see to the organization behind the group. To manage innovation is to provide the project group with the tools and also the project process that is required for innovation[52]. In Collective genius the importance of creating an environment where people feels included is described as crucial for innovative leadership to appear. This leadership of innovation will affect the project group and facilitate innovation and creativity. Looking at studies of work methods from Pixar

[50] Hill et al, 2014
[51] Adair, 2007
[52] Hill et al, 2014

studios, that has managed to produce several innovative films time and again, the importance of 'dailies' where the project members becomes up-to-date with the project and 'trial and error'. Linda Hill[53] states that the following three factors needs to be included in an innovative organization:

- *Creative abrasion* - the organization should encourage discourse and debates. The innovative solutions cannot appear without conflicts and diversity of thoughts.
- *Creative agility* - the members should be able to quickly try and evaluate ideas, discovery-driven learning is here mentioned as significant.
- *Creative resolution* - the decision-making should be patient and inclusive, to not exclude opposite ideas but instead build on a mind-set of 'both and' instead of 'either or'.

Interviewee (2) describes the issue with being unable to communicate with the remote site and describes that: "*Then you work you ass off and then you have to re-do all of it after getting the feedback too late*". He explains that his work would be more efficient if he felt that he could introduce his remote colleagues in an earlier state in the process. The ineffectiveness that this comment illustrates displays a need for a reform where changes can be made in real-time more hands on and in an agile and easy manner rather than having these bottle necks of brief, feedback, adaption and update.

Glover et al (1989) states that at least four different components is included for creativity to exist, that is the creative process, product, person and situation. In addition to this are certain important leadership skills for remote collaboration mentioned by Hill (2014) as being important for organizational creativity: understanding how to create credibility, knows how to influence without authority and engage, creates a safe environment, creative ways are found, which leads to effective collaborations and also; value different opinions.

What has been seen during the observations is that two out of ten observation had outspoken creative aims (observation 2 and 9). All of the meetings were held within the same meeting room context with the same technical aids: making a call via Skype 4 business (S4B) by the use of own computer, sharing screen with a displayed artifact. This environment is not supported by theory as facilitating and encouraging creativity and collaboration.

Only one of the observed meetings (observation 1) used the post-it/sketching tool in S4B even though several participants expressed the need for using sketch tools in S4B. To connect the three innovation factors that Hill is describing above; to feel encouraged to debate, to quickly evaluate or try ideas or to have an inclusive decision-making process is practically impossible during the observed meetings because of the rigid, non-existing or incomplete communication patterns and interactions. In the observed scenarios a creative remote meeting was regarded as almost impossible. One of the interviewees (1) expressed how he believed that most of his collaboration issues would be solved if he only had an interactive surface. But with the previous analyse in mind, this would probably not solve

[53] Scientificamerican.com 15-10-01

the core issue since the foundation of creating a creative climate is today hindered by communicational complications.

The mental threshold of ideating remotely was extra apparent in the previously described observation (9), where the brainstorming session was cancelled because a remote site was connected to the meeting. This indicates that there needs to be a top-down mentality on how to work more creative and collaborative and to engage the employees in these activities. Once again the inclusiveness is a matter, as the technical aids need to support remote workers into being equally able to contribute.

As mentioned there is a problematic situation for unfamiliar groups with encouragement to debate, quick evaluations and testing in combination with decision-making, which was often done by just a few dominant actors in the observations. To create this creative climate there is a need to build up curiosity, which is a great motivator for generating ideas. This could, as theory mentions, be done through asking a lot of questions, investigating the unknown. In the observations was this however seldom the case and this implies that communication must work before this can be achieved. Technology should thereby have the most easy-accessed communication channels in mind in order for the participants to be able to add their opinion on remote.

2.2.4 Section summary

- Letting a group of people build upon each other's ideas supports creativity best. To be able to do so, the technology should support the user to express ideas and thoughts unfiltered and without user thresholds.
- The ability to vary the meeting room environment and technology is seen as favouring interactive and creative behaviour.

2.2.5 Available technology and features

A variety of technological aids are available on the market today to facilitate the remote meeting situations, either by direct communication or by indirect managing shared artifacts. However, not all described technology applies to the in-house meeting context and some are developed products while others are services or incipient ideas. These are still described in the following section due to its relevance for his project orientation. Moreover, this section relates empiric data from both observations and interviews about the actual task and workspace at the concerned companies.

Tele- and video conferencing tools

The tele- and videoconferencing tools is enabling the users to conduct a remote meeting, either by audio, audio and video and/or by texting, examples of such tools are Skype for business (S4B) and VSee[54]. The users can here choose to communicate through either IM, video or audio, or all at the same time. At the researched company the used tool for remote meetings is, as mentioned, S4B. One other conference tools is mentioned; a telepresence system room. One participant in focus group (3) explained: "*Nobody uses this room because you have to have the same software on the other site, which no one has"*. The compatibility with different software's was lifted during focus group (1) when one of the

[54] vsee.com, 15-10-11

participants was calling in by Skype but the others had Skype 4 business, which lead to that the different participants could not connect and thereby did not hear each other. If the companies different software's are not supporting each other the chances of using the aids effectively in the meeting situation gets very small. The technology needs to be easy to use and compatible with others in order for the users to engage in the product, which has been suggested both by interviewees and focus group participants throughout the project as well as observed.

The most important function within the tele- and videoconferencing room was seen to be having good quality of sound (observations 1-10), which also was described by participants in focus group (1 and 3) and by interviewee (8). Above audial feedback visual feedback was lifted as an important function (interview 3, observation 3). In observations (1-10) it became clear that the available visual feed was often turned off. In all of the observed meetings at least one of the remote participants had not uploaded a photo of them selves but instead was visually presented by the default, anonymous silhouette. The reason for not uploading a profile picture was explained as being a conscious choice. Many of the mentioned participants did not activate the video feed during the conversation, which lead to that only audio feed was presented. One participant in focus group (1) stated that: "*I always turn the video feed of, because I don't feel comfortable with being watched*". In the focus groups the reason for turning off the video feed was explained as being to counteract technical issues, which often occurred due to poor network connection. One participant in observation (8) described: "*I have stopped trying to use the video because it has always led to problems"*. In interviews (4 and 5) it was stated that it is crucial to avoid technical errors if you want the tools to be used. This implies the importance of ease of use with few errors; otherwise the technology will be discarded entirely. Therefore should technology support users with more nuances of adaption to existing technical prerequisites such as network connection in order to still be able to give and receive information. Furthermore would it also be helpful to see when a person have got a poor connection so the speaker knows if information is not transferred accurately and can brief that individual afterwards. In interview (3) this phenomenon was brought up as one of the big thresholds for a more fluent conversation in the remote context.

In observation (7) the mediator hesitated to make a phone call because she is facing new technology and not sure in how to act, even though a description of how to make a call is printed in front of her. She stated: "*I just want to use the same as always*". The habitual way of working where habit incorporates safety, in combination with user thresholds is here apparent and illustrates how the technology must build on existing mental models as well as provide intuitive functions so that these can be understood, accessed and utilized with ease.

Opinions were scattered regarding using the visual feed during remote meetings. One focus group participant (1) described: "*If I am on remote link with 50 people on the other side, I don't want a video feed of me being displayed in front of all those people*". Interviewee (1) explained: "*I have no use for video feed, I just need good sound and a sketch surface for my meetings to be efficient*". Interviewee (2) stated another point of view: "*I must see the person I have meeting with, otherwise it is impossible to connect and to explain something properly"*. The focus group participant was seldom having remote meetings and was not

presenting on the meeting but only receiving information by others. Interviewee (1) had the same type of meetings with the same team for years. Interviewee (2) was meeting with different customers and was often conducting remote meetings with a new team where he often not had met the remote participants. Here it is indicated how the informal and social relation that has been developed helps with overcoming communicational barriers, which consequently becomes trivial in the situation of already having reached a common ground. In the first case it is therefor suggested that video feed is less important as the person already have that covered with his team. Whereas as in the situation where persons have never met, as in interviewee (2)'s case, it becomes more crucial.

Interviewee (1) and participants in focus group (1) described the process of entering a call as being complicated, with the use of pin codes that they forget all the time: "*You get a mail with the pin to access the meeting as a mediator, but you get so many mails so it is impossible to keep track of those*". The email issue was lifted several times during the user study, focus group (2) lifted the issue by stating: "*You should have some kind of priority, it is ridiculous how many emails you get every day*". Having emails appearing on the screen was also observed as distracting during presentations where users would share their screen. The technological distractions and the problem that comes with them are here of concern and also points to the fact that with more user interactions and specific complex functions it becomes harder for the user to quickly access the communication tools.

It is believed that technology could be designed for a much easier access to the meeting itself. As shown in during the pre study the participants could be located in different time zones, which is not displayed in the system for easy access (interview 2). This of course makes the need for more spontaneous contact more difficult. In focus group (1) the issue when collaborating with people within different time zones was lifted again. One participant stated: "*When I am having a meeting that includes participants from several different time zones it can be really hard to find a time slot that fits everybody*". He continues: "*I mean, it's really hard to know which time that is within business hours for both Shanghai, Texas and Sweden*". Another participant of focus group (4) stated regarding having meetings with different time zones: "*You always start with the standard questions like 'what time is it at your end?'*". If the chosen system could display this in an easy manner the user would be aided into communicating faster. In line with this is the booking of meeting rooms rigid, simply as rooms often are booked for an hour but could either be left earlier or stand empty. It is also really hard to book a meeting room with short notice, which suggest that there is a need for transformation.

Accessing functions & features

Many other features, above the basics of communicating via audio, video or text, are available in the S4B software. One of the main findings from the user studies was that the users were not aware of the available functions. The participants in observation (1) were the only ones that used the interactive sketch tool, which many other participants commented that they didn't know it existed. Voting sessions was another such example, which few knew anything about but still appreciated when noticing.

User experience may be the key factor for success when developing a solution and Kraft (2012) states that a successful user experience innovation could be the key battlefield for competition on the market. The expectations when entering a task or facing a product

has a great impact on the experience of the actual task. The user expectations may be impacted and is not static. As the trend goes towards having more remote meetings in general, the mind-set of looking at how the user experience differ depending on environment and used device. The technology should therefore be developed for an easy shift between different functions and acknowledge that different meeting needs are fulfilled in a satisfying way. With this in mind technology should be developed with the aim to make different devices fulfilling the different meeting needs.

As mentioned, during most of the observed meetings, the meeting mediator was sharing his or hers own screen for everybody to be able to view the on going presentation. One interviewee said that it was the easiest way to share the presentation on your screen, even though there are other ways you could do it (interview 4). One of the focus group participants (1) described that she was always sharing her screen if she was the mediator, but she felt uncomfortable because then everybody had full view of your entire work desk. She stated: "*If I for instance get a message from a friend, it is viewed in the screen for everybody to see. You could probably turn it off but I just don't know how*". Moreover would it be helpful to enable users to share their screens easier. At several occasions would the division of presenter in the room be changing and then that person would either had to send the document to the mediator or pull out the cord from the previous computer, plug it in his own, and then present. There are today software programs that can be directly implemented for sharing up to four screens at once on the displayed screen.

Clickshare and WePresent are two wireless solutions that enable the user to show their artifact and screen content on an on going presentation[55]. Click share is steering the presenting screen remotely with use of an usb click device or an app, enabling the users to quickly switch to their own screen. WePresent is built on the same idea, but is a router that sends wireless signals from devices to the TV screen. This enables all screens to be displayed through wireless directly on the presented area. In combination the WePresent also enable the user to draw directly in the document with use of the finger and zoom in or out.

Also, the result from these user studies indicates the need for being able to modify text, add comments to presentations and edit other artifacts together. As the working tasks are different, so are the meeting needs. Focus group (1) mentioned that their working group mainly wanted to be able to work collaboratively with text whereas several interviewees (1 and 2) and focus groups (2 and 3) mentioned the need of being able to sketch in real-time in a collaborative artifact. That there are diverse meeting situations, often shifting in type during the booked meeting hour, illustrates how having a more flexible meeting climate in the virtual environment could benefit the effectiveness and also how the employees actually desire to work.

The issue of not knowing who was online was seen during multiple observations. For instance, in observation 2, some participants was entering and exiting the call several times during the meeting and it was unclear who was participating at the meeting. One meeting participant asked "*Did we loose …?*", and another one answered: "*I have no idea*". Another reason for not being able to view which participants that was online was

[55] barco.com, 15-10-10

shown in observation (9) were the participant shared his screen and switched between different documents. When exiting the S4B window all the information of the remote participants visually disappeared for the benefit of the screen share.

Having easy access to the used tool was described as vital for a product to be used. Interviewee (1) describes how the company's program for storing artefacts is complicated, stating that: "*The software is too complicated. What everybody wants is something like Dropbox, which unfortunately also some people are using even though it is not allowed*". This highlights the importance of simplicity and low user thresholds once again making it clear that what is simple and intuitive is actually used even though other alternatives are available.

Brainstorming tools on the market

The collaborative tools that are described below have in common that they offer an interactive surface, like post-it surface or sketching surface, and that they are mainly focusing on supporting brainstorming meetings. For instance Holoport is a collaboration and videoconferencing tools that enables an interactive surface at the same time as the remote participant is displayed as a hologram, as shown in figure 2.1[56].

Figure 2.1 - Holoport

Other collaborative tools that focus on facilitating interactive sessions are for instance Firestorm (figure 2.2[57]). These kind of tool enables digital post-it sessions were extensive amount of data or brainstorming ideas are sorted to facilitate collaborative group work, though not when remote group working.

[56] Kuechler and Kunz, 2006
[57] Clayphan et al, 2006

Figure 2.2 - Firestorm

Different interactive surfaces in form of smart boards are also available on the market. One example of such is shown in figure 2.3[58] and allows the users to simultaneously sketch and input information onto the surface, which directly is displayed digitally. The information is transferred either by sketching directly on the surface or by using other devices such as smartphones or smart pads.

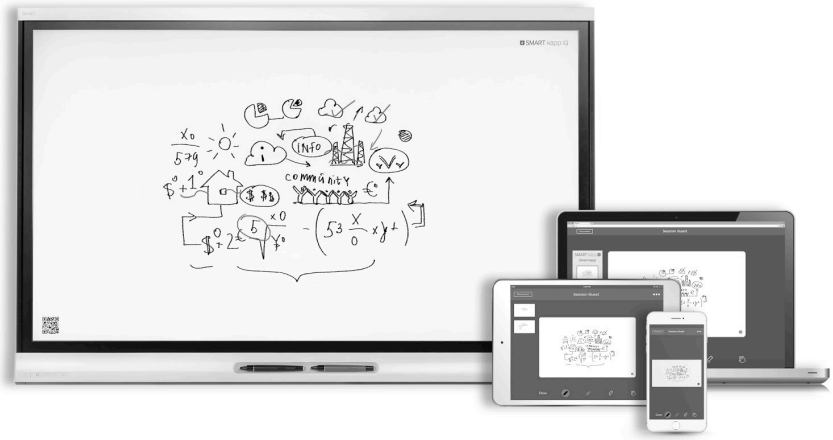


Figure 2.3 - Smart board technology

In both focus group (2 and 3) and during the interviews (1 and 2) interviewees stated that an interactive tool, such as a smart board or other digital sketch surface, would contribute to their everyday work. Interviewee (1) explained that: "*All I want is a digital surface to sketch on, it wouldn't have to be more complicated than that!!*". A focus group participant (3) described how they have tried to use a tool for mapping ideas and that the only available tools was a software that only one person could enter information in. When being asked if the interviewee felt the need for being able to have multi-user tools the participant answered that: "*Of course that would be the ideal situation*". Focus group

[58] www.education.com, 15-11-01

participants (2) describes another view when being asked if they would use an interactive tool in their work: "*Not really, we don't sketch that much".*

In observation (1) the participants were using an interactive tool in S4B. When discussing a subject one participant exclaimed "*Where are you now?! Use the pointer thing!*" to explain that he could not follow the other person's explanations when not seeing where he referenced in the artifacts. In the same observation the issue with saving the artifact was displayed. One of the participants wanted to save an interactive session using the sketch function in S4B but noticed that the text boxes they had added could not be saved in the desired, editable format. This was forcing the participants to continue the phone call instead of hanging up, adding extra five minutes to structure all the data in another document. The scenario indicates how the technology is not based on ease of use functions, neither being in line with the users mental model of the system, which consequently leads to errors and inefficiency.

The importance of having physically easy access to the interactive tool in question was lifted by interviewee (3): "*You just want it to be available to quickly use it, you don't want to be forces to book a tool to be used the week after. You want it the same moment as you think of an idea!*". Focus group participant (2) described how they are sceptic regarding an external physical tool for brainstorming: "*No I don't want a large smart board standing in the corner of a room, never being used. I know how it gets…*". Another aspect of having easy access to use the interactive tool is mentioned in focus group (2) as being important how you interact with the software. One participant explains: "*You don't want to use your finger, it's too clumsy*". And another one adds: "*Yeah, but you don't want to have a specific pencil to keep track of either. Everything gets legs and disappears*". At the same time interviewee (1) expressed *"A digital whiteboard has the benefits of equal accessibility and the natural input of writing with a pen*". During interviews, users expressed several times that they just wanted an interactive surface that they could sketch on and manage at the same time on different sites. But what has been shown during the observations is that just one of the meetings used the sketch-feature in S4B and none of the companies had bought a smart board.

Also, when discussing the interactive tools, the network connection was lifted as an important aspect to take into account. Interviewee (3) stated: "*I would not use it if it was too network heavy, then it would just become an annoying element*". Interviewee (3) also mentioned the importance of having easy access to a new tool and having a low initial user threshold: "*As soon as something doesn't work directly, you stop trying to use it*". Interviewee (5) stated: "*It is crucial to think about the first timers when wanting to implement a new technology*". With that in mind, the technology should be developed with the idea of enabling an easy implementation and use. Considering that the mental model of sketching and writhing with a pen is what is here described as desired when developing such feature.

Room decor and interior related products

Today, the benefits of incorporating a good workplace design are well known to most organizations. The author of the book "*Creating the productive workplace"* describes how the workplace can be looked upon as a factor that affects the productivity at a workplace. According to the author, a number of interacting factors are affecting the productivity;

privacy, communications, social relations, management and environmental issues. The author describes the importance of the workers being able to take control of their environment; first of all by controlling factors such as air, temperature, sound and light. As an example, the authors describe how studies have shown an average of 10-percentage activity loss due to poor quality of indoor air[59]. Here could the more activity based meeting culture be suggested for further development to solve this issue, something that has been previously described as increasing the accessibility of remote meetings. Interviewee (4) described that after his company transformed to more activity based meeting rooms at their office would the usage of the rooms be better handled and more used. Implementing activity based meeting areas is suggested to also contribute to benefit the informality at work, supporting and building better relations. In the activity based workplace you chose your work desk depending on the current need[60].

All of the observed meetings (1-10) were held within a traditional meeting context; within a booked meeting room with a desk and a number of chairs with own laptops and in some cases with an external screen. Interviewee (2) described how the sound and the size of the used screens are crucial for the meeting outcome. During observation (11) participants sat in a small room during one hour with poor ventilation, which by described theory is not facilitating an interactive meeting situation.

Moreover, interviewee (8) described how he felt discerned from one of the meetings because he was not visually experiencing the same environment as the other site. He stated: "*What I missed the most was the experience of being in the same room as the others, I was so distracted by my surrounding so I couldn't concentrate"*. Another participant of the same meeting, interviewee (7), was sitting at the other site, managing the meeting. He explained: "*I felt present and didn't lack any functions during the meeting, other than the function of knowing if the other sites perceived all the given information*". The statement suggests how the communicational transfer and the very notion of the other sites presence affect the overall experience of the user, something that is suggestively affected by the context as well as already mentioned barriers. With that in mind, the importance of the context should be taken into account when designing for remote collaboration.

2.2.5 Section summary

- The investigated teleconference system used today is not supporting the need of flexible behaviour during the remote meeting.
- The users mental model of how a teleconference is performed is strong and thereby one must look into the existing way of conducting teleconferences when designing for this environment. The technology functions should be easy accessible and possess few interaction steps in order to reduce user error.
- The technology should support the variety of user needs that occurs throughout the meeting session, enabling the users to reach different functions to fulfil these various meeting needs.

[59] Clements-Croome, 2001
[60] cio.idg, 15-11-01

- The main need throughout the user study was found to be the ability to sketch digitally, similar to simply use a pen.
- The meeting room and décor is found to be static and unsatisfying, suggesting that the technology should include the meeting environment and the ability to create a non-rigid climate.

3 The most important aspects in collaborative meetings

The following chapter describes the main result of how collaborative meetings are facilitated. The chapter starts with a methodological overview and description of how the project at this stage was carried out and the next part shows of the results, which was obtained. The work done in chapter number three acted as a basis when developing the concepts in the following chapter, which therefor is a very crucial part of the project where needs and requirements are determined of the user group. This chapter therefor also contain a very important finding: the developed informality enablers. Acting as a guideline as well as an evaluative toolkit for how to incorporate informality in the remote collaborative setting. The enablers can also be seen as an important complement to the previous work done in the MERCO project by Cao and Östin (2015), where a communication framework was designed.

3.1 Methods used

Through the methods described in this chapter a lot of important findings could be made, as described previously in the first lines of chapter 3. In order to structure the data that is presented in chapter 2 a list of requirement was done, followed by an identification of the user group through personas. This lead to the development of informality enablers as described below.

3.1.1 List of requirement

Based on conclusions from the affinity diagram derived from chapter 2 the foundation for the list of requirement could be developed. The list of requirement was derived from the groups and sub-groups that emerged from analysing the diagrams results. Findings that were interpreted as able to contribute to the posed research questions were listed and grouped depending on relevance and frequent occurrence. Each item on the conducted list was then again evaluated and re-categorized depending on relevance for the project and occurrence in literature/theories. The developed requirements were weighted separately based on the user issue importance that the investigated requirement related to. A high level of importance for the user group would provide the requirement with a weight of 3 whereas if seen as medium level of importance the weight was 2 and low importance weight 1.

3.1.2 Persona - A user group identification

Using *personas* enables the designer to think into the context of specified user group, embodied through a persona. A persona makes use of findings from the previous work and user studies, incorporates these into a made-up person with the qualities of several similar users, and thereby makes it easier to elaborate with how different ideas would

work for these[61]. The persons that were interviewed and participating in the focus groups were thereby embodied in these personas in order to use their expressed preferences, personal traits and habits as guidelines in the continuous ideation of concepts. The developed personas are described in Appendix 3.3.

3.1.3 Developing frameworks

From the previous master thesis project a communication framework to support remote meeting situations was developed, which, according to initial studies, was lifting the most important aspects of communication. When evaluating the *list of requirement* it was clear that all of the factors within this *framework of remote communication*[62] was represented and thereby considered relevant also for the future work of this project.

Above this, another framework was developed by categorising the other requirements, that was not matching the above described communication framework. When doing so, nine different areas regarding informality was detected and concluded into what further on is referred to as the *framework of informality enablers*.

3.2 Collaborating remotely

The collaborative experience when working remotely was in the previous section investigated through theoretic and empiric results, which in the following section is structured according to the mentioned methods to create an overview for the upcoming concept-generating phase.

3.2.1 Developed list of requirement

The *list of requirement* was developed based on the found user needs described in chapter 2 with both empiric and theoretic foundation. A list of these needs can be found in Appendix 2.3 and 2.4. The entire conducted list of requirement is presented in appendix 2.5 at the end of this report.

The product should encourage various degrees of formality during meetings, with focus on informal interaction and at the same time enable effective remote collaboration. The product should also enable the participants to set a clear meeting structure if required of the meeting.

The solution should encourage balanced group dynamics and different individual characteristics should be allowed space throughout the meeting. The solution should also help to create a sense of belonging to the group and task.

The product should be able to be used with the same standard of technical equipment on the various sites and focus on an intuitive use and an optimal user experience for the

[61] Garrett, 2011
[62] Cao and Östin, 2015

meeting participants. There should be a consistency between the user's mental model and the systems ability.

The product should trigger the participants' curiosity and creativity to create an interactive collaboration and aim to create a creative meeting environment. The product should encourage fluid interactions between participants and enabling them to receive and provide feedback continuously.

3.2.2 Understanding the user group

As chapter 2 displays, the user group that is observed to take part in remote meetings involves a wide range of different users, conducting different types of meetings and expressing differently, and sometimes having contradicting needs. Therefore, personas were developed in order to be able to evaluate and get an overview of the broadness of the users and their characteristics.

Dan O'brien - the experienced user	
Employment:	Full time employee at an industrially producing company, 35 years of working expertise, working mainly within the same team members.
Working pattern:	Dan is mostly conducting all types of meetings. In earlier project stages he often uses whiteboards to explain ideas, but only created by one person and during physical meetings. In the other project stages he mostly conducts remote meetings via Power point/screen share.
Technology habits:	Relatively familiar with technology regarding job-related technologies and applications, consider himself at least as it. Accustomed to working in existing work patterns and not keen on being introduced to new technical aids.
Personality traits:	Extrovert, often dominant in conversation, comfortable with his daily lives at his work place. He is at a place in life where major changes may seem difficult in the simple everyday.

Jack Everlyn – the introvert user	
Employment:	Employed as a front-end developer and has 2 years in the industry. Jack is still considered as a newcomer.
Working pattern:	Jack is participating in relatively few meetings. He works a lot in a specific project team, some of them are located in another location and thereby considered out of reach so instead Jack mostly communicates with the ones sitting beside him. These meetings are status updating.
Technology habits:	He is used to new technology and comfortable with new technologies, is not used to any specific work pattern.
Personality traits:	He has more of an introverted personality, being a thinker who needs time before he speaks. Never take a dominant place is he can avoid it. Likes work alone.

Alice Nielsen - the early adopter	
Employment:	Employed at an enterprise for 5 years. She has worked many years in the industry: working with information and systems.
Working pattern:	Alice has worked with the same team in many years, all situated on different sites. Whiteboards are common in the early process of Alice's meetings. This is done remotely and she is quite happy with it but think the tools are limiting her work. Mostly conducting ideating and problem-solving meetings.
Technology habits:	She is interested in technology and always has the latest items. She is working with many different work patterns but still has an established habit when it comes to technological aids,
Personality traits:	Extroverted and hungry for new challenges, can take space and be dominant if necessary. Wants to strive upwards in the company. Sees problems as a fun challenge instead of something negative.

Bob Ivery – the social butterfly	
Employment:	Employed as a design engineer consultant, 12 years in the industry. "The new yam" at the company.
Working pattern:	Participating in many different meeting types, often when starting up projects. He mostly listens during these meetings and if he participates it is to report from expertise. These meetings are status updating and problem solving.
Technology habits:	Comfortable with new technologies because of his expert knowledge but knows the technical errors that always appears. This makes him sceptical towards using new technologies in meeting situations.
Personality traits:	Outgoing, takes a lot of place in the meeting room. Dominates most meetings and may sometimes have problems listening to other opinions.

Diana Davis – the strong minded user	
Employment:	Employed as IT consultant with 8 years in the industry.
Working pattern:	Participating in the company's weekly meetings. Often as more of an expert person with one topic of interest or no topic of interest at all. Information sharing or status update meetings are the most common for Diana. She is not speaking in the meeting unless she really has something to say.
Technology habits:	Comfortable with new technologies. Is seen as the departments 'computer expert' and is often trying new ideas for her own work.
Personality traits:	Social if she wants to, but only when the conversation subjects interest her and is thereby otherwise loosing focus quickly of the topic.

3.2.2 Developed frameworks for remote collaboration

Findings from the user and literature study suggest that even though several interactive tools are available on the market it is rarely or not at all used at the studied companies. The analyse shows that the main reasons for this are that:

- the initial user threshold must be low for the user to start interacting with the product.
- the meeting culture does not invite the users to start engaging with collaborative tools.
- the tool in question must be compatible with the participants everyday-meeting situations, otherwise there is a risk that the tool will not be used at all.

However, it has been shown from user studies that some meetings that should not be satisfying or collaborative still are. Cao and Östin (2015) are supporting this finding when they imply that it is because of the informal relations: if the participants know each other or are used to conduct meetings, many of the other huge online, communication gaps are decreasing. This leads to the question; can this 'informal' aspect be applied or designed into the meeting so the group communication is facilitated and thereby leading to more effective meetings?

Moreover it became clear during the pre study that some aspects during predetermined meetings are crucial to take into account. This would suggestively include providing a clear meeting agenda and mediator at a designated place and with a set time frame. I.e. do the actual context have a great impact on how you address the problem. But when including the informal communication, addressing the more spontaneous meetings, you are no longer bound to the context of *within* the meeting room. This suggests that depending on the context, looking within or outside the meeting room, leads to different conditions for creating the optimal meeting situation. This is why, from here on, these two different contexts will be handled separately.

Communication framework by Cao and Östin (2015)

The previous master thesis project within MERCO developed a communication framework to facilitate remote communication. When analysing the list of requirement, one can draw conclusions that also in this study the framework is considered to be highly relevant. Thereby this framework, in combination with the informality enabler described below, will work as a ground for further evaluation of concept ideas.

The communication framework by Cao and Östin (2015) has been described in section 2.2 and is displayed in detail in table 3.1 as follows:

	Description of factor	Relevant terms	Relevant papers
1	**Presence, roles and relations** Design should support participants' to be able to perceive others' presence, their roles and relations to each other.	People's representation in the workspace; the notion of person space; informal awareness;	Gutwin, Greenberg (2002) Tee et al. (2009) Buxton W. (1992)
2	**Accessibility and adaptation** Design should provide easy accessibility of use, and adapt to workflows found in companies and meetings.	accessibility; collaboration readiness; collaboration technology readiness;	Björn et al. (2014) Grudin J. (1994)
3	**Visual view** Design should facilitate sufficient means to visually view the entire workspace.	extent of visual view; control of visual view;	Gutwin, Greenberg (2004), Nakano et al. (2003), Gauglitz et al. (2012), Rekimoto et al. (1995), Sellen A. (1992)
4	**Origin of sound** Design should facilitate sufficient means for participants to track where sounds originate from, and they should be able to perceive that they are being heard.	Audio perspective; negotiated mutual distance;	Sellen A. (1992) Buxton W. (1992)
5	**Verbal communication** Design should support explicit- as well as implicit verbal communication.	intentional communication; overhearing; verbal shadowing;	Gutwin, Greenberg (2002)
6	**Gesturing (non reference)** Design should enable watching of other participants body movements and non-verbal cues (non-reference).	consequential communication; alongside verbal productions;	Gutwin, Greenberg (2004), Buxton W. (1992), Nakano et al. (2003)
7	**Referencing** Design should facilitate use of deictic- and representational references as well as awareness of any artifact in a workspace that is referenced.	deictic references; representational references; inter-referential awareness;	Fussell et al. (2004) Gutwin, Greenberg (2004), Chastine et al. (2007) Tee et al. (2009)
8	**Grounding information** All meeting participants should be able to perceive confirmation from other participants so that they know that their communication has been perceived and understood.	visual evidence; common ground; grounding;	Gutwin, Greenberg (2004), Fussell et al. (2004), Nakano et al. (2003)
9	**Eye contact** Participants should be able to make eye contact with each other.	eye contact;	Sellen A. (1992)
10	**Artifacts manipulation** Design should facilitate full view and equal ability to manipulate artifacts to all meeting participants. They should also equally be able to perceive artifact manipulation by others and its effects.	"co-presence in the domain of the task being undertaken"; 'artifact awareness'; feedthrough;	Gutwin, Greenberg (2004) Edelmann et al. (2013) Buxton W., (1992) Tee et al. (2009)

Table 3.1 - Communication framework by Cao and Östin (2015)

The informality enablers

The developed framework for this project, *the informality enablers*, aims to support and enable for informal encounters within the remote meeting context. The relevant terms for every framework, the referenced literature that has been used for every enabler and the contextual inquiry from the empiric studies can all be found in the table 3.2 presented and thereafter described in detail below.

	The informality enablers	Relevant terms	Referenced literature	Contextual inquiry
1	**Set degree of pre-definition** The solution should enable participants to set appropriate degree of pre-definition for the specific meeting situation.	*The meeting structure, agenda, objective, mediator;* *Meeting type;*	Cao and Östin (2015) Hill et al (2014) Hoxmeier et al (2000)	Observation 1-8
2	**Balance group dynamics** The solution should encourage balanced group dynamics to occur and to create a sense of belonging to the group and task.	*Group psychology;* *Efficient team work;* *Team building;*	Adair (2007) Barker (2011) France et al (2001)	Observation 2, 3, 8
3	**Create an uniform experience** The solution should help to create a uniform experience for all participants, regardless of used technology and location.	*Collaboration technologies;* *User experience;*	Emmitt and Gorse (2009) France et al (2001) Kraft (2012)	Focus group 3 Interview 7, 8
4	**Including various characteristics** The solution should enable space for various individual characteristics to express themselves and to counteract low-monitoring behaviour.	*Behaviour psychology;* *Inclusiveness and team working;* *Motivational factors;*	Adair (2007) Harrington and Lewis (2014) Wilson (2009)	Interview 7
5	**Provide an intuitive use** The solution should provide intuitive use with focus on providing a consistency between the user mental model and system ability.	*Cognitive ergonomics;* *HMI;*	Gentner and Stevens (2014) Kraft (2012) Wilson (2009)	Observation 7
6	**Express emotions dynamically** The solution should facilitate the user to express emotions dynamically, i.e. both negative and positive feelings are revealed in a natural manner.	*Human relation building;*	Barker (2011) Emmitt and Gorse (2009) Wilson (2009)	Observation 1-10
7	**Establish an informal ground** The solution should enable the participants to establish a common, informal ground and thereby enabling information transferring in an informal way.	*Grounding of information;* *Perception;*	Cao and Östin (2015) Emmitt and Gorse (2009)	Interview 1, 2 Observation 1, 4, 9
8	**Facilitate spontaneous ties** The solution should enable some degree of spontaneous interaction, both during and after the meeting situation.	*Spontaneity*; Informal behaviour;	Hill et al (2014) Boud (2003) Wilson (2009)	Observation 2, 3, 5, 8

9	**Include meeting environment** The solution should facilitate the user to influence the surrounding meeting environment to create the optimal meeting room context.	*Work places; Meeting environment; Cognitive ergonomics;*	Emmitt and Gorse (2009) Farad and Weeks (2007)	Interview 7, 8

Table 3.2 - The informality enablers by Söderbom and Parsland (2016)

Informality enabler 1

The solution should enable the participant to set the appropriate degree of pre definition that the specific meeting requires, in terms of meeting type and structure.

The pre study has shown that a meeting within the traditional meeting room context, independent on meeting type, needs a specific pre-defined structure (preparations, agenda, objective, time frame, evaluation). At the same time the pre study has also shown that the meeting culture is defined as stiff and immobile because of the structure and is explained working against an interactive meeting climate. As seen from previous studies[63] and from conducted observations (1-10) the meeting structure is basically the same regardless of meeting type, apart from when the participants had some informality incorporated within the meeting then the degree automatically varies. Hill (2014) expresses the importance to create an open and flexible climate for being able to trigger creativity amongst employees. The conclusion of this is the importance of highlighting the need for being able to vary the level of pre-definition depending on meeting type and purpose to better match the different meeting needs.

Informality enabler 2

The solution should encourage balanced group dynamics during the meeting and create a sense of belonging to the group and task, with equal focus on the different sites.

The importance of focusing on creating balanced group dynamics is expressed by Barker (2011) when he describes the definition of a meeting to be a 'group of people that is thinking purposefully together'. To accomplish this the group dynamic aspect is crucial, being facilitated when introducing a level of informality within the meeting situation. Adair (2007) states that that creativity spring from others ideas and describes the importance of being able to share ideas unfiltered. The inclination of sharing ideas and thinking creative is thereby directly connected to the group dynamics and the trust in the group. Also France et al (2001) implies that hierarchy within the meeting situation is exaggerated when being conducted remotely which is counteracting the will for sharing ideas and thereby also counteracting the creativity. Barker (2011) states that meetings should not be conducted with more that 12 persons as otherwise subgroups and side conversations might occur, something that could exclude other parties. This has been observed in several of the occurring meetings as a phenomenon (observation 2, 3, 8). It is therefore of great importance to consider how to make the group dynamics optimized for the specific meeting situation so that all parties can reach a state of more fluent conversation.

[63] Cao and Östin 2015

Informality enabler 3

The solution should provide a uniform experience for the participants, regardless of location and used technology.

For the same reason as described previously by France et al (2001) that remote communication is enhancing hierarchy within the meeting group, the difference in technical aids contributes to the same phenomenon. That is why the designed meeting experience should be perceived as uniform and work against the influence of any technical differences. This phenomenon was made clear at several occasions during the conducted user studies, especially during interview 7 and 8 where the interviewee expressed concerns regarding lack of different devices. Also in focus group 3 the issue of attaining different experiences depending on device was expressed, one participant explained that unequal condition creates passive behaviour. A reason for the difference in experience was expressed in the interviews to be the contextual factors and these has a huge impact, also mentioned by Emmitt and Gorse (2009). Dialling to a conference through different devices as well as being on different locations impact the ability to feel present, included and contributing to the overall output of the meeting itself. One of the interviewees (7) expressed a concern with this matter as he felt unsatisfied as a moderator due to knowing that the remote parts had a much harder time to feel included which he saw as a great disadvantage to the overall results of the meetings. This enhances the type of anxiety that also impacts the experience inside the meeting room that the remote sites call in to. If the design could capture these important aspects and enable the users to strive for a more unison experience would the overall outcome be much more satisfying for all parts.

Informality enabler 4

The solution should enable space for the different individual characteristics to express themselves and counteract individual low-monitoring behaviour (LMB).

If the individual participant feels trust and comfort it increases the ability and wish to express oneself creatively[64]. Wilson (2009) expresses the importance of getting the individual participants engaged, preferably in an early stage in the meeting, to increase the comfort of active interaction during the meeting. The fact that different personality traits come with different needs is here crucial. As one interviewee (interview 7) mentioned does it appear very hard to interrupt when being on remote due to the conversation is taking place on the other site. Simply as you are isolated from the conversation and do not have the tools to be able to pick up when to interrupt as you would in the meeting room where persons can interpret body language and sense tone in relation to acts. How the message is received by the listener is hereby crucial as the factual content is there but the affective content is not, described by Harrington and Lewis (2014) as needed to get the full message.

[64] Adair, 2007

Informality enabler 5

The solution should provide intuitive use functions with focus on providing a consistency between the user mental model and system ability.

When the system ability and the user mental model are mismatched it increases the risk for user errors and the risk of experiencing uncertainty[65]. Wilson (2009) describes participants' uncertainty of used technology as one of the major reason for problems during remote meetings. Kraft (2012) states that one of the most important aspects when designing for user experience is the user expectation and weather that expectation matches the design. The literature is thereby expressing the importance of making the participant familiar with the technology used and one way to do so is to design for usability. This aspect has been expressed a number of times during interviews and is occurring in observation (7), where the meeting mediator expressed strong resistance for making a remote call because unfamiliarity with the technology. To be able to create a solution that will be used and that provides a positive experience and thereby facilitates the interactive communication is thereby crucial.

Informality enabler 6

The solution should encourage the user to express and receive emotions dynamically, meaning both negative and positive feelings are revealed in a natural manner.

It has previously been described that a larger span of both positively and negatively raised emotions through the meetings has shown to contribute positively to the overall output of the effective meetings[66]. Kraft (2012) raises the importance of including the parameter of feelings when evaluating the experience. The observations displays this as the meetings with more familiarized team members have had more nuanced and honest communication compared to the meetings were the participants were unfamiliar with each other (observation 1-10). This would lead to a discussion and a conclusion on how to reach the desired output or performing as described by Barker (2011). Emmitt and Gorse (2009) describes that with more socio-emotional exchange comes more successful meetings with the ability to create, support and recover relations if disagreement occurs. Through being able to evaluate, question and acknowledge information the team can faster reach desired results. This could also be seen upon as a managerial concern as there might also be a company culture oriented matter combined with having the appropriate technical aids.

Informality enabler 7

The solution should enable the establishment of a common ground and thereby knowledge and information transfer in an informal way.

The fact that informality impacts the user's way of grounding their communicational acts as described by Emmitt and Gorse (2009) displays the importance of having a shared common ground for achieving effective collaborative work. Cao and Östin (2015) also mentions the importance of grounding of information for how to design for successful remote collaboration. It is in many ways apparent in the results from the observations

[65] Gentner and Stevens, 2014
[66] Emmitt and Gorse 2009

(observation 1, 4, 9); teams that already had an established relation with each other had a much more open and relaxed atmosphere in the meeting room, sharing their ideas for the purpose of the meeting more freely. It were also expressed in interviews with employees that they saw less problem with existing technology when having an already working team collaboration (interview 1, 2).

Informality enabler 8

The solution should enable some degree of spontaneous interaction with the remote site in order to enable better formal ties with collaborative parts.

Hill (2014) describes how continuous updates within the project group or employees of the company increase the motivation to work towards a common goal. More frequent updates creates an atmosphere of 'daring to fail' because this way of working is incorporating transparency within the company. Another aspect to consider is the significance of informal networks for learning. If increasing the informal, spontaneous encounters towards the remote site, one increases the possibilities of learning for the employees[67]. Moreover does the remote meetings require shorter conversation loops, which is supported by spontaneous behaviour, to keep attention up and equally include all participants[68]. The importance of natural and spontaneous communication was observed in the pre study at several occasions (observation 2, 3, 5, 8). A mentioned aspect from one of the participants at observation (2) was that being able to easily connect to the other sites favours spontaneity within meeting situations. The participants should easy access the desired function and this is something that indicates that there might be technical barriers today that hinder the ease of use for creating this spontaneity.

Informality enabler 9

The solution should facilitate the user to influence the surrounding meeting environment to create the optimal meeting context.

One of the interviewees (interview 7) expressed the passive behaviour often shown from the remote site during meeting and explains the reason to be that the participant doesn't experience the same environment and is thereby not included in the same manner. Another interviewee (interview 8) explains one of the core issues for not feeling satisfied with the meeting situation on the remote site as not experiencing the same meeting environment, or as the interviewee put it: "I would need to close my eyes, and visual the entire meeting context for being able to attain proper focus". Farad and Weeks (2007) and Emmit and Gorse (2009) describe the contextual factors as being highly influential in combination with social behaviour. What the environment affords the user in matters of visual or audial cues could make a difference whether or not the persons choose to interact or not.

[67] Boud, 2003
[68] Wilson, 2009

4 Concept solutions for collaborative meetings

Following, five early concept solutions of how to create collaborative meetings remotely are presented. The chapter starts by describing the methods used to obtain the appropriate formation for all the concepts. Each concept is then presented by initiating the early ideating ideas that have lead to its development. At the end of the chapter, a concept evaluation is conducted and the final concept for continued work is chosen with a description of what lead to the selection at this point.

4.1 Creating concept ideas

The chapter of ideating character, here called creating concept ideas, brings the already given information from chapters 1-3 into a concentrated selection. The most important parts have already been discussed and brought to life, which is why this chapter aims to illustrate how these can be captured through technology in order to fulfil the described criteria. Through workshops with concerned company employees and creative sessions were ideas created and later refined into mock-ups for testing. The overall aim of this phase in general is to open up for possibilities, which are narrowed down in the following steps.

4.1.1 Methods used to conduct concept ideas

Several different methods were used during the ideation phase. Workshops, creative sessions and personas were used to generate and evaluate concept ideas and input on the current situation at the companies.

Workshops

Three workshops with external participants were conducted during the ideation phase. *Workshop* is a method used to provide in-depth insights of a certain subject and to create ideas and input either by group discussions or providing physical material[69].

The first workshop was carried out with five engineer students. The idea was to provide coffee and cake for the participants meanwhile presenting the project scope, and then have an individual assignment. This was done in order to have an informal meeting before starting the creative exercise, hoping to spur the idea generation. Every participant where to write down ways of communicating through auditory, visual or haptic means on separate notes with 2 minutes per sentence. After they were done would the notes attributing the same sense be mixed, and then combined in a collaborative exercise. The group of 5 was now to work together, combining one of every sense containing communicational way into a tool or product. They were to express their ideas verbally or

[69] sigcse.org 15-10-25

visually on a big piece of paper in matters of how they could be combined. Leading to the idea of one or several products[70].

The second workshop was more focused and with fairly precise questions addressed[71]. The four workshop members had similar background within the interaction and industrial design field. The aim for this session was to generate ideas and to think about how ideas can emerge with different stimulus. The first questions asked were open and concerned how the participants believe the remote communication industry could improve and why it does not seem to work or why it does really work in their experience. The second part was a collaborative exercise where the participants would draw ideas for communicational products. They all had 5 seconds to start to draw something on a note, then the note would be passed on to the next participant. Then another 5 seconds were initiated with a new drawing of what had already been started by previous. The drawing kept on going until it came back to the person who started it. Then she had to describe what was in front of her and how it could be used for communication. Another session would be initiated afterwards where the participants were asked to draw remote collaborative tools in the same manner as previously.

The third workshop was carried out at one of the researched companies with four participants. The four participants that was invited had similar technical background but within different fields of design and product development, and with different age span and experience. The workshop had a open scope with questions about how different technologies are used today and why these are not seen more often in the business context, even though they solve several of the problems addressed in the project. The idea was to make the different parties of the project come together and really consider the foundation for the problem posed in this report, why there is a need for a new solution and how the project will steer its concept development towards that need.

Creative sessions

Several different brainstorming methods were used during the different ideation sessions to generate concept ideas. The first two sessions conducted were classic *brainstorming session* where the two participants generated ideas during one hour, verbally or by sketching, regarding a specific problem or idea. In this case; the problem regarding why the company meetings was lacking in creativity and active interaction. The second session aimed to generate ideas regarding what different ways one can meet in an informal way remotely. The general rules during such brainstorming session are that no criticism is allowed and focusing on quantity instead of quality of ideas[72].

Another creative session *attribute listing* was used to create ideas on how the different attributes during a typical meeting could be replaced. The participants got five minutes to sketch ideas for each attribute, 12 different was in focus. The method is helpful when having a situation that can be broken down into smaller functions, often used with physical objects but could favourable be used in other contexts[73].

[70] Appendix 3.1
[71] Appendix 3.2
[72] creatingminds.org, 2015-10-07
[73] creatingminds.org, 2015-10-07

Reverse brainstorming can be used as a creative method when people find it difficult to create new ideas[74]. During the reverse brainstorming the participants asked how one could trigger less interaction and communication during a meeting.

Quick sketching and visualizing ideas

When moving on to making the developed ideas and solutions quick sketches and visualizations of ideas was made to discuss pros and cons of the different solutions. Purcell and Gero (1998) describe the importance of drawings as it's embodying abstract and complex design ideas. The sketches were evaluated by using the found user needs and the developed list of requirement as a basis.

Mock-ups

To early build mock-ups to evaluate ideas are important to early get input from users on the different functions. When constructing mock-ups valuable insights are attained, which would not be visualized in such a representative manner otherwise[75]. The purpose of mock-ups is to make a similar version of what you are trying to achieve in terms of products and functionality in order to early evaluate the idea.

Concept combination tree

Lastly, a version of a concept combinational tree was used to create and sort the different solutions and ideas into different concepts. The concept combinational tree helps evaluate the different combinations of solutions by conducting a table where the columns correspond to user needs and entries in each column correspond to a solution to satisfy the described need. When combining these different solutions in various ways, different concepts are generated[76]. In this case, concept combinations was sorted by writing or sketching each idea on a post-it note and the notes was sorted to create concepts that best would solve the found user needs. Each note placement was evaluated and restructured several times to create the most suitable concept solutions.

4.1.2 Generated concepts and referred contexts

The developed concepts are described below; the first two being within the traditional meeting room context and the other three to favour more spontaneous interactions, here called distributed collaborations.

Context 1– the traditional remote meeting room context

In the traditional meeting room context is where most of the observed meetings have been conducted. This meeting context involves most of the described meeting types: information sharing, status update and decision making meetings. Result from the pre-study shows that this context is clearly the most common context to hold a meeting in. According to literature, these kinds of meeting require a high definition of pre definition to be able to be successful as described in section 2.2.

[74] creatingminds.org, 2015-10-07
[75] Pietroforte, 2012
[76] Ulrich and Eppinger, 2000

Concept 1 - Software development for remote collaboration

In an early stage in the project, many needs for developing the existing video/teleconference tool (S4B) were found. Even though this tool is used everyday by all of the participants of the user study none of the participants explained being satisfied with the software tool. The features that were lifted during ideation were the features that caused the most user errors and issues during found in the pre study.

Concept 1, displayed in figure 4.1, is developed to improve the meeting situation within the traditional meeting room. It is based on the finding that typically non-creative meeting sessions have improvement potential in matters of increasing the interaction throughout the meeting. Without an open and trustful meeting climate, the distance to start a collaborative session becomes longer which also inhibits already existing creative solutions, like digital brainstorming tools, to be used.

Figure 4.1 - Visualization of concept 1

The technology of Concept 1 is remote collaboration software, similar to the teleconference system Skype for business, but with functions that suggestively aid the communication process in a more effective way. Through enabling the software to aid the meeting layout into becoming more interactive, the idea is that the problems occurring in the meeting situation are helped as a consequence of providing better tools.

The first problem that concept 1 aims to solve is that the interaction between sites could be supported to better aid the users into taking more active part in the meeting, as well as lower the thresholds that occur with being able to express valued opinion. As for today several participants are passive in the meeting, whereas others are more dominant as previously described. Meetings could also have a tendency to invite to sub conversations where remote sites are cut out, leaving unanswered questions in the air for a much later stage where the relevance is lost. In order to have a more fluid communication climate for all participants being extroverted and introverted, several functions are suggested. Through being able to express when wanting to add something, ask a question, agree or

disagree it is believed that the users can easier be included. This could be done through displaying individual expression icons in the interface of the software next to the person's profile. To obtain structure, the mediator should follow these indications throughout the conversation in order to include all parties in a better way.

In line with this, there should also be a more clear division of the meetings objective, agenda and mediator in order to obtain an appropriate structure. As for today are often participants both unaware of the real intention of the meeting as well as interrupting each other's speech due to no clear turn taking roles. The role division could also be seen as uneven when it comes to interaction, as the secretary mainly writes down comments from the meeting into a document. Therefore not having the possibility to interact at the same premises as the other participants. In order to release the secretary role from its un-interactive behaviour, the idea is that the system could operate with trigger words that are added when the spoken conversation wants to be captured. For instance, when presenting important details, there might be an important need to capture something that was just said. Using a certain trigger there could then record the last 60 minutes and capture them into sound or text for later access in a shared folder.

Moreover are several already existing functions in the company's available software not used. One situation is when the network connection is going down where the video or sound is cut out. Therefore should the system be designed with this in mind and still be able to incorporate important functions that succeed in providing useful information transfer. When it comes to video is this essential, especially for groups that know each other very briefly and have never met before. To be able to capture body language and personal traits are as described previously very useful when communicating as it creates a understanding of the other person. It is also a matter of providing a visual focus point for the other party to be able to direct attention. Through creating a visual representation of the person in an avatar like form with more or less personal traits, the idea is that there still would be a visual connection with the other site in order to capture some of the more basic gesture language. This could be done through available cameras on the market and body recognition reading software programmed into the final concept.

Additionally is there an expressed need to be able to book meetings and schedule personal contacts in a more facilitated manner. As for today do the booking of a meeting take place in several steps and require the effort of finding out time zone differences, availability in schedule and other practicalities. It is therefore suggested that the software should incorporate these functions in a very simple and intuitive way, so that they are easier accessed and most important so that relevant persons can be contacted and reached in a more hands-on way.

Concept 2 - Interactive projection surface

If wanting to counteract static meeting climate the used communication tool mustn't be static. Concept 2 is based on projection technology in combination with gesture recognition, projecting an interactive touch surface on top of the meeting room table. Artifacts can be managed in real time, allowing the meeting group to spontaneously start a work meeting during a session. The technology allows persons to communicate by the use of gestures to create, edit and send documents, copying artifacts and writing on a digital, projected keyboard.

An expressed problem for groups that have so called working meetings is that they are not able to sketch and write something in the digital collaborative meeting environment that is used. The importance of working together on a document is here highlighted, as the inclusiveness increases if all participants have the same easy and intuitive access to the output. The great advantage with todays gesture technology is that it can be incorporated with the use of other functions in the system, such as making gestures representing certain functions. With that in mind it enables the system to project an object on the table surface which can be interacted with through sketch, text, edits and so on. The object could be an already made artifact or a blank paper to start a new project on. See figure 4.2 for visualization of concept 2.

Figure 4.2 - Projection technology in concept 2

Another problem that goes in line with this is the realism of available technology and how well technology is derived from the user's "mental model". When it comes to whiteboards, there is already an adapted way of working for the meeting participants, which is not replaced with the digital tool that is incorporated in the available software of S4B. Often the participants would use whiteboards, which they would direct their cameras towards in order for the remote site to see something visually represented. This behaviour shows that not only is the available whiteboard function in the software available not used but also that there is a need for a more quick-and-dirty way of working. The projection technologies gesture transfer should therefore build upon

already recognizable body movements used such as swiping across the table when passing a document for instance or recognizing the pens movements when drawing. When wanting to write something, a digital keyboard would appear in order to be able to generate a collaborative text.

What more has been displayed throughout the project is how users refer to how easy and intuitive they would like to be able to share documents; a process that today requires many interaction steps in order to be achieved. The many steps in the interaction today makes the threshold bigger, consequently as there is too much effort when wanting to show something quickly. There is however new technology software where different devices can be used to very quick display an object on the shared content screen. Knowing this, it is therefore believed that this could be a useful function for when you are working collaboratively in the working meeting environment or other meetings as well. To simply be able to drag a presentation onto the table where the presented content is transferred should be one way, or just through clicking on the device that holds the document to add it on the screen.

Context 2– Meeting context to facilitate distributed collaboration
During the pre study, a need for a new terminology regarding 'meeting' was found, leading to the term 'distributed collaboration' that is referencing to a meeting that doesn't require high pre definition. The meet-ups are often informal and could favourably be happening spontaneously, both during 'traditional meetings' and everyday working tasks during the workday. The idea of looking into this other context is to favour the interaction during a meeting, not applying the 'formal' culture that the 'traditional meetings' come with.

Concept 3 - Meeting application

When looking at how the informality could be designed into the meeting context, the step of how the participants initiate a meeting was evaluated. The 'booked meeting room' was found to be contributing to the non-interactive meeting climate, working against an active meeting behaviour.

Concept 3, shown in figure 4.3, means to develop a meeting application to facilitate remote, informal conversations during a workday to connect participants from same project group but at different sites. The meeting app contains functions like sending a snap photo/video/text to another worker that is deleted after it has been seen. If the application is activated, you are be notified when another worker is at the same type of social environment as yourself and thereby potentially open for starting a conversation. On each sites' collaborative areas is mounted, providing the different sites to spontaneously start a collaborative session remotely. The sites can get a visual representation in the area of the other site and find their remote colleagues in a simple way.

An emerging problem in line with having more remote collaboration in the enterprise world is, as mentioned, that meeting informally is often left out which is ever so important. Even though this could not be replaced through virtual means entirely, the idea of meeting with less formal elements is very crucial when building relations that are

required for continuous collaborative work. Through having an app that makes it easier to find each other in the working space, not only in house but also on remote, the idea is that the persons can easier get to know each other on a personal level. Not only would the app allow users to send chats, videos or pictures but also indicate when being close to a designated meeting spot for remote parties.

It is today hard to capture each other's presence, gestures and body movements as many of the teleconferences are taking place with mainly telephone and when using video often providing a fragmented experience of the person's body language due to bad connection and limited visual feed. The app would therefore indicate when the users are within a certain proximity match from the remote meeting spot. If accessed, the meeting spot would provide a visual of the remote site so that persons could quickly interact. This could be represented through several different means; video screens, hologram technology etc. which consequently would generate different user experiences but still with the same visual representations.

Moreover do different personalities have different needs when it comes to being informal with others, for some is the threshold higher whereas others have a very natural way of instantly connecting with others. As we all are different so are our needs. Therefore it is believed that different personality types, such as introverts and extroverts, could have different use of the apps functions. For instance would perhaps the extroverted persons have an easier time to meet other sites on the remote meeting spot, whereas the more introverted persons would have more use of the chat functions, the video snapshots and so on.

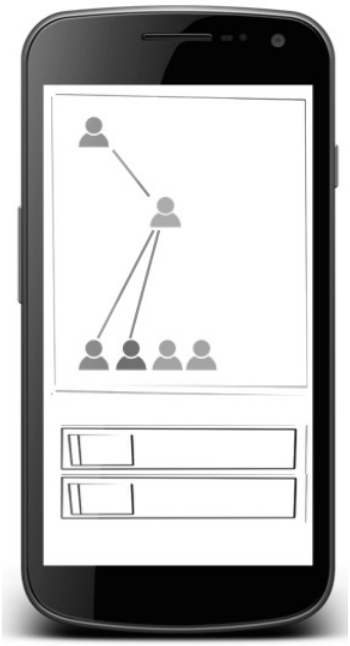


Figure 4.3 - Example of the meeting application in concept 3

Concept 4 - Remote window

Extending the company workplace by adding a remote meeting spot would as previously described likely increase the spontaneous interactions with the other sites. To reduce the initial use threshold and to facilitate the informal spontaneous encounters, the idea is that concept 4 does not require any user initiative to connect to the other sites. If a site has multiple collaborative sites the window can be connected by proximity so when different sites gets close the surface the sites are connected, shown in figure 4.4. The concept could also solve this by applying different windows to connect several sites at once.

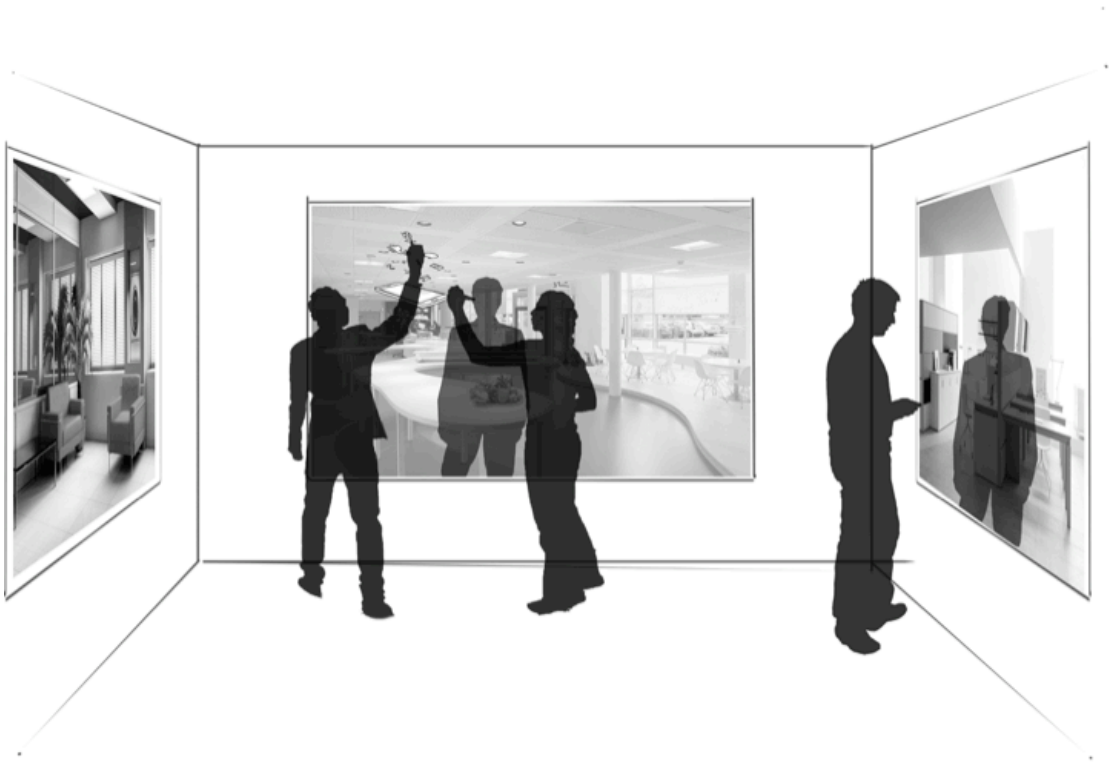


Figure 4.4 - Concept 4 with multiple connected sites

The technology used is a screen with hidden cameras behind the glass, providing the impression that eye contact has been made. The camera can switch focus depending on how close the user comes to the screen, providing a clear view of all users at all time.

The remote window concept builds on the problem that occurs when wanting to meet informally and spontaneously when working remote. One part does not exclude the other so therefore would this concept have the possibility of working together with the meeting app, having the remote window as a designated meeting spot. The remote window would always be connected and broadcast the remote site. This is done in order to achieve a feeling of inclusiveness, connecting the sites with each other, as well as creating spontaneous meeting situations that are very important in everyday communication. The user would simply just have to stand in front of the window to interact with the remote site and could quickly pass by to encounter a colleague on the other site. Just as easy as it would be to meet in the corridor.

The remote window concept also addresses the problem of wanting to work on something quickly when on remote such as make a fast sketch or quickly brief each other. This could perhaps be a place where people would meet, work collaboratively both while in-house or remote, and have work meetings and workshops together. Since the technology used is gesture recognizing it could transfer the gestures of drawing as well as other well used body language into functions that are important in this kind of interaction.

Even the possibility to play virtual games for team building activities would be considered for the concept, as in figure 3.6. Using the gesture based technology and combine it with cloud based games and problem-solving activities would be considered useful in ways of enhancing the informality. This, through engaging the participants in a more playful setting where they could meet and get to know each other, share a common interest or idea and reach a common ground.

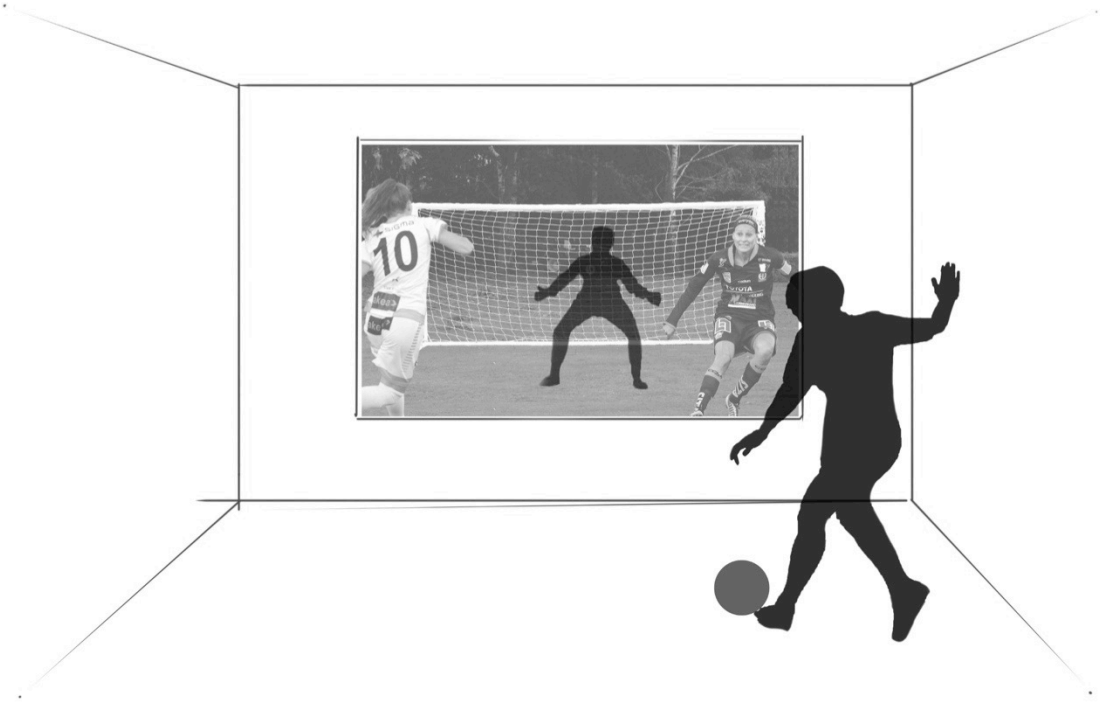


Figure 4.5 -Team building exercises in concept 4

Concept 5 - Interactive room within the common area

Looking at the actual meeting room environment was a result for being able to support the need for a more inspiring meeting situation. The external factors like the actual room used for conducting the meeting is considered to have great impact on the meeting formality. It has been seen that the environment affects the ability to be informal, meaning that the environment has a huge impact on where we choose to be informal or not through its visual cues. The idea with the interactive room is simply to aid the remote users to be able to sit down in a more comfortable environment where they can interact with both enclosed and open space possibilities, see figure 4.6. The room should facilitate remote working situations through being able to share documents, work on a

task or simply sit down and have a quick brainstorming session. This would be especially suitable for so called work meetings where you create something collaboratively.

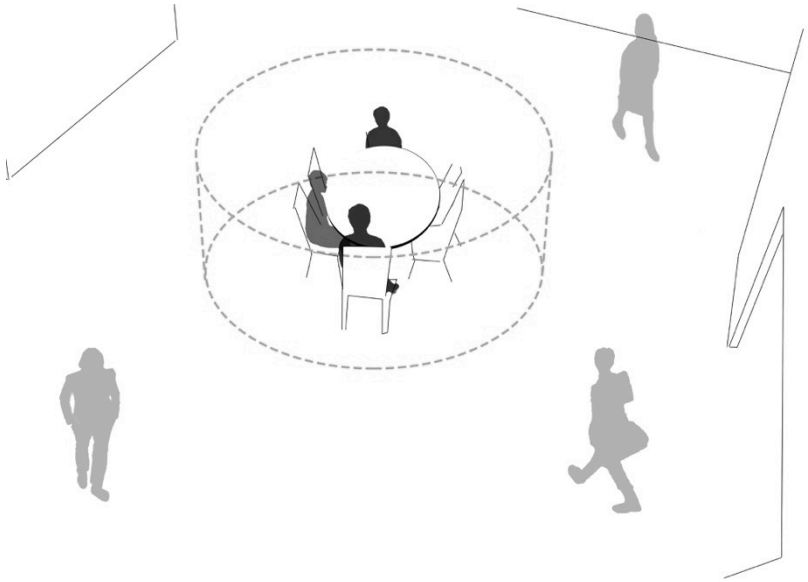


Figure 4.6 - Concept 5 interactive room

Environments that are either closed or open has as previously mentioned both shown to contribute to afford users into being more prone for informal contacts. Therefore should the interactive room be designed with this in mind, aiming to find the most suitable placement for such product with knowledge of theories of centrality, flow, as well as aid both openness and closeness of the space. See figure 4.7 for example of the collaborative area.

Figure 4.7 - The collaborative area in concept 5

In order to establish an easy access should the integrated system for the interactive room requires little of the user, meaning that the interaction should be spontaneous and intuitive. Whilst entering the interactive room should therefore the room aid the user to instantly access the needed information and tools for the interactive session with the remote part. This could be accomplished through having a cloud function working together with the room that the users enters in combination with recognizing whom ever access it. The access to the cloud could be done through for instance eye recognition, tags that are already used for other accesses or voice detection. When detected, the user would have access to his or hers document page where the required information is. This could be displayed on a standard screen or multi-touch. If something were generated throughout the meeting situation would this be stored in the same space and accessed from other directories such as whilst being online.

Moreover would the need of incorporate a visual of the remote part still be needed. Therefore the interactive room should be installed with this technological aid being either a screen or a hologram to support the gesturing and body language transfer.

4. 2 Choosing the final concept

The methods for evaluating the five concepts are described first-hand in order to display how the working process was carried out. Then followed by the results of how the methods were carried out in order to narrow down choices into one final. The final concept is more thoroughly described in chapter 5 in terms of evaluation and process for establishing a product character for the upcoming development steps.

4.2.1 Methods used for evaluating the concepts

Throughout the final concept phase several methods were used in order to discover what would be the more favourable selection, given from a number of evaluation parameters. The requirements from the theoretical and empiric results and the user perspective derived from the personas were used to determine the final choice as described.

Persona evaluation diagram

The personas represent the majority of the users that have been part of this project and their personal traits, divided into five different personalities. By evaluating the concept with that in mind the idea is to provide an overview of how different persons could benefit from the different concept ideas and what would be, from that point of view, the more beneficial. The diagram can be found in appendix 3.4.

Elimination matrix

Elimination matrices were conducted to provide a measurable result to evaluate the developed concepts. In the elimination matrix each concept was evaluated based on the five most important aspects of the project: (a) List of requirement, (b) Stakeholders, (c) PhD interest, (d) Realizable and (e) Fit project time line. The evaluated data behind each number is shown in appendix 3.5.

Each concept was evaluated based on how well it fulfilled the different requirements that it aimed to succeed. The weight was set between 1-3 whereas 1 being low fulfilment, 2 for medium and 3 for high.

4.2.2 Final chosen concept

The final concept selection is in this section described through the obtained results from the described evaluation.

Persona evaluation diagram

The evaluation shown in Appendix 3.5 indicates that the software concept would be the more beneficial for all the personas. This mainly as the concept has most potential into aiding all the users needs in matters of different meeting types, personal traits, adoptive character and technological experience. The set indication for every person have been done on the general opinion based from the personality description as well as considering how extroverted or introverted the person might be. As the software also has the possibility to be this diverse it is believed to be the most relevant to continue to develop from that point of view.

Elimination matrix

The score for each aspect and a summary of each concept total score is shown in table 4.1 below. The PhD interest was in the evaluation rated as being of greater importance than other stakeholders because this project's relevance to the MERCO project, which means that the project outcome should work in favour for the overall MERCO project outcome. As shown in the elimination matrix in table 4.1, concept 1 had the highest total score out of the entire concept and is thereby chosen as the final concept.

Concept	(a) List of req.	(b) Stakeholders	(c) PhD	(d) Realizable	(e) Time line	Summary
1	4	3.67	3.33	5	5.33	16
2	3.3	3.67	3	4.5	5.33	14.47
3	3.48	1	0.33	4.25	2.67	9.06
4	3.93	4	3.17	3.25	4.33	14.35
5	4.03	2.5	3.83	2.5	3	12.86

Table 4.1 - Result of the elimination matrix for the five concepts

5 Final concept: evaluation and refinement

In this chapter, the final concept of the project is described and evaluated in order to find the best possible outcome of every feature in this early stage of development. The process of how the final concept was realized in form of a digital prototype, a skinny system, is in this chapter also described and displayed in detail.

5.1 Final concept functions

The final concept, previously concept 1, is a digital solution based on the existing tool used for remote collaboration but with several incorporated functions. The idea is to build the functions on already existing mental models on how the system is aiding the user into communicate, but at the same time find new ways of incorporating the tools so they are easier to access and work with. The main software modes are described in figure 5.1 below.

The start page initializes the user with its own profile and contacts. The user has there the possibility to choose between three different modes: (1.1) conversation mode, (1.2) text mode and (1.3) interactive mode. The users can easily shift between the different modes in order to change between meeting orientation and conversation type. Something that the user studies imply is that this has occurred in a majority of the meetings. In the conversation mode it is also possible to enter (1.1.1) presentation mode, where the users can present and share a document collaboratively.

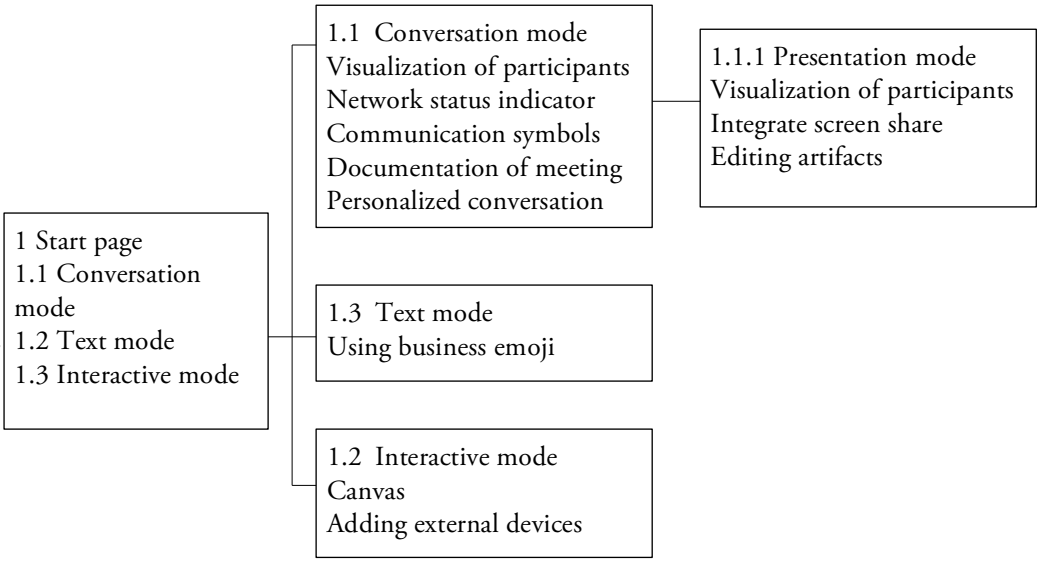


Figure 5.1 - Overview of the final concept software

The software system is developed based on the use case scenario in table 5.1 below.

Interactions	User need	User needs from system	System answer	Ideas for functions
One site calls in	Knowledge of where/when to meet	System providing information	Tools for displaying the content	Display of booked rooms, calendar and time zone
	Knowledge of meeting outcome	System providing information	Tools for displaying content	Display of objective for meeting
Other sites connect	Possibility to connect individually	System providing interaction	Tools for identification	Individual id displayed
Meeting starts	Ability to identify others	System providing information	Tools for identification	Individual id displayed
	Indication that all are connected	System providing information	Tools for identification	Indication of online persons
	Indication that the meeting is starting	System providing information	Tools for awareness	Mediator responsibility to announce meeting
Sites communicate	Ability to perceive communication	System providing information and interaction	Tools for displaying the content	Users able to connect
				Users able to switch functions with ease
Time between	Ability to raise opinion	System providing information and interaction	Tools for sharing opinion	Users can raise hands, take a vote, indicate questions
	Ability to know when to communicate	System providing information	Tools indicating when to interact	Arrange agenda, system displays speaker, users get feedback
The meeting is wrapped up	Ability to know when meeting is over	System providing information	Tools for guidance	The system provides meeting time line
				Mediator can easily wrap up meeting
The meeting is closed	Ability to know how to disconnect	System providing information and interaction	Tools for disconnecting	system displays how to disconnect

Table 5.1 - Use case scenario developed for the software design

5.1.1 Conversation mode

In the conversation mode several functionalities are aiding the user to conduct a teleconference meeting. The aim of conversation mode is to aid users with video and sound functions, but also additional functions that encourage increased interactivity during the meeting.

Function A - Visualization of the participants

The function of visualizing the participant means to support the user when the video function does not work and thereby raising the minimum level of participant visual feed from 'only audio' to 'audio and acceptable visual feed'. Meaning that the feedback represents its origin so that the participant can be recognizable for the receiver of the message. User studies in the project show of the importance of visual feedback from the remote sites. However, the video feed has showed to not always work sufficiently in the observed meeting situations. Therefore should the video feed adapt to the current network status automatically in order for the quality of conversation with sound to still be functional. As it has shown, the systems sound could be lagging if the network connection goes down, thereby the network adaption should support to cut off video in order for sound to still be supported. When this happens the video is automatically transferred to a photo mode where the participant is photographed within a range of seconds. For the next step, when the network connection is poorer, the photo snap mode goes over to a still picture of the participant. The idea is that when the network connection goes down this function is activated automatically to avoid the situation where no visual representation is provided during the meeting. The participants do have a choice to turn the function off. The assumption is that users still want a visual display of the remote site represented on the screen and that this could be captured in different ways. By doing so the system would still provide the meeting with important visual cues from the remote parties. A conclusion of related factors and enablers for this function and the relevance level for each factor are found below in table 5.2.

Function A: **Related framework and enabler**	**Relevance level (1-5)**
Informality enablers	
2. Balanced group dynamics	5
3. Create a uniform experience	4
4. Including various characteristics	5
Communication framework	
1. Presence, roles and relations	5
6. Gesturing (non reference)	4
7. Referencing	4

8. Grounding information	4
9. Eye contact	2

Table 5.2 - function A relevance evaluation

Function B - Network indicator
Moreover, the network status is indicated in the indication window close to the participant picture in order to display when the network connection is low. It has previously been described in several user studies that when the network goes down, it is not always easy to know if the person still can receive transferred communication. Something this function could aid the users with understanding through visual feedback. The assumption here is that the network indication could aid users to understand when someone might not be able to get the information. The relevance of each enabler and framework can be found below in table 5.3.

Function B: **Related framework and enabler**	**Relevance level (1-5)**
Informality enablers	
2. Balanced group dynamics	5
3. Create a uniform experience	4
5. Provide an intuitive use	4
9. Include meeting environment	2
Communication framework	
1. Presence, roles and relations	4
4. Origin of sound	5

Table 5.3 - function B relevance evaluation

Function C - Use of communication symbols
In order to encourage all personality types to engage in the conversation, communication symbols has been added to the software. These are selected in an icon menu and are displayed in the indication window of the participant. It has been shown throughout the project that when conducting remote meetings the remote participants often have problems with adding questions, comments and opinion to the meeting. The sense of timing and what is actually going on in the meeting room can be extra hard over a teleconference because no visual cues are provided. This is especially applicable to larger meetings, 8-12 persons, and meetings where participants are unfamiliar with each other. The idea is that the functions would also enable the remote users to feel more included in

the conversation. The symbols are integrated in the person's identity frame where the picture or video is displayed. When the symbol is sent, it is displayed for all the parties and the mediator can then give the person the word. When the person starts to talk the symbol disappears automatically after a few seconds. How the actual relevance of the function is related to mentioned framework and enablers is displayed below in table 5.4.

Function C: Related framework and enabler	Relevance level (1-5)
Informality enablers	
3. Create a uniform experience	4
4. Including various characteristics	5
5. Provide an intuitive use	4
6. Express emotions dynamically	5
8. Facilitate spontaneous ties	5
Communication framework	
2. Accessibility and adaption	3
4. Origin of sound	3
8. Grounding information	5

Table 5.4 - function C relevance evaluation

Function D - Documentation of the meeting

Another important factor during the remote meeting is the way the meeting is documented for later purposes, today done mainly by a secretary and by other participants to access after the meeting. What has been observed is that the person who takes notes throughout the meetings has a tendency to be less included in the meeting. Through enabling the users to save pieces of sound from the meeting that is auto saved into a folder for later access, the user is able to be more interactive and engaging in the meeting conversation. The user can see that the audio has been captured on a timeline of the meeting in the bottom of the conversation window to gain visual feedback that the capture has been stored. The assumption would be that users could be more engaging and interactive if the system would aid them with tasks that they feel responsible for. If the system can help the user with this, the overall focus is changed more to where the actual remote conversation is happening too. Table 5.5 relates the framework and enablers relevance for this function.

Function D: Related framework and enabler	Relevance level (1-5)
Informality enablers	
7. Establishment an informal ground	4
8. Facilitate spontaneous ties	4
Communication framework	
2. Accessibility and adaption	5
5. Verbal communication	5
8. Grounding information	1

Table 5.5 - function D relevance evaluation

Function E - Personalized conversations
What more have been suggested is to add more personality in to the meeting with subtle means. To be able to adjust the meeting software's background, the virtual environment, is a way to enable the user to add more of a personal choice into the conversation. Furthermore would the ability to create subgroups in the conversation aid the users to work more collaborative with individual tasks. See table 5.6 for relevance of enablers and framework.

Function E: Related framework and enabler	Relevance level (1-5)
Informality enablers	
1. Set degree of pre definition	4
2. Balanced group dynamics	5
4. Including various characteristics	3
6. Express emotions dynamically	5
9. Include meeting environment	5
Communication framework	
1. Presence, roles and relations	3

Table 5.6 - function E relevance evaluation

5.1.2 Text mode

In the *text mode* the participants can collaborate through sending messages to the meeting participants and directly to subgroups if desired. It is here believed that the use of emojis for a nuanced language could be enforced through adding more context-optimized symbols, called business emojis.

Function F - Use of business emojis

Using emojis is today growing within all informal conversations and many of the persons encountered through interviews and focus groups would use them at especially chat-based conversations with people they were more familiar with. It is believed that the somewhat unserious emojis can de-dramatize the meeting situation and also enable users to express more emotional content in their language. To develop and test business emojis and compare these to already existing emoji usage would be one way of finding out if the business emojis could be an easier way to express emotional content in text in the business context. The nuancing of language when writing instant messages adds the dimension of expressing emotions that cannot be displayed otherwise. In the business context it is however still mainly used with more informal contacts and in everyday speech. The assumption to investigate here is that persons do want a more nuanced language in text and that having more business oriented emojis could help that becoming less of a threshold for implementation. Through adding more emotions in text it is believed that persons could reach a more informal state faster and understand each other better which could improve actual work output. See table 5.7 to display the relevance to the framework and enablers of function F.

Function F: Related framework and enabler	Relevance level (1-5)
Informality enablers	
3. Create a uniform experience	3
5. Provide an intuitive use	4
6. Express emotions dynamically	5
Communication framework	
2. Accessibility and adaption	5
8. Grounding information	3

Table 5.7 - function F relevance evaluation

5.1.3 Interactive mode

The idea for this mode is that users can collaboratively generate artifacts such as design drawings and sketches with a painting toolkit and text editor. The interactive sketch function allows the user to work simultaneously with adding, editing and saving artifacts.

Common short commandos will be available, for instance ctrl + c for copying, to match the user mental model and easier access the functionality of the interactive mode. The created artifact is able to save in an editable format to further work with the artifact after concluded meeting session. Also, to enable the user to incorporate other, additional devices during the remote meeting the interactive mode is compatible with external devices such as smart boards or smart phones.

Function G - Canvas
The canvas has the functions of a drawing palette, edit text and can be accessed by all the remote users for generating a collaborative document. The document is generated in real-time and can be accessed by all participants meanwhile drawing to be able to quickly generate ideas and visualize ideas. The assumption wanted to investigate is that users want to have these collaborative tools, but that they are not user friendly enough and therefore are not used today. In table 5.8 below is the relevance level displayed.

Function G: Related framework and enabler	Relevance level (1-5)
Informality enablers	
4. Including various characteristics	4
5. Provide an intuitive use	4
6. Express emotions dynamically	3
8. Facilitate spontaneous ties	3
Communication framework	
2. Accessibility and adaption	4
7. Referencing	5
8. Grounding information	5

Table 5.8 - function G relevance evaluation

Function H - Adding other sessions and devices
The users can add their own devices such as pen tablets to enable a more mental model way of drawing. The idea is also that other sessions could be used in the interactive mode for further development. Here could for instance sessions with post-it notes, mind maps and other collaborative exercises be added to support more creative sessions in the meetings. Assumingly it is believed that users prefer to have different devices and sessions and that these could aid the collaborative sessions that occur. If more technical aids could be implemented through the software is the idea that the today occurring thresholds with having many different working programs still could be supported and thereby enable a multi-functional product. The experienced relevance level is found in table 5.9.

Function H: Related framework and enabler	Relevance level (1-5)
Informality enablers	
1. Set degree of pre definition	3
5. Provide an intuitive use	4
8. Facilitate spontaneous ties	5
9. Include meeting environment	5
Communication framework	
2. Accessibility and adaption	5

Table 5.9 - function H relevance evaluation

5.1.4 Presentation mode

From the described conversation mode the participants can reach the mode of presentation. This mode enables the users to share their own documents or artefacts in the collaborative area and display it directly to all participants, similar to the already existing working patterns of today but with new ideas of doing so.

Function I - Integrated screen sharing

It has been both observed and expressed by users that they often display their own screen and share it directly with the remote sites. Meanwhile, the disturbing objects such as emails and other messages could appear on the screen that affects the ability to focus on the actual content. Therefore it is believed that through enabling an easy direct share could this be supported in the software and aids the users to share the documents. Moreover the idea is that the users have the possibility of sharing several screens at once, which could be done today through software programs such as ClickShare. Through enabling this could one single user add a presentation, which would appear to the others together with the already displayed artifact to quickly show its content. The function is built with regards to the problem that the software's today are quite diverse and static which makes it harder to discuss and add information to the conversation. If important functions could be integrated in the same software instead the overall technical thresholds could be lowered and simplify the interaction itself, which suggestively is what is wanted to be investigated here. The relevance level of integrated screen sharing is displayed in table 5.10.

Function I: Related framework and enabler	Relevance level (1-5)
Informality enablers	
2. Balanced group dynamics	4
3. Create a uniform experience	5
4. Including various characteristics	4
Communication framework	
2. Accessibility and adaption	5
3. Visual view	4
8. Grounding information	3

Table 5.10 - function I relevance evaluation

Function J - Participant indicator
The importance of displaying the participants also when presenting have been observed at several occasions. By adding a layer above the artefact display that visualize the participant, all of the meeting participants will be provided with visual feed at all times. The visual feed in the presentation mode is similar as described in *Function A* (Visualization of the participants), but where the participant visualization is taking up a smaller part of the screen to provide room for the displayed artifact. As mentioned this is related to the expressed needs of knowing that content has been received and understood, that the network is working and also that others can add their opinion to the presented document. This mode also provides the function of sending symbols and indication of network status, as described in *Function B* and *Function C*. To view the relevance level, see table 5.11 below.

Function J: Related framework and enabler	Relevance level (1-5)
Informality enablers	
2. Balanced group dynamics	4
3. Create a uniform experience	3
6. Express emotions dynamically	5
7. Establishment an informal ground	5
9. Include meeting environment	4
Communication framework	

1. Presence, roles and relations	5
3. Visual view	5
4. Origin of sound	4
8. Grounding information	4
9. Eye contact	3

Table 5.11 - function J relevance evaluation

Function K – Real time edit of artifacts

Real time editing artifacts aim to aid users who work collaboratively in projects where there is a need to add opinion and change something quickly in a document, combined with being able to work on an editable document together in order to create a new copy of the original piece. The assumption is that today's meeting participants have a need to express themselves meanwhile discussing and presenting something in relation to the presented document which would be easier described through being able to edit directly into the document during the meeting. Thereby all participants can see what the person wants to describe and change, edit or add to the overall output of an artifact. What should also be investigated is the possibility to have an own layer function for private notes and how the difference would be compared to having a collaborative one. In table 5.12 below can the perceived relevance level be displayed.

Function K: **Related framework and enabler**	**Relevance level** **(1-5)**
Informality enablers	
2. Balanced group dynamics	5
3. Create a uniform experience	4
4. Including various characteristics	5
6. Express emotions dynamically	4
8. Facilitate spontaneous ties	5
Communication framework	
1. Presence, roles and relations	5
2. Accessibility and adaptation	4
3. Visual view	5
7. Referencing	4
10. Artifacts manipulation	5

Table 5.12 - function K relevance evaluation

5.2 Prototyping and user testing the final concept

Before the functions could be implemented in the final prototype several user tests were conducted to evaluate the different versions of each function. This chapter describes the evaluation process and the found results. Furthermore these findings are related to the frameworks of informality enablers and communication framework that is described in chapter 2.4.

5.2.1 Evaluation of concept functions

In the following section the methods used for evaluating the different function versions are described iteratively with found result from each evaluation. The described methods for evaluating each version vary depending on the received information and the need for containing further data. Function A, C and D was taken further by evaluating different versions.

The aim with the user tests was to enable people from the user group to evaluate how they would find the functions useful or not and what could be changed to improved in an early stage with both analogue tests in a quick and dirty manner as well as enable them to later test the early programmed version. The different functions and their alternations derived from the final concept are visualized below in a mapping chart in figure 5.2.

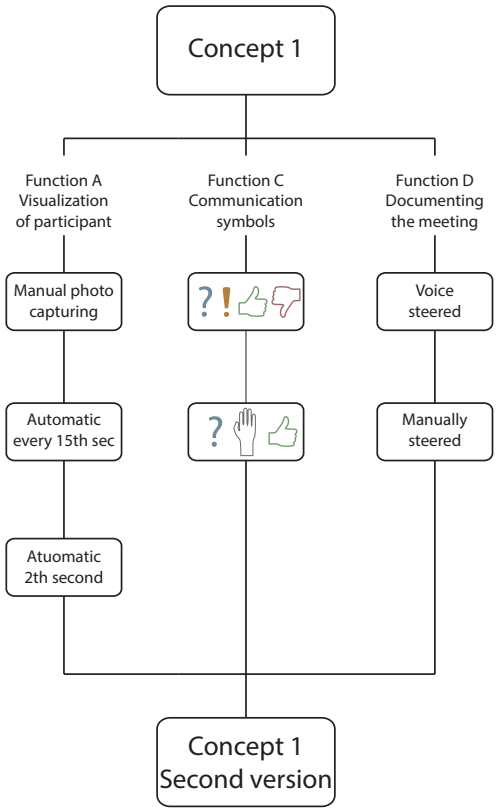


Figure 5.2 - The evaluated versions of each function

Function A: Visualization of the participants

Three different versions of how to visualize the participants were evaluated and the conducted user evaluations are described in detail below.

(A1): Manual photo capturing

Description: In this version the participant manually takes a photo of him or herself, which is sent to the remote site to provide visual feedback during the meeting.

Evaluation: This version was evaluated by conducting two semi-structured interviews with employees at one of the studied companies. The interviewees were able to experience the task of taking your own photo to be able to get a sense of how the function would work. Both of the interviewees expressed concerns regarding the function of actively having to sending your own photo; in a company culture where the informal aspects are already hard to incorporate, the function of sending a photo of yourself manually would probably not be used. The participants stated that this kind of function would only fit a certain category of users, the more extrovert kinds, which is excluding the other user categories even more.

Conclusion: (A1) was discarded due to informality enabler 3 and 4 not being fulfilled.

(A2): Automatic photo capturing – every 15th second

Description: The function of automatic photo capturing means that the software automatically takes a photo of the participants when the network connection goes down to provide visual feed. In this version, a photo is taken automatically every 15th second

Evaluation: This version was evaluated by conducting three different user tests with follow up interviews and emotional word scale evaluations. The user tests were held within a test lab to provide a sterile environment, not to impact the test subjects (figure 5.3). The participants were collaborating to solve a task, only communicating by the use of headphones. One of the participants was receiving photos of the other one every 15th second during the task while the other one got no visual feedback, this to be able to evaluate the difference of conducting the same task. Throughout the task the participants evaluated the experience by using emotional word scales (Appendix 4.3) and afterwards the task was followed up by an interview on the task experience.

Figure 5.3 - User test of version B.

The result from the word scales indicated that the participant that first didn't have any visual feed and then switched to being provided with photos of the other participants experienced the task to be more active, less formal and more collaborative. During the interviews these participants also expressed more positive attitudes towards the function then the other (Appendix 4.4). The participant that initially was provided with visual feed, however, was negative towards the photo function. One explanation was described to be that the function was providing an uncomfortable feeling and the unease of not knowing when the photo was taken. From this perspective, the function could even increase the formality and provide a negative experience.

Conclusion: (A2) was discarded since informality enabler 3 and 8 was not supported in the evaluation tests.

(A3): Automatic photo capturing - every other second

Description: The next version of how to visually present the participants' feedback is the same as in version B, but here investigated with the frequency of taking the picture every other second. This because wanting to investigate if the frequency could change the experience, providing the impression of more natural visual feedback.

Evaluation: The versions were tested through adding the feature to the software and test it accordingly with the programmer on remote and the two project initiators on one site. The speed was varied and tested for two seconds, with the idea of being possible to use every second in the future. The test suggests that a lot of visual feedback still is given, and that it appears in the situation as the video is slow rather than lagging.

Conclusion: (A3) was chosen because all related enablers were supported after evaluating the version.

Evaluation of function C - Use of communication symbols

Two different combinations of communication symbols were evaluated and are described below.

(C1): Question mark, inclination mark, thumbs up and thumbs down,

Description: By sending communication symbols of question mark, inclination mark and thumbs up/down the user is provided with symbols that states agreement, disagreement, a question and seek attention, see figure 5.4 below. The symbols were evaluated by the questionnaire shown in appendix 4.5.

Figure 5.4 - Communication symbols of (C1).

Evaluation: Two user tests with following discussion and emotional word scale evaluation were conducted to evaluate the use of the symbols and also the chosen symbols. The two user tests were conducted with four participants in each round, located at one of the researched companies. The participants were asked to sit in two different meeting rooms, conducting a fictive meeting with the use of computers that had the four symbols displayed at the keyboards.

The participants were asked to send symbols to the other participants throughout the meeting whenever they felt it was appropriate. The users could only use sound, symbols and instant message to communicate, something that was staged in order to enhance the need for the communication symbols which are assumingly more needed in the teleconference scenario when no visual cues is given. The test participants were asked to fill in a survey afterwards about their individual experience of the meeting (Appendix 4.3). The full result of the survey can be displayed in appendix 4.6.

The user tests showed that the threshold was bigger for using the symbols in the second test group than in the first. The participants in the second round suggested that this was due to being too familiar with each other and therefore they did not need the symbols. They did however say that the use with the symbols would be beneficial in a larger meeting context where more remote parts would be taking part. The same ideas were expressed in the first test. The first test did however contain a lot more optimism and all users tried the communication symbols. Moreover did users from both tests express that there was no need for a thumbs down, because this could be too sensitive when communicating remote due to possibly being misunderstood. The exclamation point was considered hard to interpret.

Conclusion: The overall result of the evaluation was that the symbols as a function was useful and did support the related framework shown in figure 4.5. Two of the symbols in (C1) were discarded (thumbs down and exclamation point) while thumbs up and question mark was retained.

(C2): Question mark, raised hand and thumbs up

Description: The second version of the communication symbols is displayed in figure 5.5 below.

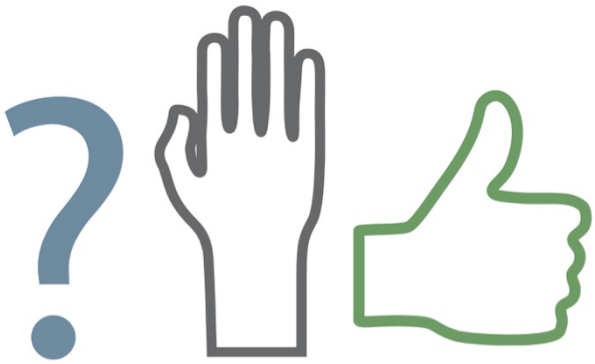


Figure 5.5 - Version (C2) of communication symbols.

Evaluation: (C2) was evaluated by two semi- structured interviews with participants from the user group. The communication symbols build upon the expressed needs from the user tests with the previously mentioned communication symbols from (C1). As the users were evaluating the symbols they described how they would like the symbols to be represented in the interface. For instance did they think that a raised hand was much more intuitive when wanting to communicate something to the others compared to the exclamation mark. They were also sceptical about the question mark but saw that it could perhaps be helpful when dividing the functions of wanting to add a question and quickly providing an overview that a message hot has been understood. The thumbs up was generally liked and used most out of the communication symbols to indicate agreement and positivism towards ideas.

Conclusion: (C2) supported the related frameworks and is thereby taken further.

Evaluation of function D - Documentation of the meeting

Three different versions of how to activate the function of documenting the meeting were evaluated. The conducted user evaluations are described in detail below.

(D1): Voice steered sound capture

Description: By voicing a trigger word, the participants would save fragments of the conversation, either back or forward in time, for 30 seconds.

Evaluation: Two semi- structured interviews regarding this phenomenon were conducted. The general opinion was that the function would be helpful but that would be hard to access just the recordings afterwards as it would require the user to listen it through again. This was also described as having its purpose would be put in context and make the user remember the exact details with tone and whose voice it was. The feature was however described by one of the participants as favourably if the documentation could be accessed in text format as well. The trigger words were considered an interesting thing, but one problem that was identified was what the word would actually be so no one would say it unconsciously and accidentally records something.

Conclusion: The result drawn from the user evaluation was to discard (D1) of the function because the risk for user error would be too great and is therefore not supporting factor 2 of the communication framework[77].

(D2): Manually steered sound capture

Description: The users are activating the sound capture by choosing the sound capture-function in the software.

Evaluation: (D2) was evaluated in the same manner as (D1), with two semi-structured interviews. (D2) was considered more intuitive at the same time as it was considered as having less potential for user error. The participants explained that it would be favourable because then the users could easily steer the capture directly, by interacting with the software and adjusting the time limit for the capture.

[77] Cao and Östin, 2015

Conclusion: (D2) was chosen for further development due to the support it had gained from the related framework described in table 5.5 above.

5.2.2 Prototyping final concept

After evaluating the different concept functions one final prototype in form of teleconference software was developed, an early step when further developing the concept.

Work process

The software prototype was developed by the use of an external resource, an experienced computer programmer from one of the stakeholders of the MERCO project. The work process of developing the software was to base the software structure on the developed skinny system, shown below in figure 5.6.

Function	Weight
1 Start page	**5**
1.1 Conversation mode	**5**
Visualization of participant	5
Network indicator	5
Communication symbols	5
Documentation function	4
Personalized background	1
Creating subgroups	1
1.1.1 Presentation mode	**5**
Participant indicator	5
Integrate screen sharing	1
Layer function	1
Save layer as editable	1
Edit layers	1
Private/collaborative layers	1
1.2 Text mode	**5**
1.3 Interactive mode	**5**
Canvas	3
Adding external device	1

Figure 5.6 - Weighted functions

In consultation with the programmer one use case (figure 5.1 and table 5.1) was designed to aid the development of the software for remote collaboration. Based on this use case was several descriptive wire frames developed to provide a base for the web design. The prototype was built iteratively through having several check- ups with the programmer

where the functions were tested by the internal project group, quickly evaluated and then taken further into a new design layout.

The programmer resource was in the prototyping phase a great asset in ways of helping with implementing the design into a skinny system and support the possibility to test the functionality of the software. A skinny system, being the skeleton of the software functions, gives the ability to evaluate the core functions that are intended for using the software. Some limitations was given due to time and cost which contributed to some of the choices taken during this phase.

Due to the limited time do the software in this stage support (1.1.1) presentation mode mainly, but have built in icons to indicate where the other modes could be positioned and accessed. In figure 5.7 the communication interface is graphically described. Visualization of participant (function A) is covering a large part of the screen, while some of the other described functions are available. The four functions that here are displayed are the visualizing the participants (Function A), documentation of the meeting (Function D), use of communication symbols (Function F) and network status and sound indication (Function B).

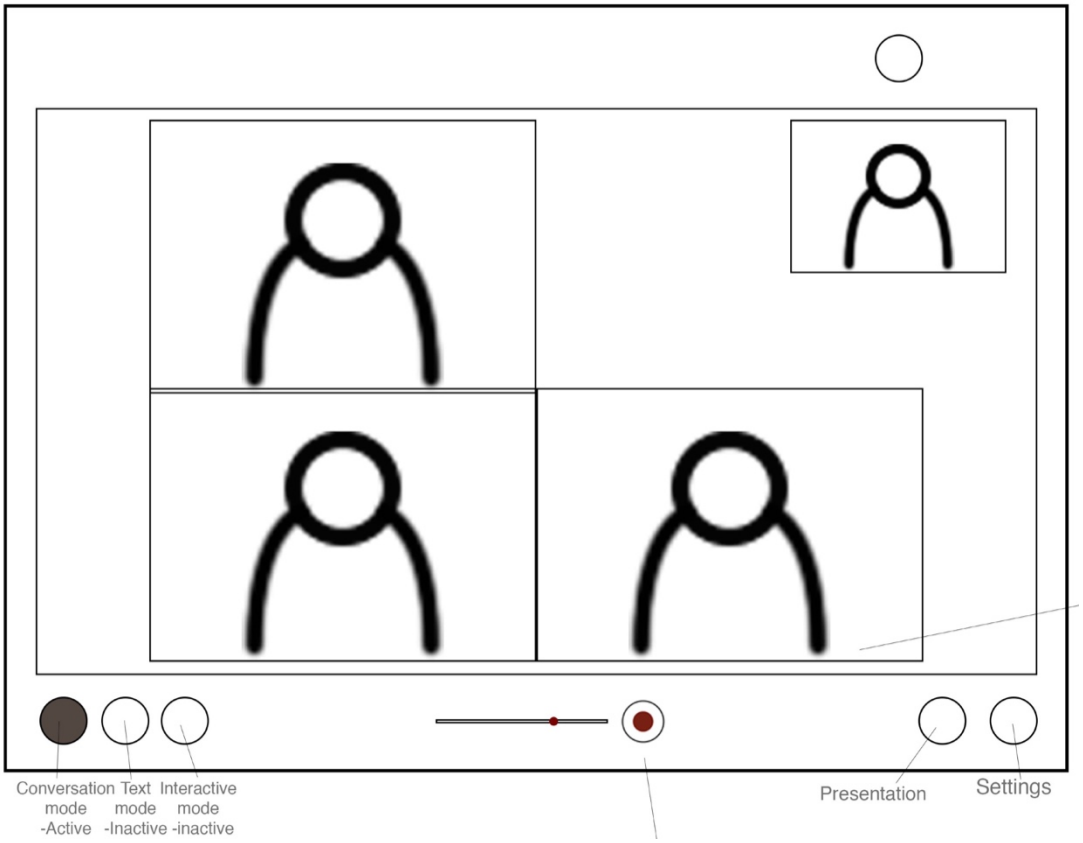


Figure 5.7 - The communication interface

The mode of the participant indicator (1.1.1) was visualized by the graphics shown in figure 5.8 below. The function of how to visualize the participant (Function A), how to provide indication on network status (Function B) and how to display communication symbols (Function C) is here displayed.

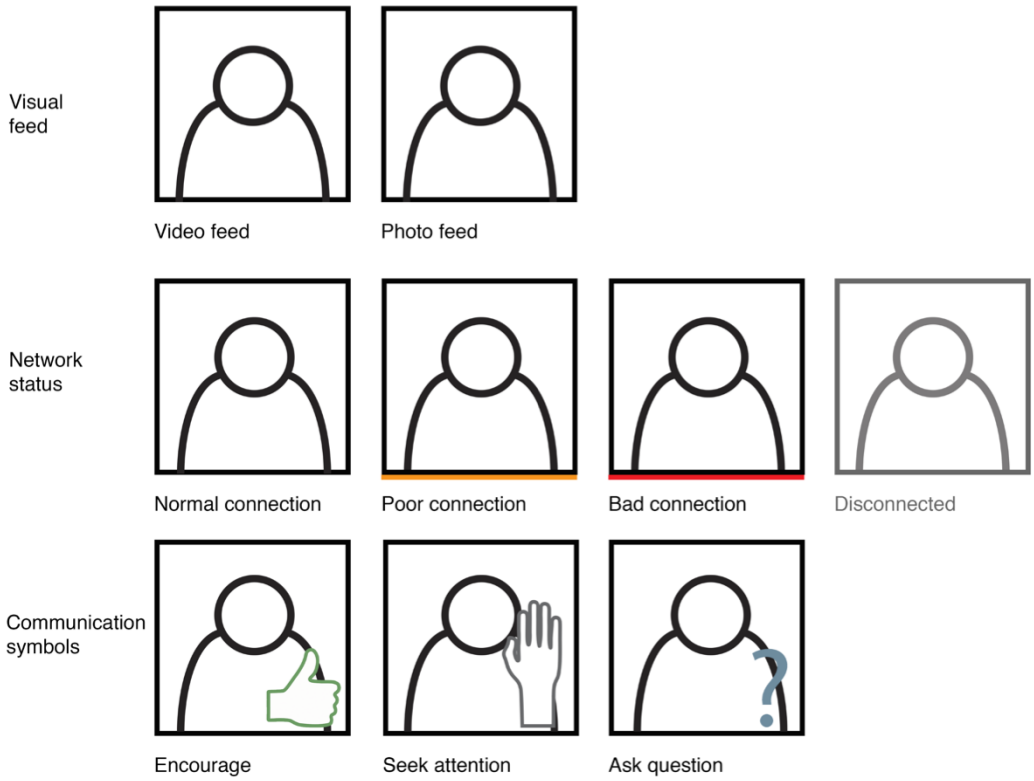
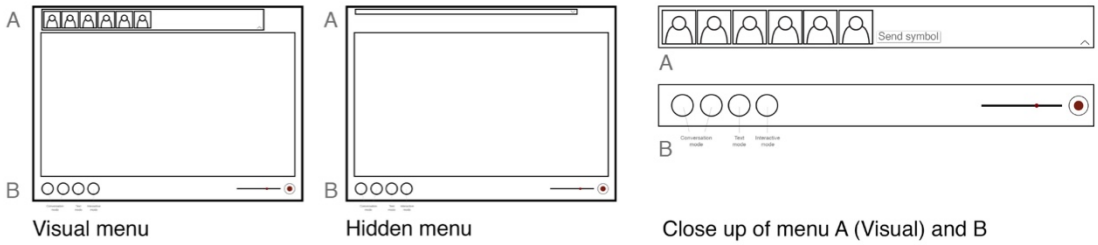


Figure 5.8 - Participant indicator modes

The presentation mode (1.1.1) is visualized in figures 5.9.1-5.9.3. The upper bar of the screen is where the participant indicators is displayed and figure X displays the status of when the participant indicator has been deactivated. The different modes (1.1-1.3) and the documentation of the meeting (Function D) can be reached at the lower bar. A close up of the lower and upper bar is shown in figure 5.9.3.



Figures 5.9.1 - 5.9.3 Presentation mode

Figure 5.10 below is displaying how the function of documentation of the meeting would be accessed. The figure shows the different modes of how the function is active and recording. When a recording session has taken place, the action points are displayed as dots at the meeting time line.

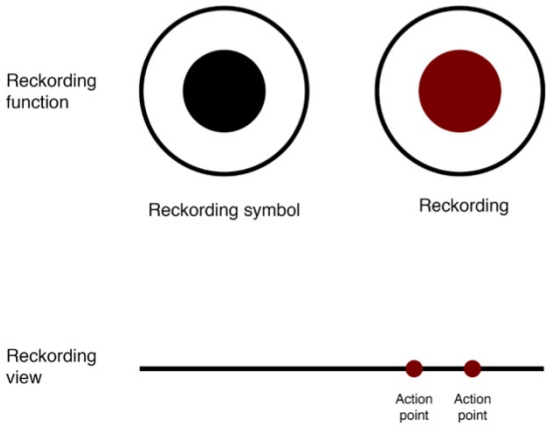


Figure 5.10 - Documentation function through recording

5.3 Prototype result

The final result of the software prototype is here described. As mentioned, the focus of the prototype has been to develop the presentation mode because of technical limitations of the developing process. The pictures shown in this section are computer desktop copies of the developed software prototype.

The initial page in the software is shown in figure 5.11 and represents (1.1.1) presentation mode. The green video box in the upper left corner here represents the visualization of the participant (function A).

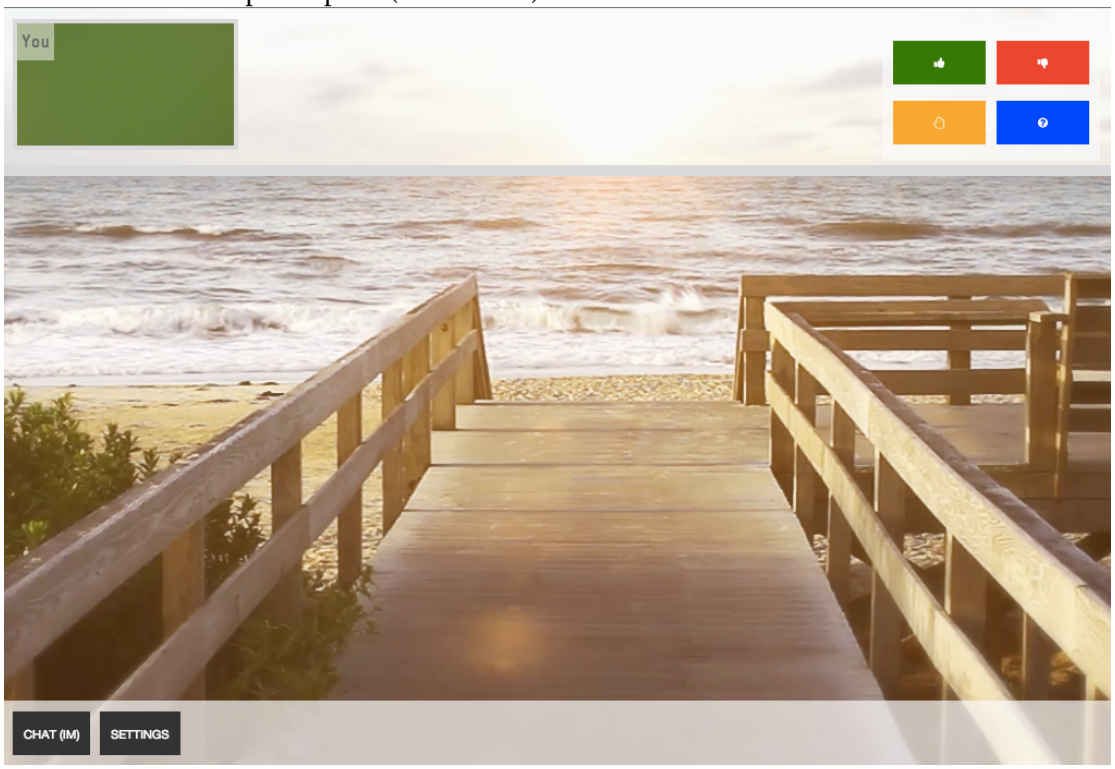


Figure 5.11 - Initial page with presentation mode

In the upper right corner are the symbols displayed and the participants are able to send the different symbols during the meeting. The artifact, here represented by a picture of a bridge on a beach, is covering most of the screen area and can be changed to any kind of artifact. When another participant want to share a screen, the artifact divides the shared area in two.

When more participants are connected, as in figure 5.11, they appear next to the first video box. As the participants are sending a communication symbol this is appearing in the video box next to the participant, shown also in figure 5.11.

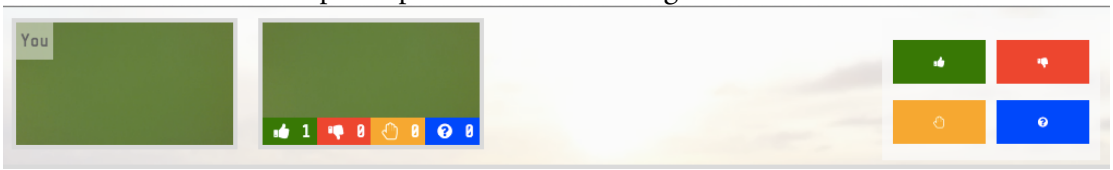


Figure 5.11.2 - Communication symbols are sent

As seen in figure 5.11.3, a sound indicator is displayed when that site is talking to provide an overview of the conversation and for the participants to track the origin of sound. It is not always easy to know which of the remote sites that is speaking, which now is indicated in the software through adding an icon for the persons who is talking. When the person starts to talk, the sound from the microphone is recognized and an icon appears for all the remote parts by that person's image. Assumingly this could aid users into receiving feedback about who is talking so that less interruption occurs.

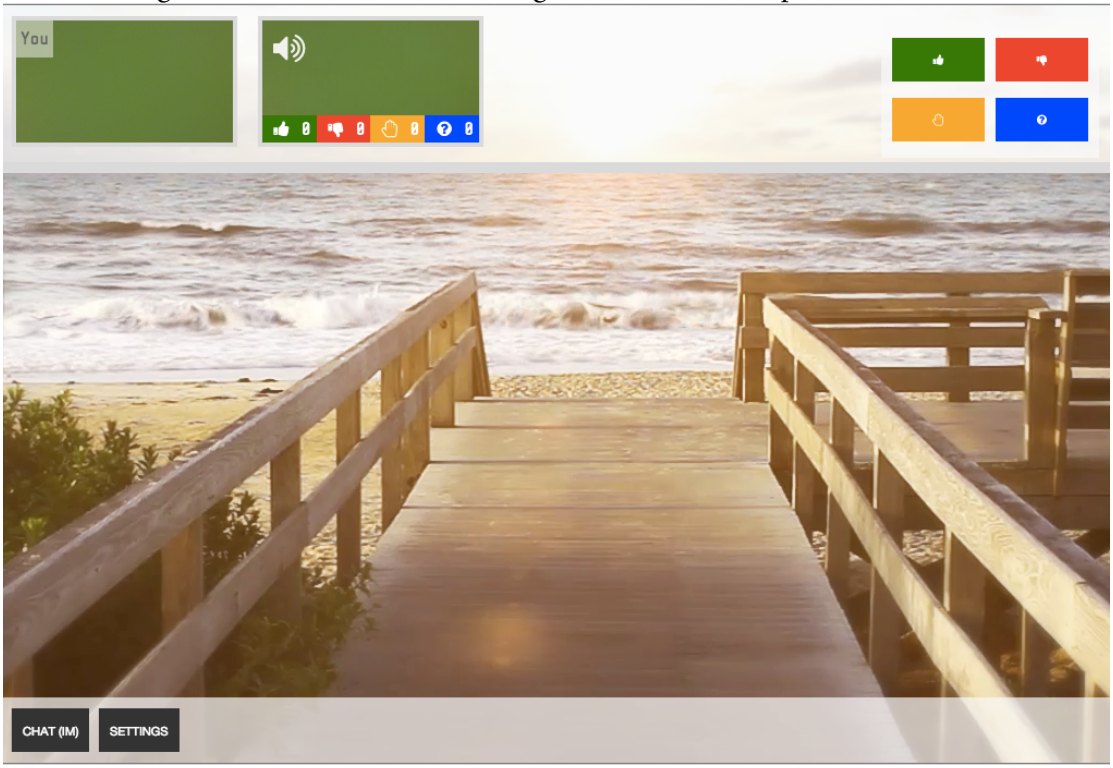


Figure 5.11.3 - A sound indicator appears on the participant window

The text function is shown in figure 5.11.4 where 'Participant A" sent a message to the meeting group. Here the participant can use the developed business emojis.

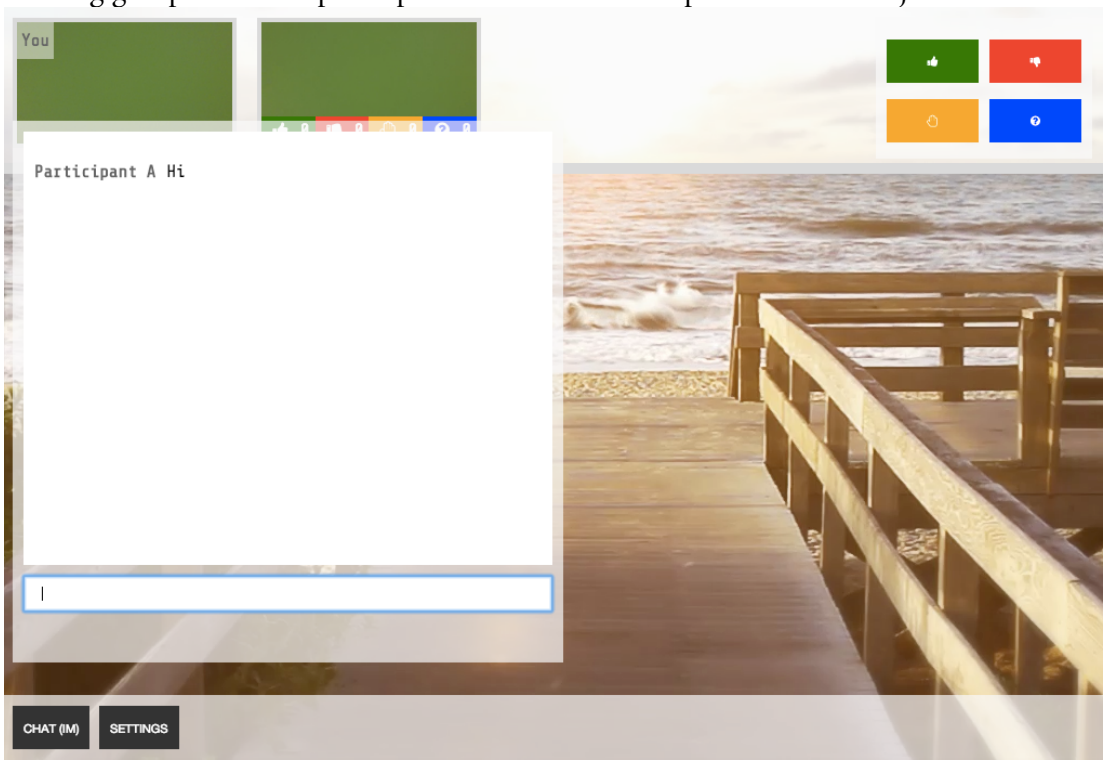


Figure 5.11.4 - Instant messages function

The lower bar of the interface is also displaying the 'Settings' function, opened in figure 5.11.5. The participants can here enter personal settings for the meeting participants to display; a nickname and an own avatar or profile picture.

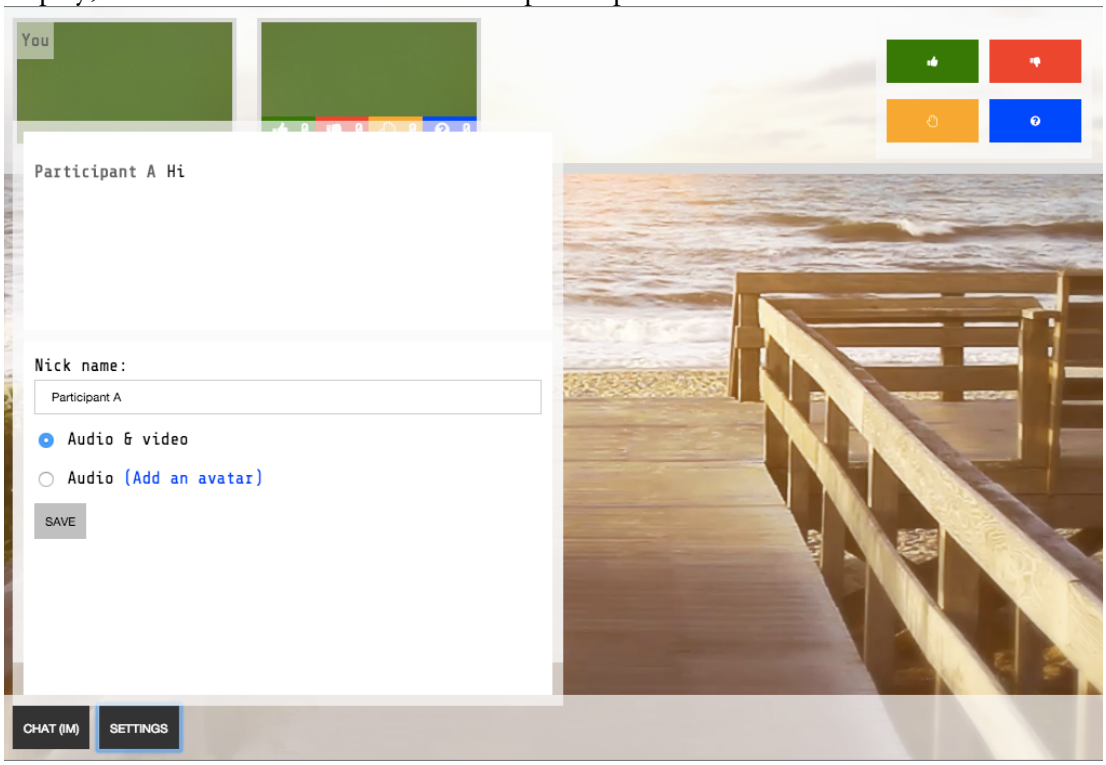


Figure 5.11.5 - Settings for personal changes

An avatar is uploaded by pressing “(Add an avatar)” - “Välj fil” followed by “SAVE”, as displayed in figure 5.11.6.

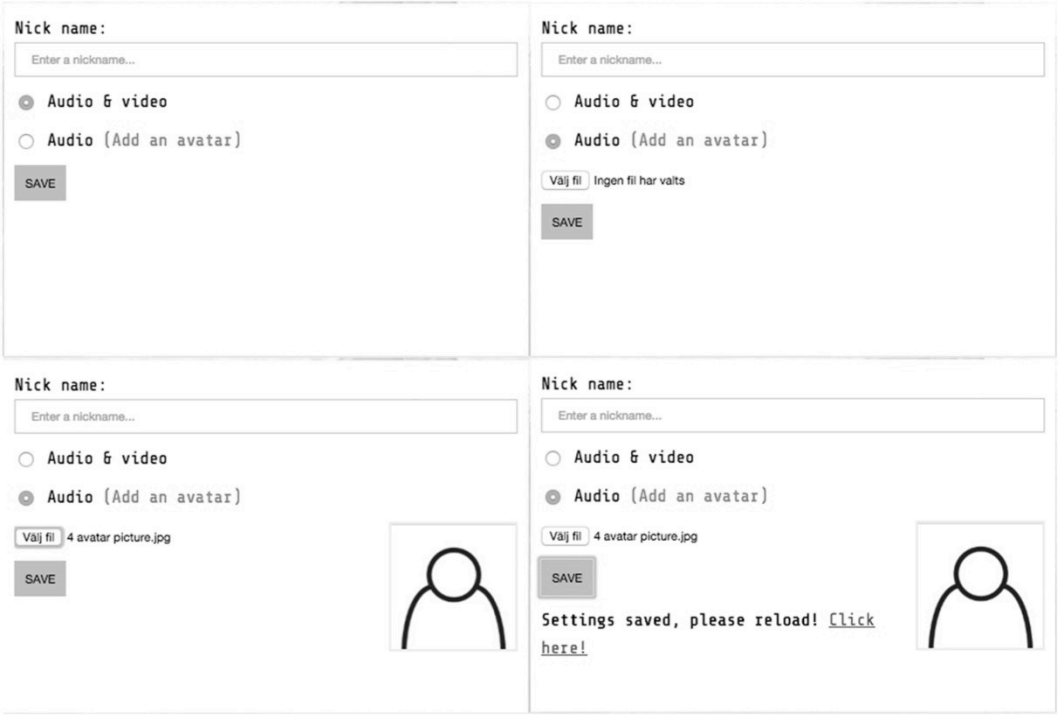


Figure 5.11.6 - Choose an avatar, a picture or video for visual feed

6 The final product

The final concept solution is a software program, supporting communication and increasing collaboration during the remote meeting situations by implemented software functions. The functions support the users into conversing more fluently and thereby the concept is providing better possibilities for communication and collaboration to appear. The functions are easy accessible and developed for intuitive use, aspects that allows the user to communicate unimpeded and to increase spontaneous interaction, which creates better support for strengthen relations and thereby facilitating informality. Through supporting communication with low technical thresholds, the developed functions support the user into collaboration and an intuitive way. The flexibility towards the wide spread of user needs with focus on increasing user interaction, the solution is stated to create a more allowing and trustful meeting climate.

6.1 Software interface and use

The software is reached through a url, which can be modified to any specific meeting purpose. In the software, it is also possible to create new subgroups that are url based from the settings menu.

When introducing a remote meeting through the software, the users are able to easy switch between the three different modes: *conversation, text* and *interactive,* as seen in the lower bar in figure 6.1, in conversation mode. Every mode has different software functions available. Depending on the specific meeting needs, the toggle between the three will vary, supporting the user if different meeting need arises.

In figure 6.1 is the conversation between two persons illustrated, here being shown as the person to the right initiated the call. The remote site, being the left window, has an enlarged frame for visual feed in order to better display visual cues. If several participants are entering a call, the visual feed will minimize the participant display window to adjust to the number of participants, as illustrated in figure 6.2 with nine sites connected. The software will automatically focus on viewing the active speaker as larger related to the rest of the sites, done through voice detection.

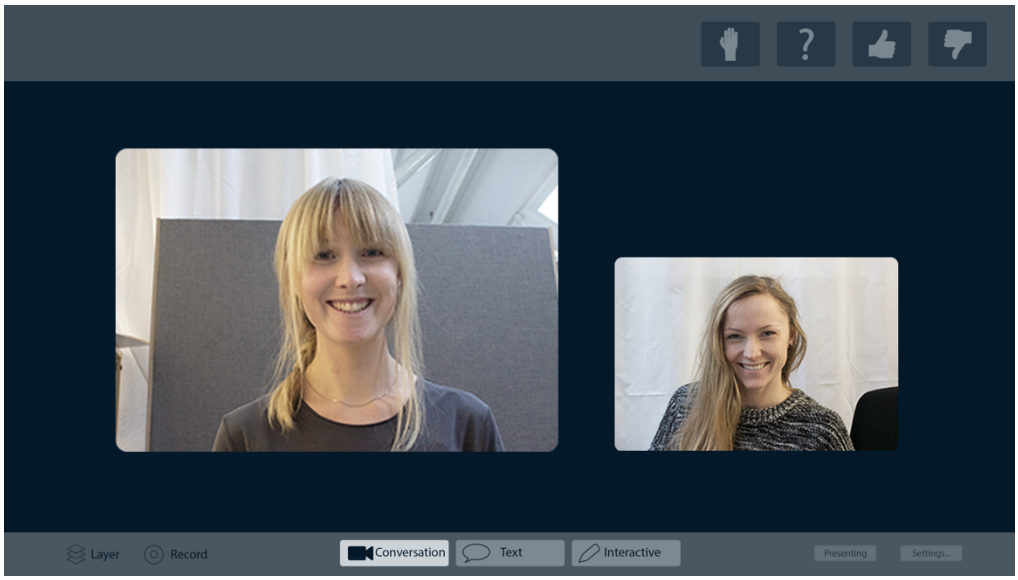


Figure 6.1 - Conversation mode with two participants

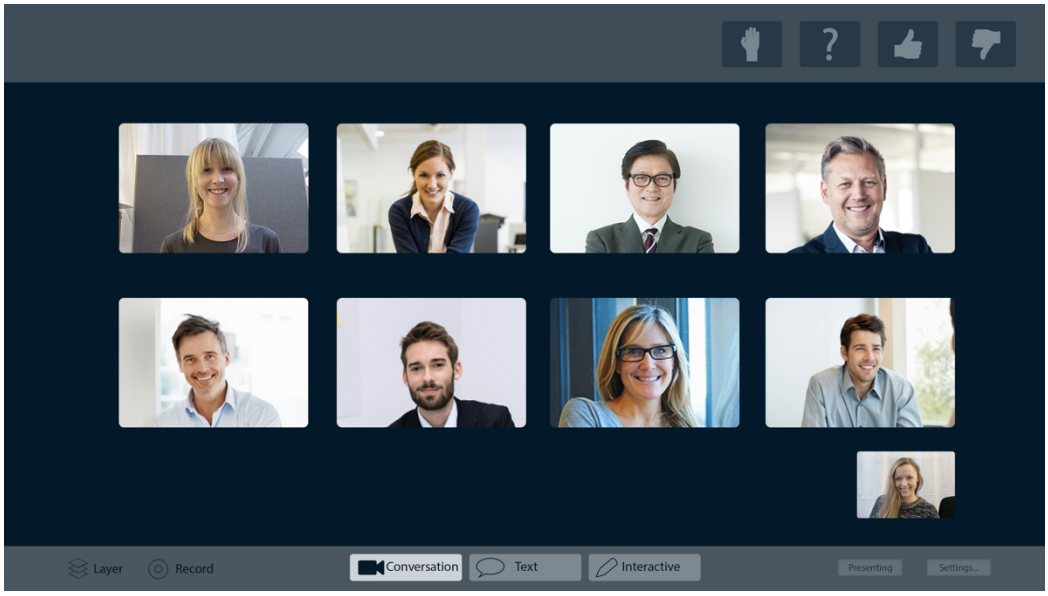


Figure 6.2 - Conversation mode with nine participants

If the network connection fails, the network status indicator will be displayed as shown in figure 6.3. The red line shows that the participants might be cut out from conversation and thereby provides feedback to the remote sites. If the participant leave the conversation or gets disconnected, the window will go into a transparent mode as shown in figure 6.4.

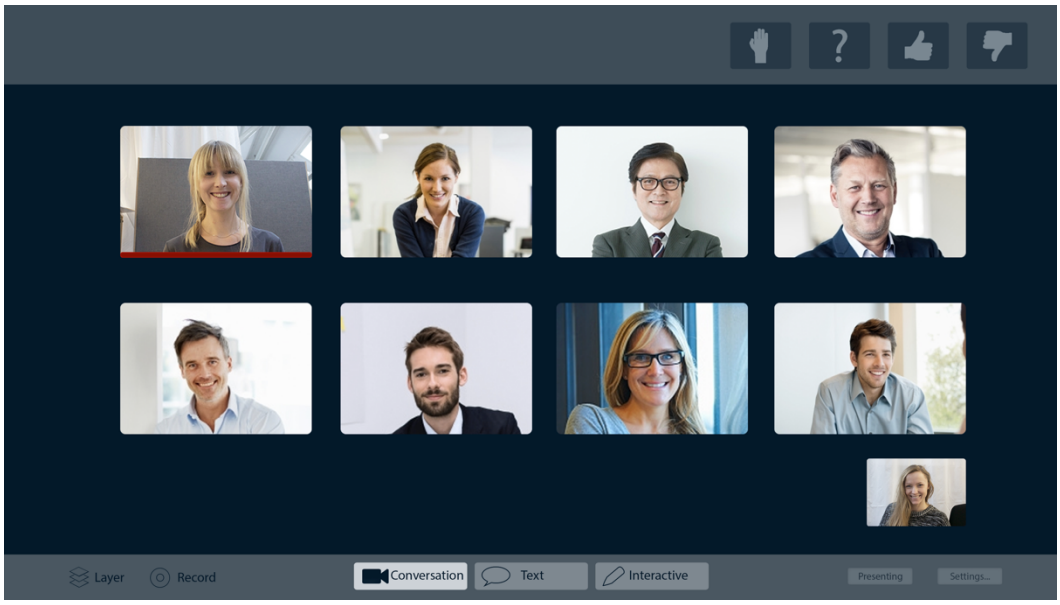


Figure 6.3 - Network status indicator displaying poor network connection

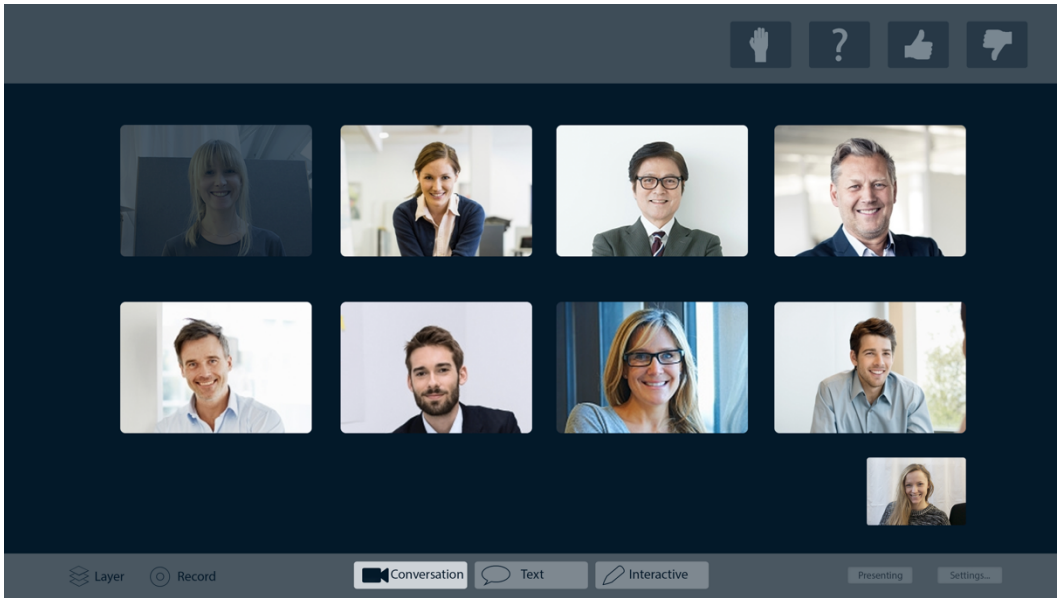


Figure 6.4 - Network status indicator displaying participant disconnected

The communication symbols are displayed up in the top right corner of the window, easily accessed for all users to give opinion throughout the meeting. The symbols appear such as in figure 6.5 and 6.6 in the participant window and disappear when the participant starts to talk (raised hand, question mark) or after a couple of seconds (thumbs up, thumbs down).

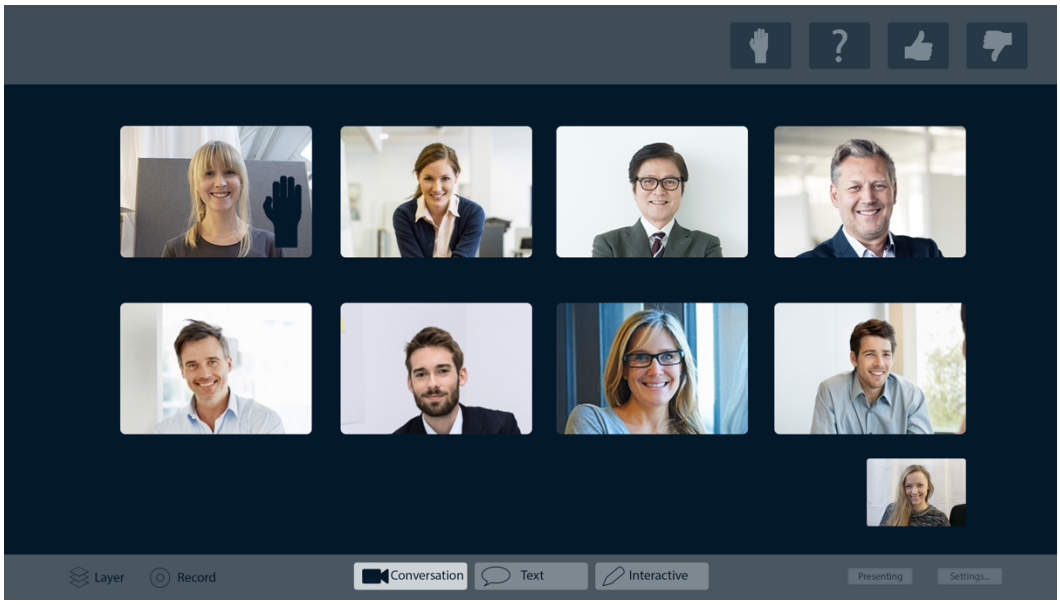


Figure 6.5 - Communication symbols - raised hand.

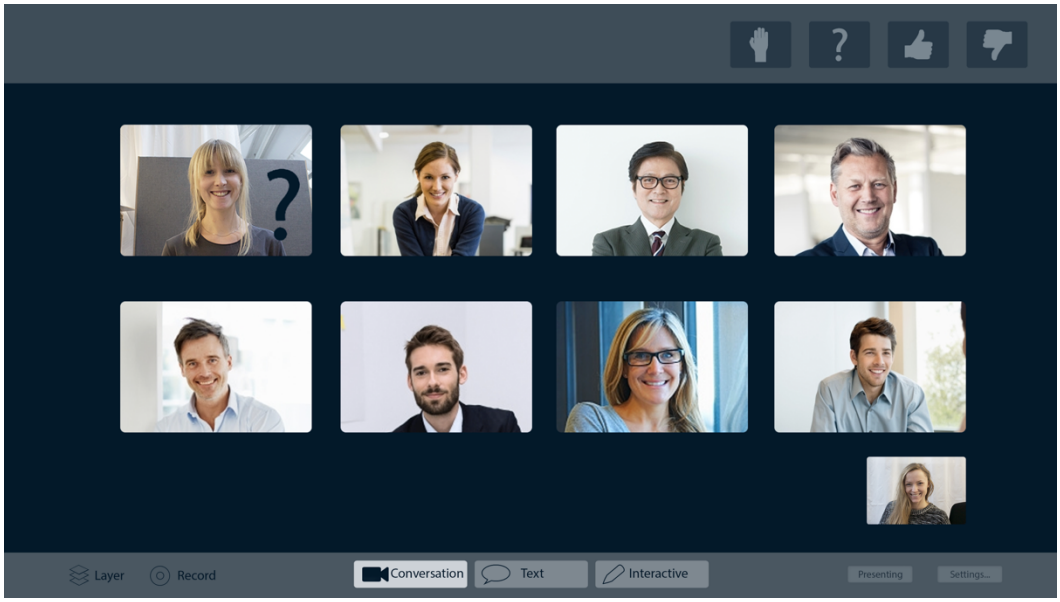


Figure 6.6 - Communication symbols - question mark

In the presentation mode, where the user is displaying an artifact for the remote sites, all the visual cues that have been described is still apparent to give feedback. Figure 6.7 illustrates how a powerpoint can be shared, showing a bar on the left side with dots that indicates the order of where in the document the conversation is taking place. When somebody wants to record an important aspect of the meeting, the record function button as shown in the left side of the lower bar is showing an indication that the recording is taking place as shown in figure 6.8.

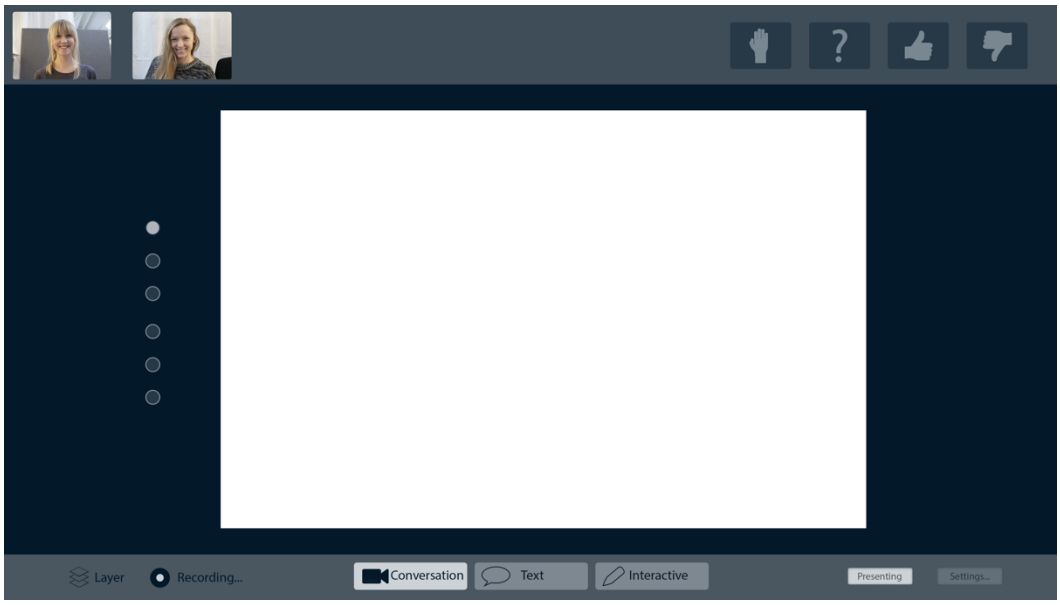


Figure 6.7 – Presentation mode

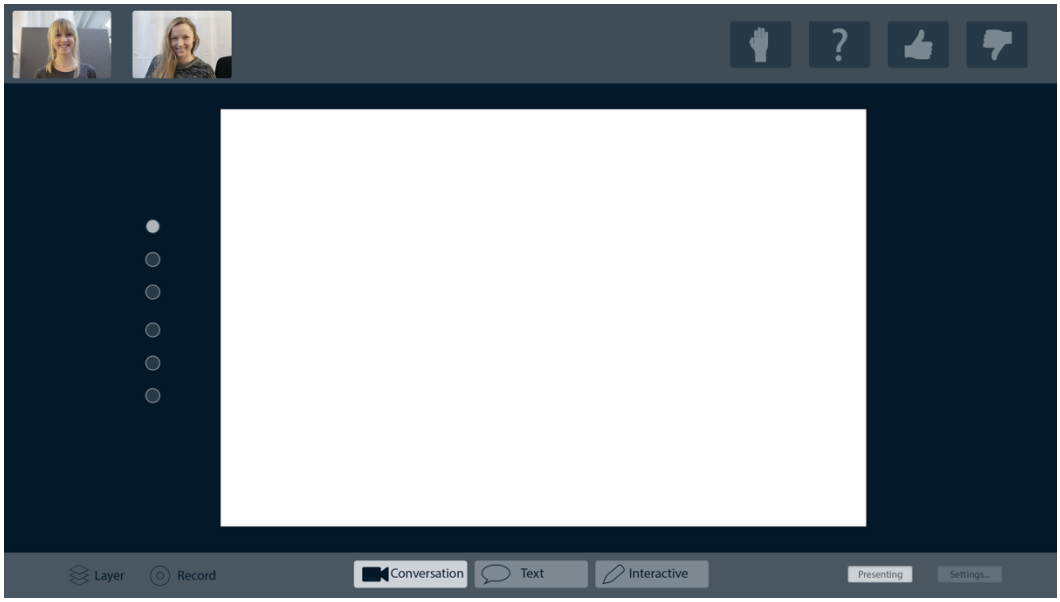


Figure 6.8 – Activated record function

The users have the possibility to add notes in presentation mode, adding comments drawings and more creative elements to the artifact displayed. The idea is that the newly changed document can be automatically saved as a new version and the original stays the same. All users have their own layer and possibility to with this add their comments, as shown in figure 6.9 below.

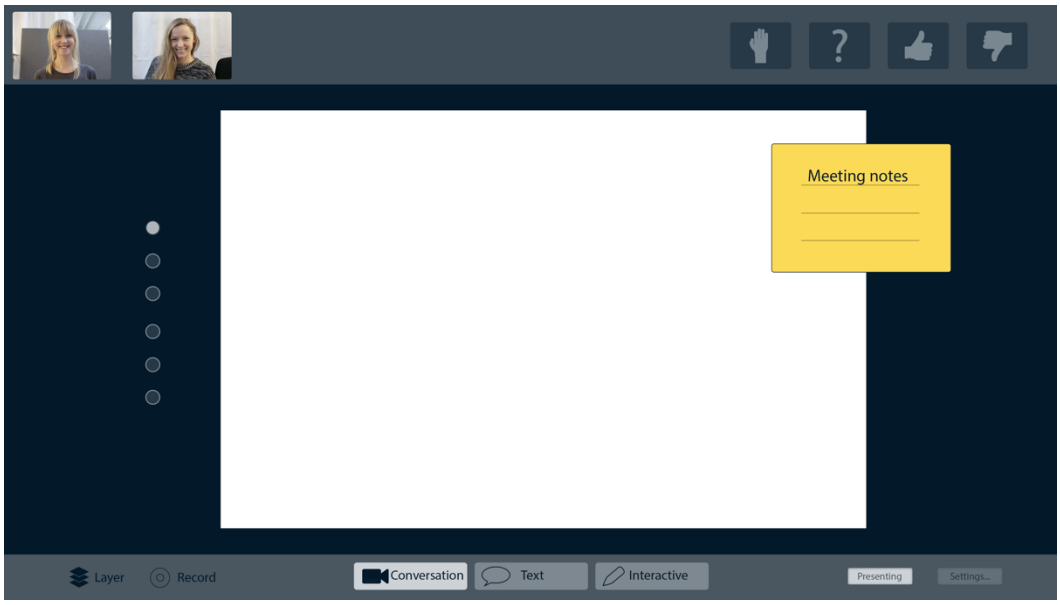


Figure 6.9 - Adding layers to the presentation mode

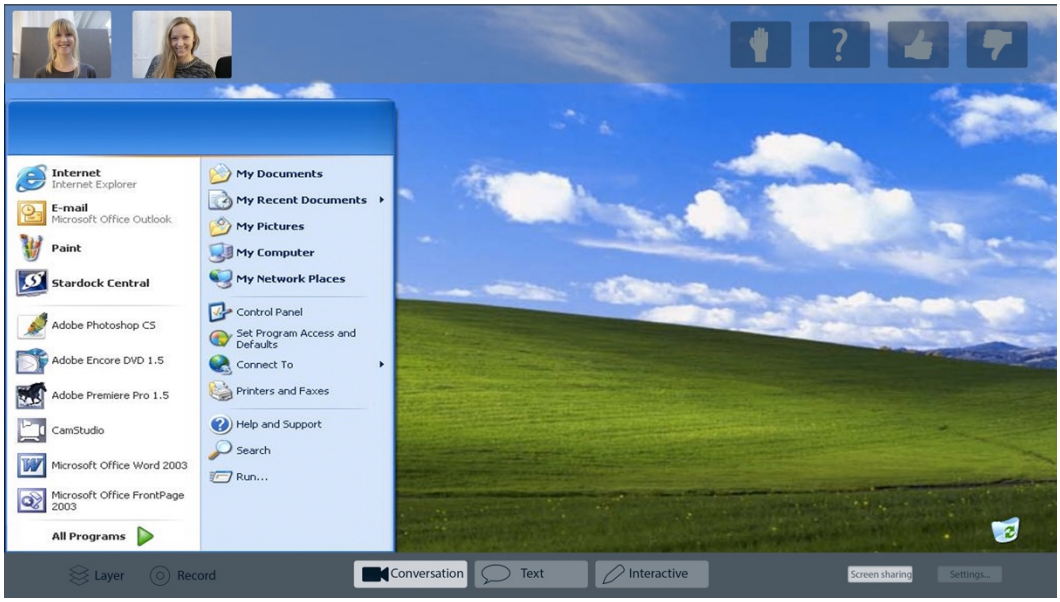


Figure 6.10 - Desktop sharing through presentation mode

The meeting could also require the user to share his or hers desktop, which the software also supports as shown in figure 6.10. The sharing still has all the important visual cues available from the symbols and the remote users.

Finally, the users can change the background in the virtual environment through the settings function to make it more personified for the specific context it is used. For instance could the user want to have a client meeting with a company specific logo, a in-house meeting with a more personal character or a friendly informal meeting with a

colleague. Figure 6.11[78] and 6.12[79] shows how this could be achieved for Ericsson and Semcon.

Figure 6.11 - Personalized background for Semcon

Figure 6.12 - Personalized background for Ericsson

[78] www.semcon.com 16-01-10
[79] www.ericsson.com 16-01-10

6.2 Software and related frameworks

In the following section the different software functions are described with relation to the informality enablers and the communication framework. It is thereby believed that the concept can be better understood in matters of how these aspects can be enhanced through software solutions in the remote meeting situation and how the functions actually contribute to this accomplishment.

6.2.1 Software functions and related informality enablers

The informality enablers, acting as both guidelines and evaluation points, are here related to the software programs' specific functions in order to discern how they are accomplished.

Set degree of pre-definition

The software's functions enables the user to toggle between the more traditional meeting contexts, where often an artifact is used to discuss around, the meeting participants are facilitated to switch degree of pre-definition throughout the meeting. If the users wishes, they can start the meeting session in one way and then end the meeting by a completely other setting. The fact that the software is available online through simply writing down an url in the browser makes it easy accessed for a non-predefined meeting as well as very predefined, and ideally reached from every device.

Balance group dynamics

The constant presence of the visual feedback will provide the user with a more positive attitude towards each other because the communication is facilitated and thereby the function is contributing to a more balanced group dynamics. In meetings with more unfamiliar group constellations this will be especially helpful to capture important non-verbal language. Through incorporating the function of communication symbols the participants will get more equal opportunity to interrupt, ask questions, and add opinion, which will be valuable for a dynamically functioning group. Especially larger groups are of concern as these have a harder time to express in this way.

Create a uniform experience

It has been proven in this project that the experience is differing when being on remote compared to being in the same meeting room. The experience of being isolated from the group is differing due to environmental attributes, technical equipment and the actual isolation and what emotions that raises. The software supports this through enable the user to access it from anywhere from a computer, iPad or phone. This gives the user more possibilities in matters of where to access the meeting, as some technical aids are installed at site for use today. The uniformity is also achieved through enable all users to express themselves through communication symbols. Moreover the enabler is supported through providing a visual feed at all times, enabling the user to always notice that someone else is present. The use of the voice to transcript documentation also supports the remote users to access the conversation afterwards if something was missed from the verbal communication.

Include various characteristics

To allow different personality types space during the meetings is supported by providing alternatives to verbal communication throughout the meeting. Introvert/extrovert, verbal/visual, and physical abilities; all kinds of individual differences are given space by nuancing the way to express yourself. The more visual expressive person is allowed to sketch and use pictures, the introvert and more quiet participant is allowed space by using the communication symbols, the persons that wants to take notes can still do so, but by adding the voice to transcript documentation it makes it easier for more persons to add what will be saved for later.

Provide an intuitive use

All described functions are developed with regards to the users' experiences and the users' mental models. The software achieves this through building upon already established mental models of what functions that are used in the meeting situation, but at the same time taking into account the found user needs. Through lifting out the important functions and reducing the amount of interactions to achieve the same result as today the software is helping use interaction and thereby interaction is encouraged.

Express emotions dynamically

By the implementation of business emojis the software aids the user to achieve an more emotionally toned language in text. The expression of emotions is also helped by the communication symbols, aiding the user to raise opinions throughout the meeting in a natural manner. The communication symbols also supports the need to express when a participant wants to speak so that others can understand this, including all participants in the conversation. Moreover, the added visual feed play a substantial part in how the users can receive the emotional content in an adequate way: to perceive facial expressions and body languages the users helps to understand connected behavior. That the video feed is adjusted when the network goes down still provides the remote parts with important visual feedback of the other sites.

Facilitate spontaneous ties

The spontaneity of the concept lies in the ease of use and accessibility, skipping all unnecessary interaction steps and goes directly to the source of what the meeting is about: communication. The software is developed to facilitate the user need of accessing different functions during the same meeting, enabling the participants to change meeting type and vary the level of interaction. Moreover, the software enables the user to conduct a meeting from any location, making the spontaneity equally possible for a café and a meeting room.

Include meeting environment

The importance of making the meeting environment inclusive and inviting for informal conversation has been lifted in this thesis. By implementing personal settings within the software the user are allowed to adjust the meeting environment depending on need of formality. The virtual environment also aims to achieve an inclusive climate where the users are invited by the interface to interact more personally through the settings,

switching between modes and being able to impact the conversation in a more dynamical way such as in real-life.

6.2.2 Software functions relation to the communication framework by Cao and Östin (2015)

The communication framework has throughout the project been a useful tool to evaluate the communicative patterns of the concepts, here used to define how well the functions are fulfilling every framework point.

Perceive other' presence, roles and relations
By providing the meeting participants with constant visual feed even though the network connection goes down the participants is facilitated to perceive others presence, roles and relations throughout the meeting. The network status indicator and that the function allows the user to discern if a participant has been disconnected helps the participants to perceive others presence during the remote meeting.

Accessibility of use and adapt to workflows
By designing the concept based on the existing technology used and allowing the user to reach all functions depending on the specific meeting need, the solution is easily accessible for the user and is developed to adapt to the user workflows. The software enables users to define the meeting as it goes, encouraging more spontaneous contact through easy accessing functions as well as supporting users who prefer more pre-definition to still be able to achieve this through other means. This as it is still possible to email an agenda, documents and other important artifacts beforehand as it is done today in that kind of meetings.

Sufficient means to visually view the entire workspace
The user is not able to view the entire workspace of the three modes at once in the software. But by allowing the user to toggle between the different modes, the means to easily view all content is considered to be supported. The visual cues from icons invite the user into switch between workspaces if needed, thereby providing a full picture of the software functionalities.

Sufficient means for participants to track where sounds originate from
The constant visuals feed in combination with the sound symbol that indicates when someone is talking in the interface gives the user feedback on where the sound originates from. With the identification of the individual users sound it is also possible to make the sound transcript individual, which act as a backlog later on when the meeting is finished.

Support explicit- as well as implicit verbal communication
By providing a constant visual feed, even though the network connection is low, the described factor is considered to be supported. The visual feed supports the transfer of non-verbal cues and body language and the risks for misinterpretations are decreasing compared to today where nu visual feed is provided.

Watching of other participants body movements and non-verbal cues

The visual feed in combination with the ability to use communication symbols will help the users to communicate and to include non-verbal cues. Since the software is providing the meeting participants with the ability to sketch and use additional communication ways, above verbal communication, the communication is supported in a non-verbal manner.

Facilitate use of deictic- and representational references

The layer function in the presenting mode provides every user with a specific layer to add their reference to, supporting a communicative behavior that today is lagging. On top of this is the visual feed with the video is of course helpful when transferring these references and as described before, the concept is designed to fit reality in a more adequate way with the network adaption.

Provide feedback that communication has been perceived and understood

The use of communication symbols helps the user to provide feedback that a message has been received and interpreted. The symbols are also an easy way to send feedback to the other sites during a meeting with a large number of participants, where it otherwise would be hard to make yourself heard. Moreover are the business emojis in the text mode helpful when communicating and can aid the users to display a reaction when a message is not transferred.

Should be able to make eye contact with each other

The users are not able to make direct eye contact by the use of the software program but the visual feed is allowing the users to see the other participants' visual focus and is thereby somewhat facilitating the users to connect with the other sites. The placement of the image of the participant is centralized when the person is speaking, covering most of the window frame. This makes the gaze appear as sufficient enough in these terms and with the technical equipment available in the portable device.

Facilitate full view and ability to manipulate artifacts

The software's functions in the presentation mode, real-time managing artifacts and sketching, are all supporting the named factor through ease of use layer functions and ability to quickly generate and/or modify artifacts. The easy access to the interactive mode also allows the user to insert new devices to an on-going meeting, inviting to manipulate artifacts when having the need for more interactive sessions.

7 Discussion points

Finally, the overall master thesis project is here discussed. The chapter begins with describing the chosen methods and implementations throughout the project. This is followed by reflections on how the project outcome relates to the overall aim and initially posed questions. Last, recommendations for future work are here discussed.

7.1 Methods and implementations

The chosen methods in this project have mainly consisted of qualitative studies in forms of observations and in-depth interviews. The validity of the study would become more solid if adding quantitative data to support the findings. Because the literature study was performed as complementary data to the user study the research finding is increasing in validity.

The user tests were conducted in the environment where the product should be used and the participants were part of the user group, which provided great insight of the use group attitudes and experiences of the developed product. The number of user tests conducted to evaluate each function differed because of the different availability of resources throughout the project. To definitely determine if the user experience of the meeting is improved more user tests would have to be conducted.

User tests was conducted in various levels, some for quick user tests by mock-ups while others where more thorough developed. The differences in the way the concept or concept functions were represented may have impacted the result, impacting the user experience of the tested function. Due to careful balance between equal evaluation methods and available time the work process can be seen as justifiable and still providing a reliable foundation for further development.

The search words of the literature study was chosen based on the beforehand set project description and would possibly would have been changed if conducting the description in a different manner. Also, the previous master thesis project within MERCO has influenced this master thesis project, which have impacted the project orientation.

The MERCO project has consisted of multiple projects with different competences but working towards the same goal. The need to fit the overall project goal has contributed to certain directions within the project and has affected some conducted choices. This has been handled and described within this report and is therefore considered as part of some of the limitations of the project.

The work process when developing the final concept was, due to limited resources, forced to first develop and evaluate single functions, and thereafter putting all the functions together in one unified final concept. The evaluation of the final concept is developed based on the beforehand conducted user tests which may have looked differently if having a different work process for developing the final concept.

7.2 Project result and posed questions

The user group has evaluated the final concept and several user tests have been conducted to evaluate the different concept functions. This reinforces the credibility of the developed concept and the chosen functions within the solution.

The developed prototype was not able to possess all the designed features that were meant to be a part of the solution because of the use of the external programmer resource. The development of the final programmed prototype has been left for further development and evaluation for future participants in the overall MERCO project. However, functions of the final concept have been evaluated towards the found user needs and one can suggest that the developed solution thereby is improving the meeting situation for the user group.

7.2.1 Driving questions

Through the driving questions in the project the idea was to be able to answer the wider and crucial research questions. This section aims to investigate how these are fulfilled.

What aspects of a meeting are important to consider with regards to the existing literature and conducted user studies, related to the research question posed?
The question was answered through the thorough pre-study where both literature and user studies were conducted. The result implies that the most substantial aspects concern the social interplay between meeting participants and with regards to previously mentioned results how this can be considered in a technical product. As the social interplay varies, suggestively in degree of formality and social interaction, so does the qualitative output and effectiveness of the meeting itself.

What type of business meetings is relevant to investigate with regards to the found aspects?
The findings show that a majority of the observed business meetings would shift between different meeting types, indicating that there is today a growing need to have technology to follow those transitions. The rather stiff meeting culture has a problem with following this need and the meetings are thereby solved with a substantial variety of different software programs, functions and methods. It is therefore considered that even though it would be considered easier to design for just one meeting type, this is not how the meeting situation looks today as the shift show of a need for more variations and that a meeting is not just set to a specific frame of what it should and should not contain.

What user needs are central when conducting a remote meeting?
The user needs, in appendix 2.5, was handled in chapter 2 by first presenting the basis for the needs and the analysing how the found needs related to the specific meeting context. The needs also lead to the creation of the informality enablers, which were used to generate and evaluate the functions together with the communication framework by Cao and Östin (2015).
How is a collaborative meeting environment created based on the findings above?

Creativity has been displayed as something that is triggered by external factors and is found in this report as a phenomenon that one can facilitate by creating a trustful climate for the meeting participants. When doing so, the participants will be motivated to interact and share ideas and information, which itself is facilitating creative result. One major finding of the project has been that the process of how an idea or thought is communicated is crucial for creating a trustful and open climate, which has been described, is facilitating creative behaviour. By creating a solution that is easy available and adjustable to the found meeting needs, the user errors are decreasing and the creative climate is facilitated.

7.2.2 Research question

How can the important and substantial aspects of communication be captured in a physical and/or digital product to support a collaborative meeting environment remotely?
The answer to that question is given at several levels. Firstly, when designing for remote collaboration it is of greatest essence to consider the social aspects of the various meeting types, group relations and individuals. The creativity is today simply not occurring due to the rigid climate that is generated in the meeting room. Creativity springs from curiosity, from being open minded and asking questions, being eager learn more and attain knowledge. The technological thresholds and barriers that are created through technology and the meeting climate itself hinder this from being achieved in the observed meeting scenarios. The technological solution must consider the fact that as much as there are different levels of group relations, there are also personality types and thereby personal traits that affect the ability with achieving a creative behaviour. Technology that is aimed to be used for a long-term purpose and to support the general mass of users must be developed with special consideration to these variations. The thresholds for technological use must thereby be minimized through building the technology on simplicity and easy access. Something that is not present today. If the users experience the threshold between them and the remote site as smaller for collaborative work is the overall effectiveness believed to increase.

What core functions will such product contain and how could these be realized?
The developed concepts in chapter 3 described different ways to develop functions that facilitate the user based on the research question above. The importance of such function is that it should match the user mental model and provide a sense of trust for the system. To decreasing the user thresholds that is not presence in a real life meeting by the implementation of the functions the user will be experiencing a more satisfying experience when communicating remotely.

Chapter 4.1 is describing the found product functions that are developed to help capture the important and substantial aspects of a real life meeting and thereby facilitating the remote meeting situation.

7.3 Further development

As described, this master thesis project has been a part of a larger project, which is on going while finishing this thesis report. Thereby the implementations and further development becomes important to discuss for future work. This master thesis report provides a solid ground for supporting future work in terms of understanding the user groups and the user needs during the remote meeting situation.

The developed concepts in chapter 4 still has potential to further be developed and reach a point for being valuable for the market and user group. Based on the findings of this master thesis project one can suggest that the social aspect is crucial to consider when designing for remote collaboration and that not only the technical aspects impact the use of the technology.

The developed prototype of the final concept would favourably be taken further and tested for continuous development. The prototype and the developed functions are seen to be in an early development stage and would require more solid ground for motivating and strengthening the concept solution.

The evaluation of the final concept based on the frameworks in chapter 6.2 was made based on an appreciation of how the developed functions would support the overall meeting, but must of course be looked into further. But continuing using the frameworks, both from previous master thesis work and this, is a final recommendation for future work within this area.

8 Conclusions

The purpose of this master thesis project has been to understand the aspects regarding remote business meetings from a user perspective and to find out the core issue of why so many meetings are impossible to conduct remotely. The study shows that the traditional meeting context of today is lacking in terms of encouraging interactive behaviour and the possibility to express oneself in a nuanced way. Creativity is found to be dependent on the ability to work within a trustful and easy-accessed environment, which is created when an individual work together with others in a group, expressing thoughts unfiltered. Moreover, by having access to proper tool that is needed for expressing these thoughts. The combination of these findings leads to the conclusion that the remote meeting situation of today is working counteractively against creative behaviour. The solution to these findings has been to develop concepts to facilitate interactive behaviour in either the traditional meeting context or outside the meeting room, focusing on including the remote site in the informal encounters. This finding has resulted in the development frameworks for enabling informality within the meeting situation.

The final chosen concept for enabling remote collaboration is a software program, developed by considering the existing software tools used to conduct remote meetings at the companies. The functions of the final concept is developed to facilitate interactive communication by focusing on providing participant feedback, a sense of being included in the group and the ability to express oneself with more than verbal communication. The concept also enables the participants to more fluid interaction, working towards a more informal meeting climate.

In conclusion, this master thesis has shown that the interpersonal relations are of great importance to consider when designing towards remote collaboration. By developing the framework of informality enablers the substantial aspects of the meeting are captured. The relevant angle of meeting types, looking at remote collaboration, would be to include all meeting types that are occurring in the remote meeting situation, simply as they are prone to shift and be diverse. The project shows examples of how a formal and rigid meeting climate hinders initiatives for creative interactions and it is thereby crucial to design with an ”all types” mentality in order to facilitate for creative meeting sessions.

The found user needs during the remote meetings varies depending on the group and the participants and the solution must thereby include a variety of contexts. The findings also show that the users desire a solution that is developed with usability and a low initial user threshold in mind. The developed solution must therefore facilitate the user needs by enabling for an easy switch between different functions, this without unnecessary use steps or waiting time when additional products have to connect for the meeting to get started.

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Appendix

2.1 Observation notes

utrustningen - människan - gruppdynamiken - mötet - gränssnittet
Social scene
- familiarity
- organization

Organizational
- agenda?
- goal?
- structure?

Gestures
- Illustrators
- barriers
- adaptors
- regulators

Artifacts shared
- how
- when
- where
- why

Time consumption
- conversation
- turn taking

technical errors
- amount
- time spent
- what kind
- cause

equipment
- organization in the room
- distances to equipment

2.2 Focus group 1

Presentera oss och vårt projekt.

Vad vi vill få ut:

Hur de skulle vilja jobba:

Hur de hade velat att det blev bättre.

Vad de ser för möjligheter/begränsningar med det sättet de skulle vilja jobba i fråga om tekniska lösningar.

Ni berättar om att ni har detta arbetssättet idag. Hur skulle ett system kunna uppmuntra er till att vara mer kreativa?
Skulle systemet kunna begränsa passivitet under möten? Hur skulle det kunna se ut?
Ser ni någon möjlighet att systemet skulle styra användaren att göra rätt? (involvera fler, korta looper etc).
Efter de berättat, undersöka inställningar till våra idéer.

Mötesstiuationer på Volvo

Vad har ni för roller på Volvo? Er arbetsbeskrivning?
Vad för typ av möten har ni oftast under din arbetsdag? (beslutande, redovisande, brainstorm, teambuilding, informationsdelning etc?)
Hur bokar ni dessa möten? Vart har ni dem oftast (bokat mötes rum, framför datorn, etc)
Har ni ofta remote möten? Ser denna typ av möten ut på samma sätt (bokas på samma sätt, samma typ, samma artifakt etc?)
Hur definerade brukar dessa möten vara?
Hur interaktiva brukar de vara?

Förklara hur det informella knyter an till vårt projekt

Informella möten

Vad för typ av informella möten uppstår i ditt arbete?
Vilken betydelse skulle du säga att de har i ditt arbete?
Hur ser den informella kontakten med andra delar inom era projekt ut?
Skulle den informella mötessituationen kunna förbättras på distans? Alltså, skulle det finnas ett intresse av att 'stöta på' människor från andra platser på ett informellt sätt?

Kreativa möten

Ni nämnde innan… / ni har inte nämnt … , brainstorming möten/workshops. Är det något som inte förekommer/ofta förekommer? Varför/varför inte?
Är det något som ni skulle vilja ha/mer av?
Finns det ett intresse av att ha dessa typ av träffar på distans? Vad skulle barriärerna vara?

Nuvarande teknik och projekt

Vilka program använder ni er av för att kommunicera?
Ser mötena ut olika i olika delar av ett projekt?
Har man en typ av arbetssätt som går igenom på samma sätt i olika projekt?Tror du det är vanligt?

Nya tekniken

Du nämnde… varför tror du att *koppla till tidigare nämda behov där ny teknik finns*
Hologram
Leap motion
Virtual reality

Våra idéer

Olika behov för olika användare? (*Produkten anpassar sig till användarens behov)*
Olika funktioner för olika projekt? (*Funktionerna anpassar sig efter mötets struktur)*
Hur skulle man vilja kunna känna av olika användare?

2.3 User needs from literature study

Provide an inclusiveness at the opening of the meeting
Provide the participants with a subject of why there is a meeting
Provide an ability to review the meeting afterwards in order to make the meeting more efficient
Need to be aware of the unspoken content
Need to be aware of the spoken content
Message must be clear and honest
Need to understand informative and affective content
Need to make conversation loops shorter than usual meetings
Need to share artifacts
Need to enhance speech, body language and gesturing compared to usual meetings
Need to have an appropriate environment for the meetings purpose
need to establish eye contact
Providing socio-emotional interaction during “forming” creates a better toolkit for the group to work together
Need of individually feeling fulfilled with physical and mental health, emotional needs, sense of belonging, sense of being in control. If these are fulfilled by the group the work becomes strengthened and the work becomes more efficient.
Need of counteracting low-monitoring behaviour (LMB)
Need of asking questions often and provide collaborative exercises to prevent uncertainty (UCT theory)
Need to provide adequate information for auditory, visually and tactilely conditioned persons
Need for creating an environment that makes the persons feel included
Need of making the organization highlight the importance of debate and discourse
Need of making decision making inclusive and patient
Need of having a leader which work actively with generating a safe environment, creates credibility, value opinions, knows how to influence without authority, finds creative ways

2.4 User needs from user study

NEEDS:
FOCUS GROUPS (FG)

Focus group V (1)

Basic social needs:
The need to express oneself understandably (language barriers could be a problem)
The need to understand when someone is about to talk (non-verbal cues)
The need to obtain a common ground
Need to be able to express emotions
need to hear what is said
The need to understand who is speaking
The need to interpret body language, (put on the camera sometimes to see the other site)
Need to feel included
Need to feel a relation to each other - when one is not reached. close contact can counteract this
Need of understanding roles, both own and others
Need for everyone to understand what is being said (language variations)
need to feel safe in the situation (trust)
Need to feel prepared
Need for informal communication

The meeting needs:
Need for good sound from the system (is lagging often today)
the need to include people from other sites when being remote (one room could have an ongoing strong discussion excluding other sites)
the need for indication when urgent meetings suitable for other sites, difficulty speaking due to time differences
need to be able to share artifacts
the needs of the agenda for the meeting structure
Need to get the technology to be more realistic - the video is not used when it feels like it does not provide a realistic experience
Need of somebody taking command of the meeting, a moderator
The need for quick dailies - being able to share something quickly be thought of. Made in the corridor or via Skype today
The need to reach the most provided with specific information
The need to use text effectively rather than sketch
The need to share documents on the screen
Need to update meeting procedures to new ways of working
Need to indicate the questions to places in the document
Need to be able to relate and group meetings to each other as they indicate if they need follow-up, subsequent encounter
Need indication of time zones, combined with the booking and email
The need to combat exclusion - combating an internal dialogue that excludes the other site
need to be able to see when the other party is Online
Need to be able to document during the meeting
The need to take more spontaneous contact with help of the software that is available (individual profile icons which becomes bigger when someone is online)
(Various job roles may require different tools, such as engineers have a greater need to be able to show a sketch, change o add simple)
Need to make the meeting enclose the participants from distractions
Need to be able to easily call (tough with all codes today)
Need to have roles in the meeting structure, one that controls and advantages.
Need for a non-traditional meeting room context

Focus group E (2)

Basic social needs:
Feeling included in the conversation
Be able to ask and get input on that the other has understood when talking
Be able to get feedback from the other side - that they hear, see, who they are, how their facial expressions relate
Be able to express emotions

Be able to explain to each other and work together on a common interest
The need to feel a connection with the other person/group
need to feel that it's the same mood between parties (especially when having international dialogues)
Need to be able to feel focused when the situation requires it

Meeting Needs:
The need of meeting spontaneously
The need to understand when someone's connectivity is poor, visually via the software would be good
A need of division of roles within the meeting so that there is a structure
The need of having an intuitive software with a low threshold
Need to be able to edit and make notes in documents
Need to be able to sketch quick and easy, intuitive, once you realize that you want to draw something
Need to be able to draw more with a "mental model" procedure with a pen, (Draw with the mouse is useless)

Fokusgroup E (3)
Basic social needs
The need to feel included
The need to enable different personality types space
The need to express when wanting to add opinion
The need to know others competence
The need to counteract low-monitoring behavior (LMB)
The need to direct attention
Need of feeling close with the persons in the communication

Meeting needs
To have the same technical prerequisites for both sites
The need to have good sound (is often lagging)
The need to make shared documents visible for all parts
The need of having a mediator that divisions roles and turn taking
The need to feel that the experience is the same on both sites
The need to direct the meeting towards more essential subjects to be effective
The need of sharing information effectively

Fokusgroup E (4)

No notes available

INTERVIEWS (I)

Interview E (1)

Basic social needs:
need to see the other party
Need to be able to read body language and have a physical picture of the other party (creates a sense of collaboration will work or not)
Need to meet spontaneously to create a relation to the other

The meeting needs:
Need to express early ideas (waiting now until the document is very clear and presents today)
Meeting the needs of both internal and external meetings: 1-1 and group meetings
Need to be able to join the meeting easier (tough with code that causes trouble)
Need to be able to operate with a moderator in some meetings, in others not (be able to talk freely between all parties)
Moderator PIN is not used
Needs that the system is available at all sites and are equally available to all parties
Need to share what is on the desktop, own material such as PP, excel
The need to minimize the percentage of e-mails (get incredible number)
Need to get work meetings work better remote (draws a document such on a whiteboard, working together on a artifact)
Need of informal contact that is useful at a later stage when collaborating the next level

Interview E (2)

Basic social needs:
Need to see if the person understands what you say
Need to express ideas in a familiar manner

Meeting needs:
The need to get information shared in an easy way with the system
Need for greater real-time capabilities so you can avoid having to prepare everything before the documents, such as annotate, draw, etc.
The need to real time edit documents (avoid having to check out, edit, check in so the next person can edit)
The need to create ideas with help of featured real life used tools such as a pencil paper or whiteboard
The need to discuss small things and their relationships in a simple way (work poorly today)
The need to draw simultaneously, edit, store add sketch, modify (film whiteboard today)
The need to share documents via an easy accessed sharepoint
Need of having a network that works well

Interview BF (3)
Basic social needs

-

Meeting needs
Need to minimize technical thresholds in the meeting situation
Need to de-dramatize the meeting situation
The need for turn taking
Need to know that the other site is there

Interview M (4)
Basic social needs
The need to be able to understand and share information

Meeting needs
Needs for management to lead the way with new work patterns
Need for designing for a distributed location when using the technology
The need to know when to have a meeting on remote and not
The need to provide meeting policies and encouragement to these for the meeting teams

Interview C (5)
Basic social needs
-

Meeting needs
The need to be able to join a meeting no matter where you are
The need to provide the first time user with the right tools and experience
The need to prove a complete system of meeting aids
The need for the function or product to relate to a certain meetings efficiency

Interview A (6)
Basic social needs
The need to be able to natural in the meeting
The need to communicate emotionally with nuances

Meeting needs
Need to know which meeting type the function is set for
Need to maintain structure within the meeting

Interview L (7)
Basic social needs
The need to feel included

Meeting needs
The need to make the collaboration with remote parts efficient

The need to perceive if the other site have got the information

Interview A (8)

Basic social needs
The need to be able to focus
The need to feel included

Meeting needs
The need to provide the right context for the meeting
The need for good sound
The need to counteract low-monitoring behavior (LMB)

OBSERVATIONS - (OB)

Observation S (1)
Basic social needs (observed):
The ability to capture deictic references and gestures
The need to get and give feedback
The ability to hear with good audio (since one is not using video)
The need of being able to focus
The need to exchange information
The need to capture nonverbal cues
The ability to know when someone is about to speak (so you do not interrupt)

Meeting needs:
The ability to see where the other person is referencing in a document
The ability to generate an artefact together
The need of being able to sketch and write in the same document in real time
The ability to save text from the sketched document in right format

Observation E (2)

Basic social needs:
The need of perceiving when someone is about to speak
The need of hearing what is said
The need of providing an inclusiveness, even for participants arriving late (not noticed now)

Meeting needs:
The need of adding participants to the meetings easy
The need of having technology that easily can aid the user when sharing an artifact
The need of having realistic sound (no echoes)
The need of stopping, asking and presenting each other becomes very apparent

Video observations E (3)

Basic social needs:
The need of getting feedback from others
The need of knowing who is speaking
The need of finding something to focus on when talking
The need to capture deictic movements
The need to hear what is being presented

Meeting needs:
The need for a mediator to initiate the meeting
The need to have a real-time experience with the technology (sound and video synced)
The need for the system to provide a good visual of the other site
The need of presenting all participants
The need of having turn taking
The need of asking questions meanwhile something is presented (now done long after)

Video observations S (4)

Basic social needs:
Need of being able to express verbally

Meeting needs:
Need of taking notes throughout the meeting
Need of being able to ask related questions easy
Need of having an agenda
Need of sharing an artifact
Need of turntaking

Video observations S (5)
Basic social needs:
Feedback from the other persons
Need of being able to focus
The need of feeling included

Meeting needs:
Feedback from the system when something is heard
Turn Taking participation of the meeting
Need of taking notes from what is said
Need of seeing what is presented on the screen
The need to counteract low-monitoring behaviour (LMB)

Observation - Phone conference (6)

Basic social needs:
The need for informality

Meeting needs:
The need to share artifacts
The need to visually display the presented document
The need for good sound

Observation E (7)
Basic social needs:
The need for inclusiveness

Meeting needs:
The need for a clear structure
The need for a mediator
The need to prepare the objective and agenda beforehand for all participants
The need to make the threshold for technology low

Observation E (8)
Basic social needs:
The need of receiving visual feedback (lots of nods and gestures observed)
The need of perceiving nonverbal cues
The need of having a focus when the situation requires it
The need of being able to express ideas
The need of understanding when someone is about to speak

Meeting needs:
The ability to provide a written outcome from the meeting
Counteraction of low monitoring behaviour
The need of turn-taking
The need of sharing an artifact
The need of adding comments to a document

Observation E (9)

Basic social needs
The need to understand when to talk, sensing timing
The need of feedback

Meeting needs
The need of an objective
The need to follow the conversation in the meeting room for the remote parts
The need of a shared artifact
The need of adding comments into a document

Observation E (10)

Basic social needs
The need of inclusiveness
The need of informal small talk, jokes, collaboration, ideas
The need of capturing referencing and gestures for remote sites
The need to counteract low-monitoring behavior (LMB)
The need of being able to express opinion and discussion

Meeting needs
The need of sharing an artifact
The need of adding comments into a document
The need of turn taking
The need of structuring and divisioning of tasks
The need of having a good sound quality
The need to include all parts interactively in the room

2.5 List of requirements

The solution should	Weight
encourage increased informality between participants during meeting	3
encourage high degree of interaction between participants	3
encourage participant curiosity	3
facilitate the user to reach a creative state of mind	3
facilitate the user with a creative environment	3
counteract low-monitoring behaviour and pasitivity	2
encourage short communication loops (2-3 minutes)	2
enabling more effective meetings	3
encourage balanced group dynamics during the meeting	2
be designed to encourage a sense of belonging to the task	2
be designed to encourage a sense of belonging to the group	2
enable space for different individual characteristics	1
enable participants to perceive others' presence, roles and relations	3
facilitate remote meetings	3
be able to connect several sites at once	3
make participants aware of the presence of others	2
make participants aware of whom is communicating	2
be developed for using the same technical aids at different sites	2
be compatible with own device	1
enable consistency between user's mental model and system ability	3
facilitate the user to visually view the entire workspace	3
enable the user to direct the visual focus to a certain point of interest	1
provide user with feedback that the communication has been received	3
facilitate users to track where sound originates from	3
be able to discern the different participants from each other	2
provide the ability to discern non-verbal cues, i.e unspoken content	2
take into account contextual factors that could affect the meeting	1
Within the meeting room context	
encourage meetings to stay within a recommended time frame	1
encourage to not include more than 12 meeting participants at once	2
make all participants aware of the meeting mediator	2
make all participants aware of the meeting agenda	1
make all participants aware of the meeting objectives	2
encourage all participants to introduce themselves	1
encourage evaluation after a completed meeting session	1
adapt to related workflows	3
encourage turn taking during presentations	2
enable managing of artifacts for multi-users	3
Outside the meeting room context	
encourage spontaneous interaction with remote site	3
adapt to related workflows	3

3.1 Workshop 1

23 september
Förbereda: Fika, skär upp bitar och koka kaffe.

Intro:
"Som ni vet skriver vi exjobb för Ericsson och Semcon, för hur man kan förbättra mötessituationer.

Det vi vill ha er hjälp till idag är att ni ska få kika lite på hur man kan kommunicera, och det är ju verkligen inget test av er utan vi vill bara se vad det finns för tankar kring ämnet. Vi kommer dela ut lappar nu där ni ska skriva ner tankar och idéer i fyra olika omgångar kring olika teman som vi kommer beskriv för er innan. Första tre omgångarna är individuella och sista i grupp. Så, då kör vi igång…"

Omgång 1:
"Ni ska skriva ner 3-5 olika sätt att kommunicera genom att endast använda sig av ***Audiella*** *medel och sinnen."*

Omgång 2:
"Ni ska skriva ner 3-5 olika sätt att kommunicera genom att endast använda sig av ***Visuella*** *medel och sinnen."*

Omgång 3:
"Ni ska skriva ner 3-5 olika sätt att kommunicera genom att endast använda sig av ***Taktila*** *medel och sinnen."*

-

Omgång 4:
"Sista omgången går till såhär att ni drar en lapp ur varje hög och försöker kombinera dessa till ett hjälpmedel att använda på distansmöten, alltså att man de olika personer inte delar samma fysiska miljö.

Ni får 1-2 minuter per dragen lapp. Använd gärna papper och penna om ni känner för det!"

…"Tack så himla mycket…"

3.2 Workshop 2

Presentera vårt projekt. Vad vår inriktning är, att vi trycker på informalitet och kreativitet. Mellanmäsnkliga mötet.

Fokus för vårt projekt: att underlätta möten på distans.
Den mötestyp vi inriktar oss på är den som är mest vanligt förekommande..
Vad vi sett är att man förlorar mycket information när man tvingas gå igenom tekniken för att kommunicera...

Start:

1. Skissa ett kommunikationsverktyg. 3 sek, sen skicka vidare papper
2. När det gått x antal rundor, förklara vad ditt papper innebär

Informalitet:

Ta 2 minuter och skriv ner hur man skulle kunna, i ett företag, mötes på ett informellt sätt.

Sedan gå igenom, skulle man kunna överföra detta till en remote situation?
-
Skissa tre produkter som du av någon anledning tycker om (3 minuter)
Vi skriver ner tre problem som ska lösas
(Kommunicera remote, skapa informell stämning, stimulera kreativitet)

3.3 a Use case – ideal case

USE CASE - Remote Status Update meeting - 6 persons (Ideal case)

Actors:

- *Room 1 - Primary*
  1 Mediator, 1 Secretary, 2 Participants
- *Room 2 - Secondary*
  2 Participants
- *Room 3 - Secondary*
  1 Participant

Meeting goal:

To update a project group located at different remote sites to the current project status

Technology provided:

Room 1

Microphone, Video, Projector, Individual computers, tele-conference system

Room 2

Microphone, Video, Projector, Individual computers, tele-conference system

Room 3

Microphone, Video, Projector, Individual computer, tele-conference system

i.e same technological equipment at all sites

Meeting goal:

To update a project group located at different remote sites to the current project status and discuss further work

Assumptions:

No permanent disconnection through technological errors
Carried out in time

Steps:

1. Room 1 meet up at the predefined time in the designated meeting room
   - 1.1 Roles are divisioned
   - 1.2 The agenda and objectives are displayed

2. Room 2-3 calls in to the meeting
   - 2.1 They call with pincode
   - 2.2 They call with user-id through the software
   - 2.3 The different sites have a similar experience of the meeting

3. The mediator presents the agenda and the objective of the meeting
   - 3.1 The mediator uses a shared document to present
   - 3.2 Questions are welcomed

4. Room 1-4 presents their status to the other rooms
   - 4.1 Everyone can see and hear the presenter
   - 4.2 Everyone can see the document presented if so
   - 4.3 Everyone is welcome to ask and show opinion collaboratively

5. Time between presentations
   - 5.1 Questions are asked by all rooms or
   - 5.2 Questions are asked by some or
   - 5.3 No one has something to add and the turn shifts

6. The meeting is wrapped up by the mediator
   - 6.1 The meeting is summarized
   - 6.2 Additional questions are asked
   - 6.3 Ideas for the next meeting is presented

7. The meeting is closed

3.3b Use case – Normal case with user error

USE CASE 2 - Remote Status Update meeting - 17 persons

(Normal case with user errors)

Actors:

Room 1 - Primary
1 Mediator, 1 Secretary, 8 Participants

Room 2 - Secondary
4 Participants

Room 3 - Secondary
2 Participants

Room 4 - Secondary
1 Participant

Technology provided:

Room 1
Microphone, Video, Projector, Individual computers, tele-conference system

Room 2
Microphone, Video, Projector, Individual computers, tele-conference system

Room 3
Microphone, Video, Projector, Individual computer, tele-conference system

i.e same technological equipment at all sites

Meeting goal:
To update a project group located at different remote sites to the current project status

Assumptions:
No permanent disconnection through technological errors

Steps with error alternations:

1 Room 1 meet up at the predefined time in the designated meeting room

1.1. The meeting is delayed
1.1.1 Due to technical errors and/or
1.1.2 Someone is late and/or
1.2 Agenda, roles and/or objective are not prepared
1.2.1 Due to undefined roles
1.2.2 Due to little time
1.2.3 Due to being forgotten

2 Room 2-4 calls in to the meeting

2.1 The video is not working and/or
2.1.1 The network connection is poor
2.1.2 The software needs to be updated
2.1.3 The computer's video is not working
2.2 The sound is not working and/or
2.2.1 The network connection is poor
2.2.2 The software needs to be updated
2.2.3 The computer's mic is not working
2.3 Artifacts are not displayed and/or
2.3.1 The network connection is poor
2.3.2 The software needs to be updated
2.3.3 The computer's program is not working
2.4 The call is not connecting
2.4.1 The pincode is incorrect

2.4.2 The network connection is poor
2.4.3 The software needs to be updated
2.4.4 The computer is not working

3 The mediator opens the meeting

3.1 Room(s) does not hear and/or
3.1.1 The network connection is poor
3.1.2 The software needs update
3.1.3 The audial aids are not working
3.2 Room(s) does not see and/or
3.2.1 The network connection is poor
3.2.2 The software needs update
3.2.3 The visual aids are not working
3.3 Person(s) is not paying attention and/or
3.3.1 The technical aids are not working
3.3.2 There are distractions in the room
3.3.3 The meetings objective is not of concern
3.4 The mediator, agenda and objective is not presented
3.4.1 The assignment is not divisioned beforehand
3.4.2 Only one or two are regarded important
3.4.3 Neither are regarded as important
3.4.3 The agenda is sent out and expected to be read

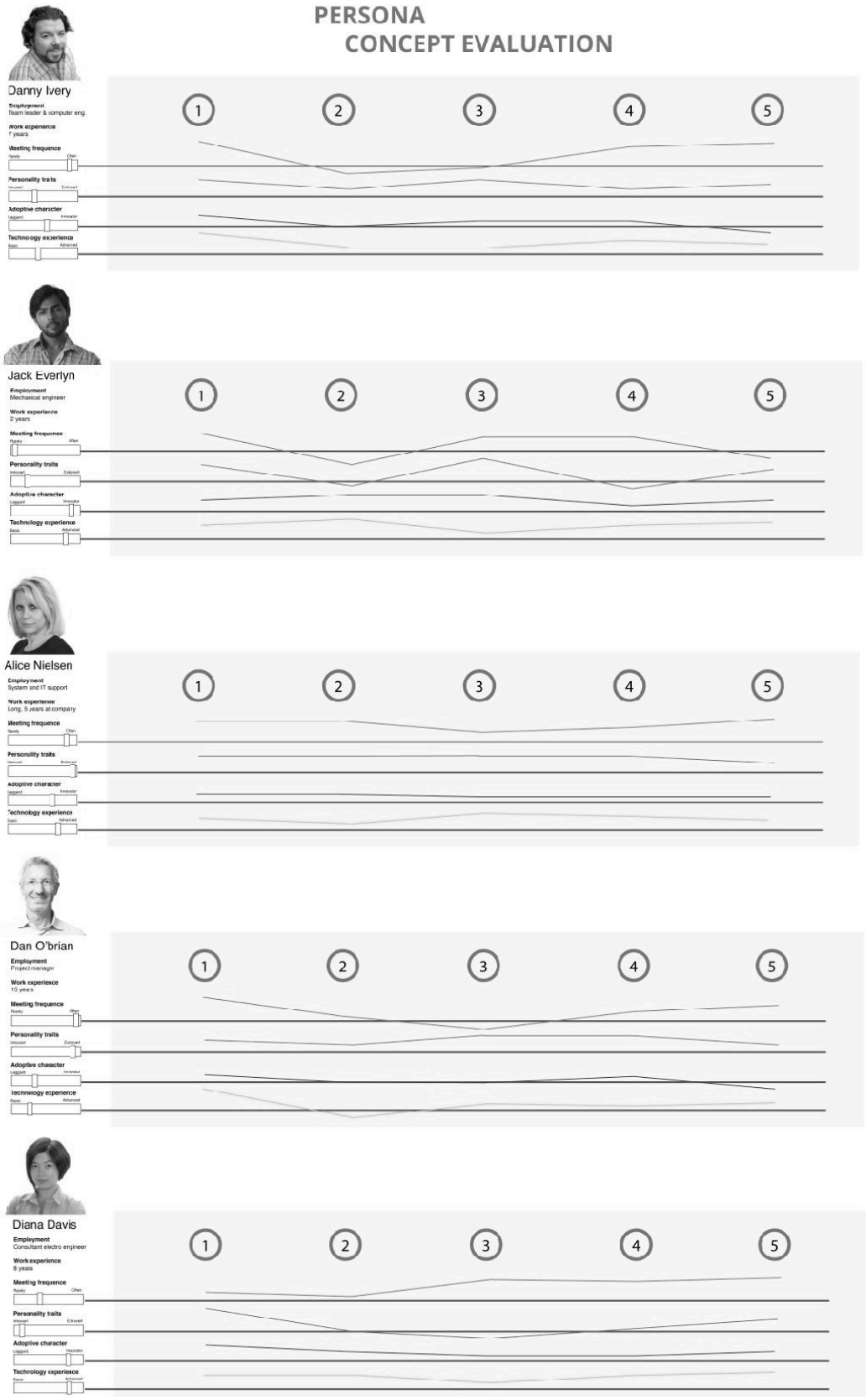
4 Room 1-4 presents their status to the other rooms
4.1 Room(s) do not hear and/or
4.1.1 The auditory aids are not working
4.1.2 The volume is to low
4.1.3 The network connection is to low
4.1.3 The person(s) are lacking attention
4.2 Room(s) do not see and/or
4.2.1 The visual aids are not working
4.2.2 The volume is to low
4.2.3 The network connection is to low
4.2.4 The person(s) are lacking attention
4.3 Artifacts are not displayed
4.3.1 The network connection is to low
4.3.2

5 Time between presentations (either case)
5.1 Questions are asked and/or
5.1.1 People are talking in unison and interrupting
5.1.2 The person(s) with dominant behavior overpower
5.1.3 No visual feedback is given
5.1.4 No audial feedback is given
5.1.5 Sites are left out from inside the room-conversations

5.2 No one has something to add
5.2.1 No visual feedback is given
5.2.2 No audial feedback is given
6 The meeting is wrapped up by the mediator

7 The meeting is closed

3.4 Persona evaluation diagram



3.5 Elimination matrix data

ELIMINATION MATRIX

(a) requirements weighted

	Requirements	Weight	Concept 1	Concept 2	Concept 3	Concept 4	Concept 5
	encourage increased informality between participants during meetings	3	6	3	6	6	6
	encourage high degree of interaction between participants	3	6	6	6	3	6
	encourage participant curiosity	3	3	6	6	6	6
	facilitate the user to reach a creative state of mind	3	3	6	0	6	6
	facilitate the user with a creative environment	3	3	3	3	6	6
	counteract low-monitoring behaviour and pasitivity	2	4	4	0	2	4
	encourage short communication loops (2-3 minutes)	2	4	2	4	2	4
	enabling more effective meetings	3	6	6	3	3	6
	encourage balanced group dynamics during the meeting	2	4	0	0	2	2
	be designed to encourage a sense of belonging to the task	2	4	4	2	2	2
	be designed to encourage a sense of belonging to the group	2	4	4	4	4	2
	enable space for different individual characteristics	1	2	1	2	0	1
	enable participants to perceive others' presence, roles and relations	3	6	3	3	6	6
	facilitate remote meetings	3	6	6	6	6	6
	be able to connect several sites at once	3	6	6	6	6	6
	make participants aware of the presence of others	2	4	2	4	4	4
	make participants aware of whom is communicating	2	4	4	4	4	4
	be developed for using the same technical aids at different sites	2	4	2	4	4	2
	be compatible with own device	1	2	2	2	0	1
	enable consistency between user's mental model and system ability	3	6	6	3	6	6
	facilitate the user to visually view the entire workspace	3	6	6	0	6	6
	enable the user to direct the visual focus to a certain point of interest	1	2	2	2	2	2
	provide user with feedback that the communication has been received	3	6	3	6	3	3
	facilitate users to track where sound originates from	3	3	3	6	3	3
	be able to discern the different participants from each other	2	4	4	4	4	4
	provide the ability to discern non-verbal cues, i.e unspoken content	2	4	2	4	4	2
	take into account contextual factors that could affect the meeting	1	0	0	2	2	2
		Part score:	**112**	**96**	**92**	**102**	**108**
	Within the meeting room context						
	encourage meetings to stay within a recommended time frame	1	2	1	-	-	-
	encourage to not include more than 12 meeting participants at once	2	4	4	-	-	-
	make all participants aware of the meeting mediator	2	4	2	-	-	-
	make all participants aware of the meeting agenda	1	2	1	-	-	-
	make all participants aware of the meeting objectives	2	4	2	-	-	-
	encourage all participants to introduce themselves	1	2	1	-	-	-
	encourage evaluation after a completed meeting session	1	2	1	-	-	-
	adapt to related workflows	3	6	6	-	-	-
	encourage turn taking during presentations	2	4	2	-	-	-
	enable managing of artifacts for multi-users	3	6	6	-	-	-
		Part score:	**36**	**26**	-	-	-
	Outside the meeting room context						
	encourage spontaneous interaction with remote site	3	-	-	6	6	3
	adapt to related workflows	3	-	-	3	6	6
		Part score	-	-	**9**	**12**	**9**
		Total mean score:	**4**	**3.297297297**	**3.482758621**	**3.931034483**	**4.034482759**

(b) Stakeholders weighted

	Expressed interests:	Weight	Concept 1	Concept 2	Concept 3	Concept 4	Concept 5
	Interaction des: Technology based research, New technology driven	1	0	2	0	1	1
	PPU: Master thesis requirements, methodology based	3	6	6	6	6	6
	Semcon: Support Merco, UX, user perspective, research knowledge	3	6	3	0	6	3
	Ericsson: Support Merco, user perspective and own profit (commercial value)	3	6	3	0	3	3
	Spree: Support Merco, inclusiveness, own profit (commercial value, show piece)	2	2	4	0	4	0
	Merco: Two new collaboration systems in hardware and software, strong laun	2	2	4	0	4	2
	Weighted total score:		**3.666666667**	**3.666666667**	**1**	**4**	**2.5**

(c) PhD interest weighted

	Expressed interests:	Weight	Concept 1	Concept 2	Concept 3	Concept 4	Concept 5
	Facilitate brainstorming session	3	6	6	0	6	6
	Using multiple devices	2	4	4	2	2	4
	Related user focus	3	3	3	0	6	6
	Technology based on smart board	1	0	0	0	0	2
	Ability to strengthen research	2	4	2	0	2	2
	Related to context	3	3	3	0	3	3
	Weighted mean value		**3.333333333**	**3**	**0.3333333333**	**3.166666667**	**3.833333333**

(d) Realizable weighted

	With regards to:	Weight	Concept 1	Concept 2	Concept 3	Concept 4	Concept 5
	Direct investment	2	4	2	4	2	2
	Continous investment (maintenance)	3	6	6	6	3	3
	Available technology	2	4	4	4	2	2
	User adoptability	3	6	6	3	6	3
	Weighted mean value		**5**	**4.5**	**4.25**	**3.25**	**2.5**

(e) Project timeframe

	With regards to:	Weight	Concept 1	Concept 2	Concept 3	Concept 4	Concept 5
	Process	3	6	6	3	6	3
	Prototyping	2	4	4	2	4	0
	Project outcome	3	6	6	3	3	6
	Weighted total score		**5.333333333**	**5.333333333**	**2.666666667**	**4.333333333**	**3**

4.1 Use case scenario

Interactions	User need	User needs from system	System answer	Ideas for functions
One site call in				
	Knowledge of where and when to meet	System providing information	Tools for displaying the content	Display of booked rooms, calendar appointments
				and timezone in the interface
	Knowledge of meeting outcome	System providing information	Tools for displaying the content	Display of objective for the meeting, the mediator
				and the agenda in the interface
Other meeting sites connect				
	Possibility to connect individually	System providing interaction	Tools for indentification	Individual id displayed in the interface
	Ability to indentify other users	System providing information	Tools for indentification	Individual id displayed in the interface
The meeting starts				
	indication that all users are connected	System providing information	Tools for indentification	Indication of online persons
	Indication that the meeting is starting	System providing information	Tools for awareness	Mediator responsibility to announce the meeting
Sites communicate with other sites				
	Ability to perceive communication	System providing information	Tools for displaying the content	Users able to connect to the same virtual meeting room
		and interaction		Users able to switch between important functions and tools with ease
Time between communication acts				
	Ability to raise oppinion	System providing information	Tools for sharing opinion	Users can raise hands, take a vote, indicare questions
		and interaction		
	Ability to know when to communicate	System providing information	Tools indicating when to interact	Arrange the agenda in time line,
				the system displays the speaker, users get feedback who is speaking
The meeting is wrapped up	Ability to know when the meeting is done	System providing information	Tools for guidance	The system provides a timeline of the meeting
				the mediator wraps up the meeting
The meeting is closed	Ability to know how to disconnect	System providing information		The system displays how to disconnect
		and interaction		

4.2 Concept evaluation based on frameworks

	Level of achievement (1-5)	Achieved framework/enabler (Nr. from original list):
Function 1 - Visualization of participant:		
Informality enablers	4	2. The solution should provide a uniform experience for the participants, regardless of used technology. (and location)
	5	3. The solution should encourage balanced group dynamics during the meeting and create a sense of belonging to the group and task, with equal focus on the different sites.
	5	4. The solution should enable space for the different individual characteristics to express themselves and counteract individual low-monitoring behaviour.
Communication framework (Cao, Östin 2015)	5	1. Presence, roles and relations – design should support perceiving others' presence, roles and relations to each other.
	4	6. Gesturing (non reference) – design should enable watching of other participants body movements and non-verbal cues.
	4	7. Referencing – design should facilitate use of deictic and representational references as well as awareness of any artifact in workspace that is referenced.
	4	8. Grounding information – all meeting participants should be able to perceive from confirmation from other participants so that they know that their communication has been perceived and understood.
	2	9. Eye contact – participants should be able to make eye contact with each other.
Function 2 - Real time edit of artifacts:		
Informality enablers	4	2. The solution should provide a uniform experience for the participants, regardless of used technology. (and location)
	5	3. The solution should encourage balanced group dynamics during the meeting and create a sense of belonging to the group and task, with equal focus on the different sites.
	5	4. The solution should enable space for the different individual characteristics to express themselves and counteract individual low-monitoring behaviour.
	4	6. The solution should encourage the user to express and receive emotions dynamically, meaning both negative and positive feelings are revealed in a natural manner.
	5	8. The solution should enable some degree of spontaneous interaction in order to enable better formal ties with collaborative parts.
Communication framework (Cao, Östin 2015)	3	1. Presence, roles and relations -
	5	2. Accessibility and
	5	3. Visual view - The design should facilitate sufficient means to visually view the entire workspace.
	4	7. Referencing – design should facilitate use of deictic and representational references as well as awareness of any artifact in workspace that is referenced.
	5	10. Artifacts manipulation - Design should facilitate full view and equal ability to manipulate artifacts to all meeting participants. They should also equally be able to perceive artifact manipulation by others and its effects.
Function 3 - Documentation of the meeting:		
Informality enablers	4	7. The solution should enable the establishment of a common ground and thereby knowledge and information transfer in an informal way.
	4	8. The solution should enable some degree of spontaneous interaction in order to enable better formal ties with collaborative parts.
Communication framework (Cao, Östin 2015)	5	2. Accessibility and adaption – design should provide easy accessibility of use and adapt to workflows found in companies and meetings.
	5	5. Verbal communication – should support explicit as well as implicit verbal communication.
	1	8. Grounding information - All meeting participants should be able to perceive confirmation from other participants so that they know that their communication has been perceived and understood.
Function 4 - Use of business emojis:		
Informality enablers	3	2. The solution should provide a uniform experience for the participants, regardless of used technology. (and location)
	4	5. The solution should provide intuitive use functions with focus on providing a consistency between the user mental model and system ability.
	5	6. The solution should encourage the user to express and receive emotions dynamically, meaning both negative and positive feelings are revealed in a natural manner.
Communication framework (Cao, Östin 2015)	5	2. Accessibility and adaption – design should provide easy accessibility of use and adapt to workflows found in companies and meetings.
	3	8. Grounding information
Function 5 - Use of communication symbols:		
Informality enablers	4	2. The solution should provide a uniform experience for the participants, regardless of used technology. (and location)
	5	4. The solution should enable space for the different individual characteristics to express themselves and counteract individual low-monitoring behaviour.
	4	5. The solution should provide intuitive use functions with focus on providing a consistency between the user mental model and system ability.
	5	6. The solution should encourage the user to express and receive emotions dynamically, meaning both negative and positive feelings are revealed in a natural manner.
	5	8. The solution should enable some degree of spontaneous interaction in order to enable better formal ties with collaborative parts.
Communication framework (Cao, Östin 2015)	3	2. Accessibility and adaption – design should provide easy accessibility of use and adapt to workflows found in companies and meetings.
	3	4. Origin of sound - Design should facilitate sufficient means for participants to track where sounds originate from, and they should be able to perceive that they are being heard.
	5	8. Grounding information
Function 6 - Generating a coherent meeting experience		
Informality enablers	4	1. The solution should enable the participant to set the appropriate degree of pre definition that the specific meeting requires, in terms of meeting type and structure.
	5	2. The solution should provide a uniform experience for the participants, regardless of used technology. (and location)
	5	5. The solution should provide intuitive use functions with focus on providing a consistency between the user mental model and system ability.
	2	9. The solution should facilitate the user to influence the surrounding meeting environment to create the optimal meeting room context.
Communication framework (Cao, Östin 2015)	3	2. Accessibility and adaption – design should provide easy accessibility of use and adapt to workflows found in companies and meetings.
	4	5. Verbal communication – Design should support explicit- as well as implicit verbal communication.
	5	8. Grounding information – all meeting participants should be able to perceive from confirmation from other participants so that they know that their communication has been perceived and understood.
	2	9. Eye contact – participants should be able to make eye contact with each other.

4.3 Emotional word scale evaluation

Your overall impression of the experience

Active Passive

Collaborative Individual

Exciting Neutral

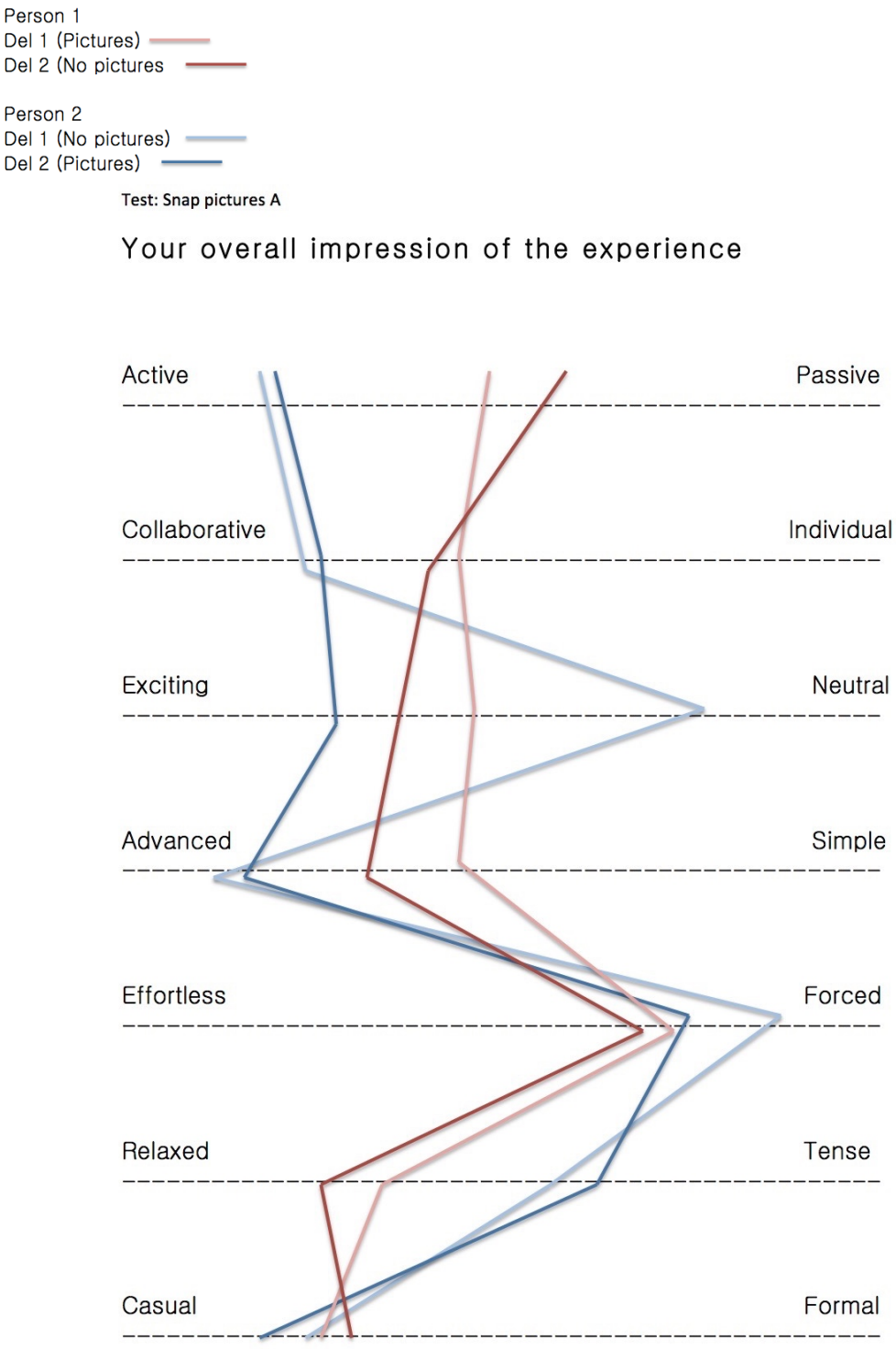
Advanced Simple

Effortless Forced

Relaxed Tense

Casual Formal

4.4 Emotional word scale evaluation

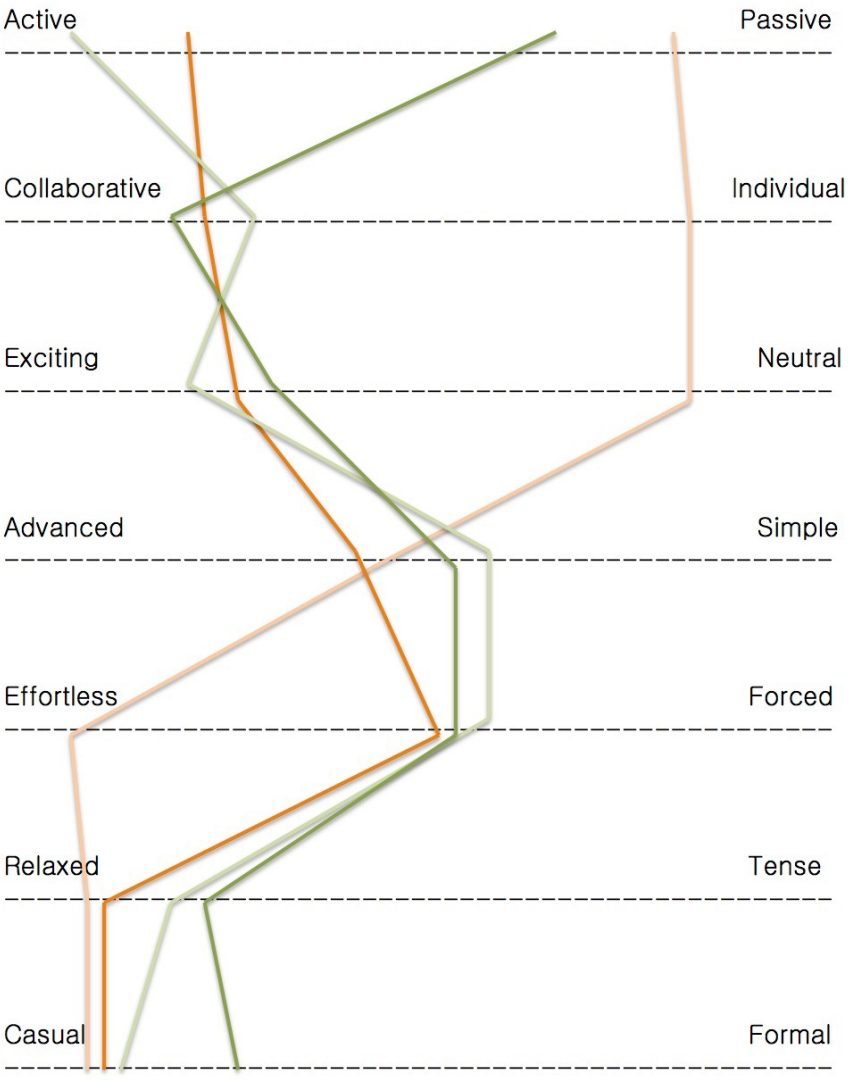


Person 1
Del 1: (pictures)
Del 2: (no pictures)

Person 2
Del 1: (no pictures)
Del 2: (pictures)

Test: Snap pictures – B

Your overall impression of the experience

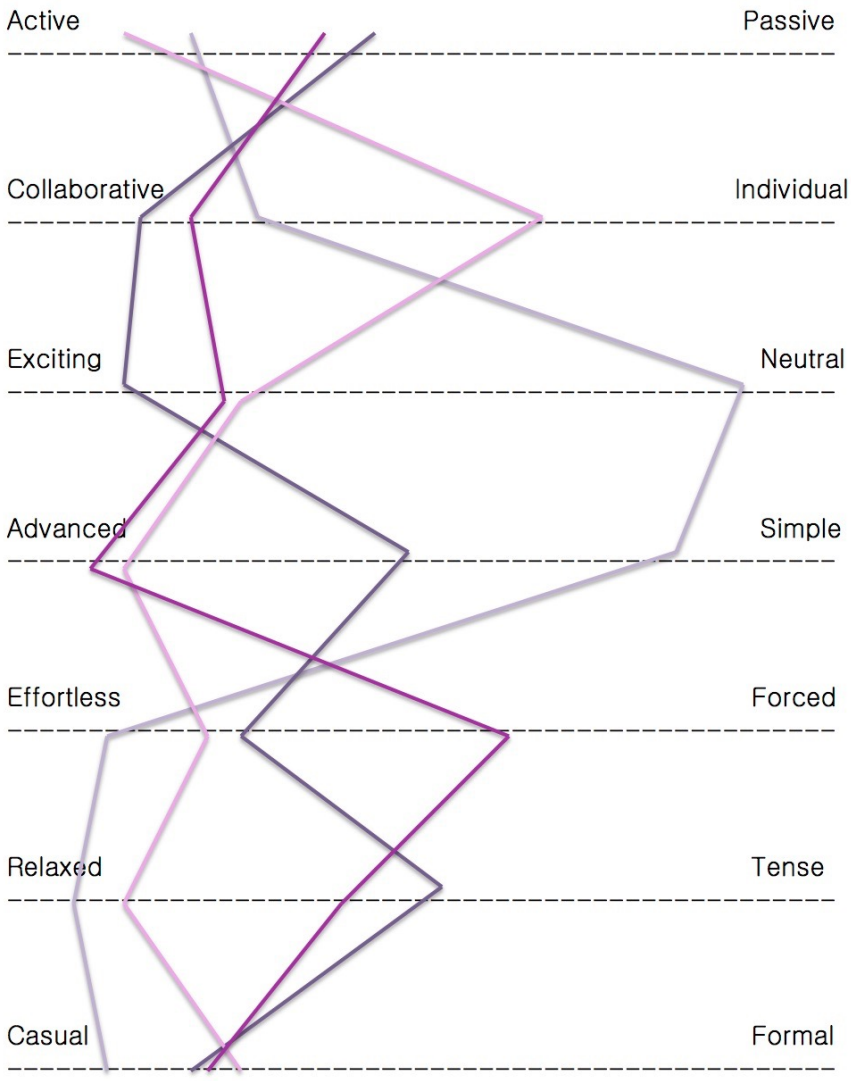


Person 1
Del 1: (pictures)
Del 2: (no pictures)

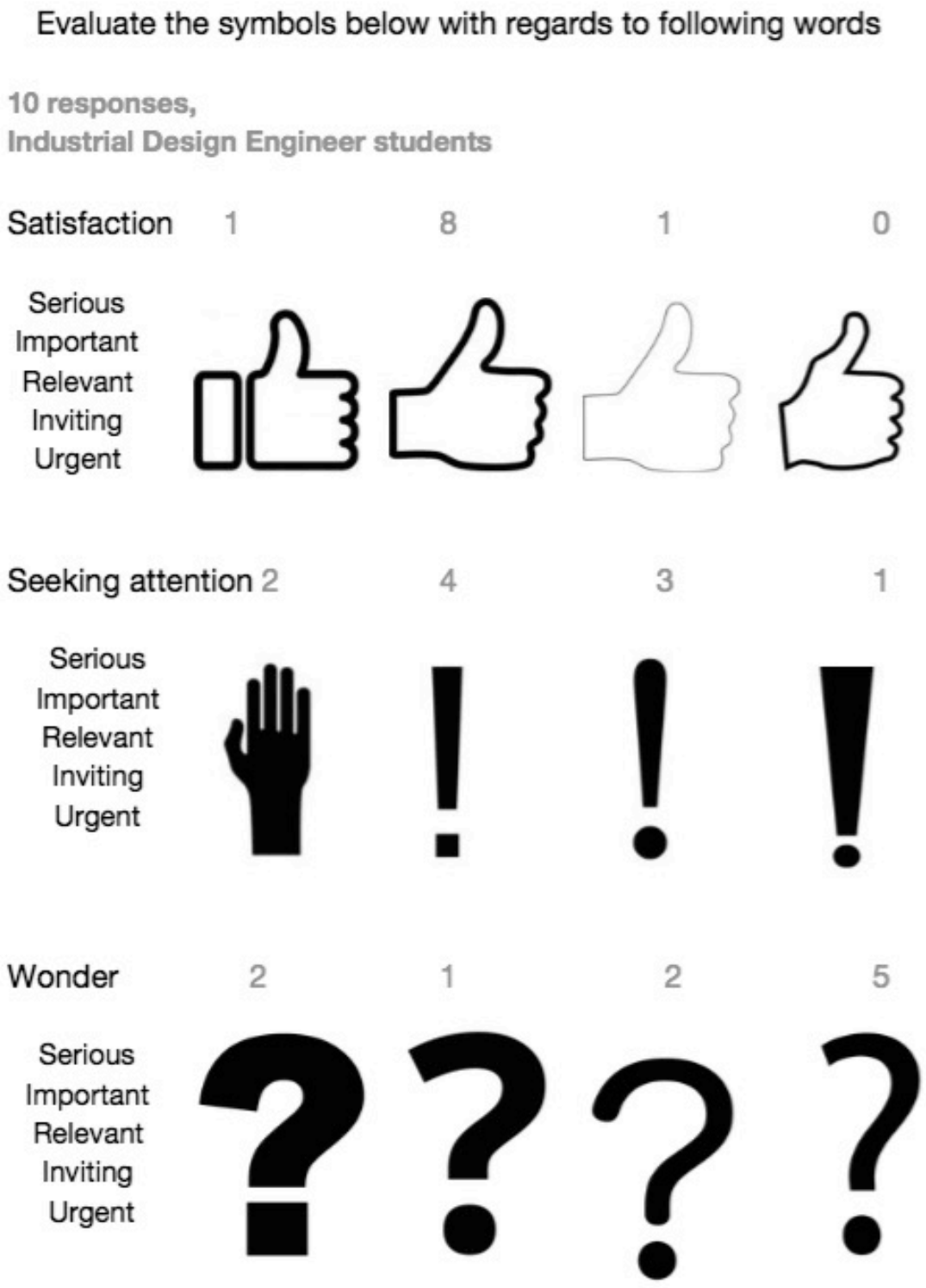
Person 2
Del 1: (no pictures)
Del 2: (pictures)

Test: Snap pictures – C

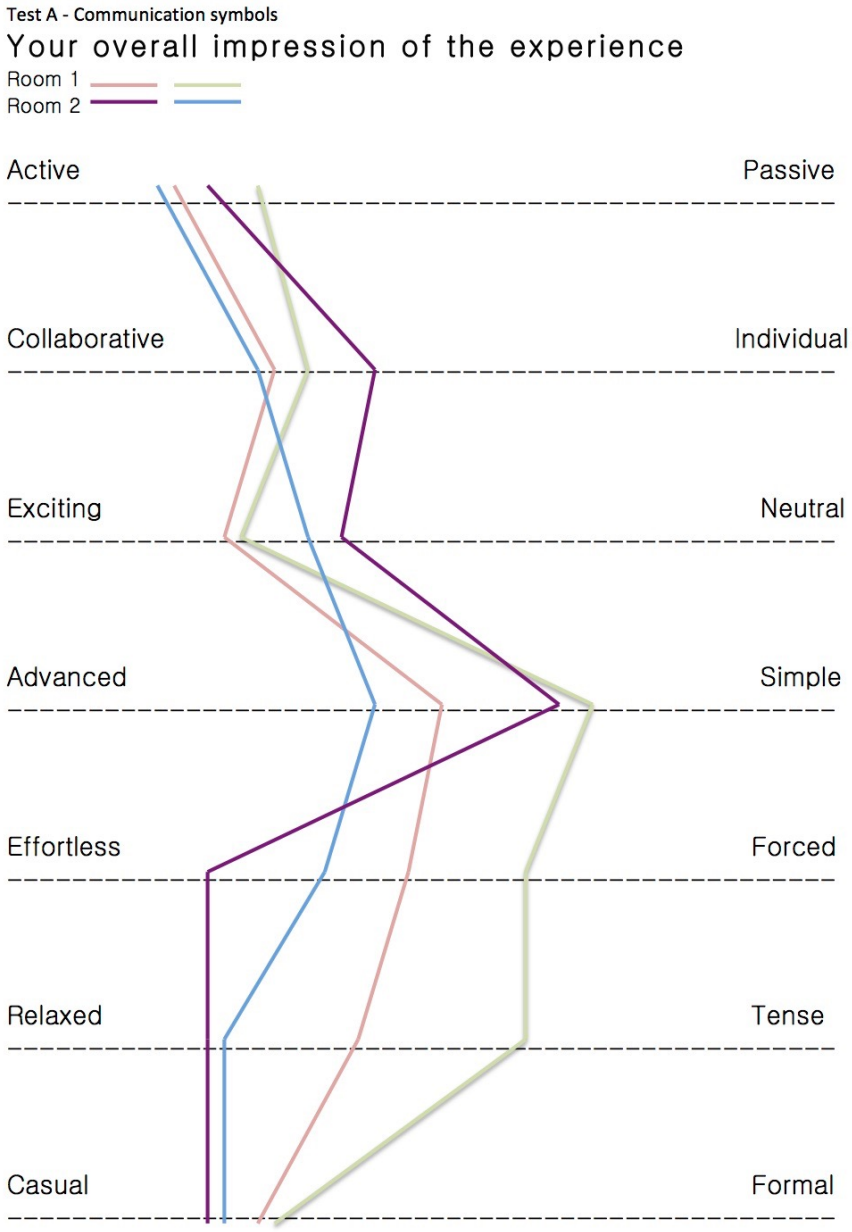
Your overall impression of the experience

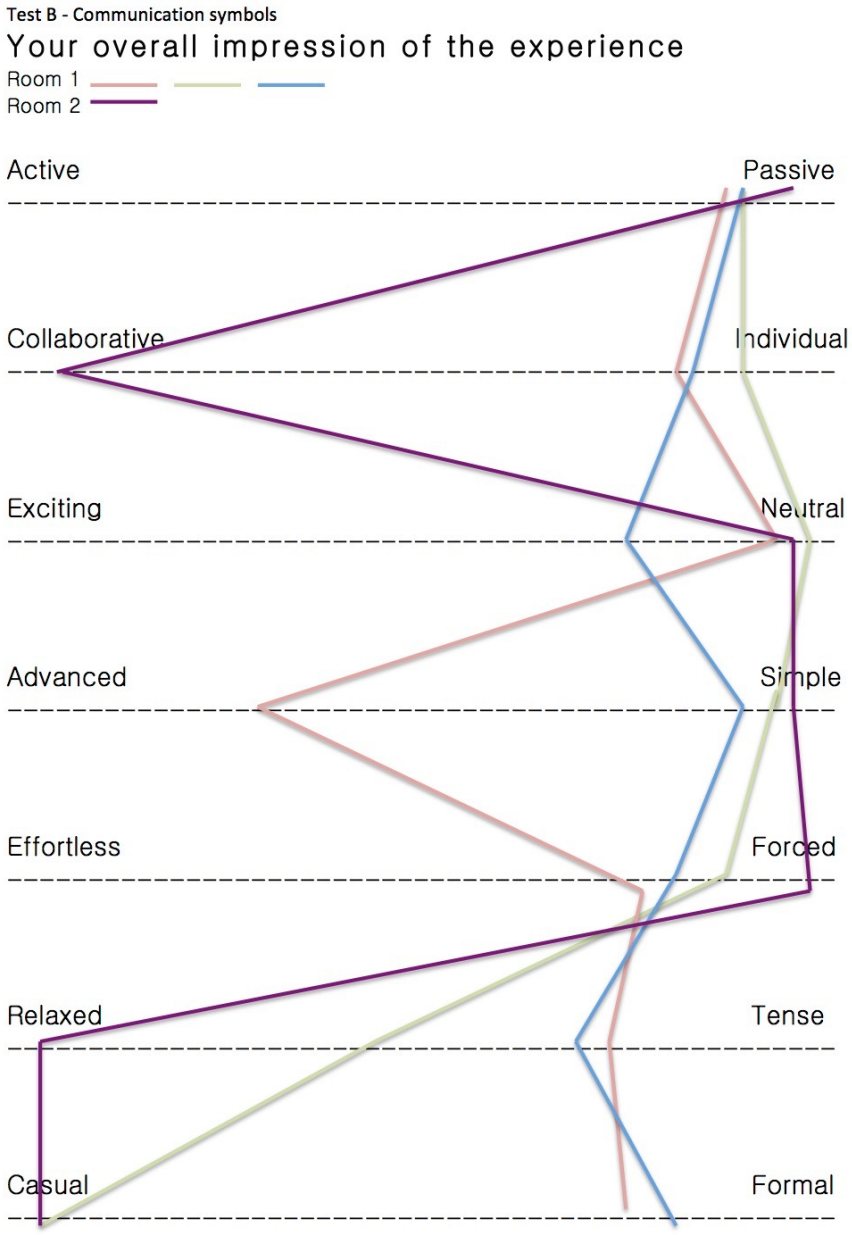


4.5 Evaluation of symbols



4.6 User test of communication symbols




Test B - Communication symbols
Your overall impression of the experience
Room 1
Room 2
Active
Passive
Collaborative
Individual
Exciting
Neutral
Advanced
Simple
Effortless
Forced
Relaxed
Tense
Casual
Formal

4.7 User experience from observation 10

Interview questions:

Person 1: (meeting room mediator)

Was the meeting satisfactory?
Yes

Did you miss any functions?
Yes I missed being able to satisfy the person who was calling into the meeting through his cell phone. I know how excluding that can be.

Person 2: (remote participant)

Was the meeting satisfactory?
Absolutely not. Mostly out of two reasons: the context were missing and I could not be entirely attentive. I had a lot of other input, there were to many channels around. ”I would like to close my eyes and imagine the meeting room in order to feel present in the context”.
It was a bad sound, so I could not hear what the others were saying which also impacted the experience and made the meeting harder to conduct.

Did you miss any functions?
Yes, the part of bringing attention to the meeting. Even if it is not a technical function I missed the function of just being able to focus and be attentive. It was hard to break into the conversation, which made me very passive.

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