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The Relationship between Task, Culture and Communication Technology in Virtual Collaboration

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The Relationship between Task, Culture and Communication Technology in Virtual Collaboration

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Life is a journey and this thesis in front of you is a milestone in mine.

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Abstract

Virtual collaboration is a growing trend and characterized by computer mediated communication and high cultural diversity (Clear & MacDonell, 2011). Because of its composition, virtual collaboration is exposed to several challenges which prejudice the performance (Hollingshead, McGrath, & O'Connor, 1993). Team effectiveness and performance can be improved by a good fit between task and communication technologies (Beise, Carte, Vician, & Chidambaram, 2010).

This study is aimed to learn more about how the choice of technology is related to the different tasks in virtual collaboration. An additional aim is to better understand the influence of culture on this relationship.

A qualitative research method was implemented by conducting interviews, via communication technologies, with participants from various cultural backgrounds who are involved in virtual collaboration. The interviews were transcribed prior to the data analysis phase, where the data were coded based on content using a semi-inductive interpretation method.

Based on the results a clear relationship between the task and technology choice was confirmed. Routine or support tasks, are mainly executed through asynchronous communication tools that offer information richness. For non-routine tasks, which require synchronous communication technologies, the media richness and social presence that the technologies offer is more important. For building and maintaining relationships a variation in use between the various technologies is essential, since all technologies contribute in their own way to building and maintaining relationships.

Cultural dimensions limited impact the task-technology relationship, which can be explained by a low awareness of cultural diversity among the participants. When considerable time differences or a gap in infrastructure exist, this can have a big impact on the choice of technology, because technologies get useless. The language barrier affects the task in the sense that more accuracy or interactivity can be required, leading to increased use of complementary technologies.

Keywords: Virtual collaboration, virtual teams, task, technology, culture, cultural diversity.

Resumo

A colaboração virtual é uma tendência crescente, caracterizada pela comunicação mediada por computador e diversidade cultural (Clear & MacDonell, 2011). Devido à sua composição, a colaboração virtual é uma forma de trabalhar exposta a vários desafios, prejudicando o desempenho (Hollingshead, McGrath, & O'Connor, 1993). A eficácia e o desempenho das equipas podem ser melhorados através do ajuste entre as tecnologias de comunicação e a tarefa (Beise, Carte, Vician, & Chidambaram, 2010).

Este estudo tem como objetivo saber mais sobre a escolha de tecnologia em relação com as diferentes tarefas na colaboração virtual. Um objetivo adicional é entender melhor a influência da cultura nesta relação.

Um método de investigação qualitativa foi implementado através da realização de entrevistas, via tecnologias de comunicação, com participantes de várias culturas estando ativamente envolvidos em colaboração virtual. As entrevistas foram transcritas antes da fase de análise de dados, onde os dados foram codificados com base no conteúdo usando um método de interpretação semi-indutivo.

Os resultados deste estudo mostram que a tarefa e a escolha da tecnologia estão claramente relacionados. Tarefas rotineiras ou de apoio são executadas principalmente por ferramentas de comunicação assíncrona que oferecem uma riqueza de informações. Para tarefas não rotineiras síncrona, a riqueza dos media e presença social são importante. Para construir e manter relacionamentos, uma conjugação entre as diversas tecnologias é essencial, dado que as tecnologias contribuem na sua própria maneira para isso.

As dimensões culturais não afetam drasticamente a relação tarefa-tecnologia, podendo isto ser explicado por uma baixa consciência da diversidade cultural entre os participantes. Quando existem grandes diferenças temporais ou lacunas na infraestrutura pode haver um grande impacto nesta escolha, porque as tecnologias tornam-se inúteis. A barreira da língua afeta a tarefa de tal forma que pode ser necessária mais precisão ou interatividade, levando ao aumento do uso de tecnologias complementares.

Palavras-chave: Colaboração virtual, equipas virtuais, tarefa, tecnologia, cultura, diversidade cultural.

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1. Introduction

In the past decades the collaboration between time and location dispersed team members who communicate using technologies has grown tremendously. Due to globalization and the effects of the financial crises, virtual collaboration became even more important (Clear & MacDonell, 2011). Because of their composition, virtual teams are confronted with more challenges than face to face collaborations. This can influence team effectiveness (Hollingshead, McGrath, & O'Connor, 1993).

A good fit between task and technology can have a positive effect on team performance and effectiveness (Beise, Carte, Vician, & Chidambaram, 2010). However, the ideal fit of technology-task for virtual collaboration, both in models and implemented in vivo, is far from achieved (Goodhue, 2006; Zigurs & Khazanhi, 2008). To improve the understanding of this fit, this qualitative research focused on the task technology relationship in virtual collaboration using first hand experiences.

To better align the fit with the reality of virtual collaboration and fill a gap left by current literature, two critical aspects were evaluated with special attention. The first is building and maintaining relationships, which is a challenging task in virtual collaboration because of its dispersed character and the computer mediated communication. Members in virtual teams can feel isolated and disconnected and trust may seem hard to establish (Kimble, 2011; Shachaf, 2008). Another challenge that influences the communication is the high degree of cultural diversity that usually characterizes virtual collaboration (Shachaf, 2008). To adjust a task-technology fit to the reality of virtual teams, it is important to know how such an important aspect of virtual collaboration influences this relationship.

In order to get more insight in a task-technology fit that is consistent with the complex environment in which virtual collaboration takes places, the next two questions were central in this research.

1. How is the choice of technology related to the different tasks in virtual collaboration?
2. What is the influence of culture on the relationship between communication technology and task?

Virtual collaboration is becoming part of the work context of an increasing number of people. From the perspective of work and organizational psychology it is important to collect information about this emerging way of working to understand its effects on employees and work circumstances. This research focused on the communication in virtual collaboration and the gathered information can be used to promote the well-being and effectiveness of individuals and groups working in virtual teams. Work and organizational psychology also aims to improve facilitating conditions in the work environment. The results of this research can contribute to the improvement of facilitating conditions within the virtual work environment.

For the review and investigation of the relationship between technology, task and cultural diversity in virtual collaboration, this thesis consists of six different chapters, started with this introduction.

In the second chapter, the theoretical framework gives an introduction to the relevant topics. First the concept of virtual teams is described, followed by the types of tasks and the concept of trust in virtual collaboration. Next, communication in virtual collaboration is addressed and the dimensions and technologies of the communication are presented. In the next part the models and studies relating technology and task in virtual collaboration are discussed, including a task-technology matrix that lies at the basis of this research. The last concept that is elaborated in the theoretical framework is cultural diversity.

The chapter corresponding to the methodology is chapter three in which the methodological choices are addressed. After the presentation of the research question, the participants are described. Then the research instruments and procedures for data collection and data analyses are explored.

The fourth chapter is dedicated to the analysis and discussion of the results. The general data are presented using the coding schema and results are analysed and discussed using the review of literature presented in chapter two.

In chapter five these results are discussed more profoundly in order to find relationship between the three main topics; technology, task and culture. Analyzing and discussing these results led to answers for the research questions.

Finally, the main conclusions of the study are presented. A brief overview of proposed future research and limitations of this study is also given.

2. Theoretical framework

2.1. Virtual teams

In 1986 Miles and Snow refer to the virtual team as an evolutionary form of a network organization. In modern days virtual teams are an integrated part of globally dispersed organizations. Originally, in both traditional and virtual contexts, the words 'group' and 'team' were used to refer to the same concept (Powell, Piccoli, & Ives, 2004). In recent literature the two words are not interchangeable anymore. The word team is used according to the widely accepted definition of Cohen and Baily (1997, p. 241):

“A team is a collection of individuals who are interdependent in their tasks, who share responsibility for outcomes, who see themselves and who are seen by others as an intact social entity embedded in one or more larger social systems, and who manage their relationship across organizational boundaries.”

A virtual team therefore also has these characteristic, but distinguishes itself from traditional teams on several aspects. According to Jarvenpaa and Leidner (1998) a virtual team is culturally diverse, which rely heavily on electronically communication to overcome geographical dispersion and is temporary, in the sense that the members did not work together in a group nor expect to work together in the future. Powell et al. (2004, p. 7) define virtual teams as “groups of geographically, organizationally and/or time dispersed workers brought together by information and telecommunication technologies to accomplish one or more organizational task.” In this research these two definitions are combined leading to the following definition of a virtual team: a group of geographically, organizationally and/or time dispersed workers, often from different cultural backgrounds that work together, relying heavily on computer mediated communication, to accomplish one or more organizational tasks (Jarvenpaa & Leidner, 1998; Powell et al., 2004).

Virtual collaboration offers several benefits to organizations. Virtual teams facilitate fast response to demands of a globalized market, can be in contact with experts worldwide and are adaptable to changing conditions of the environment and complexity of the task. Virtual teams can also lead to more constructive dialogues, more knowledge and a more profound processing of content due to the diverse character of its members (Liu, Magjuka, & Lee, 2008; Quinn, 1992). Besides the advantages of these virtual teams, working virtually also brings about some risks and challenges. Reed and Knight (2010) investigated the project risk differences between face-to-face and virtual teams and discovered that virtual teams have a significant greater risk on seven of the 55 risk factors included in their research. The elevated risks for virtual teams include insufficient knowledge transfer, lack of project team cohesion, cultural or language differences, inadequate technical resources, inexperience with the company and its processes, loss of key resource(s), and hidden agendas. Communication is considered to be one of the main challenges for virtual teams, caused by the lack of face-to-face

contact, space-time dispersion and team diversity (Quinn, 1992). Complexity, increased isolation and a less-structured environment are three barriers for successful virtual partnership indicated by Workman, Kahnweiler and Bommer (2001).

2.2. Task

An important factor in the study of virtual teams is the task, because it has an essential influence on the dynamics and results of a team. There are several typologies about tasks with criteria such as cognitive versus physical requirements, the requirements of collaboration or interdependence (Shaw, 1973; Steiner, 1972). The typology of McGrath (1984) is a theory that is used in various studies about computer mediated communication (Daly, 1993; DeSanctis & Gallupe, 1987). McGrath divides the tasks in various categories, based on the two dimensions conflict versus cooperation and conceptual versus behavioral which results in four basic processes. The first process is 'generate', which refers to the process and need of generating new ideas or plans. The choosing task is about selecting the right or most preferable option. The negotiating task has resolving conflicts of interest that are the result of topics where facts, values and attitudes can be contradictory, as its focus. The last category, execute, is often not included in studies and literature about virtual teams. For, computer mediated collaboration does not offer the possibility to execute tasks because of the lack of psychomotor tasks.

Driskell, Hogan and Salas (1987) made a classification of the task based on the primary behavior requirements or activities of team members. The theory distinguished six group tasks requirement categories: mechanical/technical, intellectual/analytic, imaginative/aesthetic, social, manipulative/persuasive and logical/precision. Daft and Lengel (1986) made an important contribution to the literature about tasks with their classification based on two dimensions; uncertainty and equivocality. Uncertainty represents the difference between the information needed to execute a task and the information available. The bigger the gap, the higher the uncertainty. Equivocality refers to the ambiguity of the task: the extent to which various interpretations of the context of the task exist (Naik & Kim, 2010). This ambiguity is also represented in the negotiation task in McGrath's (1984) typology. Tasks can also be classified using the dimension of difficulty. In this dimension the relative degree to which the members of a team have to make a mental effort to find a solution for the problem, defines the difficulty of the task (Driskell & Salas, 2006).

A categorization of the tasks that is used in literature about conflict is the distinction between routine and non-routine tasks (De Dreu & Weingart, 2003). Seen from a behavioral approach, routines are regularities in behavior where patterns of interaction are repeated (Becker, 2005). Between organizations the description of a routine may vary but, in general, routine tasks are seen as tasks whereof the results are already clear at the beginning of the process. The process itself is already

operationalized by standard procedures, which are recurrent in a certain amount of time and are often executed sequentially. Non-routine tasks are more complex tasks which do not have a pre-defined solution. These tasks do not have a clear structure and the teams' interaction is needed to resolve the task in a complex and uncertain process (De Dreu & Weingart, 2003; Smedlund & Choi, 2009).

Duarte and Snyder (2001) are specialized in the context of virtual team collaborations and differentiate four types of tasks, including the routine and non-routine tasks. Besides these, they distinguish between two other kinds of tasks that teams work on. The first is the task that initiates collaboration: "generating ideas and plans about team's work, including collecting data to make decision about plans." (Duarte & Snyder, 2001, p. 27). The second team task Duarte and Snyder distinguish is the interaction between team members in a situation of conflict, which can be interpersonal as well as technical.

2.2.1. Trust

For virtual teams that are geographically dispersed, trust is an essential part of collaboration because it can be seen as glue that holds the team together and drives a team to the completion of the project (Sarker, Lau, & Sahay, 2001). Trust that exists between the members of a team is defined as "the extent to which a person is confident in, and willing to act on the basis of the words, actions, and decisions of another" (McAllister, 1995, p.25). Trust is very multifaceted and includes beliefs, expectation, values, attitudes and emotions of team members. Because of this complexity, the virtual environment does not seem the ideal place to establish trust (Jarvenpaa, Knoll, & Leidner, 1998; Holton, 2001). The success of virtual teams is challenged by many factors, such as the dispersed character (O'Leary & Cummings, 2007), the limitations of receiving context cues (Daft & Lengel, 1986; Short, Williams, & Christie, 1976) and the complexity of computer mediated communication (Jarvenpaa & Leidner, 1998; Paul & McDaniel, 2004). Despite the fact that the virtual context might not be considered ideal for the development of trust, in this context trust is an essential and indispensable factor to achieve team effectiveness (Jarvenpaa, Shaw, & Staples, 2004). The development of trust is essential for virtual teams that deal with these challenges, because trust can help to control behavior and responses of team members (Dirks & Ferrin, 2001). Trust helps the team to stay together (O'Hara-Deveraux & Johansen, 1994) and affects the teams' effectiveness in both a direct and mediated way (Jarvenpaa et al., 2004).

Trust is based on various components and these components can lead to different kinds of trust. Greenberg, Greenberg and Antonucci (2007) distinguished cognitive and affective trust. Cognitive trust is based on rational or calculative inputs, such as a person's integrity and ability. Affective trust is founded on emotional ties, which are the result of interpersonal relationships where one person shows sincere care and concern for the other person's well-being. The component that is assessed for the level of trust is benevolence. A trustworthy person is described as honest, able and

caring (Greenberg et al., 2007). In the virtual setting the possibilities we have to get to know each other and to evaluate each other's trustworthiness are limited because of the fact that virtual team members almost never or never meet each other in person (Greenberg et al., 2007; MacDonough, Kahn, & Barczak, 2001; Naik & Kim, 2010). In the original research about computer mediated communication, the technologies were not seen as appropriate to establish these kind of relationships (Daft & Lengel, 1986; Short et al., 1976; Altschuller & Benbunan-Fich, 2010). The fact that the communication is computer mediated also complicates the understanding of idioms and humor, which has a delaying effect on the development of trust (Beise et al. 2010; Jarvenpaa & Leidner, 1998; Knoll & Jarvenpaa, 1995).

Against all expectations, researchers have found high levels of trust in virtual temporary teams, teams that have to accomplish a task in a certain amount of time and who just started working together (Jarvenpaa et al., 1998; Jarvenpaa et al., 2004). It is not surprising that the first impression within virtual communication is very important and influences later communication (Kimble, 2011; Jarvenpaa & Leidner, 1998). Other important factors for the development of trust in virtual teams are actions such as information sharing, timely responses to electronic communications and keeping commitments made to virtual teammates (Rosen, Furst, & Blackburn, 2006). Neither Teams that have neither a shared past, nor a foreseeable future collaboration are anticipated to have high levels of trust because of the lack of traditional sources of trust, like evaluation of a person's integrity or shared experiences. Even though some research found that these teams show elevated levels of trust, this trust is very fragile and easily broken (Greenberg et al., 2007).

It is important for virtual teams to elaborate and strengthen the initial trust. Building and maintaining relationships between team members of virtual team is also essential. One of the pitfalls of virtual teams is that they tend to be overly task focused. Investing in relationships between team members will have a positive effect on trust within the team, which in turn will have a positive effect on the effectiveness of the team (Greenberg et al., 2007). One part of building and maintaining relationships is self-disclosure, something that is highly linked to trust (Wheless & Grotz, 1977). Sharing personal information stimulates reciprocal trust, because if people disclose to you, you feel trusted and will open up in turn, which will promote the trust relationship. Self-disclosure is positively related to trust and also seen as one of the key elements for online friendships (Henderson & Gilding, 2004; Sarker et al., 2001; Yum & Hara, 2006). In virtual collaboration, co-presence is another factor that is contributes to trust within the team and is also related to a higher quality of team performance (Sarker et al., 2001). Co-presence is the subjective feeling that team members have of being together with others in a virtual environment (Ma & Agarwal, 2007). Besides this feeling, co-presence also takes away delays in communication and gives the ability to check what team members are doing (Ma & Agarwal, 2007; Nardi, Whittaker, & Bradner, 2000).

2.3. Virtual team communication

Virtual teams have to rely heavily on computer mediated communication. New technologies make it possible to communicate while being geographically dispersed; from different places and asynchronously; from different times zones (Montoya-Weiss, Massey, & Song, 2001). The essential difference between face-to-face and computer mediated communication is the reduced ability to receive nonverbal information (Sarker et al., 2001). Zack (1993) characterizes the communication via technology to be lean, have low social presence and little interactivity. Some of the effects of asynchronous communication are interruption of the communication, which hinders the transmission of cues and delays the feedback process (McGrath, 1991; Crampton, 2001). In asynchronous communication, because discussions are interrupted and feedback is low, it happens that several topics are discussed at the same time, which can result in excessive amounts of information (Ocker, Hiltz, Turoff, & Fjermestad, 1995-1996). Another complication of computer mediated communication is the lack of forms of social control such as physical closeness, direct supervision and social trust (Jarvenpaa et al., 1998). Liu et al. (2008) state that effective communication can also be intermitted by misunderstanding and disagreements as a result of a lack of visual signs. Crampton (2001) argues that misinterpretation in virtual teams is caused by five types of communicational defaults:

- failure in communicating information equally;
- communicating circumstantial information;
- differences in the relevance given to information;
- speed of access to information;
- the meaning given to silence.

Computer mediated communication on the other hand can benefit negotiations and conflict resolution, as found by Damian, Shaw and Gaines (2000). In their research about the negotiation of requirements, the lack of nonverbal cues had a positive effect on resolving differences. Other research found more contradictory information; whereas in some situations face-to-face communication was needed, in others it turned out to be beneficial not to have face-to-face communication (Dube & Robey, 2008).

The problems in communication could be cause for conflicts (Jarvenpaa et al., 1998). The virtual environment also makes it easy for conflicts to be overlooked and only be noticed at a later stage (Griffith, Mannix, & Neals, 2003). It is important to reduce the problems and the effects of these problems by managing them properly. The problems caused by ineffective communication can be reduced by decreasing the need for regular communication. In a research project by Liu et al. (2008) was found that within in a non-hierarchical structure the need for frequent communication is smaller when executing a complex task than in a rigid hierarchical structure. Consequently they recommend the structures of virtual teams to be as non-hierarchical as possible. Another way of dealing with the challenges of asynchronous and dispersed communication is to establish rules to facilitate virtual timing (Griffith et al., 2003). Other authors define this as the temporal coordination mechanism, which

means developing a structure for group communication concerning the patterns, timing and content of the communication (Montoya-Weiss et al., 2001; Ocker et al., 1995-1996; McGrath, 1991).

2.3.1. Dimensions

There are several dimensions in computer mediated communication that have a large influence on how the communication works and is being experienced. The first dimension is asynchronous versus synchronous communication. Synchronous communication is communication where people who take part in the interaction are present at the same time, like in face-to-face interaction. Synchronous communication gives the participants the opportunity to adjust the message and clarify it while being transferred, due to its dynamic and interactive character (Picot, Assmann, Korsgaard, Gallenkamp, & Wigand, 2009). For asynchronous communication active presence of all members that are included in the communication is not required. Forms of asynchronous communication are voice-mail messages or e-mail (Duarte & Snyder, 2001). Sivunen and Valo (2006) make the distinction between hot and cold interaction. Hot interaction involves synchronous communication that requires active participation of the members of the team and the communication is fluid and can be dynamic. This kind of communication is also referred to as 'online' working. On the other hand there is the cold interaction, the 'off-line' working. Team members work individually on a common goal and do not need be co-present to be able to carry out their task. The information exchange during the cold interaction is asynchronous.

Another dimension is media richness, a concept developed by Daft and Lengel in 1986. The media richness theory describes and ranks communication media by the amount and variety of information that the media transfers. Face-to-face communication is high on media richness, because it has the ability to accurately transfer clues that support the meaning of the communication, for example body language. Media richness is based on four factors of the media; immediacy of feedback, the amount of cues and channels that are available, the variety in language and the degree of focus on the recipient. The higher the media richness, the higher the accuracy of transferring cues regarding the meaning of the communication, which helps reduce confusion and misunderstanding. The media richness theory states that information rich media are better suited for more ambiguous and uncertain tasks. Media rich communication media are used most effectively for equivocal tasks and less rich media for non-equivocal tasks (Naik & Kim, 2010). One of the foundations for the media richness theory is the contingency theory. The contingency theory claims that there is not one best way to do something, but that the best way depends on situational factors which can be both internal and external. The contingency theory is an approach which has led to a variety of theories on different subjects since the late 1960s. Carte and Chidambaram (2004) categorize two different capabilities of communication media; reductive en additive capabilities. Reductive capabilities are factors such as anonymity and characteristics such as asynchronity that make the media less comparable to face-to-

face communication. Additional capabilities stimulate interaction in the communication, for example file sharing. Because the categories suggest that some media might be more desirable than others, this theory matches with the media richness theory (Beise et al., 2010). A term that not should be confused with media richness is information richness. While media richness refers to the transmission of clues that support the meaning of the communication, information richness is the amount of detail a message encloses.

The final dimension is social presence which was originally defined as the degree to which people are aware of others in the interaction and the following identification of interpersonal relationships (Short et al., 1976; Kimble, 2011). Social presence is the degree to which technology gives the sense that interaction is with other individuals and helps to build personal connections (Duarte & Snyder, 2001; Kimble, 2011). High social presence is needed in situations that are ambiguous, uncertain or need expression of emotions. Higher social presence is not always better, for example routine tasks might be better executed with technologies that are low on social presence (Duarte & Snyder, 2001). Social presence should not be mistaken for co-presence, which is the subjective feeling that team members have of being together with others in a virtual environment (Ma & Agarwal, 2007).

2.3.2. Technologies

Technology is very important for virtual teams, because it is the technology that bonds the team and connects each individual to the team (Maruping & Agarwal, 2004; Beise et al., 2010). Compared to face-to-face teams, virtual teams' communication is weakened because they always have to deal with leaner media than face-to-face communication (Kiesler & Sproull, 1992, Naik & Kim, 2010). Because of this challenge it is even more important that virtual teams fully exploit the communication potential they have and choose the right technology to create the most effective communication (Powell et al., 2004). Proactivity in the use and choice of technology is a key factor for high performance of virtual teams. Teams who fully exploit all the possibilities of technology will have better results, both on task and relational outcomes (Beise et al., 2010). Important in this exploitation is the technological adaption, a process where the used technologies are being altered to fit better with the goals and tasks to be reached (DeSanctis & Poole, 1994; Thomas & Bostrom, 2010). The success of the teams interaction depends on the effectiveness of this adaptation process (Majchrzak, Rice, Malhotra, King, & Ba, 2000; Malhotra, Majchrzak, Carman, & Lott, 2001; Thomas & Bostrom, 2010). This relationship was also confirmed vice-versa; effective virtual teams know how to adapt the technology to meet their requirement (Beise et al., 2010; Powell et al., 2004). Massey and Montoya-Weiss (2006) indicate that the technology adaptation is important to maintain team productivity.

A wide range of technologies is available for virtual teams with a high variety of functions and characteristics. The main asynchronous technologies are e-mail, bulletin board, document sharing and voice-mail. The main synchronous technologies used nowadays are instant messaging, phone, Skype/Lync/etc., phone conference, video conference and web meeting platform. Together these technologies are called groupware; the complete range of technologies that are available for a virtual teams' computer mediated communication (Duarte & Snyder, 2001). Synchronous technologies score higher on social presence than asynchronous technologies. In the business world asynchronous technologies, like e-mail and document sharing, are the most commonly used (Daim et al., 2012). Asynchronous technologies have the ability to reach a larger amount of recipients at the same time and also allow team members to focus on the content. This has to do with the fact that there is time to reflect on the content and consider its content more profoundly (Vaidyanathan, Sabbaghi, & Debrot, 2010). Synchronous communication in return, gives the sender the possibility to adapt the message to the needs of the interaction. Groupware that has the ability to create anonymity can benefit teams because of the possibility to share opinions and ideas anonymously, which can reduce the fear for sharing an opinion (Vaidyanathan et al., 2010; Duarte & Snyder, 2001).

2.4. Virtual team communication models

Virtual teams are more effective when they actively choose their communication technologies. Being actively involved has as the effect that the team members communicate more about the technologies they are going to use. More importantly, this attention ensures that the selected technologies are updated and altered to meet the needs of the team in the best possible way (Thomas, Bostrom, & Gouge, 2007). The needs of the team however, are very flexible and dependent on the situation. Corresponding with the contingency theory, there is not one best technology that can be selected for virtual team communication. In the selection of the technology it is very important to consider the situational factors. The models for communication in virtual teams are based on variable factors that influence the technology choice. One of the most important factors to be considered in this selection is the task of the team. Fuller and Dennis (2009) found that teams who performed highest adjusted the technology use to the task that had to be reached. Zigurs and Buckland (1998) also found that a good match between the available technology and the task at hand increases team effectiveness. According to Dennis and Valacich (1999) this relationship between task and technology is not simple. They state that every task to be accomplished has its specific communication process. This communication process and the teams familiarities and situational constraints, and not the task itself, should be matched with the technology and its capabilities. The media richness theory and the importance of social presence, correspond with this theory (Naik & Kim, 2010). Duarte and Snyder (2001) do consider the task to be the main factor in selecting the most appropriate technology for the communication of the team. Concurring with Dennis and Valacich (1999), Duarte and Snyder (2001) describe several other situational factors that influence the technology selection, being: 'permanence,

symbolic meaning, experience and familiarity with virtual operations, time constraints, organizational and functional cultures, access to technological training and support' (Duarte & Snyder, 2001, p. 29).

One of the task types that is being distinguished is routine task. Routine tasks in general require high media richness and low social presence. Both asynchronous and synchronous technologies can be effective in accomplishing a routine task. Routine tasks normally require fact based information and can be accomplished by using a technology like e-mail (Maruping & Agarwal, 2004). Non-routine tasks have a significantly different communication structure because of their more ambiguous character and the higher need for nonverbal cues. More social presence is needed to pass nonverbal cues that can be necessary for interpreting or understanding more complex information (Hinds & Weisband, 2003). Members who are seen as highly on centrality, are those that have many connections with others, own large amounts of information and have the competence to influence other people. Resolving non-routine tasks is stimulated by centrality, so higher social presence is desirable (Smedlund & Choi, 2009). Maznevski and Chudoba (2000) observed decision making processes and distinguished three task types in this process where each task type connects to several communication technologies. Information gathering can be done through the more leaner media such as e-mail and faxes. For solving problems, longer phone calls or conference calls were needed and generating ideas could best be done with high media richness; through face-to-face communication. High effectiveness can be reached when there is the right media of information richness in the various stages of the decision making process. This does not mean that more media richness is automatically better. In some situations leaner media can be more effective than the more information rich media (Finholt, Sproull, & Kiesler, 1990). If we want, for example, to simply send a file to someone, we do not have to schedule a virtual meeting; a simple e-mail can do the job. The task/communication-mode matrix developed by Duarte and Snyder (2001) intersects with the observations of Maznevski and Chudoba (2000). Duarte and Snyder differentiate four types of tasks in the model which are; generating ideas and plans and collecting data, solving problems with answer, solving problems without answer and negotiating technical or interpersonal conflict. Three communication modes they distinguish are data only, video only and audio only. They consider data only a good fit for generating ideas, plans and data collection. Problems with or without answer both have a good fit with video and audio communication. For negotiating technical or interpersonal conflicts, video communication is seen as the best, but not the perfect fit.

Communication technologies are not only used to accomplish a task, but also to coordinate activities and to build relationships (Beise et al., 2010). Goodhue's (1998) task-technology fit paradigm states that the needs differ if the focus is different. The focus of communication can be on completing a task, developing relationships or process management (Beise et al., 2010). Developing relationships is a complex collaborative task that need a technology like video conference. High social

presence and high information richness help to reinforce relational connections (Daft, Lengel, & Trevino, 1987).

2.4.1. Technology versus task matrix

At the center of this deductive research is a technology versus task matrix based on three types of tasks; routine tasks, non-routine tasks and building and maintaining relationships. The origin of these task types comes from traditional research on group development and conflict literature (Jehn & Mannix, 2001; De Dreu & Weingart, 2003). In this literature three main dimensions are distinguished; task, process and relationship. These dimensions are represented in the type of conflict that occur in groups, but are also seen as the main processes that are going on in groups. A task conflict, for example, reflects differences in point of view and opinions referring to a team's task. Conflict is highly related to the process, because it can be seen as an extension of the process, however in a conflict situation there is an undeniable incompatibility between two or more people. In a virtual team context the task and relationship dimension are the main processes that occur. The relationship dimension is essential in virtual teams because it helps to build trust, which is an essential factor for high performing virtual teams. Relationship conflict can be grouped under this dimension as well. The task dimension is divided in routine and non-routine tasks because both require different levels of informational richness and social presence and therefore require very different communication technologies. The technologies that are represented in the matrix are consistent with the modern communication technologies available for virtual teams.

The matrix is shown in figure 1 and shows the three types of tasks and all the different technologies available. The compatibility of the technologies with a certain task is indicated by a smiley, from least compatible to most compatible (☹ - 😐 - 😊 - 😄).

Figure 1. Original technology versus task matrix

<i>Asynchronous communication:</i>				<i>Synchronous communication:</i>			
	Routine tasks	Non routine tasks	Building & Maintaining Relationships		Routine tasks	Non routine tasks	Building & Maintaining Relationships
E-Mail	😊	☹	😐	Instant Messaging (WhatsApp / BBM)	😊	☹	😊
Bulletin Board	😊	😐	😐	Phone	😊	😊	😊
Document Sharing	😊	😐	☹	Skype / Lync / etc.	😊	😊	😊
				Phone Conference	☹	😐	😊
				Video Conference	☹	😊	😊
				Web meeting Platform	☹	😊	😊

Source: Cune & Fogelberg, 2011.

The matrix indicates that asynchronous communication technologies are appropriate for routine tasks, but not for non-routine tasks or building and maintaining relationships. This is compatible with the results of Maruping and Agarwal (2004). Non-routine tasks are more compatible with technologies that are synchronous and higher on media richness, which is also confirmed by Hinds and Weisband (2003). Building and maintaining relationships best compatible with phone or video conference. These media are both high on social presence and information richness. Daft et al. (1987) also confirmed that development of relationships could best be done under these circumstances. The matrix also shows that the more ambiguous the tasks are, the higher the need for media rich technologies.

2.5. Cultural diversity

Because of the dispersed character of virtual team members, people from different cultural backgrounds work together in virtual teams. The type of diversity among team members that is based on differences in culture, race, gender and age is categorized as social category diversity. Another type of diversity is called functional diversity, based on differences in educational background, experience and know-how (Pelled, Eisenhardt, & Xin, 1999). The third kind of cultural difference is between organizations in for example the organizational structures. In this research context the cultural background based on nationality is relevant (Daim et al., 2012). Culture is part of social category diversity and can be seen as specific differences between nations such as language. Culture also has a broader effect for example on the common values within and the effect of these values on behavior (Hofstede, 1991).

Hofstede (1991) has indicated five dimensions for cultural background: power distance, uncertainty, individualism, masculinity and long-term orientation. Power distance refers to the level of expectation and acceptance of unequal power distribution by the members with less power. Another dimension is the individualism versus collectivism dimension, where importance of the care for the individual is contrasted with the care for and the importance of the group. Masculinity is represented in the dominant values of the society such as competition and assertiveness and a clear distinction between social gender roles. Feminine societies have more equal social roles, are more modest and are more concerned with the quality of life. The dimension uncertainty avoidance refers to the degree to which people try to avoid uncertain or unknown situations because they feel threatened by it. The last, fifth dimension, is long-term versus short-term orientation where there is a shift in focus between the future and the present.

Another dimension of cultural diversity comes from the high and low context culture theory of Hall (1976). According to the theory the cultural background of a person influences the need for contextual information when he is in interpersonal interaction. People from high context culture find it important to know more about the person's background in order to contextualize what he is saying. For a person from a high context culture, it might be much more important how someone says

something than what he says. People from low context cultures such as North America are more focused on the facts in the communication. The communication is more direct and action orientated.

The effect of cultural diversity in the background of the virtual team members on team performance is not yet clearly established (Carte & Chidambaram, 2004). Yet it is confirmed that teams with high diversity have a higher rate of task conflict (Pelled et al., 1999). Diversity in teams also has a big advantage, which is the fact that creativity is increased within more cultural diverse team, due to more different perspectives (McLeod & Lobel, 1992). This creativity increases the performance of virtual teams and also makes them better at finding alternatives and generating solutions than heterogeneous teams (Watson, Kumar, & Michaelson, 1993).

The differences in cultural background influence the communication. Not only does the cultural background influence how decisions are being made, it also influences the verbal and nonverbal communication style (Gudykunst & Ting-Toomey, 1988). Not only are the communication styles different, the cultural diversity also has as the effect that communication technologies are used in different ways (Kayworth & Leidner, 2000; Maznevski & Chudabo, 2000). These differences caused by the cultural diversity create challenges for effective communication (Sarker & Sahay, 2002).

3. Methodology

3.1. Introduction

In this chapter the processes around the participant selection, instrument usage, data collection and analysis executed in this research are described in detail. Giving detailed insight in the procedures used in this research improves the research reliability, because it gives other researchers the possibility to repeat the research under equivalent conditions.

There are two main approaches for the relationship between research and theory, being the deductive and inductive theory (Bryman & Bell; 2007). The theories distinguish themselves on the fact that data are gathered to test a theory or data are gathered to build a theory. In this case a semi-inductive approach was used, where some ideas already existed at the beginning of the research and data were gathered to further build a theory based on the observations and findings of the research. When a research is being conducted to gather information to elaborate a theory and in this way being able to confirm or disprove a theory, the deductive approach is applied (Ghauri, Grønhaug, & Krisianslund, 1995).

Qualitative and quantitative approaches are based on different paradigms and assumptions. In this research the reality was seen from a constructivism or interpretivist paradigm, on which qualitative researches are based. This paradigm assumes that reality is constructed in a specific time, context and culture and can be observed in specific social contact and through experiences of people (Johnson & Onwuegbuzie, 2004). For answering the research questions, the main focus was on revealing realities that are socially constructed and time, context and cultural dependent.

3.2 Research questions

In this research, the relationship between task and the choice for communication technologies in virtual collaboration was analyzed. The influence of culture on this relationship was also examined. The main objectives of understanding these aspects better, were reached by answering the following specific research questions:

1. How is the choice of technology related to the different tasks in virtual collaboration?
2. What is the influence of culture on the relationship between communication technology and task?

3.3. Participant

To reach the goal of gaining multiple perspectives in the area of technologies choice for communication in virtual teams, the participant for this study were selected using the maximum variation sampling strategy (Creswell, 1998). For the study a small number of participants was recruited, who had experience in working within teams with the following characteristics; geographically, organizationally and/or time dispersed, culturally diverse and having computer

mediated communication (Jarvenpaa & Leidner, 1998; Powell et al., 2004). To maximize the diversity relevant for the research questions, the secondary criteria for the selection was variety in cultural background. Diversity in cultural background is important to maximize the chance that the results of the study are as generalizable as possible and not only valid in a specific cultural context. In the research a total of seven different nationalities were included, with a maximum of two participants for each nationality.

The participants with the right characteristics were found looking within a community of organizations and people that are actively involved in virtual collaboration. A company specialized in training virtual teams offered the researcher access to this community. This concept, referred to as gatekeepers (Hatch, 2002), helped the researcher not only in accessing the population of study but also helped in gaining the trust of potential participants. The company used their network to approach the potential participants. In some cases the company would have one person of the network in an organization which helped contacting other potential participants inside that organization. This effect, where informants give information to researchers to get in contact with other participant, is also referred to as snowball sampling (Noy, 2008).

Table 1. Participants characterization

	Gender	Age	Nationality	Country of residence	Company	Team role	Virtual working experience
P1	Female	36	USA	USA	A	Member	2 years
P2	Female	43	USA	USA	A	Member / Leader	15 years
P3	Female	33	German	Belgium	A	Member/ Leader	8 years
P4	Female	46	Spanish	France	A	Member	6 years
P5	Female	41	Dutch	Netherlands	B	Member/ Leader	12 years
P6	Male	57	French	France	C	Leader	20 years
P7	Female	50	Dutch	Belgium	D	Leader	7 years
P8	Female	50	Belgium	Belgium	E	Member/ Leader	10 years
P9	Male	33	Portuguese	UK	F	Member	2,5 years

3.4. Instruments

The instrument used in this research is an interview guide. The interview guide helped to discover in depth information that is time and context specific. One guide was developed for all the different participants. The construction of this guide for the interviews was based on the specific research questions as formulated above as well as on the reviewed literature. The interview guide consisted of eight sections which all consist of several questions. Finally, there is a part with some demographic information about the participants, such as gender, age and nationality. The interview guide can be found in appendix I.

In this research the data were collected by conducting semi-structured qualitative interviews. In qualitative research a more flexible and unstructured approach than quantitative research is used in the interviews, in order to capture as much of the perspective of the interviewee as possible. In the semi-structured interviews the data collection was structured by a list of topics and questions. In this research this was listed in the form of the interview guide. This guideline ensured that all important topics were covered during the session. Apart from this the researcher also had the freedom of changing the order of the topic or adding any questions which may have come up due to the responses given by the participants. Using the semi-structured method the interview is conducted so that the interviewees felt encouraged to talk about their experiences and share their opinion (Bryman and Bell, 2007). In this research was chosen for the semi-structured interview in order to capture detailed information of the perspectives and experiences of the interviewees while guaranteeing that a variety of topics is covered during the interview. Given the great diversity among the participants, these methods with open ended questions and a flexible structure gave the opportunity to gather in depth information about specific elements brought up by the interviewees. This contributed to the richness of information gathered (Darmer, 1995).

3.5. Procedures

3.5.1. Procedures of data collection

Ethical aspects have also been considered in this research. All the individual participants signed an informed consent (Appendix II) in which they stated that they are aware of the objectives and processes of the research and data collection and participated out of free will. The participants and the information that they shared were treated with confidentiality during the whole research. Neither the names of the participants nor the names of the organizations in which they work were referred to anywhere in the research.

Because of the global characteristics of this research it was not possible to complete face-to-face interviews. This research focused on the use of communication technologies in a virtual environment and the participants are part of a virtual team. Conducting the interviews in a virtual environment via various communication technologies was a logical step since the participants were familiar with communicating virtually. Interviewing in a virtual environment had low costs and is innovative and a convenient method. It also brought a lot of advantages regarding the reach of the participants. This method offered access to participants without geographical restriction. It also opened opportunities for interaction with participants which may not have been possible otherwise (Mann & Stewart, 2000).

The participants were offered various possibilities to conduct the interview, that is via a virtual meeting platform, via teleconference or via Skype. The advantage of this is that all interviewees had the possibility to choose a technology that was the most convenient, familiar and comfortable to them. All of these technologies offer synchronous audio contact, which makes them comparable to the more

known interview method, which is the telephone interview. This method is characterized by synchronous communication of time and asynchronous communication of place (Opdenakker, 2006). Besides the given advantages, telephone interviews also brought some disadvantages compared to face to face interviews. One of the disadvantages was a reduced transmission of social cues, because sources of information such as body language were lost. A sufficient amount of social cues like paralinguistic cues were transmitted to conduct the interview without any problem (Opdenakker, 2006). Another possible disadvantage of a telephonic interview is the loss of control in creating a standardized interview environment, for example the privacy in which the interview is held or the interruption during the interview (Opdenakker, 2006). Because all participants in this research are used to remote working and were in a private or home office, this disadvantage did not have a big influence on the interviews done in this research. Because of the synchronous communication during the interview, the same interactivity as during a face to face interview remained and the spontaneity of the answers was not prejudiced (Opdenakker, 2006).

The interviews with each participant took forty-five minutes to an hour and were audio-recorded. The researcher also took notes during the interview. Before starting the recording it was also confirmed if the participants had read and understood the informed consent form, sent to them prior to the interview by e-mail.

3.5.2 Procedures of data analysis

The qualitative data analysis was a dynamic process where data collection and analysis partially ran simultaneous. The recordings of the interviews were transcribed and this process of transcription was fulfilled during the process of data collection. Transcribing the interviews helped the researcher to become more familiar with the data.

For the data coding process, that started after all interviews were transcribed, a semi-inductive interpretation method was used. After the researcher got acquainted with the data, the first initial coding categories were developed. In the process an open coding strategy was used, where categories were developed during the process of data coding, allowing the creation of new categories when new types of information, patterns and relationships emerged for the collected data (Braun & Clarke, 2006). During the coding, the meaning of the data is essential for the coding. This means that the analysis units were divided by meaning and that the data were not coded sentence by sentence or answer by answer. Based on one of the principles of the Grounded theory, multiple meanings were associated to analysis units, which can be found in several categories. Throughout this process, names of categories were adapted and new categories and subcategories were created to present all found data. The category system can be found in appendix III.

For the process of the data analyses the software program for qualitative research Nvivo 10 was used.

4. Results analysis and discussion

In this chapter the results are presented. The data are presented using the coding scheme that was established in the data analysis phase of this research. In this research the relationship between task, culture and communication technologies is investigated. The coding scheme represents these three principal categories. The next three paragraphs show the results for each category, starting with the presentation of the part of the coding scheme applicable to that category. All categories are explained and in some cases examples are provided from the interviews and discussed using relevant literature.

4.1. Technology

TECHNOLOGY (1.) is the first main category and in the subcategories of this category the various types of technology are found that are used by the participants in virtual communication. In the sub-subcategories and the sub-sub-sub categories the characteristics and functionalities of each of the technologies mentioned by the participants are found.

Table 2. Coding scheme technology

1. Technology	1.1 E-mail	1.1.1 Asynchronous	1.1.1.1 Preparation time	
			1.1.1.2 Response moment	
			1.1.1.3 Reflection time	
				1.1.2 Low social interaction
				1.1.3 Low media richness
				1.1.4 Clarity
				1.1.5 Permanence
				1.1.6 Group audience
				1.1.7 Sending information
				1.1.8 Complementary technology
		1.1.9 Quick in use		
		1.1.10 Over usage		
	1.2 Telephone	1.2.1 Synchronous	1.2.1.1 Interactivity	
			1.2.1.2 Quick response	
		1.2.2 Media richness	1.2.2.1 Paralinguistic	
			1.2.2.2 No kinesics	
			1.2.3 Personal connection	
			1.2.4 Sensitivity	
			1.2.5 Easy to use	
		1.2.6 Need to schedule		
		1.2.7 Interruptive		
	1.3 Telephone conference	1.3.1 Group call		
		1.3.2 Low involvement		
		1.3.3 High structure need		
	1.4 Video conference	1.4.1 Kinesics	1.4.1.1 Body language	
			1.4.1.2 Facial expression	
			1.4.1.3 Abundance	

	1.4.2 Personal connection	
	1.4.3 Sensitivity	
1.5 Video conference 2.0	1.5.1 Face to face reality	
	1.5.2 Group meeting	
1.6 Web meeting platform	1.6.1 High interactivity	
	1.6.2 Flexibility	
	1.6.3 Document sharing	
	1.6.4 Group meeting	
	1.6.5 Low involvement	
	1.6.6 Preparation	1.6.4.1 Need to schedule
		1.6.4.2 Starting up time
1.7 Text messaging	1.7.1 Quick message	
	1.7.2 Urgency	
	1.7.3 Low interruptive	
1.8 Chat	1.8.1 Presence	
	1.8.2 Co-presence	
	1.8.3 Semi - synchronous	1.8.1.1 Quick response
		1.8.1.2 Interactivity
	1.8.4 Divided attention	
	1.8.5 Impersonal	
	1.8.6 Emoticons	
	1.8.7 Permanence	
	1.8.8 Short conversation	

1.1 E-mail

The first technology discussed is E-MAIL (1.1), a technology used by all participants and seen as an indispensable tool in the communication. Participant 2 described e-mail as the default tool or the standard communication tool that is used unless there is a specific reason to use another tool. E-mail is a tool that can be used for ASYNCHRONOUS (1.1.1) communication where not all members have to be actively involved at the same time. This characteristic leads to two functionalities that the use of e-mail gives; preparation time and response time. PREPARATION TIME (1.1.1.1) represents that because there is no direct interaction, the sender of a message can take as much time as needed to form and revise the message. P5 - *"I'm quite long winded and in e-mail I can write three sentences in an e-mail and say it all. And I can just blurb it out and then shorten in a little bit and work on it a little bit and then work on it and that is actually why I like e-mail."* Because of the asynchronous character of e-mail there is also more response time which has its practical impact in two different ways. First is the fact that the receiver of a message is in control of the RESPONSE MOMENT (1.1.1.2), of when he reads the e-mail, which makes e-mail a useful tool when working in different time zones. P1 - *"It is nice you know, when you send an e-mail it does not matter what time you send it and people can respond at their convenience, so it can kind of helps to overcome time differences"* Secondly it gives the receiver of the information the freedom not to respond immediately, but can take some time to think the information over, REFLECTION TIME (1.1.1.3) as described by participant 7; *"Also if I want people to look at several options I do e-mail, so that they can reflect, they can think about it."* Vaidyanathan et al. (2010) point out the importance of using asynchronous communications tools

when the focus of the communication should be on the content, because there is time to reflect and consider the content.

Resulting from the fact that e-mail is an asynchronous tool it is characterized as to have LOW SOCIAL INTERACTION (1.1.2). 89% of the participants remarked this low interactivity and comment that because of this, e-mail is not useful for tasks that require high interactivity. P3- *“Ehmm but when it comes to maybe a workshop planning or something, then you have synchronous communication, because we need the creativity. And some people bouncing of ideas to each other. That does not work by e-mail.”*

E-mail also has LOW MEDIA RICHNESS (1.1.3), which is considered a weakness because in some cases the lack of social cues, makes it complicated to achieve effective communication. P8 - *“Just to come back on written communication, sometimes you really have to be, sometimes you read sentences and you may interrupt them and when you go back to the person who sent you the message, he may have meant something completely different, but you may have interpreted in a way, so this is something you have less with the phone for sure.”* On the other hand e-mail is very useful for the communication of unambiguous information, because of the CLARITY (1.1.4) it can give. P5 - *“My colleague in rewards, she was a rewards specialist, she did a lot of e-mailing, because her tasks were instructions, very different. So, team you do this, you do this, here is you spreadsheet, very clear.”*

Another advantage of e-mail, pointed out by all participants, is that it offers PERMANENCE (1.1.5) of the information that is being communicated. P3 - *“Ehm e-mail is great because you can always fall back to it... You have recordings of the information you want to share.”* When participant 5 was asked why she uses e-mail, she answered as followed; *“Yeah, to get a message across to a large group or to get a document across, like an agenda or document linked to a meeting, ehm. Those type of situation.”* In this example three functionalities of e-mail are mentioned. The first is the GROUP AUDIENCE (1.1.6), sending information to multiple people at once. Vaidyanathan et al. (2010) also indicate that the ability to have a large amount of recipients at the same time is a characteristic of asynchronous communication technologies. The second, a functionality confirmed by 77% of the participant, is that e-mail is used for SENDING INFORMATION (1.1.7) or documents. Finally there is the fact that e-mail is often used as a COMPLEMENTARY TECHNOLOGY (1.1.8). Complementary use of e-mail is communication that supports meetings, executed through other tools, such as sending a document to be discussed, planning a meeting or clarifying the meetings' outcomes. For 8 participants this is how they used e-mail most of the time. E-mail is also seen as technology that is QUICK IN USE (1.1.9), which might be related to the fact that e-mail is a technology that was indicated by OVER USAGE (1.1.10) by three participants. Another explanation for the excessive amount of information passed through asynchronous communication tools is low feedback and interruption of discussions, causing the existence of several discussions at the same time (Ocker et al., 1995-1996).

1.2. Telephone

TELEPHONE (1.2), a technology used by all participants, is a synchronous communication tool, which results in INTERACTIVITY (1.2.1.1). P1 - *“Well I think you know with synchronous, sometimes that can be more efficient ehm you can ask follow up question, you can really get into an issue, ehm you can involve, you know, you can get more interaction between people.”* Picot et al. (2009) and Viayanathan et al. (2010) confirm the importance of being able to adjust or clarify the message while communicating using synchronous tools. Because the communication is synchronous, it also leads to a QUICK RESPONSE (1.2.1.2), as opposite to asynchronous communication tools like e-mail. Both factors were indicated by almost all participants as relevant factors when using the telephone as a communication tool. The MEDIA RICHNESS (1.2.2) of telephone is much higher than the media richness of e-mail, because there is the possibility to transfer cues via the PARALINGUISTIC channel(1.2.2.1). The transfer of these cues by for example voice use can have a huge contribution to the communication and it is an important aspect of telephone according to all participants. Participant 6 described the contribution of paralinguistic in the following way: *“Once you can talk over the phone and feel what the other persons think, you know when you talk and you listen to someone, even just over the phone, you can feel a lot of things that you cannot feel through e-mail.”* Because of the degree of social presence and media richness that telephone offers, 77% of the participants described the telephone as a good tool to build a PERSONAL CONNECTION (1.2.3) and some participants also said it is a good tool to discuss issues that are high on SENSITIVITY (1.2.4). Even though telephone is more media rich than e-mail, telephone does not transfer any cues related to kinesics. NO KINESICS (1.2.2.2) such as body language or facial expressions are transferred, which is a missing factor in telephone contact as commented by 77% of the participants.

The telephone was described by some of the participants as a tool that is EASY TO USE (1.2.5), but paradoxically it is not common to pick up the phone and just call someone. More than half of the participants confirmed the next characteristic of the telephone as a communication technology; NEED TO SCHEDULE (1.2.6). P6 - *“I try to agree on the time we are going to call in advance, I do not call just you know like that, because the person could have his or her own agenda. So and we discuss and they know that I’m call and they can get the ideas ready if they have any point they would like to cover, so I try to anticipate a little bit and try to avoid just to call like that you know, because then you can disturb the other party.”* The need for scheduling also has to do with the fact that telephone is seen as an INTERRUPTIVE (1.2.7) technology, because once you’re on the phone it is hard to continue your other activities. If there is no call scheduled prior, some people choose for a less interruptive communication technology instead.

1.3. Telephone conference

For telephone the distinction between telephone and telephone conference was made. Telephone conference has the same characteristics of interactivity and media richness as telephone,

but it offers the possibility to connect with more than two people at the same time. Telephone conference is a technology that almost all participants referred to use. Telephone conferencing is a good communication tool for a GROUP CALL (1.3.1) according to participant 1; *“I guess you know if there were multiple people involved then WebEx or phone is usually best.”* Equal to phone, phone conference does not transmit kinesics. As a result of the amount of people present and the lack of cues in the form of kinesics, members experience LOW INVOLVEMENT (1.3.2) in a telephone conference call. P5 - *“When I was in a large teleconference with a lot of locations linking in, I would just mute my phone, do work and then link in...”* In contrast to telephone, telephone conference was not mentioned as a good environment to build a personal connection or to discuss sensitive topics.

HIGH STRUCTURE NEED (3.1.3), which can come in various forms, is another characteristic of teleconference. P3 - *“If you have a telephone conference, there are a lot of etiquettes necessary to ehm understand who’s talking and saying what, because you only have one communication channel.”*

1.4. Video conference

VIDEO CONFERENCE (1.4) is a technology that does offer the possibilities of transmitting KINESICS (1.4.1) cues, like BODY LANGUAGE (1.4.1.1) and FACIAL EXPRESSION (1.4.1.2), which is the main reason why eight out of the nine participants indicated to use videoconference. P4 - *“You know that, you know I’m a firm believer that your, that body language is key and if you’re not in front of someone, there is all that part of the communication that you do not have. That’s for sure. And even you know having someone in front like that in the screen it is already it’s a middle way, it’s a middle way.”* According to 77% of the participants video conference helps to build a PERSONAL CONNECTION (1.4.2). Some participants also stated that video conference is adequate for discussion topics with SENSITIVITY (1.4.3.), also because of the transmission of cues through facial expressions. P5 - *“Particular if you want to get a sensitive point across, you want to have a look at the facial expressions to see how it’s taken and how it comes across.”* In some cases the video conference gives too many cues. This ABUNDANCE (1.4.1.3) in some cases is experienced as distracting, as stated by 44% of the participants. P7 - *“Ehm with video I’m less, I’m more distracted.”* This distraction can be explained by the fact that higher concentration is required to pick up cues in comparison to face to face contact. The more people are involved, the more complicated it gets to pick up these cues, for example, because of the decreasing size of the images.

1.5. Video conference 2.0

Due to developments video conferencing is getting much more advanced. In this research a distinction was made between video conference and VIDEO CONFERENCE 2.0 (1.5), which the participants referred to as HALO or telepresence. P5 - *“HALO [video conference 2.0] is a very advanced video conference technique where the table that you sit at resembles exactly the table at the*

other side. And the sound is, is managed in such a way that it looks like you are sitting across the table. So you are looking at a range of screens in front of you and then they are looking at you. It is really, you have to experience it, you have to be there, but it is really like you are sitting across the table.” This technology is so close to FACE TO FACE REALITY (1.5.1) that one participant even referred to face to face contact when in reality he was talking about using this technology. Confronted with the confusion of the researcher he responded; P9 - *“I’m honest, for me telepresence is exactly like a face to face meeting. When I started no, but now it is exactly the same. When I go to a meeting and clients come to the office in London to visit, the feeling and the way I can communicate is exactly if I do a telepresence with someone on the other side of the world.”* Resembling this face to face contact, characterized by high media richness and interactivity, the video conference 2.0 was named as a very good tool for GROUP MEETING (1.5.2).

1.6. Web meeting platform

A web meeting platform is a synchronous technology that offers a high variety of tools to communicate, in addition to the main spoken interaction that takes place. P4 - *“You can switch screens, share with other, you can draw on the screen yourself, you can ask questions, you can raise your hand.”* Apart from HIGH INTERACTIVITY (1.6.1) this technology offers a high variety of options and FLEXIBILITY (1.6.2). The flexibility is the main reason why seven participants use this tool. Another functionality is DOCUMENT SHARING (1.6.3), a functionality where various people in the meeting can see and work on a document at the same time. This document sharing, used frequently by six of the participant, gives high information richness to the tool. Because the tool is synchronous and there are various options to transmit cues, the tool works very well for a GROUP MEETING (1.6.4) according to five users. One of the participant stated that LOW INVOLVEMENT (1.6.5) is inherent to the use of this tool, because interactivity is not optimal due to technical barriers. Another disadvantage of this technology, confirmed by several participants, is the PREPARATION TIME (1.6.6). Not only has the tool a NEED TO SCHEDULE (1.6.6.1) in advance, this tool also requires STARTING UP TIME (1.6.6.2) due to the technical complexity of this tool.

1.7. Text messaging

Less than halve of the participants use text messaging in their work context. Text messaging is used to send small and QUICK MESSAGES (1.7.1) or questions, like participant 4 does; *“It is quick, it’s quick, you know, it is quick and if you want to say something quick to someone, like I’m late or something.”* The choice of using text message as a communication technology is influenced by the URGENCY (1.7.2) of the message communicated. Participant 7 for example says: *“I use SMS when I need an answer within one hour.”* Text message is a communication tool that was characterized as LOW INTERRUPTIVE (1.7.3), compared to for instance telephone, but still results in fairly fast information exchange.

1.8. Chat

The last technology is chat, a communication tool often integrated in other communication technologies such as telephone, e-mail and web meeting platforms. Chat distinguishes itself from the other technologies by the fact that you can see the status of PRESENCE (1.8.1) of the people; whether they are online or not. This communication technology creates a sense of CO-PRESENCE (1.8.2) that is being experienced by five users of the chat. P4 - *“I can see on my screen if someone is connected and available. So we can chat and it is more instant than calling and again it feels like closer, that’s a feeling of proximity that’s being created with these things, that does not exist when you use classic telephone or when you use WebEx or when you conference calls.”* Chat is a SEMI-SYNCHRONOUS (1.8.3) communication tool and if people are online, chat offers a FAST RESPONSE (1.8.3.1) and HIGH INTERACTIVITY (1.8.3.2). Chat gives members of the interaction the possibility to use chat while working on other things but maintaining the real time of the conversation. This DIVIDED ATTENTION (1.8.4) is described as an advantage of chat by one-third of the participants and gives chat a special position compared to the other technologies. P9 - *“The main advantage is that it is real time. And you can have a real conversation without the members having to.... Do both members to be present at the same time. Like I can see something, then when the other partner sees the message and he can reply, but then at the same time, when something urgent is going in, then I can ring the bell, I make noise on the other end and maybe he was distracted with something and then I can call his attention, so for that purposes, Bloomberg is the best.”*

Chat is a technology that transfers neither paralinguistic nor kinesics cues. The technology is therefore also seen as a very IMPERSONAL (1.8.5) way of communication by most of the users. To increase the sense of social presence in the interaction, most chat programs offer the possibility to express yourself using other things than words, such as EMOTICONS (1.8.6) or signs. The three participants who use chat for communication also expressed to use emoticons to enforce the message they want to communicate. Another advantage of chat is PERMANENCE (1.8.7); there will be a record of the communication. Half of the participants indicated to use chat for SHORT CONVERSATIONS (1.8.8) that are not complex.

4.2. Task

The second main category in the coding scheme is task, which refers to the assignments and jobs that have to be reached through virtual collaboration. In the sub category of this category three types of task in virtual collaboration are found; routine, non-routine and building and maintaining relationships. In the sub-sub categories specific activities for routine and non-routine tasks are presented. Under building and maintaining relationships activities and actions are represented in the sub-sub categories and sub-sub-sub categories that contribute to building and maintaining relationship.

Table 3. Coding scheme task

2. Task	2.1 Routine	2.1.1 Clear assignments		
		2.1.2 Distribute information		
		2.1.3 One way feedback		
		2.1.4 Planning		
	2.2 Non-Routine	2.2.1 Explaining		
		2.2.2 Generating ideas		
		2.2.3 Negotiating/ discussing		
		2.2.4 Producing document		
		2.2.5 Career development		
	2.3 Building and Maintaining Relationship	2.3.1 In between tasks		
		2.3.2 Informal talk		
		2.3.3 Offering support		
		2.3.4 Frequency		
		2.3.5 Personal connection		
2.3.6 Social presence		2.3.6.1 Voice contact		
		2.3.6.2 Knowing a face		

2.1. Routine task

The first task to be discussed is the routine task, a task of which the results are already clear at the beginning of the process. The first activity in the category routine task is a CLEAR ASSIGNMENT (2.1.1). Clear assignments are activities that do not raise any questions in execution. Naik and Kim (2010) indicate this as a low level of uncertainty, where all information needed for the execution is present. Participants gave examples such as sending invoices, holiday planning approval and instructions for payments. The second task is DISTRIBUTE INFORMATION (2.1.2), an activity executed by all participants. P9 - *“Routine task: writing a daily e-mail with what happened during the overnight time in Tokyo and London opening and for in São Paulo when they wake up. That’s a routine task on daily basis.”* The third routine activity is ONE WAY FEEDBACK (2.1.3), which can be explained by the example of participant 1: *“But if you know like: I need you to review this document and give feedback back to me, than I would just send it in an e-mail.”* One way feedback is considered a routine task because the outcome of the task is clear. The last activity in routine task is PLANNING (2.1.4), an activity mentioned by almost 50% of the participants. Planning in virtual teams for a great part focuses on scheduling meetings or contact moments, but also appointing deadlines can be classified in this category.

Routine tasks in general are characterized by low need of media richness, as indicated by participant 3: *“If you’re just having a session of alignment or information exchange, than you do not need the visual information.”* An explanation for this, offered by Maruping and Agarwal (2004) is that routine tasks normally require fact based information. A trend that was also found within the routine tasks is a low need for synchronous communication; asynchronous communication can even be preferred, as demonstrated in the following example given by participant 2. *“But if you know like: I*

need you to review this document and give feedback back to me, than I would just send it in an e-mail.”

2.2. Non-routine task

Non-routine tasks are complex tasks that do not have a pre-defined solution. These tasks do not have a clear structure and the task is resolved through a complex and uncertain process where team interaction is needed. The first activity within this task type is EXPLAINING (2.2.1). In explaining, synchronous communication is important to ensure interactivity. Social presence is also an important factor, because a personal connection should be established to confirm if the message is understood. P5 – *“If it was about instructions as well, particular to my team. Then I would use video conference. I found typically very difficult to instruct people over the phone. (...) And because you cannot see if someone really understands it.”*

The next activity is GENERATING IDEAS (2.2.2) , also known as brainstorming. This task corresponds with the process called ‘generate’, indicated in the task typology of McGrath (1984). Generating ideas is an important aspect of virtual collaboration, as 88 % of the participants named this activity. Participant 3 stated that interaction is needed to be able to execute this task. *“Hmm but when it comes to maybe a workshop planning or something, then you have synchronous communication, because we need the creativity. And some people bouncing of ideas to each other.”*

Another activity is DISCUSSING OR NEGOTIATING (2.2.3), which also is an activity executed by almost all participants. This type of task is also referred to in the typology of McGrath (1984) and is called the ‘negotiating task’. Synchronous communication is seen as the most appropriate for the task ‘discussing’ as indicated by participant 3; *“Synchronous communication for anything where you need anything, where you need multiple people because you need their view on something.”* Apart from the interactivity created by using a synchronous communication tool, media richness also has its importance in this task. P7 - *“I prefer when I’m selling I need to see non-verbal’s. I need to see responses because that is the only way I can find out whether I’m speaking their language”*

The next activity mentioned is PRODUCING DOCUMENTS (2.2.4), where people work together on a written assignment. In the typology of McGrath (1984), this task would be referred to as the execute task. Information richness is an important factor of the execution of this activity because the file being worked on should be available for all people involved. Visual input is important to be able to execute the task properly. Participant 3 learned this the bad way when she had to collaborate without the visual input. P3 - *“For a while in our research team we were doing interview coding. And our colleague from New York is a bit technology adverse, so I was trying to make fit my way of working to hers and we were trying to do everything on the phone, but really did not work.”* Synchronous communication is also indicated as an important factor, because high interactivity is seen as important for working together effectively. The amount of media richness needed during this

interaction is more ambiguous. Some participants find it important to both see the document, were others prefer to have kinesics and paralinguistic cues while producing a document together. P8 - *“If you want something to be achieved, to be built together, to be ehm I still prefer a tool where you ehm where you can see each other or ehm and does not have to be, physical in the same place, but at least ehm, yeah.”* Not in all cases synchronous communication is effective for producing documents. Sometimes working offline, where people individually work on a common goal, is an effective way to carry out a task (Sivunen & Valo, 2006). P3 - *“Once it gets complex, like an article or a real plan, then I prefer asynchronous communication, so everybody can do the thinking and then communicate to the team afterwards. So I would do for example, for a project plan, you always send it around by e-mail and you might add a routine list to it, like who is going to read it and then send it to who and so on...”*

The last activity, CAREER DEVELOPMENT (2.2.5), has to do with human resource management; activities are for example contract negotiations, career development plans, evaluations and even firing processes. Human resource management does not just include human resource managers, but all elements of an organization. Because career development concerns topics that are very personal and sometimes sensitive, a personal connection and sense of social presence between the elements in the communication is important. Kinesics and paralinguistic information therefore is seen as essential, as illustrated by the quote of participant 8. *“If I want to have an interview, or to have a discussion with one of the HR persons, to discuss about possible career development or whatever I think it is important to see the persons and not to do that over the phone.”*

It is interesting is that a type of task which is referred to by various authors, for example Duarte and Snyder (2001), conflict, did not come up in the tasks described by the participants. An explanation for this could be offered by Griffith et al. (2003) who say that conflicts in the virtual environments are easy to be overlooked and so maybe the participants are not aware of any situations of conflict in their virtual collaboration.

2.3. Building and maintaining relationships

The last task, building and maintaining relationships, often might not be seen as a real task, because it is something that happens IN BETWEEN TASKS (2.3.1), as participant 1 sees it: *“And yes we spend some time on that relationship building, but I do not know how to categorize our tasks that way.”* Participant 8 highlighted the importance of building and maintaining relationships as a task in virtual collaboration. *“What you also see a lot is that, virtual teams they come together, when they come together they do their coffee corner stuff and talk about the relationship piece and then when they meet virtually they are just about the task. (...) This balance between task and relationship is the only way to get things done virtually and you do not wait until you meet up in June to go talk about kayaking and hobbies. You do that in the virtual space as well.”* This is also confirmed by Greenberg et al. (2007), who say that virtual teams tend to be task focused. What this quote also represents is the

fact that in building and maintaining relationships it is very important to have INFORMAL TALK (2.3.2) and talk about personal things and not just about task related topics. All participants described informal chat as a part of building and maintaining relationships. In literature self – disclosure and sharing personal information, what happens during the informal conversations, is related to building relationships and even online friendships (Henderson & Gilding, 2004; Sarker et al., 2001; Wheelless & Grotz, 1977; Yum & Hara, 2006).

Apart from informal conversations, OFFERING SUPPORT (2.3.3) is also seen as an instrument that helps to build and maintain relationships. P1 - *“The other thing what I mean by relationship building is like supporting each other and so a lot of times we will send out an e-mail: I’m challenging, I’m dealing with this issue, I need advice, any resources I should look at? You know, just send of a quick e-mail and the fact that we are all quickly respond and help each other out kind of helps to build a trust and just feeling of: I can rely on my team.”* Support, trust and relationship building are three highly connected and essential elements of virtual collaboration. According to Greenberg et al. (2007) interpersonal relationships in which, care and concern for each other, in other words support, is offered, will lead to trust.

Several things were indicated by the participants that influence the building and maintaining of relationships in a virtual environment. One of the factors is the FREQUENCY (2.3.4) of interaction, named by 55% of the participants. P9 - *“It takes a long time, like a year or something, to build that kind of relation. If the person on the other end is rotation, you will never feel like that. But if it’s a steady relationship and you almost speak on daily basis and receive e-mails and call and everything, than you have a very good relation even if you do not know the person.”*

Important in the building and maintaining of relationships is building on a PERSONAL CONNECTION (2.3.5). Great majority of the participants stated that SOCIAL PRESENCE (2.3.6), in various forms, contributes to this personal connection. Participant 9 specifies the importance of VOICE CONTACT (2.3.6.1): *“Yeah, I think in that case the voice; telephone and voice get people closer. It is more than just reading something that the other person is typing. You know something about the person, at least the voice.”* Not just the voice, but also KNOWING A FACE (2.3.6.2) is important to build this more personal connection. P1 - *“We had a new member joining the clients’ side of the team, so to be able to meet that new member and see her face, was to me important for that relationship building.”* This can be reached with media that provide video images, such as video conference, video conference 2.0 or the web meeting platform.

4.3. Culture

The last category is culture which is divided in five subcategories. Primarily the subcategory assembles all data about whether or not culture has an impact on virtual communication. The subcategory dimensions represents the various forms of the effect of culture through the behavior of

people. The last three subcategories present circumstances in which the communication in virtual collaboration takes place due to the cultural diverse character.

Table 4. Coding scheme culture

3. Culture	3.1 Effect	3.3.1 General effect	
		3.3.2 No effect	
	3.2 Dimensions	3.2.1 Directness	3.3.1.1 Direct
			3.3.1.2 Timid
			3.3.1.3 Holding back criticism
		3.2.2 Power distance	3.2.2.1 High power distance
			3.2.2.2 Low power distance
		3.2.3 Uncertainty avoidance	
		3.2.4 Context orientation	3.2.4.1 High context orientation
			3.2.4.2 Low context orientation
	3.3 Circumstances	3.3.1 Time difference	
		3.3.2 Infrastructure	
		3.3.3 Language barrier	

3.1. Effect

The EFFECT (3.1) of culture on virtual collaboration is not very clear. On the one hand 66% of the participants confirm that culture has an influence on communication in virtual teams, the GENERAL EFFECT (3.1.1). P4 - *“You know we have all these clichés about all the cultures and I would not want to have have to same one all the time, I think it is very rich to work with. It can be very complex, but it is very rich to work with people from different ehm cultures.”* P3 - *“It is totally different, of course the culture has major, major implications for virtual communication.”* On the other hand when directly confronted with the question if they notice any differences related to culture in the virtual collaboration, five participant do not confirm any effect of culture on virtual collaboration. These answers were placed in the category NO EFFECT (3.1.2). This conflicting information can be a result of very little awareness of the influence of culture in virtual collaboration. Participant 8 came to the same conclusion during the interview. *“Ok honestly I do not think I’m, ehm that my feeling is that I’m enough culturally aware to think about that. At least I would not do it consciously at this time, but perhaps we should do it, I do not know. I would be interesting!”*

3.2. Dimensions

The differences in behavior between people from various nationalities, mentioned by the participants, are placed in various DIMENSIONS (3.2). The first dimension DIRECTNESS (3.2.1), which has to do with the ease at which people can express themselves, is presented in three levels. Five of the nine participants indicated some areas and counties, such as Northern Europe or South Africa, have a direct national culture. DIRECT (3.2.1.1) countries have culture in which the people are direct in what they say or feel comfortable interrupting someone. People that are little direct were characterized as TIMID (3.2.1.2), this characteristic was given by five participants to people with

mainly a Asian background. P4 - *“Completely, you know in a meeting, if you have Chinese guy, a Japanese Guy, they would never interrupt for example or they would not even say what they think.”* HOLDING BACK CRITICISM (3.2.1.3) is a characteristic that is attributed to counties from Asia and Southern USA by a small amount of participants. P3 - *“Ehm I also find that if, especially when it comes to sharing information about something that might be an issue or a problem or any considerations that are not all positive. Yeah, they are not so easy to offer them voluntarily.”*

Another dimension mentioned is the influence of hierarchy in communication. POWER DISTANCE (3.2.2) is one of the five dimensions indicated by Hofstede (1991) related to cultural diversity. HIGH POWER DISTANCE (3.2.2.1) is primarily related to Asia, but also to the USA by someone from a Latin country. P5 - *“I had a Chinese colleague in our management team and she was a peer of mine and she would understand perfectly what I meant. And she would not say no, she would in fact interrupt, but she was my peer. People to me or reported to someone were, they were even more difficult. They would say yes to the manager and not to me.”* A country associated by one of the participants with LOW POWER DISTANCE (3.2.2.2) was Brazil. However, Hofstede (1991) indicated Brazil to be high on power distance.

Another dimension is UNCERTAINTY AVOIDANCE (3.2.3), also defined by Hofstede (1991). This is mentioned by three participants. Uncertainty avoidance influences the communication by influencing the level of planning needed prior to the actual communication.

The last dimension is low versus high CONTEXT ORIENTATION (3.2.4), a dimension defined by Hall (1976). P7 - *“I think the only time I see cultural differences is when I see how long people spend on the phone and what they write in the e-mail.”* HIGH CONTEXT ORIENTATED (3.2.4.1) cultures are represented as orientated to personal and long term relationships Within high context cultures information about the culture is needed to understand the communication within this culture. LOW CONTEXT ORIENTATED (3.2.4.2) countries, such as Anglo-Saxon countries, are focused on the task and communication is more explicit. Participant 6 described how the difference between high and low context orientation influences his communication and technology choice. *“The example I could give for instance, if I have a difficult task to ask to someone, and because I have the requesting for top management for instance, maybe with some more Latin type of culture, rather than sending an e-mail saying this is the request we have to deliver in a few days and thank you, maybe I would try to explain over the phone that I understand that it is difficult and that it is going to put a lot of pressure on them, but I know that they will do them best, but to have this really personal discussion to make it easier for them to accept the overwork yeah. Maybe with some Anglo-Saxon country it would be less important to do it; I mean that is my feeling at least.”* Hall (1976) describes low context cultures as more direct and more action orientated, as shown in this example.

3.3 Circumstances

Cultural diversity also leads to different CIRCUMSTANCES (3.3) for communication compared to mono cultural teams. One factor that influences communication in virtual teams is TIME DIFFERENCE (3.3.1). 5 participants declared that time difference influences the communication, for example when synchronous communication is desired, but only asynchronous communication is possible. P5 – *“It was a challenge because time zones ehm were challenging, in particular because we had a team in Asia and we had a team in America. Linking that to Europe was challenging, linking different time zones, linking people is challenging.”*

Four participants named the existence of a LANGUAGE BARRIER (3.3.2) in virtual collaboration. This has an impact on the technologies that should be used. Some technologies are suitable for native speakers but inadequate when someone is not fluent in a language.

A final factor influencing communication in virtual teams related to cultural diversity is the technical INFRASTRUCTURE (3.3.3). Not all technologies work in the various countries or have the same reliability. Some examples that were named are that in India no one has voice-mail and in South Africa internet is very unreliable. Participant 3 said: *“One of the things that I have to do be mindful about is sometimes I have to, I have meetings with people in China and I would usually Skype, but a Skype does not work in China, so then I always have to plan for another technology.”*

5. Answer to research questions

5.1. Technology versus task

In the previous subchapters various technologies and types of tasks have been presented. In this subchapter the relationship between these two essential elements in virtual communication are further explored. By linking the technology and task the first main research question should be answered:

How is the choice of technology related to the different tasks in virtual collaboration?

Below the technology fit are presented separately for the three types of tasks. Afterwards all the information is combined in a new technology task matrix. In the last subchapter all data are summarized and the first main research question is answered.

5.1.1. Routine

Amongst the activities in routine tasks executed by the participants there are several similarities in needs for communication for the execution of these activities. Whether an assignment is communicated, information distributed, a planning is being made or even one way feedback is given, the clarity of the communicated information is essential. One factor that contributes to clarity is written information. P3 - *“That is the advantage, it can also be, you can really clarify, you can plan things much more easily, so the clarity that you have in any written information you might want to achieve in a ehm overall communication.”* Technologies that offer information in writing are e-mail, chat and text messaging. Participant 2 confirmed that chat is used because of this functionality. *“Often in my kind of work you need information in writing, that, because you need to be very specific, that is one of the reasons I use instant messaging as well. (...) If you’re being sort of technical about what you’re saying it’s very helpful to be able to go back to the text later and read it if you have questions.”* Technologies such as phone, video conference and web meeting platforms do not offer this clarity of written information.

In routine tasks information, that is not up for interpretation, should be communicated in a clear manner, Naik and Kim (2010) refer to this as unambiguous tasks. The explicitness of the information communicated leads to a low need for media richness. Visual information such as kinesics or voice contact that entails paralinguistic information, is not necessary to execute the task. P4 - *“Weekly meeting with your boss to update each other and we use remote, we just use communicator [chat] now, we use the communicator. We do not need the tool were we can see each other for example.”* In some cases the kinesics or paralinguistic can be distracting from the actual message that is being communicated. P7 - *“I find it easier to have a phone conversation rather than a face to face video ... because it makes me listen more to the conversation, to the content, rather than looking at the non-verbal’s. ...ehm with video I’m less, I’m more distracted.”* More media rich communication technologies, such as phone conference, video conference or web meeting platforms therefore do not

seem suitable for communication for routine tasks. This conclusion is in line with the findings of Duarte and Snyder (2001) and Maruping and Agarwal (2004), who state that technologies that are low on social presence are often better for the execution of routine tasks. E-mail, chat and text message are suitable because they do not distract from the main message that is being communicated. Maruping and Agarwal (2004) also indicate technologies such as e-mail as best for the execution of routine tasks, but both synchronous as well as asynchronous technologies can be used. Even though telephone is a technology that offers some sort of media richness by giving paralinguistic, telephone is used for executing routine tasks. P8 - *“Well as I, if you just want to communicate something or to inform somebody about something and you do not expect a lot of input it will, yeah you can easier do it over e-mail or over the phone.”* P5 - *“In the operation team for HR e-mail would be perfect, and to give you an example of the work that they did there, the work that they did there was hiring people, contract and they would call each other quite a lot, short call.”* One explanation found is that the use of telephone also gives a more personal connection while executing a routine task.

Telephone is also seen as a useful and preferable tool for a routine task when there is a need for synchronous communication. P4 - *“When you need a quick answer for example, you know pick up the phone, are you coming to the meeting in two hours. Why would I send an e-mail asking that? Can you give me the telephone number of X? People send an e-mail for that, pick up the phone and ask for it.”* Synchronous communication offers that urgent matters are instantly discussed. When you know someone is online, chat is a technology that offers semi-synchronous communication, but it is seen as less interruptive and is used for short and simple conversations. Text message is also not seen as interruptive but generates a fast response and therefore a good alternative for times when there is a sense of urgency and synchronous communication is not possible. Even though video conferences or web meeting platforms also offer synchronous communication, the fact that they need to be scheduled in advance makes that they are not very useful for urgent unplanned communication. E-mail does not offer synchronous communication and is not very useful when the matter is urgent. But in handling routine tasks, in many cases asynchronous communication is needed. P2 - *“But if you know like: I need you to review this document and give feedback back to me, than I would just send it in an e-mail.”*

E-mail is considered a good technology for the execution of routine tasks, because it offers clarity, is low on media richness and offers response time. This is confirmed by the fact that all participants use e-mail for routine tasks. Some participants also indicate to use chat and text message for routine tasks, in situations where for better interaction more synchronism is needed or a quick response is required. 33% of the participants use a phone for routine tasks, which offers some more media richness, synchronous interaction and a personal connection. Technologies such as phone conference, video conference; normal and 2.0 and web meeting platforms are not used by the participants for routine tasks. This corresponds with the fact that the characteristics of these technologies are not adequate for routine tasks.

5.1.2. Non-routine

The identified non-routine tasks are career development, explaining, generating ideas, negotiating and discussing and producing documents. When looking at two major dimensions, media richness and synchronism, it was demonstrated that the need for both of these elements is much higher for the execution of non-routine tasks than for routine tasks. No participants identified a need for media richness for executing routine tasks, while 7 participants expressed that media richness contributes to accomplishing non-routine tasks. High media richness can help overcome misinterpretation in virtual communication (Crampton, 2001; Liu et al., 2008) by passing nonverbal signs or helping to give meaning to silence. For executing routine tasks only 22% of the participants use synchronous communication technologies, while for non-routine almost all participants do so. Looking at the pure asynchronous communication tool, no participants mentioned to use text messaging for the execution of non-routine tasks. In a few cases e-mail is used for the communication for non-routine task, but this is mainly used for support activities like planning meetings, sending documents in advance or resuming the meeting results. P6 - *“If it is something that is complicated, what I would do is first send an e-mail with the frame and then after that I would discuss the details or clarify over the phone.”* Only one participant uses e-mail for a non-routine task, producing documents, because it gives the team members the possibility to work on a document in a linear process. E-mail and text messaging are generally not seen as good tools for executing non-routine tasks, because of these asynchronous characters which leads to low interactivity, but also because of the low media richness as earlier indicated.

What the results showed is that different types of media richness are required for different types of non-routine tasks. For example, the majority of the participants use telephone for generating ideas, 77%, and negotiating and discussing, 66% of the participants. For the activities career development and explaining, only 11% and 22%, respectively, use the telephone and for producing documents no one of participants uses the telephone. Telephone offers paralinguistic information which is important in for example negotiating and discussing. P6 - *“The big difficulty it is just to ehm exchange information or discuss through e-mail. Once you can talk over the phone and feel what the other persons think, you know when you talk and you listen to someone, even just over the phone, you can feel a lot of things that you cannot feel through e-mail.”*

For the execution of the activities career development and explaining, the information given by the voice does not transfer enough cues, body language and facial expressions are very important. Video conference and video conference 2.0 are therefore the most frequented mentioned technologies for the execution of these tasks. P8 - *“Well for instance ehm I’m thinking, for instance in the context in HR if you, if I have, being HR manager for the HR population and I want to to have an interview, or to have a discussion with one of the HR persons, to discuss about possible career development or whatever I think it is important to see the persons and not to do that over the phone.”* P9 - *“For instance if I want to talk about something related to human resource or something that has to do with*

my career, I prefer to talk on telepresence and talk directly to my boss on a telepresence.” In case of executing the activity explaining, participant 5 clarified that the media richness offered by the video conference is important to confirm whether the explanation has been understood. *“If it was about instructions as well, particular to my team. Then I would use video conference. I found typically very difficult to instruct people over the phone. Because there is no visual expression and because you cannot see if someone really understands it.”* Phone conference and web meeting platforms are not used for either of these tasks. Apart from the fact that phone conference is lower on media richness than video, this may also be explained by the fact that video conference and video conferences 2.0 are mentioned as good tools to establish personal contact.

For the task negotiating and discussing for example phone conference is a technology used by participant 3 *“...where you need multiple people because you need their view on something.”* Participant 8 prefers video conferences for this task: *“If you really want to interact, if you really want to have interaction, I believe that a tool or a well a communication channel where you still can see the other person, it is probably more effective.”* Four participants indicated web meeting platform as the technology used for negotiation and discussion. The web meeting platform offers the flexibility to have plenary discussions as well as discussions in smaller groups. P7 - *“We have a quarterly meeting, we use WebEx [web meeting platform] and we use, we also have something, some learning and we use virtual break out rooms for group discussions and people love it.”* Even though various technologies are used for this task, they all are synchronous technologies and include voice contact, the main element needed for the execution of non-routine tasks. For participant 9 however discussing and negotiating cannot always be done by this type of technology and is done by chat. *“But when things happen, like someone, there are some headlines hitting the wire like a mayor politician saying something, like there are different groups having discussions over what is going in real time. So in the chat you can follow different discussions and participate in them all at the same time. On the phone you cannot. That is important.”* Chat is a technology that offers semi-synchronous communication, which allows the participants to follow more conversations at the same time, while it is still a real time conversation. Another factor for using chat is the urgency that is connected to the communication. Even though the chat is the most used technology for participant 9, when possible also he indicated to prefer more media rich tools like video conference 2.0. *“For the, my daily routine, because it is quicker and very user friendly, Bloomberg [chat] is the best. But it depend if it is a specific issue or more a strategic meeting, you can of course adopt other, you go through other channels, because it is more, it is easier to communicate.”*

When looking at the task of ‘generating ideas’, telephone was demonstrated to be a common used technology, but only when two people are involved in the communication. When the task involves groups, then video conference or web meeting platforms are the used technologies. These technologies offer more possibilities and media richness than the phone. P5 - *“I was a specialist and that meant that my team was specialist and needed to do a lot of brainstorming. And particularly*

because we designed and did a lot of conceptual work, east definitely. No we would do a lot of brainstorming, we would do that, through phone would work, to a certain extent and we would use video conferencing quite a lot as well.” Generating ideas is not done by any of the participants by phone conference, which is not surprising because brainstorming is a creative and unstructured process while phone conferences are characterized by a high need for structure.

The last routine task is producing documents, which is a task that requires high information and/or media richness. Video conference or video conference 2.0 are used for this task, because it offers media richness. P8 - *“But again if you want something to be achieve, to be built together, to be ehm I still prefer a tool where you ehm where you can see each other or ehm and does not have to be, physical in the same place, but at least ehm, yeah.”* The web meeting platform offers the possibility not only to see each other, but also to look at the documents. Because of the flexibility and all the possibilities, the web meeting platform is the participants preferred technology for producing documents together. P1 - *“Definitely if we are going to be collaborating, working on documents, or if I need to share printed information, then I would definitely do WebEx.”*

5.1.3. Building and maintaining relationships

Building and maintaining relationships is essential for virtual collaboration. P3 - *“My basic strategy is that I say, I can work with people that I cannot see, but I cannot work with people that I do not know. So I need to establish that feeling of knowing each other. And that can be that I, I see them face-to-face sometimes; it can mean that we talk a lot about hobbies, it can be that, yeah, I write a card or I make a present.”* For building and maintaining relationships all technologies are relevant, because the different factors indicated to be related to building and maintaining relationships can be obtained using different technologies. Moreover building and maintaining relationships takes place in between other tasks. Important therefore is that for reaching the goal of building and maintaining relationship, a high variety of technologies should be used. All technologies contribute to building and maintaining relationship is a complementary way, as known by participant 3. *“What I do try and do, I try to use different media. That for me is important, because I feel you get a more full picture of the person if you do not know the person through only on communication channel.”*

Informal conversation is a factor named by all participants that contributes to building and maintaining relationships. Different synchronous technologies such as telephone and video conference and the semi-synchronous tool chat offer the possibility for informal talk. Important for building and maintaining relationships is the personal connection that synchronous communication tools greatly offer (Daft et al., 1987). Telephone is used by most participants for informal conversation, as participant 3 described, where also humor is included: *“So for example those informal calls to just, you know I just call someone and say, hey what’s upppp? As a funny thing.”* Humor is essential for building trust and relationship, but according to literature (Beise et al., 2010; Jarvenpaa & Leidner, 1998; Knoll & Jarvenpaa, 1995) computer mediated communication complicates the understanding of

humor. It is important that people find a technology in virtual collaboration in which they feel free to use humor in the communication. Participant 7 indicated to prefer the video conference when she wants to include a social component into the meeting. *“I tend to do video with my consultancies, this more when I want to connect with them and chat and ask and then do some work as well. But it is more of a hey let’s get together for 30 minutes. Tis, there’s more a social component in it for me.”* Chat is also seen as an informal environment, because of the emoticons, where some more informal conversations easily can take place. P7 - *“Now the interesting thing about Skype [chat] for example is, you have these emoticon, I do not even know how to say it, and you can play around, you saw the little smileys I send you, and the tea. Yeah, so and you can, it is more playful, but is also given you more of an idea, or given your receiver more of an idea of what your state of mind is.”*

Even though a small majority claims that building and maintaining relationships in virtual teams is impossible without occasional face to face contact, technologies can offer a lot to reduce or even eliminate the need for face to face contact. Media richness, hence, is another important dimension, especially in building a relationship. Media richness contributes a lot to the feeling that people have of knowing each other. Daft et al. (1987) also confirm that high social presence and media richness contribute to reinforcing relational connections. First of all there is the voice contact, which is established through the phone, which is indicated by 66% of the participant as important. P1 - *“Again it can get some more personal versus e-mail. You just see words on the screen versus hearing someone’s voices is the next level of kind of connection. So for relationship building I think it is important to talk on the phone.”* This voice contact can also be reached through phone or video conference or web meeting platform. The next level of social presence, brought by the video is not just knowing a voice, but also knowing a face. P1 - *“Ehm you know it’s just, I feel like if you see each other’s faces you feel like you are getting to know them better or something. So specially with our client, with my client I have only met her in person once, just to be able to see her face and she my face it becomes more personal than just a voice.”* With the video conference 2.0 the technology is very near to face to face contact. P5 - *“Only at the HALO table [video conference 2.0] I truly felt that particular facial experience and body language could be transferred. But a normal video conference thing that was tricky. When working with Halo you can really look each other in the face, look each other in the eyes and make your movement.”*

An important aspect of the factors named above is that a personal connection is created. Video helps to build this personal connection, because you can get to know something about the person’s state without them having to express that to you. P6 - *“But it is good, at least you can see the people and so I can feel, you can see if they look tired or if they are in a good shape, there are some elements you can identify so that is good.”* Although telephone is not the most media rich technology, for most participants this technology gives the most personal connection, which might be related to the fact that it is highly used for informal conversations. P3 - *“Sometimes if I just want to bond you know, for the social part, I also love telephone, because it is easy and it is traditional and it has the feeling of*

coziness.” Phone conference is seen as much less personal than an individual phone conversation, as illustrated by participant 6: “*For me the individual discussions it is more, you cannot put the things same as group, but of course can include as well some more personal thing, while when it is a group call I think it’s less personal, it is more task oriented.*”

The relationships are maintained by, among others, frequency of interaction. P1 - “*I mean I do not talk, if you talk to someone every day you start to feel more comfortable and establish, get to know how you work with that person and learn about your working preferences and if you talk to someone every month or every few months it is kind of starting over each time a bit.*” High frequency of interaction also causes a sense of co-presence, as in the situation of participant 4. “*For example very simple ways that is getting us closer to each other. We have created, we are four colleagues working remotely, we have created a group in Whatsapp application [text messaging]. We are all in the group and that means that someone says something and everybody can react and that still technology but it is kind of you know, you feel people closer to you. You have a bad conversation with a client you see that. My god and you have someone reacting to it immediately so it is closer than e-mail.*” This feeling of co-presence contributes to trust in virtual collaboration according to Ma and Agarwal (2007) and trust is subsequently highly related to building and maintaining relationship.

This example of participant 4 is also related to another factor, offering support. Offering support is essential for feeling close to each other and establishing trust within the collaboration. Offering support can be done through various technologies, of which some asynchronous tools such as text messaging or e-mail. P1 - “*The other thing what I mean by relationship building is like supporting each other and so a lot of times we will send out an e-mail: I’m challenging, I’m dealing with this issue, I need advice, any resources I should look at? You know, just send of a quick e-mail and the fact that we are all quickly respond and help each other out kind of helps to build a trust and just feeling of: I can rely on my team.*” This is in line with the theory of Rosen et al. (2006) who say that trust is developed by actions as information sharing and commitment as demonstrated in this example. Synchronous communication technologies are also used for support, such as e-mail and chat, as demonstrated by participant 5. “*Yeah maybe little messages now and then, it is a socials thing. Ehm an also with colleague, when you’re working on the same assignment you work have coffee and have little discussions, little sidebar discussions. I would do that over the phone or through communicator [chat] as well. To name you an example, for our management team, a time that we would need that 800 staff across the world would do their performance reviews and would term them in, for a certain time, mostly had all your hands on deck across the world and then little messages would help, like oh your still working, oh your still leaving away. Good luck, do you need any help.*”

P9 - “*But when you start working with them on a daily basis and you start sharing information over e-mail and you start talking over the phone. Sometimes you, not sometimes, every time that that happens and the relationship is for a long time, you start feeling more closer to the person and you start feeling like you have a personal relationship with that person, even if you have never saw him in*

his whole life.” This example shows that relationships are built and maintained with various factors using various technologies. It appears that media rich and synchronous communication technologies are essential for building relationships, because it gives the people the chance to know each other through informal conversations and getting to know a voice and a face. Frequency of interaction and offering support seem essential for maintaining relationships, also because of the sense of social presences it creates. For this various technologies are used, but mostly this type of communication goes through informal and easy to use communication technologies, such as chat, phone, text message and e-mail.

5.1.4. Matrix

In the theoretical framework a matrix that links technology to task was presented. The original matrix is based on three types of tasks and various types of technologies. The fit between task and technology is indicated by various types of smileys, from least to most appropriate (😞 - 😐 - 😊 - 😄). The data and insights acquired from the interviews lead to review of this matrix. Adopting a technology -task matrix assumes that some technologies are a better fit to execute some tasks than others. This presumption, and the fact that a good match will positively influence team effectiveness and performance, is confirmed in literature (Beise et al., 2010; Duarte & Snyder, 2001; Fuller & Dennis, 2009; Powell et al., 2004).

The results from the interviews do not support the choice for the types of tasks distinguished in the original matrix. First of all, the word routine seems to be interpreted in a negative way, for example by participant 1: *“You know that it does not feel very routine, it is not like ohh every week we do 20 of this and 30 of that. It is hard to figure out what is routine in terms of the team, each project is like customized and so it’s hard to come up with a very routine task.”* For participant 2 the distinction between routine and non-routine is not enough focused on the real task. *“It is basically the same, but it depends on exactly what the task is. Routine versus non routine does not really matter. It depends on exactly what the task is.”* Considering that all routine tasks mentioned by the participants contribute to the execution of another task, support tasks may be a more appropriate name for this category. Despite the fact that there are several different activities incorporated in this task, the technological needs are very identical, therefore these various activities can all be merged in the same group in the matrix: support tasks.

Similarly, the term non-routine task is not considered very appealing either. Moreover, in the category non-routine task a high variety of activities were found with different technology needs. The name non-routine task does not do justice to the richness of activities in this category and the variety of necessities. Based on the different needs for communication for the activities in routine task, these activities should be subdivided in various separate tasks. The activities ‘career development’ and

‘explaining’ would be merged into the category interpersonal tasks, because they both require a high personal connection in the communication. In the second category the activities ‘generating ideas’ and ‘negotiating and discussing’ are merged, considering the high need for media richness to transfer kinesics and paralinguistic information. The last activities within the non-routine tasks is ‘producing documents’, which is represented in a separate category. This is a type of activity that is characterized by a high need for synchronism and for the execution information richness is essential.

The last original category, building and maintaining relationships, might be seen as the most debatable category, because it is not really a task in virtual collaboration but an ongoing process. However, this category is justified in this matrix because building and maintaining is something that is often forgotten in virtual collaborations, but it is essential for effective team work and highly related to trust in virtual collaboration. P8 - *“What you also see a lot is that, virtual teams they come together, when they come together they do their coffee corner stuff and talk about the relationship piece and then when they meet virtually they are just about the task. (...) This balance between task and relationship is the only way to get things done virtually and you do not wait until you meet up in June to go talk about kayaking and hobbies. You do that in the virtual space as well.”* Greenberg et al. (2007) say that a weak point of virtual teams is being too task focused. They state that investing in relationships is good for trust and will increase teams’ effectiveness.

When considering the technologies indicated in the matrix, there are some differences between the technologies named in the matrix and as used by the participant. The technologies bulletin board and document sharing are two technologies named in the matrix that never came up in the interviews. The fact that bulletin boards were not mentioned can be explained by the fact that the bulletin board refers to intranet, a technology that has already passed its peak of popularity. Linked to document sharing, two possible explanations can be offered. First is that document sharing has been integrated into technologies such as e-mail, video conferencing and web meeting platforms. Secondly, technology has developed and documents sharing has become so automated that it is not experienced as communication no more. One technology that is mentioned in the results but was not present in the matrix is video conference 2.0, simply explained by the recent emerging of this technology.

In the original matrix a distinction between asynchronous and synchronous communication tools is made which is not be adapted in the new matrix. First of all, in the new matrix, two out of the three original asynchronous communication tools are not represented anymore. Secondly, according to the results text messaging and especially chat are seen as communication technologies that are semi-synchronous. This is why a matrix is chosen wherein no distinction is made between synchronous and asynchronous technologies.

Figure 2. Revised technology versus task matrix

	Support tasks	Producing documents	Interpersonal tasks	Brainstorming and discussing	Building & Maintaining relationships
E-mail					
Text message					
Chat					
Phone					
Phone conference					
Video conference					
Video conference 2.0					
Web meeting platform					

In the task – technology matrix the match between the first category ‘support task’, previously routine tasks, and the various technologies stayed unaltered.

In the non-routine task, which is divided in three types of tasks, several changes are suggested. The technologies ‘e-mail’ and ‘text messaging’ are still seen as a poor match with the non-routine tasks because of the lack of media richness and synchronism. However for ‘producing documents’, ‘e-mail’ was added as a relatively good match because it offers information richness, which is important in the execution of this task. ‘Chat’ was marked as medium instead of good, it is not favored by the users due to its low media richness. Synchronous communication tools ‘phone’ and ‘phone conference’ remain a good and excellent match for the ‘interpersonal tasks’ and ‘brainstorming and discussing’. The only exception is the activity ‘producing documents’ for which the ‘phone’ and ‘phone conference’ are a good and medium match, respectively, because of the lack of information richness. For ‘producing documents’ with the growth of information and media richness, the match gets better. Contrary to the original category non-routine tasks, the ‘interpersonal task’ and ‘web meeting platform’ are not seen as an excellent match with ‘web meeting platform’, because the technology is not high on social presence. Participants seemed to find the ‘video conference’ an excellent match for ‘brainstorming and discussing’, especially when it concerned the ‘video conference 2.0’.

In the category ‘building and maintaining relationships’ ‘phone’ is indicated as an excellent match and it is the most used technology. The participants see telephone as the best tool to establish a personal connection and a good tool for informal conversations. Contrary to the phone, the ‘phone conference’ is a medium match, because of the high need for structure and high task orientation.

Originally phone conference was seen as a very good match for 'building and maintaining relationships'. Even though 'video conference 2.0' provides a very personal connection and is high on social presence, the exclusivity that is related to the use of this technology makes that the collaboration is always very task orientated and therefore not necessarily the best match for 'building and maintaining relationship'.

5.1.5. Task – technology relationship

The first research question, namely 'How is the choice of technology related to the different tasks in virtual collaboration?', can be answered. From the results of this chapter and the matrix as a summing reflection, it can be concluded that task and technology choice are very highly related in virtual collaboration.

When considering routine tasks, it is demonstrated that these activities require technologies that generally offer high information richness. For the execution of these support tasks, both asynchronous and synchronous communication technologies that are not very high on media richness are a good match. The most common used technologies for support tasks are e-mail followed by phone, chat and text messaging.

Non-routine tasks fit best with technologies that are synchronous and have high media richness. The interactivity and transmission of nonverbal cues this offers, is needed to deal with the ambiguity of the tasks. Communication technologies that offer synchronous communication are the best choice for non-routine tasks. Of the various options of synchronous communication tools, some technologies are better suited for certain activities within the non-routine tasks than others. For example, high social presence is very important for the interpersonal tasks, include the activities 'career development' and 'explaining'. Video conference 2.0 best meets the requirements for these types of task. All other synchronous technologies offer some of the characteristics needed for executing these type of tasks, apart from phone conference which is poor match for the execution of these tasks. When brainstorming or discussing, media richness is very important, which is also found in the video conference 2.0. For producing documents, the web meeting platform is most suitable, because of its high information richness.

Building and maintaining relationships is something that happens all the time and therefore through all communication technologies. Media richness and synchronous communication are important to get to know each other through informal conversations. It also contributes to getting to know a face or voice, which adds to building a relationship. To maintain a relationship, frequency of communication and support are important, contributing to a sense of co presence. Various technologies can be used, but chat and telephone are common because they are easy to use, are informal technologies and create a sense of co-presence or social presence.

Technology choice and task are highly related, but task is not the only influence on the selected technology. Dennis and Valachich (1999) point out that we cannot overlook situational constraints and context factors that influence technology selection. Some factors of influence that cannot be linked to a specific task were already mentioned before, such as sensitivity and urgency. Urgency and technology availability are two influence factors that are also described by Duarte and Snyder (2001). When a number of these factors come together while executing a task, a tradeoff between the most important technology characteristics has to be made. Urgency, for example can imply that a task that normally would be best solved with a media rich technology has to settle for another technology, because there is no time to schedule the technology in advance.

Summarizing, task is decisive for the type of technology used for the communication, but this relationship can sometimes be influenced by context factors that are not seen as a specific characteristic of that type of task.

5.2. Cultural influence

The type of task greatly influences the communication tool chosen for the execution of the task. Even though this relationship is essential, there are some factors that influence this relationship, for instance culture. The impact is investigated to answer the second research question:

What is the influence of culture on the relationship between communication technology and task?

To answer this question the effect of various cultural dimensions on the task-technology relationship are discussed. The effect of the circumstance factor of cross cultural working such as time difference, the language barrier and the infrastructure are also discussed.

5.2.1. Dimensions

As already demonstrated in the previous chapter, culture influences the communication in virtual collaboration in various ways. Participant 3 confirmed that the impact of culture is very important. *“It is totally different, of course culture has major, major implications for virtual communication.”* Some of these influences also have an impact on the technology selection in virtual collaboration and therefore influence the task-technology relationship.

The first cultural dimension which has an impact is high versus low context orientation. Some countries, such as Latin countries, were indicated to be more focused on the relationship, which effects the communication technologies chosen for a certain task as demonstrated by an example of participant 6. *“No I could not really give, but maybe the example I could give for instance, if I have a difficult task to ask to someone, and because I have the requesting for top management for instance, maybe with some more Latin type of culture, rather than sending an e-mail saying this is the request we have to deliver in a few days and thank you, maybe I would try to explain over the phone that I understand that it is difficult and that it is going to put a lot of pressure on them, but I know that they will do them best, but to have this really personal discussion to make it easier for them to accept the*

overwork yeah. Maybe with some Anglo-Saxon country it would be less important to do it.” Not only the Latin countries, but also the Middle East is indicated as a region that, preferably, should be approached by telephone because of the relationship building, in comparison to South Africans and people from Northern Europe or Anglo Saxon countries. Technologies that are higher on media richness, contribute to relationship building. P7 - *“The French, the French, my French consultants do like the video. Because they are more relationship based.”*

Northern European countries, for example tend to be more task focused. P3 - *“Hmm different where you are coming from in Europe, but overall I think we are, and of course my typically tainted view of European people, it is focused on task, also on positive and negative in the task and ehm, depending where they are from, we have a bit of iciness in the beginning, sometimes we have Smalltalk afterwards, lets talk about the task first and then afterwards they talk about people if there is still time. ... talk about the weather first and relationship building that way.”* This task orientation makes them more suitable to execute a task through for example phone conference compared to people from a relationship focused background, because this technology does not leave much space for interaction that is not task related.

Besides the relationship building, people from a high context culture also were indicated to prefer more media rich media because of the transmission of kinesics cues. *“We from southern Europe, you’re in Portugal, you have probably seen that, we use our hands a lot to speak, so that misses something, you know.”* Gudykunst and Ting-Toomey (1988) confirm that verbal and nonverbal communication style is influenced by the national background. The people from the United States were indicated by several people as being very comfortable on the phone. P7 - *“The US, the US seems to be OK with phone and what is interesting if I, If I may. My sales colleague who work in the US, would make, would sell over the phone, whereas in Europe we were never able to sell, to close a deal over the phone.”* North Americans are indicated by Hall (1976) as focused on facts in the communication and very direct. This explains the comfort they experience with contact over the phone, compared to more media rich technologies.

When talking about the characteristic timid, seen as having a hard time speaking up and interrupting, the most referred cultural background by the participants was Asian. Participant 5 demonstrated why it is important to have a communication technology with video when working with people from culture which to which was attributed the characteristic timid. P5 - *“I found that in particular working with my Asian colleagues, because I wanted to involve them I meeting and they would not speak up, particular on the phone you would not hear them at all. When the group became large, you would not hear them anymore. And where there were video conferences I could actually look at them and say hey, have you got something to say or yeas, so it is a cultural aspect as well.”* Directness does not only influence the communication during a meeting, but also before or afterwards. The directness has impact on the communication technologies used. For example, because of lack of directness it is more important for meetings held through technologies based on spoken interaction, to

be complemented with clear written communication technologies after the meeting. P3 - *“Ehm and then you go to the west coast [USA], it is sometimes a bit airy-fairy in that people are having a hard time in making concrete statements and concrete commitments. So sometimes, that is why I often use the combination that I have the WebEx call, I also send around minutes, especially when it comes around to do lists or so.”*

A last example is related to uncertainty avoidance and therefore a higher need for structure in the communication. P5 - *“When you have a discussion with someone from Japan, you have to send them an e-mail before calling them. Ehm so you cannot just call them, and it is very Dutch, to just pick up the phone and have that direct contact to say, hey what is the matter and is there an issue. They would be shocked.”*

5.2.2. Infrastructure

Availability of technology is an essential factor of influence on the choice of technology choice and the relationship between task and technology. Between the various cultures and countries there is a great difference in access to technology. This can cause a lack of access to a specific technology, which can be a reason to choose a less optimal technology for communication. P3 - *“Well not every culture has access to everything. And eventually in term of internet coverage it is sometimes also limited, so I know there are some people who do not have reliable access to internet, especially working with people in South Africa or in North Africa. They cannot do WebEx, they have to do phone and hope it works.”* Apart from the bad internet in South Africa indicated by several participants, other examples are absence of Skype in China or Voice-mail in India.

The different technologies available do not only influence the access to the technologies, but also the norms connected to the use of the technology. P2 - *“So I know one situation were an Indian colleague was in a meeting with an American colleague and she took a call from India on here cell phone. The American colleague got spinning mad, because in America that is incredibly disrespectful to the team, but she took the call because she knew the person would not leave a voice-mail, because this person was Indian. And she would miss the call and it was a really important call, so because she understood the culture of were the person was coming from and there norms and behaviors within that country.”* Information about the technologies available is essential for good virtual communication. P2 - *“Yeah, once you understand the infrastructure available in the country and in the different areas of the country, you can have a better idea of what sort of norm you are going to come about for communication.”* The differences in infrastructure and availability of technology can lead to inadequate technical resources, a risk factor for virtual project teams (Reed & Knight, 2010).

5.2.3. Language barrier

Collaboration between various cultures also results in variation in native languages and the fact that not all teams members always have the same proficiency of the common language used for

the communication. Language differences are another risk factors for virtual collaboration as indicated by Reed and Knight (2010). Adaptions in the technology selection for the executing of a task can help to overcome this challenge, for example by having more or less media richness or having synchronous or sometimes rather asynchronous communication. Participant 3 explained to deal with this challenge in the following way: *“Because, you know, on the asking by e-mail, if you have to ask someone to understand something, it is even a higher barrier then asking for clarification on the phone. Or I would do both, I would say I send the e-mail with my suggestions and then I say can we talk about it and discuss it. And to a native speaker I would maybe say: let me know what you think and then they get back to me. I would be more, I think I would be more purposeful and proactive in ensure that there is a two way communication if it is someone who does not have the same language proficiency.”* This demonstrated how different choices of technology are made when dealing with a language barrier in the execution of a task.

5.2.4. Time difference

Another factor of working in a cross cultural team is the fact the collaboration might involve different time zones, which makes synchronous communication much more challenging. When working between different time zones, e-mail is a technology that becomes much more valued and used. P1 - *“I guess with the time difference, especially sometimes we are working with people that live in Europa or in Asia, ehm but even between San Diego and Greensboro there is a three hour time difference so when I arrive in the morning and get situated and starting to get involved it is already time for everybody to go have lunch in Greensboro, so. It is nice you know, when you send an e-mail it does not matter what time you send it and people can respond at their convenience, so it can kind of help to overcome time differences if you use..”* In some situations an effort is made to reach synchronous communication. But when time differences are big, it happens that a person might not be in the office no more and does not have access to the same technologies. P5 - *“I would, particularly if we had a call or a video conference with people from locations across the world, then someone had to build, particularly if you wanted to invite a colleague, we had a college in Boston and the majority of the team was based in Singapore and The Hague, so we would, those who we would link to the video conference, but we could not ask our colleague to come to the office in the middle of the night, so she would dial in.”* Working with time differences means that sometimes compromises have to be made when choosing a technology for a task.

5.2.5. Influence

To answer the second research question: What is the influence of culture on the relationship between communication technology and task? attention is given to both the influence of cultural dimensions as well as to the influence of the changes in the circumstances of communication that are a result of cultural diversity in the collaboration.

Culture influences the behavior of people on several dimensions, as also demonstrated earlier. These dimensions also influence communication and choice for technology in virtual collaboration. However, the effect of these dimensions on the relationship between technology and task is limited. Due to the effect of culture only a small adjustments in the technology choice are made, such as more media richness or synchronous communication. The fact that a limited effect of culture on the relationship between communication technology and task was found in this research, does not mean that this is the best way of dealing with the effects of cultural diversity on communication in virtual collaboration. One explanation for the limited influence could be the low awareness of cultural differences in virtual collaboration. Another explanation could be the limited variety in cultural background among the participants.

When looking at the specific circumstances for culturally diverse teams, a larger impact is found. Technologies can be useless, as a result of time differences and the actual infrastructure in some countries. Even though some examples of big influences were found, it is important to remember that the effect of these changing circumstances can be more moderate. The impact of on hour time differences on the communication is more limited than for example the impact of a twelve hour time difference.

The language barrier that can exist as an effect of national diversity, influences the choice for technology in a way that more complementary technologies are used for the communication, such as an email with a summary after a telephone meeting. Language differences can also be an extra obstacle for building and maintaining relationships.

According to these findings the cultural dimensions do not drastically impact the task-technology relationship. This may be explained by a low awareness for cultural diversity. When considerable big time differences or a gap in infrastructure exists, this can have a big impact on the technology choice. The language barrier affects the task in a way that more accuracy or interactivity can be required, which can lead to more use of complementary technologies.

6. Conclusions

In this research a qualitative method was used to explore the relationships between task, technology and culture in virtual collaboration. The main objective was answering the two research questions:

1. How is the choice of technology related to the different tasks in virtual collaboration?
2. What is the influence of culture on the relationship between communication technology and task?

After completing literature research, data collection, analyses and discussion of the data, a clear relationship between the task at hand and the chosen technology can be confirmed.

Different types of tasks are best executed with different technologies.

Routine tasks, which are tasks that can be seen as support tasks for more complex tasks or interactions that have to be executed, are best performed with technologies that offer high information richness and clarity. Media richness is not essential, since the message is, most often, unambiguous. Both synchronous and asynchronous technologies can be used, but the preferred technology is e-mail.

Contrary to routine tasks, non-routine tasks are best executed using synchronous and media rich technologies. The non-routine tasks are divided into several categories of activities with different needs of media richness, information richness and social presence. Interpersonal tasks, including activities such as career development or explaining, match well with video conference or telephone, because of the high social presence. In brainstorming or discussion media richness is of high importance and therefore this task is best executed via video conference or video conference 2.0. Information richness, obtained through web meeting platforms, is essential for the task producing documents.

Building and maintaining relationships is a task that returns in the execution of all other tasks. All technologies contribute to building and maintaining relationships, but there are some factors that are very important and can be better reached through specific types of technologies. Synchronous communication technologies and tool that contribute to social presence are important for relationship building. Frequency of communication and support, but also contributing to a sense of co-presence are essential. For this, mostly easy accessible and informal technologies are used.

However the relationship between task and technology choice is not established in a vacuum and various factors influence this relationship, such as urgency and sensitivity.

Secondly the effect of culture on the relationship between task and technology has been discussed. National culture affects the relationship through the difference in behavior and through the changes in the circumstances of the communication. However, no major influence on task - technology fit was found. This may be explained by the low awareness of the effects of cultural diversity and the limited diversity amongst the participants.

The circumstances of the communication effected by the cultural diversity had a bigger influence. For example, infrastructure varies between countries and makes some technologies unavailable. Time difference results in a much higher use of asynchronous communication technologies, even for non-routine tasks. A language barrier that sometimes exists creates a higher need for confirmation in the interaction and therefore the use of complementary technologies such as the use e-mail and phone for the execution of the same task. Even though some big influences of the circumstances on the choice for technology were demonstrated, it is important to remember that the effect of these changing circumstances can be more moderate.

One of the limitations of the study was the access to participants from only a small variety of national and cultural backgrounds. The effects found of culture on the relationship between task and technology were limited, which could be caused by this high similarity in background of the participants. If participants from for example Asia, South America or Africa would have been included in the study, the effect of culture may have been more visible. Another limitation of the study was the duration of the interviews with the participants. Because the most participants have a tight work schedule, there was a limited amount of time for the interview, therefore some topics could not be addressed as profoundly as wished. Another limitation of this study can be found in the construction of the coding scheme. Because the various technologies had similar and overlapping characteristics, the exclusivity of each code in the scheme could not always be retained.

Future studies should explore the influence of culture on the task-technology fit from an intercontinental perspective, including participants from a wide range of cultural backgrounds. This way, the impact of culture can be assessed to a large extent. Secondly, I recommend research around the effectiveness of this model in virtual collaboration. For example, measuring effects on criteria such as team effectiveness and team performance. Also recommended for future study would be to study the effect of each technology on building and maintaining relationships in more detail. Finally, future study should explore the effect of organizational culture on the task – technology relationship. Interesting also is to investigate if a strong organizational culture reduce or moderates the impact of national culture on the task-technology fit.

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Appendices

Appendix I – Interview guide

Introduction

- Ask if the time is still convenient
- Welcome & thanks
- Recording & confidentiality
- Goal of the interview.
 - o How to use tools for virtual communication
 - o Explain what communication technologies are (all ways that can be used to communicate).
- Estimated time schedule

Questions

Part 1

How much experience do you have working in virtual teams?

How many years of experience do you have working in virtual teams?

What is your role in these teams, member or team leader?

What kind of purpose did these teams have?

What are/were the tasks these teams have?

What is it like for you to work in a virtual team?

Part 2

Some people say that there are differences in communication between face to face and virtual teams.

What do you think about that?

Do you notice differences in the way you communicate in a virtual setting compared to a face to face setting?

Do there exist virtual etiquettes for the communication?

Are there formal moments in which you discuss the communication within your team?

What are the subjects of these discussions? Are there any actions taken?

Do you reflect personally on the communication in your team?

Part 3

Which communication technologies do you use?

What are your preferred communication technologies?

What do you see as advantages of these communication technologies?

What do you see as disadvantages of these communication technologies?

In what kind of situations do you prefer to use this kind of communication technologies?

Which factors influence your choice in selecting the communication technologies you are going to use?

Do you consciously select the communication technology for the task at hand?

Do you ever have doubts in choosing the right communication technologies?

Can you give a specific example of a situation in which you were not sure which communication technology to use?

Part 4

With which countries others than your one have you work with?

Can you identify differences in communication when working in a culturally diverse setting?

How do cultural differences influence the way a task is being handled?

Some countries are more direct than others.

How does cultural diversity influence the communication?

How does cultural diversity influence the selection of communication technologies?

In what ways do you adjust the communication technologies you use when you are talking to someone from a different cultural background?

Part 5

Interviewer explains:

asynchronous/synchronous: Synchronous should be present at the same time, for asynchronous communication active presence of all members that are included in the communication is not required.

social presence: Social presence is the degree to which technology gives the sense that their exists interaction with other individuals and helps to build personal connections

media richness: describes and ranks communication media by the amount and variety of information that the media transfers

How do these dimensions influence you selection of communication technologies?

Interviewer explains types of tasks used in model (routine task, non-routine task, building and maintaining relationship):

Can you name an example of a non-routine tasks and a routine task at your work?

What kind of technology would you use for a routine task?

What kind of technology would you use for a non- routine task?

What kind of technology would you use for building and maintaining relationships?

Do you consider task as a main factor for the selection of communication technologies?

Do the types of tasks as describes match with the types of tasks of you team?

Closing

- Ask if something important is left unsaid
- Give a short resume
- Facts
 - o Age
 - o Nationality
 - o Local residence
 - o Company
- Planning: when results, how
- Thanks

Appendix II – Informed consent

INFORMED CONSENT FOR INTERVIEWS

[Master thesis: Communication in Virtual Teams]

Anouk Eggen, student of the Portuguese Catholic University - Porto, Portugal is conducting a project/Master Thesis entitled: Communication in Virtual Teams.

This thesis is part of the master's degree in Psychology, with a specialization in Work and Organizational Psychology. The purpose of this research is to investigate the most appropriate ways of using communication technologies in a virtual team given the different tasks and the influence of cultural diversity.

I hereby declare that I understand the intent and purpose of this research and thus agree to be interviewed for this project. I am also aware that my participation in this interview is voluntary. If, for any reason, at any time, I wish to stop the interview, I may do so without having to give an explanation.

I declare that I have been told of the confidentiality of information collected for this project and the anonymity of my participation.

I agree to participate in an electronically recorded interview for this project and I am aware that the results of this thesis will be presented publicly and that results of this study may be published in an academic journal.

I agree that any information obtained from this research may be used in any way thought best for this study.

I have read the above form, and, with the understanding that I can withdraw at any time, for whatever reason, I consent to participate in the interview.

_____ Date _____

Signature of Interviewee

Appendix III – Category system

Code	Name	Description	Example of data	Sources	References
1. Technology					
1.1 E-mail - A system for sending and receiving messages electronically over a computer network.					
1.1.1 Asynchronous – Communication where active presence of all members that are included in the communication is not required.					
1.1.1.1	Preparation time	Refers to the time the sender of a message has to form and revise the message	P5 - <i>“I’m quite long winded and e-mail, in e-mail I can write three sentences in an e-mail and say it all. And I can just blurb it out and then shorten in a little bit and work on it a little bit and then work on it and that is actually why I like e-mail.”</i>	4	9
1.1.1.2	Response moment	Refers to the fact that the receiver of a message is in control when he/she is reading the e-mail.	P1 - <i>“It is nice you know, when you send an e-mail it does not matter what time you send it and people can respond at their convenience, so it can kind of help to overcome time differences ...”</i>	3	4
1.1.1.3	Reflection time	Refers to the period of time between receive an e-mail and sending an answer back, which can be used to think over the information that is communicated.	P1 – <i>“Like if we are doing, if we are talking about, right now we are designing a session for a training that we are going to be doing. I would rather say send me the outline of the design first, let me think about it and kind of make some notes and then I send it back and then we have a discussion.”</i>	8	27
1.1.2	Low social interaction	Refers to the low ability of having social interaction when using e-mail for communication .	P1- <i>“I guess it is just like seeming inefficient and ehm people are asking questions via e-mail and then you get three or four different opinions and then the person still does not really have the answer that they need and then you know, it would have been easier for everybody just to be all talking it through.”</i>	8	23
1.1.3	Low media richness	Refers to the low amount and variety of communication cues that the media transfers.	P8 - <i>“Just to come back on writing communication, sometimes you really have to be, sometimes you read sentences and you may interrupted them and when you go back to the person who send you the message, he may have meant something completely different, but you may have interpreted in a way, so this is something you have less with the phone for sure.”</i>	7	16
1.1.4	Clarity	Refers to the characteristic of e-mail for the communication of unambiguous information that is	P5 - <i>“My colleague in rewards, she was a rewards specialist, she did a lot of e-mailing, because here tasks were instructions, very different. So team you do this, you do this, here is you spreadsheet,</i>	5	7

		explicit and easy to understand.	<i>very clear.”</i>		
1.1.5	Permanence	Refers to the characteristic of e-mail that information send through e-mail is stored and accessible at a later moment.	P3 - <i>“Ehm e-mail is great because you can always fall back to it... You have recordings of the information you want to share.”</i>	8	15
1.1.6	Group audience	Refers to the fact that e-mail can be used to sending information to multiple people at once.	P4 - <i>“When you, when I, when you have something to share with a group of people, a message to send to a group of people. If you want to make sure you are sharing needs to get to ahh a large group, I think that it is a good tools. I think that it is a good tool.”</i>	3	5
1.1.7	Sending information	Refers to one of the functionalities of e-mail which is sending information.	P5 - <i>“Yeah, to get a message across to a large group or to get a document across, like an agenda or document linked to a meeting, ehm. Those type of situation.”</i>	8	17
1.1.8	Complementary technology	Refers to the fact that e-mail often is used for support communication needed for the execution of a task through another communication technology.	P7 - <i>“One is if you are talking to someone that is very unstructured and very creative. If you have a phone call with them, which they love because it’s a personal connection, you always have to follow up with an e-mail saying this is what we talked about, is that right?”</i>	7	14
1.1.9	Quick in use	Participants refer to e-mail as a technology that is fast in application.	P1 - <i>“And I guess it is another disadvantage, a small extra step that you have to go through to set up a WebEx to be able to share the documents compared to sending a quick e-mail or picking up the phone.”</i>	4	7
1.1.10	Over usage	Refers to the fact that e-mail is used too much.	P4 - <i>“Well we use a lot of e-mail, I think we use to much e-mail ehm if you think that I think it is a communication tool, but it is overused and pretty often misused, so ehm that why you know inboxes are very often overloaded and people cannot, it is just. Outlook, messaging management can take a lot time.”</i>	3	6
1.2 Telephone – A communication tool through which spoken conversations from remote locations can take place between two individuals.					
1.2.1 Synchronous - Communication where the people who take part in the interaction should be present at the same time.					
1.2.1.1	Interactivity	Refers to the two way communication and the fact that roles between sender and receiver can be switches easily.	P1 - <i>“Well I think you know with synchronous, sometimes that can be more efficient ehm you can ask follow up question, you can really get into an issue, ehm you can involve, you know, you can get more interaction between people.”</i>	8	28
1.2.1.2	Quick response	Refers to the fact that when a question or request is made via telephone an answered will be provided directly.	P4 - <i>“I think we have talked about it, if I want to have you know quick response would pick up the phone.”</i>	7	22

1.2.2 Media richness – Various elements that contribute to amount and variety of information cues that are transferred.					
1.2.2.1	Paralinguistic	Refers to all information and signals send out via the use of the voice.	P6 - <i>Once you can talk over the phone and feel what the other persons think, you know when you talk and you listen to someone, even just over the phone, you can feel a lot of things that you cannot feel through e-mail.</i>	9	19
1.2.2.2	No kinesics	Refers to the absence of the transmission of information through body language and facial expressions.	P5 – <i>“Phone, the only thing with phone is that you cannot see each other.”</i>	7	28
1.2.3	Personal connection	Refers to the subjective feeling expressed by the participants of feeling highly connected on a personal level using telephone for the communication.	P6 – <i>“For me it is very clear, if I want to have a personal contact with the person to feel the person I will go for phone.”</i>	7	26
1.2.4	Sensitivity	Refers to the fact that telephone is seen as a good tool for the discussion of information that is delicate.	P2 – <i>“When there’s a sensitive issue going on it is better to pick up the phone.”</i>	3	6
1.2.5	Easy to use	Refers to the fact that the use of telephone is characterized by non or few technical obstacles.	P1 – <i>“And people are used to it. I do not know many people who are uncomfortable taking a phone call, I mean for technological reasons.”</i>	3	13
1.2.6	Need to schedule	Refers to the identified necessity of discussing in advance about when the telephone conversation is going to take place.	P6 - <i>“I try to agree on the time we are going to call in advance, I do not call just you know like that, because the person could have his or her own agenda and so and we discuss and they know that I’m call and they can get the ideas ready if they have any point they would like to cover, so I try to anticipate a little bit and try to avoid just to call like that you know, because then you can disturb the other party.”</i>	5	15
1.2.7	Interruptive	Refers to the situation when someone picks up the phone, all other activities that someone was doing at that moment have to be temporarily stopped.	P5 – <i>“And I’ve also started picking up the phone with clients and usually I never do, because I find e-mail, o phone call is interruption and an e-mail is not really an interruption because you can answer it when you are ready, but I’m picking up the phone with my clients and I’m have ten minutes conversations and I can cover five e-mail that way and get a response back.”</i>	3	5
1.3 Telephone conference - A communication tool through which spoken conversations from remote locations can take place between more than two individuals.					
1.3.1	Group call	Refers to the situation in which more	P1 - ; <i>“I guess you know if there were multiple people involved then</i>	4	4

		than two people are involved in a conversation over the phone.	<i>WebEx or phone is usually best.</i>		
1.3.2	Low involvement	Refers to the indication of participants that active participation during a phone conference can be hard to reach.	P5 - <i>“When I was in a large teleconference with a lot of locations linking in, I would just mute my phone do work and then link in or, if the conversation was a bit distance.”</i>	3	3
1.3.3	High structure need	Refers to the, by the participants indicated, disadvantage that a lot of structure is needed to make a phone conference effective and understandable for all participants.	P3 - <i>“If you have a telephone conference, there are a lot of etiquettes necessary to ehm understand who’s talking and saying what, because you only have one communication channel.”</i>	4	9
1.4 Video conference – A meeting systems where people are remotely connected and sound and video images are provided.					
1.4.1 Media richness - Various elements that contribute to amount and variety of information cues that are transferred.					
1.4.1.1	Body language	Refers to transmission of gestures and postures expressed as part of the communication.	P8 – <i>“Well the fact that, what I said earlier, that you can see the people and you can see their body languages, you can really, you can really read from their face if they agree or they do not agree with you. And they are, and you can see how people are expressing themselves.”</i>	8	19
1.4.1.2	Facial expression	Refers to transmission of gestures expressed with the facial muscles as part of the communication.	P5 - <i>“Particular if you want to get a sensitive point across, you want to have a look at the facial expressions to see how it’s taken and how it comes across.”</i>	8	14
1.4.1.3	Abundance	Refers to the feeling expressed by some participants that the amount of cues transmitted through the communication channel can be too much and can be distracting from the actual spoken message.	P7 - <i>“Ehm with video I’m less, I’m more distracted.”</i>	4	6
1.4.2	Personal connection	Refers to the subjective feeling expressed by the participants of feeling highly connected on a personal level using video conference for the communication.	P1 – <i>“Ehm you know it’s just, I feel like if you see each other’s faces you feel like you are getting to know them better or something. So specially with our client, with my client I have only met her in person once, just to be able to see her face and she my face it becomes more personal than just a voice.”</i>	7	13
1.4.3	Sensitivity	Refers to the fact that video conference is seen as a good tool for the discussion of information that is delicate.	P5 - <i>“Particular if you want to get a sensitive point across, you want to have a look at the facial expressions to see how it’s taken and how it comes across.”</i>	2	4

1.5 Video conference 2.0 – A advance remote meeting systems resembling a face to face meeting.					
1.5.1	Face to face reality	Refers to the high similarities between the use of the video conference 2.0 for communication and face to face contact.	P9 - <i>“I’m honest, for me telepresence is exactly like a face to face meeting. When I start no, but now it is exactly the same. When I go to a meeting and clients come to the office in London to visit, the feeling and the way I can communicate is exactly if I do a telepresence with someone on the other side of the world.”</i>	4	13
1.5.2	Group meeting	Refers to the participation of multiple people when this technology is used.	P5 - <i>“...for group purposes definitely video conferencing or HALO.”</i>	4	6
1.6 Web meeting platform – A virtual meeting room that offers several tools that can be used for the communication and support of the execution of a task.					
1.6.1	High interactivity	Refers to the two or more way communication and the fact that roles between sender and receiver can be switches effortless.	P7 - <i>“And of course the fact that you can actually write yourself, or type on a whiteboard, you can actually get involved as if you have a flipchart in a real room. And it is actually easier, because when you have a flipchart in a real room, you have to actually get up and go to the flipchart, write something. And here it is much more quick and spontaneous.”</i>	6	16
1.6.2	Flexibility	Refers to the high variety of options of tools available in this communication technology between which easily can be changed during the communication.	P4 - <i>“You can switch screens, share with other, you can draw on the screen yourself, you can ask questions, you can raise your hand.”</i>	7	18
1.6.3	Document sharing	Refers to the possibility of showing a document on the screen while it is being adapted and where various actors of the communication have the possibility to make changes in the document while others can see the document.	P1 - <i>“I think the big advantage is being able to share documents, you know share your desktop so if you are working on a document together you can have it actually pulled up and you are working on it and the other person can see exactly what you are doing. Or if you want to wrap, if you want to show them something then you can pull it up and point at things.”</i>	6	10
1.6.4	Group meeting	Refers to the participation of multiple people when this technology is used.	P7 - <i>“Yes, I use WebEx, but only when it is a group, when it is bigger than three – five people.”</i>	5	10
1.6.5	Low involvement	Refers to the indication of participants that active participation during a meeting on a web meeting platform can be hard to reach.	P4 - <i>“Ehm I can easily disconnect from a meeting that is just from WebEx If I can’t hear what they say I switch of, I really switch of. If I would be in the room I would probably say you know can you speak loader. I I have to raise my hand in the WebEx and wait until someone put me back in unmute until I can say I cannot hear your , you have one minutes that’s already gone here, so I just switch of, it easier.”</i>	1	2

1.6.6 Preparation – The proceedings that has to be executed before communication through this technology can take place.					
1.6.6.1	Need to schedule	Refers to the identified necessity of discussing in advance when the meeting on the web meeting platform is going to take place.	P3- <i>“Ehm disadvantages is I think maybe that you have to schedule it ehm or at least if you do not schedule it, it is do a one click meeting then the other person has to have the e-mail online to accept it.”</i>	3	6
1.6.6.2	Starting up time	Refers to the technical obstacles that have to be passed before someone can access the virtual meeting space.	P7 – <i>“I think the disadvantage is that is still is, I continues to be difficult technically. People still have difficulties with audio and even people like me who use headsets and do use WebEx, there are times, maybe one on ten, where my audio does not, for some very strange reason. So even if you’ve been doing this for long time there seem to always be, so that is why it’s always great to have technical person as part as the WebEx meeting.”</i>	3	7
1.7 Text messaging – A written message send from one cellphone to another.					
1.7.1	Quick message	Refers to the type of information being passed and asked for through this communication technology.	P4 - <i>“It is quick, it’s quick, you know, it is quick and if you want to say something quick to someone, like I’m late or something.”</i>	4	7
1.7.2	Urgency	Refers to the situation of urgency in which text message is used for the communication.	P7 - <i>“I use SMS when I need an answer within one hour.”</i>	3	6
1.7.3	Low interruptive	Refers to the statements of a participant that text message is a technology that easily is used in between other tasks without being interruptive.	P7 – <i>“Exactly and the interesting thing is, well and you actually you get through , because if you call and they are not at their desk. SMS I know, I’m sure that they have received the message. Because I have not come across any person jet on this planet that does not respond on the Ping when they get an SMS (laughing).”</i>	1	2
1.8 Chat – A communication tool used from the real time exchange of written messages.					
1.8.1	Presence	Refers to the ability of chat that you can see if someone is present through the on- or offline status.	P5 – <i>“And communicator is just nice to see is someone is there. Particularly when you work close in a team, communicator works perfectly.”</i>	6	10
1.8.2	Co-presence	Refers to the subjective feeling that team members have of being together with others in a virtual environment.	P4 - <i>“I can see on my screen if someone is connected and available. So we can chat and it is more instant than calling and again it feels like closer, that’s a feeling of proximity that’s being created with these things, that does not exist when you use classic telephone or when you use WebEx or when you conference calls.”</i>	5	9
1.8.3 Semi-synchronous – Members of interaction have to be present at the same time, but are not actively involved in the communication all the time.					
1.8.3.1	Quick response	Refers to the fact that when a question	P9 - <i>“The main advantage is that it is real time. And you can have a</i>	3	8

		or request is made via chat an answered will be provided directly.	<i>real conversation without the members having to.... Do both members to be present at the same time. Like I can see something, then when the other partner sees the message and he can reply, but then at the same time, when something urgent is going in, then I can ring the bell, I make noise on the other end and maybe he was distracted with something and then I can call his attention, so for that purposes, Bloomberg is the best."</i>		
1.8.3.2	Interactivity	Refers to the two way communication and the fact that roles between sender and receiver can be switches easily.	P2 - Sometimes with ehm one person or another I'll instant message rather than e-mail because I'll know I'll get a faster response because I know they're on the IM system that we are using. Instant messaging is easier for conversations in comparison with e-mail.	5	8
1.8.4	Divided attention	Refers to the ability of doing other things while having a conversation on chat.	P9 – <i>"If you are having a conversation in the phone, you can just have one conversation at the time. If you are in the chat, you can be in 20 discussions in the same time, so your time will be more, you are more productive. That is a point."</i>	3	10
1.8.5	Impersonal	Refers to the experiences feeling that communication through chat is not personal.	P5 – <i>"But phone I find quite personal, yeah and communicator and e-mail I find very impersonal."</i>	4	4
1.8.6	Emoticons	Refers to the symbols used in chat to give expression to feelings.	P9 – <i>"Also I do like if it is, I, there are like, as in any other chat, highlighting things, you can use caps, you can use symbols, you can make noise by ringing the bell, you can do a lot of different things."</i>	3	5
1.8.7	Permanence	Refers to the characteristic of chat that information send through chat is stored automatically and accessible at a later moment.	P3 – <i>"And I also like that you have the history of the chat and you can always go back and get what you need."</i>	3	6
1.8.8	Short conversation	Refers to the type of conversations participants have on chat.	P7 – <i>"Not all of my consultants are on Skype, so I do not really know who's in the office, in the building, but when I did, yes, it was very easy to use messenger and ask questions very quickly and get very quick answers."</i>	4	8
2. Task					
2.1 Routine – All tasks whereof the results are already clear at the beginning of the process.					
2.1.1	Clear assignments	Refers to the activity of communicating unambiguous instructions that have to be executed.	P5 – <i>"My colleague in rewards, she was a rewards specials she did a lot of e-mailing, because here tasks were instructions, very different. So team you do this, you do this, here is you spreadsheet, very clear, and so that is yeah."</i>	4	5

2.1.2	Distribute information	Refers to the activity of distributing information.	P9 - <i>“Routine task: writing a daily e-mail with what happened during the overnight time in Tokyo and London opening and for in São Paulo when they wake up. That’s a routine task on daily basis.”</i> (9	19
2.1.3	One way feedback	Refers to the activity where one person provides feedback on for example a file without having direct interaction with another party about this.	P1 - <i>“But if you know like: I need you to review this document and give feedback back to me, than I would just send it in an e-mail.”</i>	3	5
2.1.4	Planning	Refers to the activity of planning and scheduling.	P1 - <i>“But if you know like: I need you to review this document and give feedback back to me, than I would just send it in an e-mail.”</i>	4	5
2.2 Non-Routine – All tasks that are more complex tasks which do not have a pre-defined solution.					
2.2.1	Explaining	Refers to the activity of giving complex instructions that require interaction to confirm if the message came through.	P5 - <i>“If it was about instructions as well, particular to my team. Then I would use video conference. I found typically very difficult to instruct people over the phone. (...) And because you cannot see if someone really understands it.”</i>	5	8
2.2.2	Generating ideas	Refers to the process of brainstorming.	P3 - <i>“Ehmm but when it comes to maybe a workshop planning or something, then you have synchronous communication, because we need the creativity. And some people bouncing of ideas to each other. That does not work by e-mail.”</i>	8	24
2.2.3	Negotiating/ discussing	Refers to the activity of discussing topics or negotiating.	P5 - <i>“Synchronous communication for anything where you need anything, where you need multiple people because you need their view on something”</i>	8	25
2.2.4	Producing document	Refers to the activity of working together at the same time on the same document.	P8 - <i>“If you want something to be achieved, to be built together, to be ehm I still prefer a tool where you ehm where you can see each other or ehm and does not have to be, physical in the same place, but at least ehm, yeah.”</i>	5	10
2.2.5	Career development	Refers to various activities related to career development, like performance reviews or career planning.	P9 - <i>“If I want to have an interview, or to have a discussion with one of the HR persons, to discuss about possible career development or whatever I think it is important to see the persons and not to do that over the phone.”</i>	4	11
2.3 Building and Maintaining Relationship – This category contains all activities or factors mentioned by the participants that contribute to building and maintaining relationships in a virtual environment.					
2.3.1	In between tasks	Refers to the moment in which the building and maintaining relationships takes place.	P1 - <i>And yes we spend some time on that relationship building, but I do not know how to categorize our tasks that way.”</i>	4	4

2.3.2	Informal talk	Refers to the activity of talking about not task related subjects.	P3 – “Some things that I find really, really important in virtual teams is to make time and share positive news and celebrate. Yeah, sometimes you might always focus on the task, but you know you do not. I mean, those informal things, the chat on the coffee machine or the pat on the back, if someone did a good job, you do not have so you really have to make time and ensure that is happens.”	9	29
2.3.3	Offering support	Refers to the process of giving support to members of the virtual team.	P1 - “The other thing what I mean by relationship building is like supporting each other and so a lot of times we will send out an e-mail: I’m challenging, I’m dealing with this issue, I need advice, any resources I should look at? You know, just send of a quick e-mail and the fact that we are all quickly respond and help each other out kind of helps to build a trust and just feeling of: I can rely on my team.”	5	10
2.3.4	Frequency	Refers to an element of communication, being the frequency, that influences the building and maintaining relationships.	P9 - “It takes a long time, like a year or something, to build that kind of relation. If the person on the other end is rotation, you will never feel like that. But if it’s a steady relationship and you almost speak on daily basis and receive e-mails and call and everything, than you have a very good relation even if you do not know the person.”	5	8
2.3.5	Personal connection	Refers to the subjective feeling expressed by the participants of feeling highly connected on a personal level.	P5 – “But phone I find quite personal, yeah and communicator and e-mail I find very impersonal.”	5	12
2.3.6 Social presence – In this category factors are described that contribute to the sense that interaction exists with other individuals in the virtual communication.					
2.3.6.1	Voice contact	Refers to the contribution of the element voice in the communication to building and maintaining relationships.	P9 - “Yeah, I think in that case the voice; telephone and voice get people closer. It is more than just reading something that the other person is typing. You know something about the person, at least the voice.”	7	16
2.3.6.2	Knowing a face	Refers to the contribution of the ability to get to know a face through the used communication technology on the building and maintaining relationships.	P1 - “We had a new member joining the clients’ side of the team, so to be able to meet that new member and see her face, was to me important for that relationship building.”	4	11
3 Culture					
3.1 Effect – all testaments related to the effect or absence of the effect of culture on the virtual collaboration.					
3.1.1	General effect	Refers to statement of participants	P4 - “You know we have all these clichés about all the cultures and	6	17

		indicating that cultural diversity influence virtual collaboration without specifying how.	<i>I would not want to have have to same one all the time, I think it is very rich to work with. It can be very complex, but it is very rich to work with people from different ehm cultures.”</i>		
3.1.2	No effect	Refers to statements of participants that do not confirm the influence of cultural diversity on virtual collaboration.	P1 – <i>“I cannot think of a good cultural difference....”</i>	5	15
3.2 Dimensions – Include the various elements by which differences due to cultural diversity are described.					
3.2.1 Directness – This dimensions includes various levels of directness expressed by the participants.					
3.2.1.1	Direct	Refers to the characteristic of people who are direct in what they say and feel comfortable interrupting someone.	P4 – <i>“If you have Spanish, a French or a German, they would interrupt all the time and they would always say what they think, so it really really influences the way the communication goes.”</i>	5	9
3.2.1.2	Timid	Refers to the characteristic of people who are shy: do not feel comfortable interrupting or expressing their feeling and opinion.	P4 – <i>“Completely, you know in a meeting, if you have Chinese guy, a Japanese Guy, they would never interrupt for example or they would not even say what they think.”</i>	5	16
3.2.1.3	Holding back criticism	Refers to the characteristic where criticism is not easily expressed.	P3 – <i>“Ehm I also find that if, especially when it comes to sharing information about something that might be an issue or a problem or any considerations that are not all positive. Yeah, they are not so easy to offer them voluntarily.”</i>	1	3
3.2.2 Power distance – The level of existence and acceptance of unequal power distribution.					
3.2.2.1	High power distance	Refers to a high level of existence and acceptance of unequal power distribution.	P5 – <i>“I had a Chinese colleague in our management team and she was a peer of mine and she would understand perfectly what I meant. And she would not say no, she would in fact interrupt, but she was my peer. People to me or reported to someone were, they were even more difficult. They would say yes to the manager and not to me.”</i>	5	6
3.2.2.2	Low power distance	Refers to a low level of existence and acceptance of unequal power distribution.	P9 – <i>“The people from Brazil, or at least the person I work with within the company they have, like it is kind of a partnership. The hierarchy inside the company it is like they do not exist. Of course it exist if we have to make a decision, the higher in hierarchy will have the power to decide in the last instance, but in the daily interaction you do not notice the difference. The CEO sits five meters away from me and goes to the desk and speaks with me. With me and with all the people around and you do not feel like that</i>	2	2

			<i>level of hierarchy inside. One of the characteristics is the open space. At the office, from the CEO till the IT support desk, all sits in the same area. That is exactly what they bring as a culture for the company and it is very relevant for the information to flow more easily inside the company.”</i>		
3.2.3	Uncertainty avoidance	Refers to the degree to which people try to avoid uncertain or unknown situations because they feel threatened by it.	P5 - <i>“When you have a discussion with someone from Japan, you have to send them an e-mail before calling them. Ehm so you cannot just call them, and it is very Dutch, to just pick up the phone and have that direct contact to say, hey what is the matter and is there an issue. They would be shocked.”</i>	3	7
3.2.4 Context orientation – The level of need for contextual information in interpersonal interaction.					
3.2.4.1	High context orientation	Refers to people from cultures that are orientated to personal and long term relationships	P7 - <i>“I think the only time I see cultural differences is when I see how long people spend on the phone and what they write in the e-mail.”</i>	4	29
3.2.4.2	Low context orientation	Refers to people from cultures that are more direct and more action orientated	P6 – <i>“The example I could give for instance, if I have a difficult task to ask to someone, and because I have the requesting for top management for instance, maybe with some more Latin type of culture, rather than sending an e-mail saying this is the request we have to deliver in a few days and thank you, maybe I would try to explain over the phone that I understand that it is difficult and that it is going to put a lot of pressure on them, but I know that they will do them best, but to have this really personal discussion to make it easier for them to accept the overwork yeah. Maybe with some Anglo-Saxon country it would be less important to do it; I mean that is my feeling at least.”</i>	5	23
3.3 Circumstances - Condition that determine or must be considered in the determining of a course of communication in culture diversity teams.					
3.3.1	Time difference	Refers to the effect differences in time zones between various people in the collaboration.	P5 – <i>“It was a challenged because time zones ehm were challenging, particular because we had a team in Asia and we had a team in America. Linking that to Europe was challenging, linking different time zones, linking people is challenging.”</i>	5	12
3.3.2	Infrastructure	Refers to resources available for the communication in virtual teams, which are different in the various countries.	P3 - <i>“One of the things that I have to do be mindful about is sometimes I have to, I have meetings with people in China and I would usually Skype, but a Skype does not work in China, so then I always have to plan for another technology.”</i>	5	13
3.3.3	Language barrier	Refers to the obstacle that exists when	P3 - <i>“Because, you know, on the asking by e-mail, if you have to ask</i>	4	13

		<p>not all participants of communication have the same and/or required proficiency of the language used for the communication.</p>	<p><i>someone to understand something, it is even a higher barrier then asking for clarification on the phone. Or I would do both, I would say I send the e-mail with my suggestions and then I say can we talk about it and discuss it. And to a native speaker I would maybe say let me know what you think and then they get back to me. I would be more, I think I would be more purposeful and proactive in ensure that there is a two way communication if it is someone who does not have the same language proficiency.”</i></p>		
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