The relationship of media choice and communication quality

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The relationship of media choice and communication quality

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To keep a promise, long given

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Abstract

As in the last decades more and more media for communication became available, an educated choice between those tools became harder and harder. Because of this, a multitude of theories on media selection was created, which partly extend and partly contradict each other. The two most important streams of thought are on the one hand, theories that claim a medium and its qualities can be objectively measured and rated to find the ideal medium for a specific communication task and on the other hand, theories that claim that a medium can only be rated subjectively based on experiences and perceptions of the user of the medium.

Two central ideas that can be found in most of the theories are that there are different types of communication tasks that have different requirements on media and that there needs to be a fit between a communication task and the medium that is used in order to ensure high communication quality.

The empirical results of the study suggest that communication is always beneficial for communication quality, while e-mail and telephone communication are only beneficial, if the actual usage and the perceived fit of the medium match and they are used in tasks that focus on convergence of information.

Kurzfassung

In den letzten Jahrzehnten wurden mehr und mehr Kommunikationsmedien entwickelt und für die Gesellschaft verfügbar, wodurch es immer schwieriger wurde ein geeignetes Medium für eine Aufgabe auszuwählen. Aufgrund dessen wurden in dieser Zeit auch verschiedene Theorien zur Medienwahl aufgestellt, die sich in ihren Ideen teilweise ähneln und ergänzen, sich aber teilweise auch widersprechen. Die beiden wichtigsten Lehrmeinungen zur Medienwahl sind einerseits, dass ein Medium und seine ihm eigenen Qualitäten rational gemessen und bewertet werden können, um das ideale Medium für eine Aufgabe zu wählen und andererseits, dass ein Medium nur subjektiv bewertet werden kann und diese Bewertung auf den persönlichen Erfahrungen des Nutzers/der Nutzerin beruht.

Zwei zentrale Thesen, die sich in den meisten der vorgestellten Theorien wiederfinden sind erstens, dass es verschiedene Arten von Kommunikationsaufgaben gibt und diese verschiedene Anforderungen an Medien haben und zweitens, dass es eine Übereinstimmung zwischen dem Medium und der Kommunikationsaufgabe geben muss, um hohe Kommunikationsqualität zu gewährleisten.

Die Resultate der empirischen Studie legen nahe, dass persönliche Gespräche (face-to-face Kommunikation) sich immer positiv auf die Gesprächsqualität auswirken, während E-Mail und Telefon sich nur positiv auswirken, wenn die tatsächliche Nutzung und die persönliche Einschätzung der Eignung des Mediums übereinstimmen und die Medien genutzt werden, um in der Kommunikation einen Sachverhalt zu diskutieren beziehungsweise zu klären.

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List of Abbreviations

A/C	Air-conditioning
CMC	Computer-mediated communication
DACH	A geographic region consisting of Germany, Austria and Switzerland
F2F	Face-to-face (communication)
GSS	Group support system
I-P-O	Input – process - outcome
MRT	Media richness theory
MST	Media synchronicity theory
TAM	Technology acceptance model
TTF	Task technology fit
VoIP	Voice over IP

1. Introduction

For as long as people have worked together to achieve common goals, they have needed to communicate to reach consensus about what must be done to reach those goals. In earlier periods, people mainly communicated by talking directly to each other; writing required a level of education most people did not have (Roser, 2014). As time passed, more people became able to read and write, and therefore written words and letters became more important methods of communication.

The development of new methods of communication continued, and in the 19th century, telegraphs and telephones were invented. These devices allowed people to communicate over long distances in real time and became the foundation of the age of information. In the 20th century, the telephone and technologies such as the fax machine –which were based on the same technological foundation as the telephone – were the predominant methods of communication (Serbanescu, 2011).

Beginning in the 1960s, scientists began working on connecting various computers in a network, creating new ways for machines and people to communicate with each other. In the early 1990s, Tim Berners-Lee developed the theoretical foundation of the World Wide Web, which became the most important communication technology of the current era (Abbate, 1999). The World Wide Web is the technical base for the many communication methods people use nowadays, such as e-mail, chat, videoconferences, group decision support systems, collaborative systems or screen-sharing tools. The internet also changed the nature of telephones. Today, most phone calls are processed using voice over IP protocols (VoIP), which means the calls are transmitted as data packages over the internet.

Given these inventions of recent decades, we can now choose from a multitude of communication methods. Most of them enable people to communicate with each other independently from time and space, as long as there is an internet connection available.

While these tools enable people to communicate with each other in their leisure time, they are also valuable for companies around the world to process professional communication with team members, partners and other stakeholders. Whereas in their spare time, people are free to choose whatever method of communication they prefer and to switch between them as desired, in companies a range of methods is usually predetermined. Introducing a new communication tool in a company is an expensive task; hence, managers who decide on the communication methods need viable support for their decision. Scientists have thus formulated various theories that focus on the optimal selection of a specific method of communication for a specific task (Löber, 2008).

The central idea of media selection and theories about it is that selecting a suitable medium increases the quality of communication in a group. Although different theories have different ideas of what constitutes a suitable medium, most share the belief that there is some kind of fit between a medium and a communication task. However, theories differ regarding how this fit is rated. Some theories focus on the medium and its inherent qualities, whereas others extend this view and consider other aspects, such as the users of the medium and their perceptions or the environment in which communication must occur.

Depending on which theories a manager chooses to follow, it might be enough to examine only the attributes of the media and corresponding tasks. This would mean that no matter the environment and the users, there is always one medium that is the "best choice" for a communication task. By contrast, if a manager is guided by theories with a broader view on media selection, they will also have to examine the people who are supposed to work with the tools (Fulk et al., 1990). Therefore, it might make sense to allow a broad range of tools, as the employees of a company tend to differ in their subjective perceptions and preferences (Tolbize, 2008). Younger employees, especially, are used to a broad variety of communication tools from their leisure time. Providing

them with the same variety at work is necessary for employers to attract and keep such

employees (Rendell & Brown, 2011).

1.1. Purpose of the Thesis

The purpose of this thesis is to show that communication quality can be improved by using a medium that the communication participants perceive as suited for a communication task. This goal is achieved by answering the following research question empirically:

> *How does adequate media usage influence the quality of communication by the communicating parties, for different types of communication tasks?*

To provide a theoretical foundation to answer this question empirically, an overview of theories in the field of media selection is provided in the next chapter of the thesis. In the subsequent chapters, the research question is answered empirically, by leveraging an already conducted survey that was analysed in depth. The survey was conducted within an Austrian-based company that operates various offices across Europe. At the time of the study, the company was implementing new communication guidelines and new tools for communication.

2.   State of the Art

During recent decades, various theories on media selection have emerged. They enable the educated selection of a medium to provide efficient communication and to improve communication quality. Following Webster and Trevino (1995), most of these theories can be classified into one of two groups, which differ regarding the criteria for rating media. The first group of theories state that media have inherent qualities that can be measured objectively. The second group claims that while characteristics of media play a secondary role in media selection, the most important influences are personal experience with different media and the environment in which the communication is to happen. Through these experiences, the qualities of a medium are perceived differently depending on the user.

The first group of theories claim that only the inherent qualities of a medium must be considered, and that those qualities stay the same no matter who uses the medium. This approach can be seen as an objective process of media selection. Following a rational process, every medium can be measured and rated. Thus, once all available media are rated, the one with the highest rating can be chosen. One of the first theories of this type was the social presence theory by Short, Williams, and Christie (1976), which proposed classifying media by their capability to transport the social presence of users. This theory became a main influence for Daft, Lengel and Trevino's media richness theory (Daft & Lengel, 1986; Daft, Lengel, & Trevino, 1987), as illustrated in Figure 1. Media richness theory was one of the most popular theories about media selection during its time but became more contested as empirical tests of the theory showed mixed results. Although some researchers found evidence to support media richness theory, roughly an equal number of studies contradicted it. (Details on these empirical results appear in chapter 2.1.2, where media richness theory is discussed). The inconclusive empirical findings related to media richness theory spawned many other theories in the attempt to improve the understanding of such results.
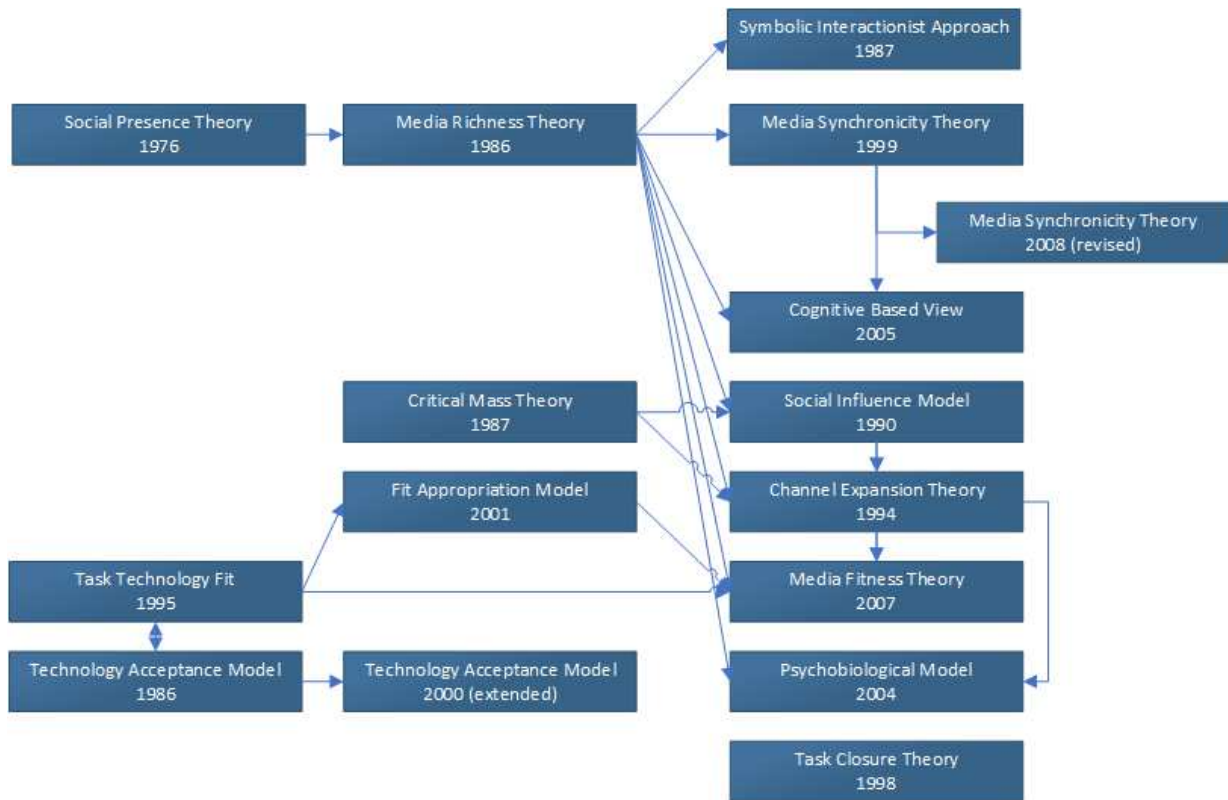
Figure 1: Overview of theories on media selection

One of the theories that attempted this was the symbolic interactionist perspective created by Trevino, Lengel and Daft (1987) – the authors of media richness theory. The symbolic interactionist perspective was an attempt to extend media richness theory with additional influencing factors and should therefore not be seen as an entirely new theory.

Another theory that was created to address the weaknesses of media richness theory was the media synchronicity theory by Dennis and Valacich (Dennis & Valacich, 1999; Dennis A., Valacich, Speier, & Morris, 1998). Media synchronicity theory was the first theory to advocate switching between different media for different parts of a communication task. Its 2008 revision by Dennis, Fuller and Valacich (2008) remains one of the most important theories in the field of media selection and is the most advanced theory in the group that focuses on the inherent qualities of a medium.

The social influence model by Fulk, Schmitz and Steinfield (1990) was another theory that was created to provide a better explanation of media choice than did media richness theory. In contrast to other theories, Fulk et al. extended their view by considering social influences on the users of the medium. While it was not their intention to neglect the findings related to media richness theory, they wanted to move the attention to such social influences; they believed that those influences weighed more heavily than the medium's specific qualities. A user's knowledge and experience with a medium and social influences leads to their subjective view of the medium, which the user then compares with the task to be completed in order to choose the best medium (Fulk et al., 1990). As such perceptions differ among users, different media might be chosen for the same task.

Similar concepts of a perceived fit between the subjective view of a medium and the task also feature in other theories, such as Goodhue and Thompson's task–technology fit (1995). The combined model of task–technology fit and the technology acceptance model by Dishaw and Strong (1999) is another example. The original technology acceptance model was created by Davis in 1986 and can be seen as a theory that focuses on the subjective views of users. Another theory that builds on Goodhue and Thompson's task–technology fit and uses it as an integral part is the fit appropriation model by Dennis, Wixom and Vandenberg (2001).

The channel expansion theory by Carlson and Zmud (1994) was created to explain empirical findings regarding the media richness theory. It focuses on the perceived qualities of a medium but emphasizes how this perception can change over time as a user gains experience with a medium. This change in perception is also an important influence in Kock's psychobiological model (2004), in addition to social presence. Kock adapted that idea from social presence theory, media richness theory and Charles Darwin's theory of evolution.

With the cognitive-based view, Robert and Dennis, one of media synchronicity theories original authors, extend media synchronicity theory with a cognitive aspect about how media choice influences cognitive processes during communication, and how this relates to the users' effort in processing the received information (Robert & Dennis, 2005).

Media fitness theory takes ideas from various theories, such as task-technology fit and media synchronicity theory and adds further environmental factors to provide a holistic view of media fitness and media choice. Because media fitness theory considers the perceptions of users, it can be counted in the group of theories that do not rely on the inherent media qualities alone but have a broader view (Higa & Gu, 2007).

While the central idea of Markus' (1987) critical mass theory can be found in other theories, such as the channel expansion theory as an influencing factor on media usage, critical mass theory itself does not itself help in selecting the "best" medium for a task but rather explains why media might fail when they are introduced into a community.

One theory that is loosely connected to others through a general subjective influence on media choice is the task closure theory by Straub and Karahanna (1998). It focuses on the need of the sender of a message to have a feeling of closure in communication tasks.

As seen from this introduction, many theories on the topic of media choice exist. Various streams of thought appear in multiple theories, while others stand alone and provide additional relevant input on the topic. In the following chapters, these theories are introduced and explained in detail to provide the background for the empirical study in Chapter 3.

2.1.   Focusing on the medium and its inherent qualities

In this chapter, theories that focus on the medium itself and its objectively measurable characteristics are presented. These theories assume that it is possible to define the core characteristics of a medium, which have quantifiable effects on communication quality and performance and are the same for all users (no matter what experiences users already have with a medium). By assessing these characteristics and comparing them with the communication task to be completed, the medium with the highest rating can be seen as the ideal choice for a communication task (Löber, 2008).

Figure 2 illustrates which theories belong to this group. Social presence theory is the oldest theory that is presented in this thesis and was the theory that started the "objective" school of thought. Today, media synchronicity theory – which is also part of this group – is one of the most important theories on media selection.
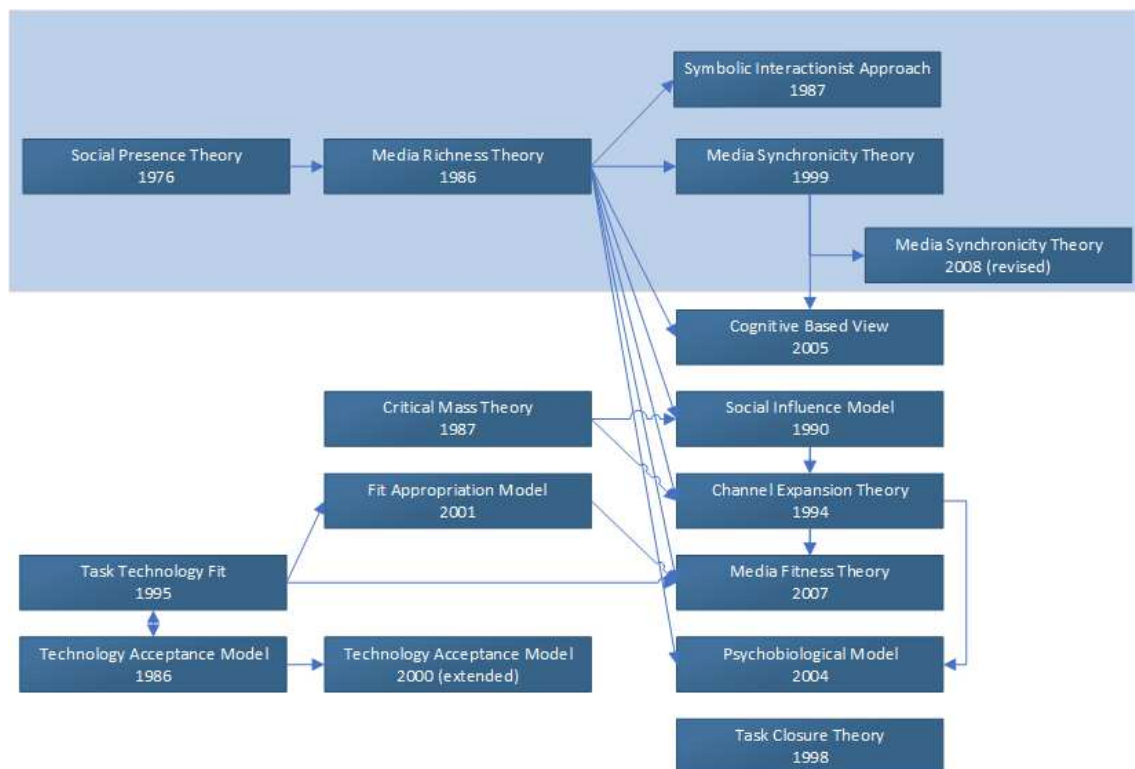
Figure 2: Theories focusing on the medium and its qualities

Figure 3 shows the development of the "objective" theories over time, with social presence theory forming the foundation. Social presence theory is based on the idea that each medium transmits the social presence of the sender to some degree; communication is efficient if the transmitted social presence matches the required social presence to complete a communication task (Löber, 2008). This view of media was extended by media richness theory, which added further aspects of media qualities. Another extension of social presence theory was the classification of communication tasks into different types by differentiating between uncertain and equivocal tasks; these types call for different levels of media richness (Löber, 2008).

Media richness theory, in turn, was extended by the symbolic interactionist perspective by the same authors. Rather than being an independent theory, the symbolic interactionist perspective should be seen as an extension of media richness theory (Löber, 2008).
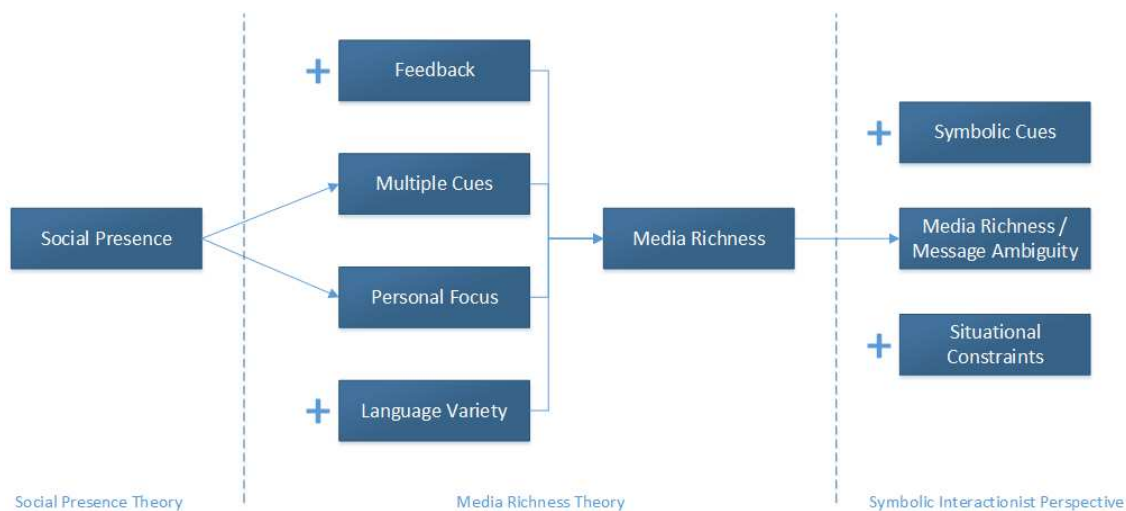
Figure 3: Development of theories focusing on the medium itself (Löber, 2008)

Like the preceding theories, media synchronicity theory also focuses on the inherent characteristics of a medium. Dennis and Valacich (1999) created media synchronicity theory because in their view, media richness theory has certain weaknesses. The weak empirical support found in multiple studies was the most important problem. While

earlier theories stated that a single, best-fitting medium can be chosen for a communication task, media synchronicity theory advocates switching between media over the course of a communication task. The reasoning here is that different subtasks require different attributes from a medium.

2.1.1. Social Presence Theory

The social presence theory by Short, Williams, and Christie (1976) was the first theory to focus only on the inherent characteristics of a medium. Its main premise is that media are classified by their ability to transport the social presence of the sender. In this context, "Social presence is the degree to which the medium facilitates awareness of the other person and interpersonal relationships during the interaction" (Fulk, Schmitz, & Ryu, 1995, p. 118).

Aspects of social presence are facial expression, gestures, posture, movement of the eyes, clothes, pitch of the voice and so on. The more aspects a medium can convey, the higher its social presence is valued. An important point is that social presence in this theory depends entirely on the medium, not on the person who sends the message, because the absence of social signals is itself a social signal (Short, Williams & Christie, 1976; Löber, 2008).

In this classification, face-to-face communication has the highest social presence, as it transports all the signals that a person sends. Formal print media have the lowest social presence as they hardly transport any signals aside from the plain information that is written down (Short et al., 1976)

Social presence theory sees communication as efficient if the level of social presence in the selected medium matches the level of social presence required for a communication task. This means that tasks that require high social presence, such as negotiations, require a medium that supports high social presence. Tasks such as informing a group

of people about something require a low social presence; therefore, a written notice might be the ideal medium (Fulk et al., 1995)

2.1.2. Media Richness Theory

Media richness theory was developed by Daft, Lengel and Trevino (Daft & Lengel, 1986; Daft, Lengel, & Trevino, 1987) and is based on social presence theory (Short, et al., 1976; Dennis & Valacich, 1999). Daft and Lengel (1986) argued that organizations process information, and that communication is part of such information processing, because they want to reduce uncertainty and resolve equivocality.

Uncertainty, in media richness theory, is defined as the absence of information; uncertainty decreases as information increases. More specifically, uncertainty is the difference between the amount of information that is necessary to resolve a situation and the amount of information that is available. To reduce uncertainty, members of an organization – such as managers – have the possibility to ask questions and obtain answers (Daft & Lengel, 1986).

Equivocality is the second motivator of information processing, and "means ambiguity, the existence of multiple and conflicting interpretations about an organizational situation." (Daft & Lengel, 1986, p. 555). In equivocal situations, asking questions is hard because there are no clear answers available. Rather, the communicators in equivocal situations must figure things out and reach consensus through discussion and sharing their opinions (Daft & Lengel, 1986).

Uncertainty and equivocality are two complementary forces. Therefore, by combining them, four types of communication foundation can be identified (Daft & Lengel, 1986), as follows: 1) situations that are low in uncertainty and low in equivocality, 2) situations low in uncertainty but high in equivocality, 3) situations high in uncertainty but low in equivocality and 4) situations that are high in both aspects. Depending on the structure of the situation, different types of communication are feasible, according to media

richness theory (Daft & Lengel, 1986). Daft and Lengel (1986) identified three main sources of organizational uncertainty and equivocality. These are technology, interdepartmental relations and the external environment.

Another central aspect of media richness theory is the eponymous **media richness**, which was first called "information richness" by Daft and Lengel (1986) but was then renamed. Daft and Lengel defined information richness as follows: "Information richness is defined as the ability of information to change understanding within a time interval. Communication transactions that can overcome different frames of reference or clarify ambiguous issues to change understanding in a timely manner are considered rich. Communications that require long time to enable understanding or that cannot overcome different perspectives are lower in richness." (Daft & Lengel, 1986, p. 560).

In the 1980s, Daft and colleagues (Daft & Lengel, 1986; Daft et al., 1987) ranked communication media in the following hierarchical order, starting with the richest medium: face-to-face meetings, telephone calls, written addressed documents, unaddressed documents (such as bulletins or standardized reports) and numeric reports. Ochsman and Chapanis (1974) identified the ability for oral communication as the main distinguishing difference between rich and lean media.

In the original media richness theory (Daft & Lengel, 1986; Daft et al., 1987), electronic media were not included but were added later in various studies (e.g. (Rice R. E., 1992), (El-Shinnawy & Markus, 1992)). Because of its written nature, e-mail was ranked rather low on the richness scale (El-Shinnawy & Markus, 1997). Nowadays, people assume that instant messaging is an important communication medium; it would be rated rather low as it does not support oral media.

Four different factors define the richness of a medium, according to media richness theory:

- *Feedback*: This is the capacity of the medium for immediate feedback. Immediate feedback allows for quick correction of unclear topics or misunderstandings. Faster feedback implies higher richness.

- *Multiple Cues:* This factor includes the number of cues a medium supports. Cues can be physical presence, voice, gesture and facial expression, words, numbers or graphic symbols. This factor integrates one part of social presence theory into media richness theory.

- *Language Variety:* This is the range of meanings that can be transmitted using the medium. While numbers are highly specific, natural language allows for transmitting a broader set of meanings.

- *Personal Focus:* This factor describes to what extent the medium supports the transmission of feelings and emotions during the communication. This factor integrates another part of social presence theory into media richness theory (Daft & Lengel, 1986; Daft et al., 1987; Löber, 2008)

The central thesis of media richness theory is that the richness of the medium and the equivocality of the message should match, if communication is to be effective (see Figure 4). This means that if equivocality is low, that is, when the issue of the message is well-defined and deals with a standard situation, lean media should be used. If, by contrast, equivocality is high, rich media should be selected, as such media are suited for achieving a common understanding of a problem and finding a path of action to address it (Daft et al., 1987).
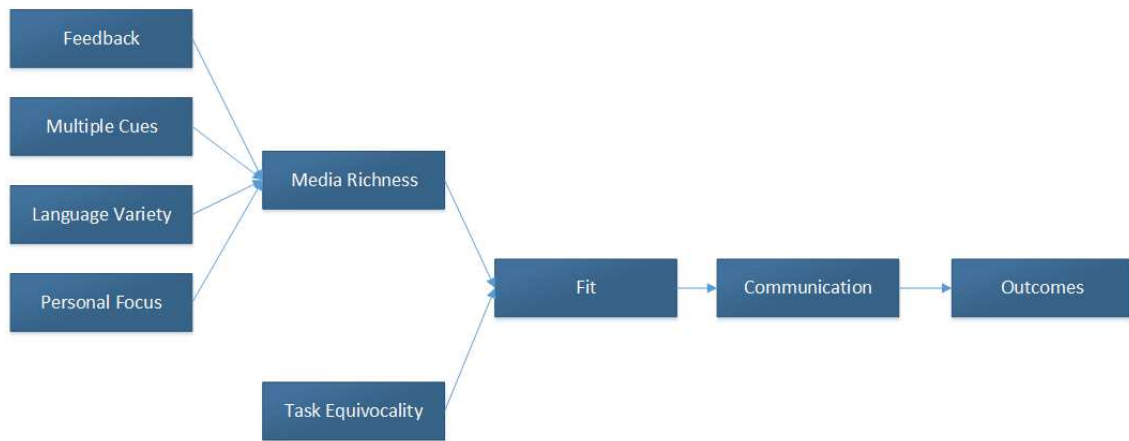
Figure 4: Media richness model (Kinney & Dennis, 1994)

Therefore, selecting the communication medium is a crucial task. On the one hand, the medium must include all relevant cues, because otherwise the views on the topic could be obscured. On the other hand, the medium must not be too rich, because this could overcomplicate the communication and puzzle participants with unnecessary cues. Thus, there exists a range of effective communication means for any given task. Each task is supported by certain media, whereas other media are either too simple or too complex (Daft et al., 1987; Picot, Reichwald, & Wigand, 2001). This range is summarized in Figure 5, based on the work of Picot et al. (2001). Figure 5 highlights the area in which communication is efficient and communication quality can be assumed to be high.

An implication of the matching of media richness and task equivocality is that before a fitting medium can be selected, the sender of the message must know about the equivocality of the task. This is sometimes hard to assess at the start of a communication (Löber, 2008). This aspect is therefore a weakness of media richness theory.
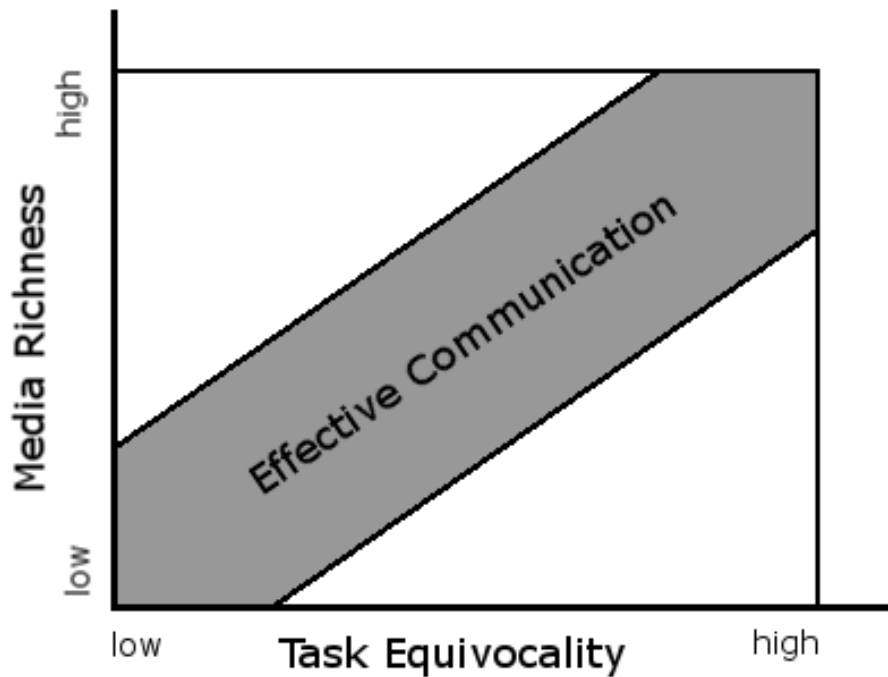
Figure 5: Range of effective communication (Picot et al, 2001)

Another weakness of media richness theory is that a task might consist of various subtasks having different levels of uncertainty and equivocality. These subtasks may emerge during the work on the task and might not be clear initially. Media richness theory does not address the topic of changing levels of equivocality during the course of a communication but assumes there is an ideal medium for every task (Dennis & Valacich, 1999; Löber, 2008).

Although media richness theory appears sound and logical, empirical tests of the theory have yielded mixed results. While some studies found support for media richness theory, other studies found contradicting results.

Daft et al. (1987) conducted an empirical study and found evidence that rich media were preferred for tasks that were highly equivocal. Their results were derived from giving managers of a company a set of communication tasks with a wide range of uncertainty and equivocality. The managers were asked what communication medium they would

use to solve the task. In a second step, the researchers identified the most and least media-sensitive managers, and found that many high-performing managers were media-sensitive.

Rice, Hughes and Love (1989) reported a direct contradiction to media richness theory. They found that top management utilized lean media more often than did lower level managers. This was a contradiction because the higher the management level, the higher the percentage of equivocal tasks tends to be (King & Xia, 1997).

Rice (1992) analysed data from five research projects on computer-mediated organizational information and communication systems. The findings provided very weak support for media richness theory, especially regarding the notion that lean media are superior for tasks with high uncertainty (Kinney & Dennis, 1994).

Kinney and Watson (1992) conducted an empirical study with dyadic groups that were asked to solve various tasks with one of three media: face-to-face, telephone or chat. The authors tested 1) how quickly participants solved the tasks, 2) the change in consensus that was reached and 3) the satisfaction with the communication. They found that media that were text-supported required more time than oral media. Regarding change in consensus, they found no significant differences between the media. This finding contradicts media richness theory because it suggests that richer media could achieve higher consensus than lean media. Also, satisfaction was not significantly different for the three types of media.

In her interface paper on Kinney and Watson's study (1992), El-Shinnawey (1998) argued that one of the reasons for the popularity of e-mail for a wide range of tasks, including those that are seen as non-optimal by media richness theory, is that it is sender-friendly while the factors that define media richness in media richness theory are focusing on the receiver.

In 1992, El-Shinnawey and Markus conducted an empirical study in which they tested voicemail and e-mail as communication media. While media richness theory suggests

that communication participants would prefer voicemail for equivocal tasks because voice is a rich medium, the contrary was observed in this study. Participants preferred e-mail for equivocal tasks and for uncertain tasks alike (El-Shinnawy & Markus, 1992).

Kinney and Dennis (1994) empirically tested whether electronic media – specifically videoconferencing and chat – were used as media richness theory suggests. Participants were students of a business course and were assigned to one of the media groups and were able to receive either immediate or delayed feedback. During the experiment, they were tasked with solving different tasks with a communication partner using the assigned medium. Like Kinney and Watson (1992), Kinney and Dennis found no support for media richness theory when using "new media".

In 1999, Suh (1999) conducted another experiment on media richness theory, which also did not support the theory. Suh tested four different media (face-to-face, video, audio and computer-mediated chat) in dyadic communication situations. The task was either intellectual, namely calculation of taxes with shared information, or a negotiation task (cutting the budget of eight university faculties while participants had opposing preferences). Participants in the experiment were college students who did not know each other and were randomly assigned to one medium and one task. Before and after the experiment, the participants answered surveys. Decision time and quality (correctness of the calculation in the intellectual task and payoff points in the negotiation) were measured. Decision quality was the same for all tested media, for both tasks, whereas media richness theory implies that face-to-face communication would have the highest quality for negotiation. Decision time varied only for the media, independently from the tasks. For example, text-based chat always demanded the longest time. Another finding was that communication satisfaction and performance were not correlated; this implies that satisfaction and media choice might differ from the most rational choice (Suh, 1999).

Dennis, Kinney and Hung (1999) also conducted an empirical test, in which the setting was extended by including only females, only males, and mixed-gender dyadic communication groups. Other studies had shown that women send, receive and understand nonverbal cues to a greater extent than men and might therefore be more affected by a medium that lacks the ability to transmit such cues (Briton & Hall, 1995). As in most studies on media richness theory, teams were asked to resolve one task high in uncertainty and one high in equivocality, using face-to-face communication and computer-mediated communication (CMC) in the form of chat. Dennis et al. concluded that leaner media influenced the decision time but did not affect decision quality. This finding could be due to typing being slower than oral communication. For mixed-gender and all-male teams, no support for media richness theory was found. The all-female teams reacted as predicted by media richness theory when nonverbal cues were missing in the communication medium (Dennis, Kinney, & Hung, 1999).

In summary, the empirical findings on media richness theory are mixed. While there is some support for media richness theory regarding traditional media, the findings for new (electronic) media were not significant in the reviewed studies.

2.1.3. Symbolic Interactionist Perspective

Trevino, Lengel and Daft (1987), who also developed media richness theory, later created the symbolic interactionist perspective to extend the theory with additional influencing factors. Therefore, the symbolic interactionist perspective is not entirely independent but should rather be seen as an extension of media richness theory (Löber, 2008).

The symbolic interactionist perspective is based on the sociological theory of symbolic interactionism by Blumer (1969). In symbolic interactionism, society is viewed as a web of interactions, and all interactions are symbolic. That is, people assign meanings to every interaction. Values and norms are created through interactions using these symbolic meanings. Organizations are viewed as systems in which meaning must also be

created and maintained dynamically, as people within an organization interact. To create new organizational meanings, discussion, negotiation and feedback are required (Blumer, 1969).

Based on symbolic interactionism, Trevino et al. (1987) founded their theory of media choice. They identified three variables that influence media choice in organizations, namely message ambiguity, symbolic cues and situational constraints.

Message ambiguity is defined similar to equivocality in media richness theory (Daft & Lengel, 1986; Daft et al., 1987). This is no surprise as the authors of both theories were the same. Messages that are ambiguous can be interpreted in different ways, and to find a shared understanding, people must interact. For ambiguous messages, media richness theory states that rich media are the best fit, whereas lean media should be used for messages with less ambiguity (Trevino et al. 1987). Message ambiguity in the symbolic interactionist perspective is thus equivalent to the media richness concept in media richness theory (Löber, 2008).

The second influencing variable is the **symbolic cues** of the media. In symbolic interactionism, anything can be a symbol and therefore carry a meaning. For example, face-to-face communication may symbolize personal contact and caring. The constant use of cutting-edge communication technologies might be viewed as technology prone and "up-to-date". A written letter, by contrast, can be seen as highly personal and not urgent. The communication medium is not just a transmitter but also carries meaning itself and must therefore be carefully selected to support the intended meaning of the transmitted message (Trevino et al. 1987).

The last variable that influences media choice is **situational determinants**. Usually, media choice is constrained by various factors, such as geographical distance, time pressure, expectations others have regarding the sender of a message, and the basic availability of a medium. For example, if a manager needs to talk to an expert in another country, he or she will probably use the telephone instead of face-to-face conversation,

although the message ambiguity might require a richer medium. Situational constraints define the limits within which media can be chosen and therefore override the other variables that influence media choice (Trevino et al. 1987).

Trevino et al. also conducted a field study regarding their theory. They interviewed 65 managers from different companies and universities and asked them about typical conversational situations, which medium they would choose for each one and why. They found that face-to-face communication was mainly used if the content of the message requested a rich medium and the symbolic cues were favourable, whereas telephone and e-mail were mostly used for situational reasons.

2.1.4. Media Synchronicity Theory

Because of the weak empirical findings regarding media richness theory, Dennis and Valacich formulated a new theory of media choice, known as media synchronicity theory (Dennis & Valacich, 1999; Dennis A., Valacich, Speier, & Morris, 1998). The central concept of this theory is the eponymous term "**media synchronicity**", which is defined as "the extent to which individuals work together on the same activity at the same time; i.e., have a shared focus" (Dennis & Valacich, 1999, p. 5). Dennis and Valacich (1999) identified five characteristics of media that influence the synchronicity of a medium.

- *Immediacy of Feedback:* This characteristic is defined similarly to the concept of feedback in media richness theory; it is the extent to which a medium allows for rapid exchange of feedback. More generally, it is the ability of a medium to support bi-directional communication (Dennis & Valacich, 1999). Immediacy of feedback increases the shared focus in a communication and therefore enables high synchronicity.

- *Symbol Variety:* "Symbol variety is the number of ways information can be communicated" (Dennis & Valacich, 1999, p. 2). It combines two factors from media richness theory, namely multiplicity of cues and language variety. According to media synchronicity theory, symbol variety influences the time to

create, transmit and understand a message (e.g. a small gesture as a sign of approval instead of a formulated sentence) and the accuracy of a message (e.g. sending an actual picture instead of describing the picture using words only) (Dennis & Valacich, 1999; Löber, 2008). The more natural a symbol set is for a user, the more it can support synchronicity (Kock, 2004).

In contrast to media richness theory, symbol variety is regarded merely as a hygiene factor that only bears influence when a needed set of symbols is not available (Schwabe, 2001; Dennis, Fuller, & Valacich, 2008). Although a communication medium might provide all symbols that are necessary to transmit a message, using that medium might be inefficient because the transmission of specific symbols might be more efficient via another medium. For example, software source code can also be transmitted using an oral medium as all the necessary symbols are available; however, compared to written communication, it is inefficient because some symbols are cumbersome to express orally (Niinimäki, Piri, Lassenius, & Paasivaara, 2010).

- *Parallelism:* This factor describes the ability of a medium to convey distinct conversations simultaneously in an effective way. For example, a telephone can only support one conversation at a time, whereas chat enables users to communicate in various communications simultaneously (Dennis & Valacich, 1999). Media that are high in parallelism allow users to contribute whenever they want and they do not have to be concerned about the channel opening up (DeLuca & Valacich, 2006; Dennis et al., 2008). Parallelism lowers the shared focus of a group; hence, high parallelism has a negative impact on synchronicity (Dennis et al., 2008).

- *Rehearsability:* Rehearsability describes to what extent the sender of a message can edit a message before it is sent. Whereas oral communication does not really allow for editing messages before sending, writing a letter or an e-mail allows great leeway for editing and finding the best expressions (Dennis & Valacich,

1999). The better participants know each other or share a mental model, the less important is rehearsability, as they can communicate with mutually known symbols and protocols. Rehearsability lowers synchronicity, as it can delay transmitting a message while the sender composes it (Dennis et al., 2008).

- *Reprocessability:* This factor describes the ability of the medium to support participants to re-examine or reuse an old message. For example, an e-mail is easily stored and can be forwarded, whereas an oral presentation is not reusable (Dennis & Valacich, 1999). Just like rehearsability, reprocessability lowers synchronicity and shared focus because it can create delays, this time on the side of the message receiver (Dennis et al., 2008).

Parallelism, rehearsability and reprocessability are asynchronous characteristics. By contrast, immediacy of feedback (and transmission velocity in the revised media synchronicity theory by Dennis et al., 2008) and symbol variety are synchronous characteristics (Ryoo & Koo, 2010).

As can be seen in Figure 6, these five factors affect different parts of the communication process. The characteristic of rehearsability is an advantage only for the sender of a message, because they can edit a message before sending it. During the sending part of the communication process, immediacy of feedback, symbol variety and parallelism influence the process. After the message is received, reprocessability mainly affects the receiver as they can reuse the message afterwards (Schwabe, 2001).
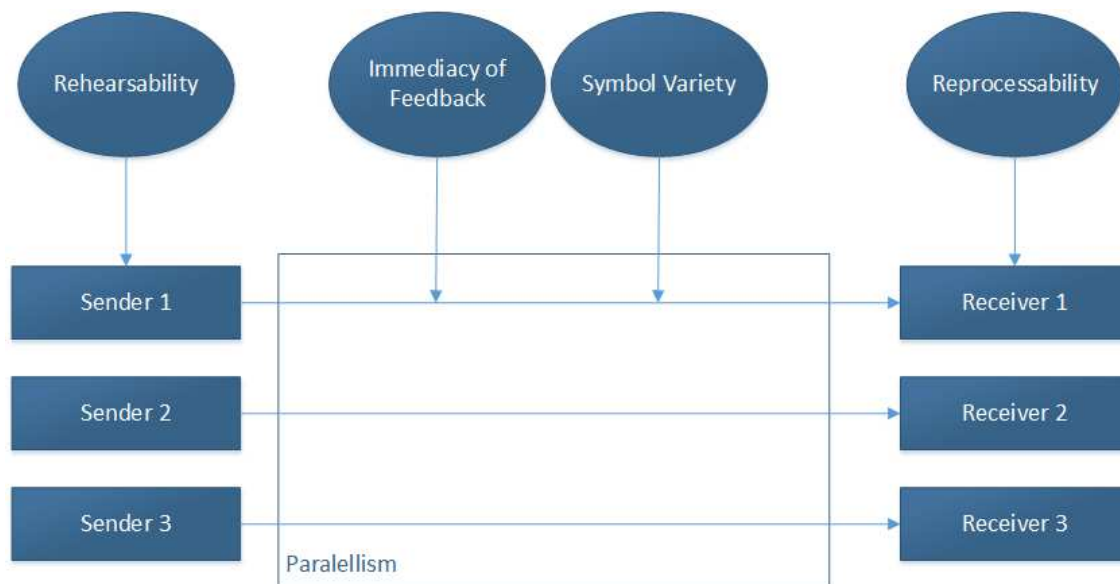
Figure 6: Media characteristics in media synchronicity theory (Schwabe 2001)

With these five factors in mind, it is evident that there is no one richest or leanest medium; they all support different factors to a different extent. As shown in Table 1, no medium has the highest value for all five factors. It would not even be possible for one medium to have the highest rating across all factors because some of them are contrary to others. For example, rehearsability is contrary to immediacy of feedback, as is parallelism (Schwabe, 2001). Dennis and Valacich (1999) argued that ranking media in a hierarchical order, as done by Daft et al. (1987) in their media richness theory, is impractical because the context of the communication should be considered.

Dennis and Valacich stated that "Media possess many capabilities, each of which may be more or less important in a given situation. The "richest" medium is that which best provides the set of capabilities needed by the situation: the individuals, task, and social context within which they interact. Thus, concluding that face-to-face communication is the "richest" media is inappropriate." (David & Valacich, 1999, p.3).

Essentially, media with high immediacy of feedback and low parallelism allow for high synchronicity. By contrast, low immediacy of feedback and high parallelism allow for low synchronicity (Löber, 2008).

	Immediacy of Feedback	Symbol Variety	Parallelism	Rehears-ability	Reprocess-ability
Face-to-face	High	Low-High	Low	Low	Low
Video Conference	Medium-High	Low-High	Low	Low	Low
Telephone	Medium	Low	Low	Low	Low
Written mail	Low	Low-Medium	High	High	High
Voice mail	Low	Low	Low	Low-Medium	High
E-Mail	Low-Medium	Low-High	Medium	High	High
Chat	Medium	Low-Medium	Medium	Low-Medium	Low-Medium
Group Supporting Systems	Low-Medium	Low-High	High	High	High

Table 1: Media characteristics according to media synchronicity theory (Dennis & Valacich, 1999)

Following the work of Weick (1985), Dennis and Valacich (1999) defined five strategies of sensemaking that groups use. These were as follows:

- *Action:* the act of asking questions or proposing solutions, ideas and opinions to other participants in the communication
- *Triangulation:* trying to see information through different representations and from different sources to gain a holistic picture of the situation
- *Contextualization:* Setting current information in relation to past events
- *Deliberation:* The reasoning one must perform for oneself to process the received information
- *Affiliation:* Finding a mutual understanding of the situation within the group

The first three strategies are focused on **conveyance of information**, which is the process of gathering new information and spreading information to other participants. Deliberation is necessary to process the conveyed information but is not involved in conveyance per se. The fifth strategy, affiliation, differs from the first four. Affiliation is focused on the **convergence of information**, which is the finding of shared meaning in the conveyed information. It is necessary for communication groups to reach a common

understanding and to agree that this understanding was reached (Dennis & Valacich, 1999).

According to media synchronicity theory, low media synchronicity is preferred for conveyance, whereas high synchronicity is preferred for convergence of information (Dennis & Valacich, 1999). If the primary goal of a communication is conveyance, low synchronicity leads to better performance and communication quality. The reason is that media with low synchronicity usually allow for higher parallelism, and the relatively slow feedback does not pose a problem for conveyance. By contrast, if the main goal is convergence, high synchronicity leads to better communication. The reason is that media that are high in synchronicity support rapid feedback and reduce parallelism, so participants can concentrate on and discuss one problem effectively (DeLuca & Valacich, 2006).

Media richness theory states that a task is either one of uncertainty or one of equivocality. The media synchronicity theory challenges this view and posits that during every task, phases of both conveyance and convergence are necessary; these phases differ regarding the percentage of the total effort in the communication. For tasks high in equivocality, the amount of convergence is higher than for tasks high in uncertainty, but both phases remain necessary (Dennis & Valacich, 1999).

The construct of "task" is another point of criticism regarding media richness theory, because tasks are not an adequate unit on which to base media selection. Dennis and Valacich (1999) proposed the use of micro-level communication processes instead of tasks. Dennis et al. continued to value the concept of task but concluded that it provides an inappropriate level of analysis as it is too broad (Dennis et al., 2008).

Dennis et al. defined two functions that groups perform while working and communicating, following the "time, interaction, performance" (TIP) theory by McGrath (1991). Unlike media synchronicity theory, McGrath's TIP theory states that groups perform three functions while they work. The first is the **production function**, which

means solving a problem or producing new ideas. The second function relates to group well-being, through which social structures are defined and groups are able to work together. The third and last essential group function is member support, which supports the individual members of a group. In their media synchronicity theory, Dennis, Fuller and Valacich summarized the functions of group well-being and member support into one, called **social function** (Dennis et al., 2008).

Again, following McGrath's TIP theory (McGrath, 1991), Dennis et al. identified four modes through which group communication can occur for each fundamental function. First, in the mode of **inception**, the goals of the project are defined. This mode tends to occur in the beginning of a project but may recur later, as participants and situations change, and the group needs to re-evaluate or change its goals. The second mode that a group might be in is **technical problem solving**, during which questions regarding roles, technologies and options for solving the problem are discussed and resolved. The third mode is **conflict resolution**, during which various conflicts in the group are solved; examples are conflicting personal values or work assignments. The fourth mode is that of **execution**, during which the actual work is performed, and problems are solved (McGrath, 1991; Dennis & Valacich, 1999).

According to Dennis and Valacich (1999), there is no order in which these modes have to occur, and they might not occur at all. Only the inception and execution modes are necessary for the production function of any situation. Also, whether or not members of a group already know each other will influence the amount of time the group spends in each mode. Newly formed groups tend to spend more time in inception, technical problem solving and conflict resolution, whereas experienced teams enter the execution mode faster (DeLuca & Valacich, 2006).

Although many factors influence communication and therefore media selection in media synchronicity theory, DeLuca and Valacich (2005) summarized the essentials as follows: "media synchronicity theory is based on a three-dimensional model which

examines the five media capabilities […] to support the two communication process of conveyance and convergence across the three group functions of production, group well-being and member support" (DeLuca & Valacich, 2005, p. 3).

The final and most important resolution in media synchronicity theory is probably that "Media switching may be most appropriate" (Dennis & Valacich, 1999, p.9). The reason is that no single medium can support the convergence and conveyance phases to the same extent because of the different requirements the phases have for media characteristics – and therefore for media synchronicity.

The first empirical tests of media synchronicity theory were conducted by Dennis et al. (1998), who found experimental support for the theory. Another study supporting the theory was published by Murthy and Kerr in 2003. They compared the performance of groups that communicated either face-to-face or via CMC and found that face-to-face groups outperformed CMC groups when convergence became more important. In the conveyance processes, CMC and face-to-face users performed equally well (Murthy & Kerr, 2003).

DeLuca and Valacich (2005; 2006) also found empirical support in their study on media synchronicity theory. They noted that the more mature a group was, the greater the extent to which asynchronous media might be used effectively. The freedom that was provided by the use of asynchronous media was highlighted by many participants as a benefit; they enjoyed it because it did not interrupt their daily work as synchronous media would.

In 2008, Dennis et al. revised media synchronicity theory and published a new paper on the topic. Although most of the theory remained unchanged, Dennis et al. expanded the original theory and strengthened the theoretical foundations. One change they made in comparison to the original theory was that immediacy of feedback was removed from the five media characteristics and was replaced by transmission velocity. Immediacy of feedback is now viewed as an outcome of the communication, whereas transmission

velocity describes the speed of a message if it is sent using a medium. Media high in transmission velocity allow messages to reach recipients in real time or with minimal delay. Similar to immediacy of feedback, high transmission velocity enables high media synchronicity and is thus favourable for convergence of information (Dennis et al., 2008).

A second change to media synchronicity theory was the new differentiation between **information transmission** and **information processing**. Information transmission refers to spreading information, whereas information processing is the individual processing of gathered information. Conveyance needs information transmission for a person to gather new information, and information processing to make sense of the gathered information. Convergence usually needs fast information transmission that goes back and forth to exchange small amounts of pre-processed data. Information processing is also needed, to incorporate other participants' views and ideas into one's own model (Dennis et al., 2008).

Dennis et al. (2008) also presented a more detailed view on the typical ratios of convergence and conveyance during the four modes of communication (inception, problem solving, conflict resolution and execution). These are shown in Figure 7 and Figure 8. Figure 7 shows the case of participants in a communication being familiar with each other as well as the problem and the media being used. Because they already have established norms, they usually proceed quickly from inception to execution. The convergence processes in inception and execution are brief, as the participants share a mental model and have common values and norms (Dennis et al., 2008).
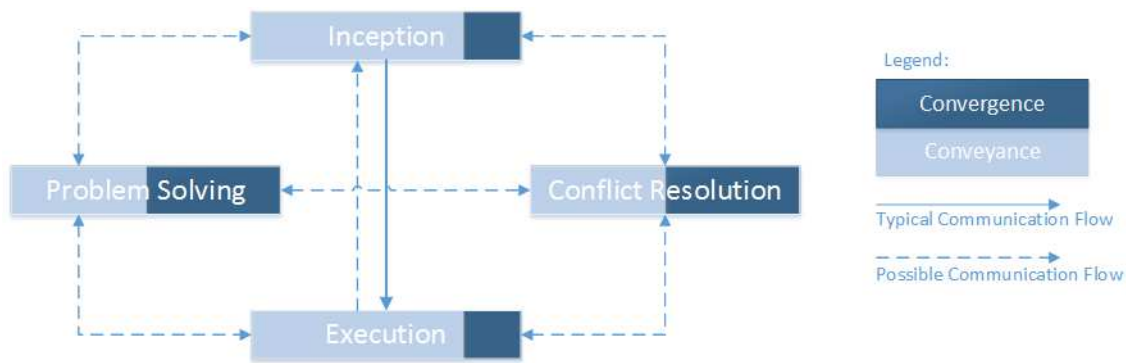
Figure 7: Familiar communication context in media synchronicity theory (Dennis et al. 2008)

In Figure 8, the contrasting situation of a novel communication context is pictured. In this situation, the individuals lack common experiences and are unfamiliar with the problem or the media. In a novel situation, convergence in the modes of inception and execution is more important than it is in familiar situations. The participants must develop shared understandings, common goals and a strategy for solving the problem (Dennis et al., 2008).
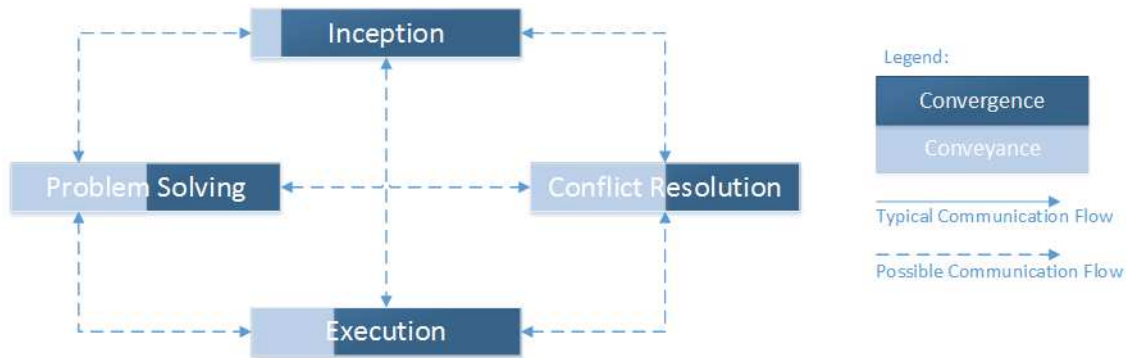
Figure 8: Novel communication context in media synchronicity theory (Dennis et al. 2008)

Mixed situations may occur – for example, if the participants are familiar with each other but not with the problem or the media. In this case, the social function follows the familiar communication context depicted in Figure 7, whereas the production function follows the novel communication context illustrated in Figure 8 (Dennis et al., 2008).

Dennis et al. summarized that "For a given situation, as the communication context moves from novel to familiar, regardless of the function or mode, relatively fewer

convergence processes will be needed. Thus, over time, individuals will have less need for high synchronicity media" (Dennis et al., 2008, p. 592).

2.2. Focusing on the perceived qualities of the medium

The theories introduced so far, all focused on the medium itself and its measurable characteristics. By contrast, the theories in the following chapters shift the focus to the perceptual aspect; that is, the perceived qualities of a medium and how those perceptions are constructed. It is important to note that these theories do not neglect or contradict the theories from the first group. Indeed, most of the following theories state that objective factors also play a role in media selection (Fulk, Schmitz, & Steinfield, 1990).

A person's perception of a medium is influenced by their experiences and by their colleagues and supervisors talking about the medium or perceived qualities of the medium. Such perceptions do not have to be the same, as "objective" theories would suggest; these perceptions can change over time, with new experiences (Löber, 2008).

Figure 9 shows which theories belong in this group by highlighting them. As evident in the figure, most theories in this group were influenced by media richness theory and its inconclusive empirical support and were created to find explanations for these results. Another important similarity among the theories in this group is that generally the perceived qualities of the medium are weighed against the perceived requirements of the communication task that is to be conducted with the medium. Usually, the medium that is perceived as the fittest match in this comparison is used for that task.

The critical mass theory is an exception in this group. It does not provide any rules or guidelines about how to choose a medium; it only helps to explain why certain media fail if not enough people use them.

Figure 9: Theories that take subjective perceptions into account

2.2.1. Social Influence Model

The social influence model of Fulk, Schmitz and Steinfield (1990) is based on the premise that perceptions about the characteristics of a communication tool are influenced by personal experiences with that medium, as well as by personal views and the social environment (Fulk et al., 1990; Löber, 2008). Fulk et al. developed this model because "current media-use theories fail to recognize a central premise of current organization theory: Behaviour occurs in a very social world which is far from neutral in its effects" (Fulk et al., 1990, p. 117).

To support the above statement, Fulk et al. listed various empirical findings from other studies that could not be explained using objective rational-fit models. For example, many studies found that conflict resolution and negotiation were performed by e-mail, which is a low social-presence medium and therefore not a suitable tool for such tasks, according to social presence theory or media richness theory (e.g. Steinfield, 1985; Fulk

et al., 1990). Another finding was that the extent of e-mail use by colleagues and supervisors was a predictor of an individual's e-mail use (Schmitz J. , 1987). In media richness theory and media synchronicity theory, these aspects would not influence the media selection because they are not inherent qualities of the media itself.

Nevertheless, Fulk et al. did not intend to neglect objective rational theories. They stated that "Clearly, they are determined to some degree by objective features such as ability to provide a permanent record, asynchronicity and the like" (Fulk et al., 1990, p.121). However, they wanted rather to emphasize social influences – such as statements, attitudes and behaviour.

Co-workers and supervisors influence a person's perception of a medium in various ways. There are **direct statements about the medium**, such as judgements, personal opinion and stories, which refer to the medium. There is also **vicarious learning**, which occurs when others use the medium and observers are influenced by what they see. Vicarious learning can enforce a positive or negative attitude towards the medium, depending on the outcome of the observed usage (Fulk et al., 1990).

Another form of social influence regarding a person's perception of a medium is company culture, which is the **social environment**. For example, a culture of "do not fix what ain't broken" results in a rather negative view of new forms of communication, whereas a culture of "you do not get anywhere by standing still" could encourage people to engage with new media and could lead to positive views (Fulk et al., 1990).

Fulk et al. stated that social influence is reduced when people already have some knowledge of a medium. That is because they can base their perceptions on their own experiences and do not rely solely on social cues.

In another study in 1995, Fulk, Schmitz and Ryu found that the opinion of co-workers was a stronger influence than the opinion of supervisors. They stated that the views of people similar to oneself might be perceived as more relevant than those of supervisors (Fulk, Schmitz, & Ryu, 1995).

Fulk et al. identified another set of factors that influence media selection and usage; they called this set "situational factors". These factors include aspects such as individual differences between people and facilitating factors such as the general accessibility of a medium, the critical mass of users and the reliability of the medium. A third group of factors also falls into this category, namely direct constraints. These include aspects such as geographical barriers between people who need to communicate, which affect media selection.

To summarize the social influence model, Figure 10 shows which factors influence the decision about the medium to use for a communication task. To decide which medium should be used, a person's evaluation of the various media available – and not excluded by situational factors – must match with the evaluation of the task to be performed. The evaluation of a medium is influenced by the perceived features of the medium, the experience one already has with the medium and the social influence (discussed above). Similarly, evaluation of the task is influenced by one's experiences in fulfilling similar tasks, one's general skills, the specific features of the task and the social influence.

As a result of these evaluations, the person selects the medium that best matches the task according to their subjective perception. The actual use of a medium also influences the evaluation of the medium, because evaluation is an ongoing process that also occurs while the medium is being used. Social influence directly influences media use if it occurs after the initial decision about a specific tool and can change this decision (Fulk et al., 1990).
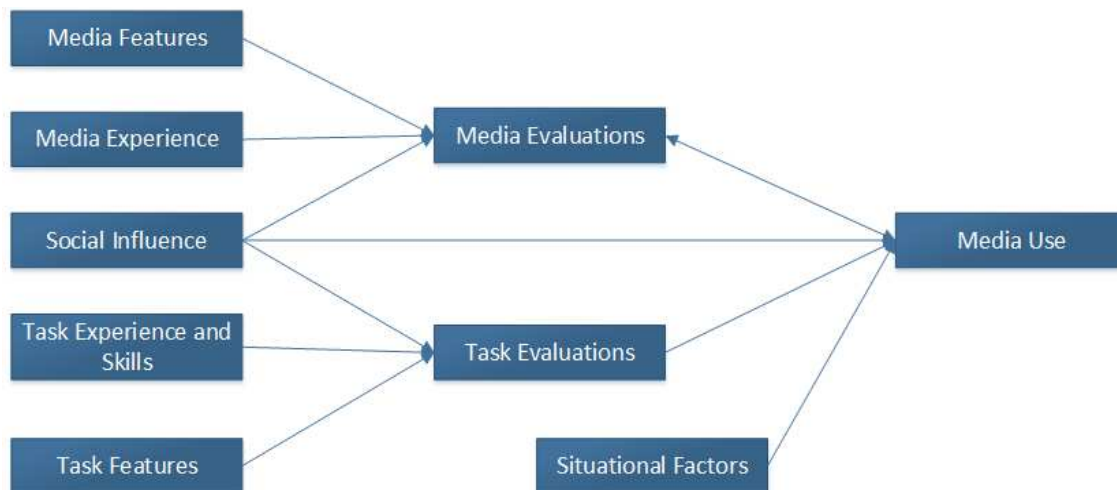
Figure 10: A social influence model of media use (Fulk, Schmitz, Steinbeck, 1990)

After the social influence model had been postulated, many studies indicated that the social environment does influence the selection of communication media. Webster and Trevino conducted two studies in which they used policy capturing[1] combined with classical survey methods, within a non-profit organization and a profit-oriented organization. In these studies, they showed that social influence affected the media choice (Webster & Trevino, 1995). In a later study, Campbell and Russo showed that the social environment influenced the use of mobile phones (Campbell & Russo, 2003).

In 1991, Rice and Aydin released a study that criticised the social influence model for various reasons. One argument was that most theories on social influence failed to specify who exactly the "relevant others" are that influence a person's view of communication media. Also, they miss differentiation between the attitudes that others are believed to have, and their actual attitude. In their empirical study, Rice and Aydin found that the estimated social information (social projection) from others was heavily

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[1] Policy capturing is a method where the participants of the study are presented with multiple scenarios and have to make choices at the end of each scenario. By using this technique, it is possible to get more realistic results. In traditional surveys, people tend to give answers they deem socially desirable or they overestimate minor aspects of the decision-making process (Webster & Trevino, 1995).

correlated with a person's own attitude, but was not correlated with the actual attitudes that those "others" reported (Rice & Aydin, 1991).

Nevertheless, Rice and Aydin (1991) found support for the general influence of social factors on media choice. They also found that relationally close sources (i.e., people who work together and talk to each other regularly) had a stronger influence than positionally close sources (i.e., people who occupy similar positions or have similar roles in an organization), who in turn had more influence than spatially close sources (i.e., people who work close by). They found that people with whom an individual communicated most often, as well as the individual's supervisor, had the strongest influence in terms of social information. Rice and Aydin's conclusion was as follows: "We also suggest that social information processing, in the complex and changing arena of ongoing organizational activities, can play no more than a small role in influencing attitudes toward ambiguous phenomena such as a new information system" (Rice & Aydin, 1991, p. 241).

2.2.2. Technology Acceptance Model

The technology acceptance model (TAM) by Davis (1986, 1989) does not deal specifically with communication media but acceptance of modern technology in general. Therefore, communication media such as face-to-face meetings or the telephone are not considered in this model (Löber, 2008).

Davis based his model on the theory of reasoned action by Fishbein and Ajzen (1975). This is a psychological theory that explains human behaviour by understanding the behavioural intention that is said to determine behaviour (King & He, 2006). The technology acceptance model is based on the premise that perceived ease of use and perceived usefulness are the main influences when a person decides whether or not to use a technology (Davis, 1989).

Perceived usefulness is defined as "the degree to which a person believes that using a particular system would enhance his or her job performance" (Davis, 1989, p. 320).

Perceived ease of use refers to "the degree to which a person believes that using a particular system would be free of effort" (Davis, 1989, p. 320). Perceived ease of use is influenced by far more factors than the user interface of an information system, as many believe (Mathieson & Keil, 1998).

In two studies by Davis (1989), it was shown that perceived usefulness was more influential than ease of use. That is, perceived usefulness was more strongly linked to the intention to use a tool, and therefore to actual usage, than was perceived ease of use. Davis theorized that the function a technology could perform was the main driver of adoption, whereas ease of use could be subordinated if a new technology provided the needed functionality. By contrast, a system will not be adopted if it does not give any functionality, no matter how easy it is to use (Davis, 1989).

Another finding of Davis's empirical studies was that the perceived ease of use operated through perceived usefulness as well, as illustrated in Figure 11. This means that perceived ease of use is expected to increase the perceived usefulness of a medium (Davis, 1989; Löber 2008). Similarly, Schepers and Wetzels found that the influence of ease of use decreased the longer people actually worked with a specific technology (Schepers & Wetzels, 2007). Their work comprised a meta-analysis regarding the technology acceptance model.
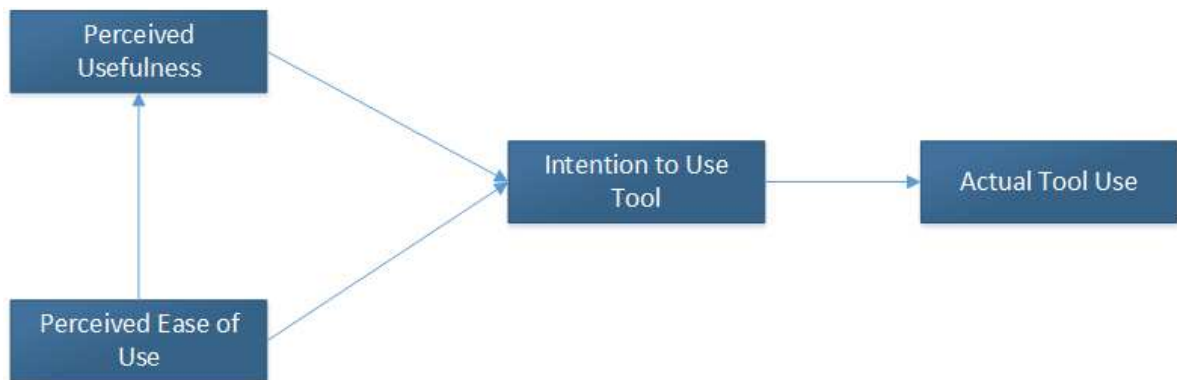
Figure 11: Technology acceptance model (Venkatesh & Davis, 2000)

In 2000, Venkatesh and Davis proposed an expansion of the technology acceptance model to include social influence and cognitive instrumental processes. They introduced a model that they referred to as TAM2, illustrated in Figure 12 (Venkatesh & Davis, 2000).
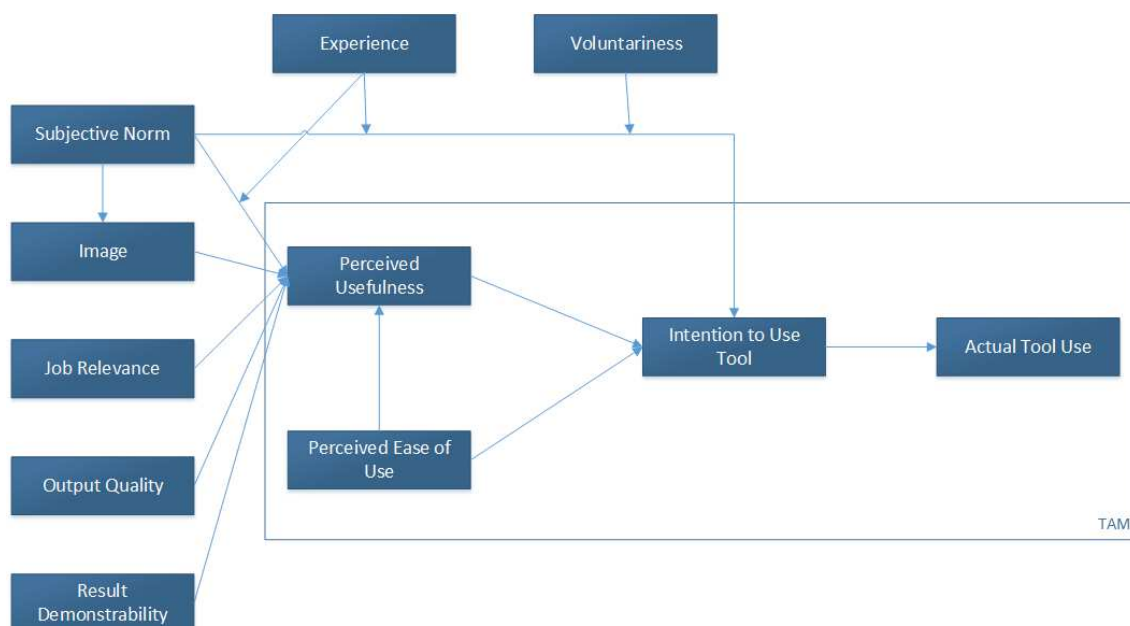
Figure 12: Extended technology acceptance model, TAM2 (Venkatesh & Davis, 2000)

TAM2 incorporates all elements of the original technology acceptance model but also includes certain external variables. These variables, listed in bold below, influence the intention to use a technology through their impact on perceived usefulness (Venkatesh & Davis, 2000).

Social norm in this context refers to a "person's conception that most people who are important to him think he should or should not perform the behaviour in question" (Fishbein & Ajzen, 1975, p. 302). Venkatesh and Davis argued that social norms influence a person's intention to use a medium. They stated that even if a person does not favour a behaviour, they may choose to adopt the behaviour anyway if they believe important referents think they should do so (Venkatesh & Davis, 2000).

Following a study by Hartwick and Barki (1994), Venkatesh and Davis stated that social norms influence the intention to use a technology only in mandatory settings, not in voluntary settings. V**oluntariness** was thus introduced as a variable that moderates the influence of subjective norms (Venkatesh & Davis, 2000).

The influential factor of **image** describes the extent to which a person believes a behaviour can help them to establish a favourable image of themselves in a group. Because social norms influence the characteristics of favourable images, adhering to the social norm can improve one's image within the reference group (Venkatesh & Davis, 2000).

Experience is another factor that moderates the influence of subjective norms on the intention to use a tool. This dependency was introduced because Hartwick and Barki (1994) found that the influence of subjective norms rapidly decreased once people actually started using a technology.

Job relevance is defined as the degree to which the technology in question is applicable to the person's job (Venkatesh & Davis, 2000). **Output quality** is an estimation of how well the technology can perform the tasks in question (Venkatesh & Davis, 2000).

Result demonstrability refers to the degree to which improvements in performance can be attributed to the technology. This is the final influencing factor and is relevant because a system that is seen to improve performance is likely to be perceived as useful. If the benefit of a system is unclear, usefulness is likely to decrease (Venkatesh & Davis, 2000).

The technology acceptance model was tested and validated in various studies (e.g. Davis, 1989; Venkatesh & Davis, 2000; Schepers & Wetzels, 2007; King & He, 2006). It remains one of the most important theories in this area of research.

2.2.3. Task Technology Fit

Just like the technology acceptance model by Davis (1986; 1989), the task technology fit (TTF) model also deals with usage of information technology in general. It is not focused only on communication technologies.

Task technology fit was introduced by Goodhue (1995) and Goodhue and Thomspon (1995). The premise of this model is that a technology, in order to be chosen, must be perceived as a good fit for the task to be performed. Being a good fit in this context means that the functions of the tool must support the user in their activities or tasks.

One representation of the task technology fit model that follows Dishaw, Strong and Bandy (1998) is shown in Figure 13. The t**ask requirements** of a specific task and the **tool functionality** of the eligible tool are weighed by the user, and a subjective task technology fit is estimated based on what the user knows. The task technology fit, combined with the experience the user already possesses regarding the tool, in turn influence whether the user chooses the specific tool or does not use it at all (Goodhue & Thompson, 1995; Strong, Dishaw, & Bandy, 2006).
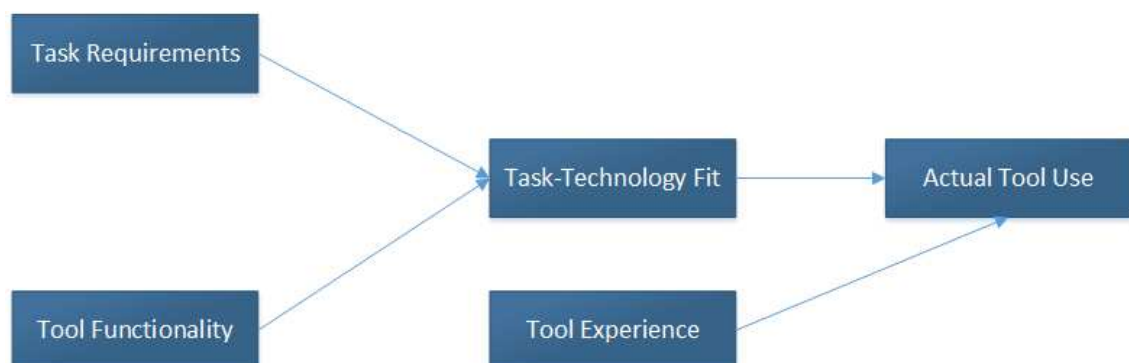
Figure 13: Task technology fit (Dishaw & Strong, 1998)

Dishaw and Strong (1999) suggested extending the technology acceptance model with constructs from task technology fit. They stated that, "We believe that TAM and TTF overlap in a significant way and, if integrated, could provide an even stronger model than either standing alone" (Dishaw & Strong, 1999, p. 9). This attempt at integration was justified because Goodhue linked his task technology fit model to the technology use model by Bagozzi (1982), which was developed from behaviour models (as was technology acceptance model). The empirical study further justified the integration because it provided better explanations than either the technology acceptance model or task technology fit model alone (Dishaw & Strong, 1999).

As shown in Figure 14, Dishaw and Strong (1999) used the technology acceptance model as a basis and added elements from task technology fit to improve the model. They found that experience with a specific tool had a positive influence on the perceived ease of use and the perceived usefulness. By contrast, functionality was negatively correlated to ease of use; that is, the more functionality a tool offered, the harder it generally was to use. Perceived ease of use was also influenced by the task technology fit, because if a tool was suitable for a task then it seemed "to be made" for that task and thus was relatively easy to use (Dishaw & Strong, 1999; Mathieson & Keil, 1998).

Another somewhat unexpected finding was that there was no direct connection between task technology fit and perceived usefulness in the empirical results regarding the proposed model. Although Dishaw and Strong had expected this connection to be rather strong, no evidence emerged. Nevertheless, the indirect connection via perceived ease of use was rather significant. The authors thus theorised that a fitting tool might only be perceived as useful if it was also perceived as easy to use (Dishaw & Strong, 1999).
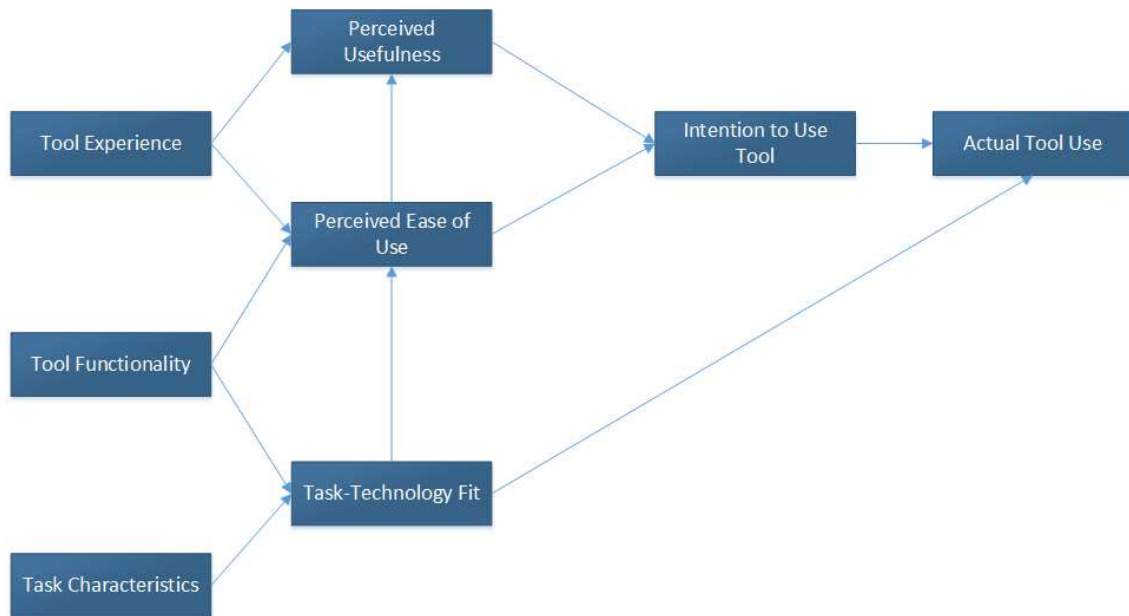
Figure 14: Integrated TAM/TTF model (Dishaw & Strong, 1999)

2.2.4. Fit Appropriation Model

Dennis, Wixom and Vandenberg published a paper in 2001 in which they attempted to integrate decision-based theories with the social technology approach. Theories based in the decision-theory school include task technology fit theory, whereas theories based in the social technology school include the adaptive structuration model. The aim was to better interpret the effects of group support systems on group performance. The result of this integration was the "fit appropriation model" (Dennis, Wixom, & Vandenberg, 2001).

Dennis et al. defined group support systems as "software tools, that have the potential to change the nature of information exchange and decision processes during group discussions" (Dennis et al., 2001, p. 169). The most important characteristics of a group support system, according to Dennis et al. – who followed the approach of DeSanctis and Poole (1994) – are **social structures**, i.e., characteristics that influence how a group is working, and **structural features**, i.e., the specific capabilities of the group support system.

Three types of social structures were emphasised by Dennis et al. (2001), namely communication support, information processing support and process structure. **Communication support** includes all aspects of the group support system that support communication among the participants, such as parallelism and anonymity. **Information processing support** describes the ability of a group support system to support evaluation, aggregation and organization of information. **Process structure** describes all aspects of the process that a communication group follows to accomplish a task as effectively and efficiently as possible (Dennis et al., 2001).

Communication support and information processing support can be thought of as enabling structures, as they offer ways of communication and information processing to a group and they affect the fit between a medium and a task. Process structure is different. Process structure guides a communication group to use the options offered in the categories of communication support and information processing support, in the way intended by the designers of the group support system. In this function, process structure can be seen as appropriation support – a term that is used as an equivalent to "process structure" by Dennis et al. whereas communication support and information processing support can be assessed by examining the group support system alone, this is not true for appropriation support (Dennis et al., 2001).

If communication support and information processing support fit the task, faithful appropriation of the medium leads to improved performance. If a group is well established, appropriation might not be as critical because the group already has norms to follow. If a group is not well established, external appropriation support might be needed to adopt the group support system correctly. If a medium fits a task but is not appropriated correctly, improved performance is unlikely. A medium that is faithfully appropriated but is a bad fit for the task will similarly not lead to increased performance. Following this argument, it can be stated that task technology fit affects performance, but this effect is moderated by the appropriation. Appropriation in turn is influenced by the fit: a good fit tends to result in suitable appropriation (Dennis et al., 2001).
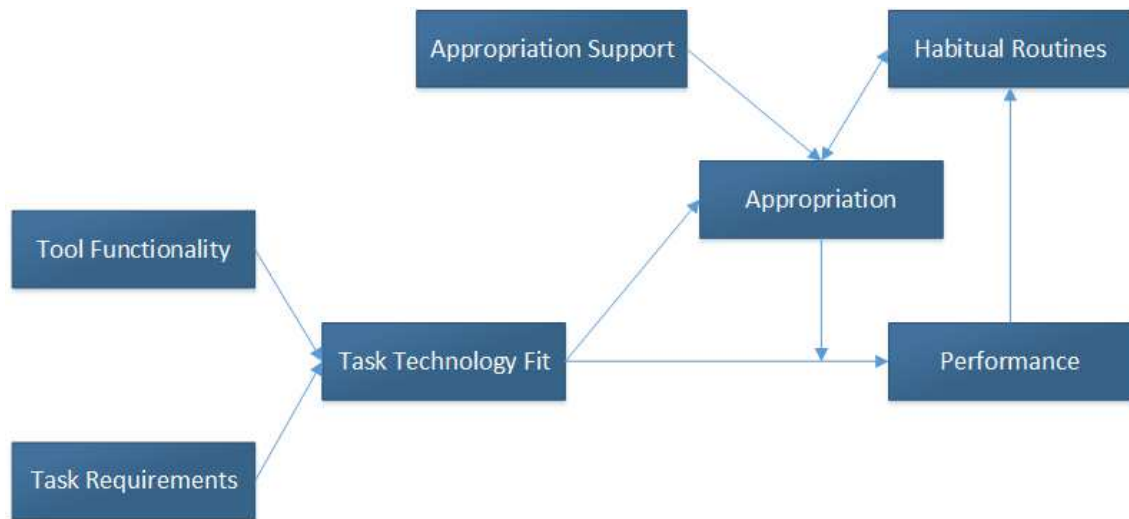
Figure 15: Fit appropriation model (Dennis et al., 2001)

To investigate their hypotheses, Dennis et al. conducted a meta-analysis of published studies on group support systems. Their analysis of 61 studies and articles showed that the use of a group support system was associated with more ideas being generated, increased time needed for task completion and decreased satisfaction with the process. Decision quality and satisfaction with the outcome were not influenced. Dennis et al. further reported that proper appropriation support improved efficiency and participant satisfaction with the process when a group support system was used.

In 2009, Fuller and Dennis conducted an empirical study on the effects on performance of task technology fit and appropriation in repeated tasks. Many tasks in an organization are performed multiple times and are therefore important to consider. Their central finding was that when a group support system was first used for such tasks, the task technology fit influenced the performance, but over time this influence became progressively weaker. Their experiment involved a team that received a task and a group support system considered to be a good fit, according to task technology fit theory ("fit team"), versus a team that was required to use a non-fitting tool ("poor-fit team"). The fit teams displayed strong performance from the beginning of the experiment, whereas the poor-fit teams started at a low level of performance. However, over time, the poor-

fit teams increased their performance to a larger extent than the fit teams, which stayed at the same level.

Fuller and Dennis explained these findings with the ability of appropriation the poor-fit teams had to utilize. Over time the poor fit teams changed the ways they appropriated the medium and found ways to overcome the poor fit that hindered them initially. Because the fit teams rarely had to change their ways of appropriation, their performance also stayed the same over time. Following from this finding it can be stated that, over time, appropriation has a higher influence on performance than task technology fit. This partly contradicts the fit appropriation model, as it originally states that in case of a poor fit technology, appropriation won't increase performance, which has been shown to only be correct for the beginning of group support system usage. Fuller and Dennis suggest that the fit appropriation model is therefore better applied in new working context or single tasks but also conclude that this is consistent with the fit appropriation model as it was based on a meta study of mostly single task studies (Fuller & Dennis, 2009).

For practical selection of communication media, and group support systems more specifically, Fuller and Dennis suggested implementing systems that are flexible and allowing the adaptation of usage over time. They also suggested introducing appropriation training into companies to sensitize employees to the importance of appropriation (Fuller & Dennis, 2009).

2.2.5. Channel Expansion Theory

Channel expansion theory was introduced by Carlson and Zmud in 1994. Its central argument is that different types of experience change the perception of the richness of a specific medium. Carlson and Zmud (1994) created this theory because media richness theory, which was a leading theory about media selection at the time, was not supported consistently by empirical studies. They wanted to create a model that improved the understanding of media selection. The main difference from media richness theory is that "media richness is seen to be less as an inherent characteristic of the channel being used, and more a perception of the user, which is based on experience and familiarity with the medium, experience and knowledge concerning the messaging topic as well as experience with communication co-participants." (Carlson & Zmud, 1994, p. 280).

Another difference from media richness theory is that media richness is a dynamic construct, which tends to increase over time as the mentioned experiences increase (Carlson & Zmud, 1999). However, like media richness theory, channel expansion theory implements the media richness notion in Daft and Lengel's theory, but it is called "nominal media richness" to differentiate it from other constructs. Nominal media richness refers to the objective richness of a medium, which is defined by its inherent qualities – such as number of clues, personal focus, language variety and speed of feedback (Carlson & Zmud, 1994; Daft & Lengel, 1986).

N**ominal media richness** is not what the user of a medium perceives. It is, instead, the main determinant of communication richness, which is the amount of channel bandwidth used in a specific communication. This relationship is moderated by experience with the used channel, experience with the message topic and experience with other communication participants (Carlson & Zmud, 1994).

Schmitz and Fulk (1991) identified the **experience that a user** has with the medium as an important factor in the perception of a medium's richness. However, unlike the social

influence model (Fulk et al., 1990), channel expansion theory posits that experience with a medium does not determine media richness but rather moderates it. Experience with the medium usually results in expertise with that medium, which may enable a broad spectrum of message richness to be transmitted effectively (Carlson & Zmud, 1994). In addition, the way in which a medium is used is important. For example, if a person uses a medium such as e-mail for several years in a lean manner that does not change, they will not improve their knowledge about using e-mail in richer ways (Carlson & Zmud, 1999).

The experience of a communication participant with co-participants also moderates communication richness. Through a shared communication history, people develop knowledge and understanding about each other. Therefore, information can be encoded in a way that is optimized for a specific co-participant to allow richer messages to be transported effectively. This can be accomplished using various methods, for example jargon, organization-specific symbols or special formatting of the message (Carlson & Zmud, 1994).

Experience with the topic of the message is also viewed as a moderator. Through sharing a common knowledge base with the receiver of a message, the sender can encode the content of the message more effectively. The sender can use and refer to this established knowledge base (Carlson & Zmud, 1994).

By increasing one's experiences with a medium, co-participants and the message topic, one's perception of the medium will become richer (Carlson & Zmud, 1999). This means that richness perceptions change over time, and participants in a communication might rank various media differently at different times as their knowledge expands and social influences change. The corollary is that participants in a communication may simultaneously perceive the richness of a medium rather differently (Carlson & Zmud, 1999). Another implication is that one person might perceive a specific medium

differently rich at a single point in time, based on the co-participants and the topic the conversation is about (Carlson & Zmud, 1999).

To remain consistent with critical mass theory, Carlson and Zmud (1999) stated that a critical mass of users in an organization would need to develop such knowledge bases before the installation of a new medium can succeed. Therefore, for a medium to be introduced successfully in an organization, future users of the tool must have opportunities to develop their skills and comfort with the new medium (King & Xia, 1997). Because media that are known for some time tend to be perceived as richer than new and unknown media, and people are more used to the older tools, employees tend to prefer older media over the new medium (King & Xia, 1997).

A second determinant of communication richness is the intended information richness or level of richness that the communication participant desires. Intended information richness in turn is influenced by the perceived need for information richness and is moderated by situational constraints. These include the organizational levels of the participants (Carlson & Zmud, 1994). Communication richness is bi-directionally related to the perceived media richness and the perceived information richness.

"Media richness concerns the capacity of a particular channel to carry equivocal information. If a channel can successfully carry equivocal information, it is considered a rich medium. Information richness, on the other hand, is the capability of information to reduce the equivocality experienced by communication participants. This capability of the information is not determined by the channel through which it was communicated, but rather by the interaction of the information and the communication participants within a given context." (Carlson & Zmud, 1994, p. 281)

Like social influence theory (Fulk et al., 1990), channel expansion theory posits that perceived media richness and perceived information richness are influenced by social information (Carlson & Zmud, 1999). A summary of the relationships in the channel expansion model is provided in Figure 16.
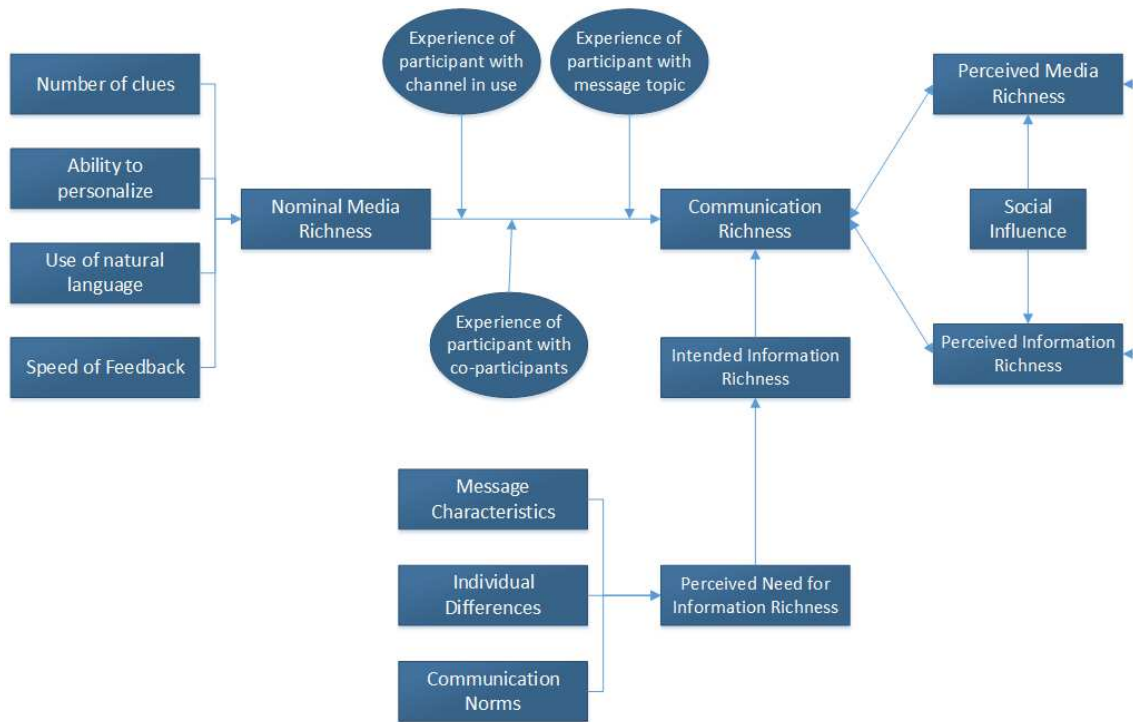
Figure 16: Channel expansion model (Carlson & Zmud, 1994)

The channel expansion theory was empirically tested in various studies (e.g. Carlson & Zmud, 1999; King & Xia, 1997; Majchrzak, Rice, King, Malhotra, & Ba, 2000). The results showed that the choice of media was significantly correlated with people's previous experiences with the media. Majchrzak et al. reported that during a longitudinal experiment with chat-based communication, participants gradually became able to compensate for poor perceived media richness of a medium to some extent. Hence, with time, they perceived the media richness as being higher than at the beginning of the experiment.

2.2.6. Psychobiological Model

The psychobiological model was developed by Kock in 2004. Kock wanted to find an explanation for various findings from empirical tests of media richness theory that were not adequately explained by the theory. Kock based his theory on the theory of

evolution by Charles Darwin. He postulated that communication abilities are partly the result of evolution in humans, which favours the fittest beings who have abilities that maximize their chance of surviving (Darwin, 1859).

Evolution by natural selection is based on two principles that are interdependent and should always be viewed as such (Gould, 2002). The first principle is **repeated use**, which means the optimization of a specific organ for a specific use is correlated with the amount of time the organ is used for the task. Following this principle, the human body is optimized for communication using gestures, facial expressions and sounds; for most of evolutionary human history, these were the predominant forms of communication. Written communication, by contrast, occurred rather late in human history. It could thus be concluded that humans are not designed for such communication.

The second principle is **brain-body coevolution**. This principle states that the human brain and body coevolve, and every change in the body is closely followed by a change in the brain – and vice versa. Following these two principles, it can be assumed that the human brain and body are mainly suited for face-to-face communication (Kock, 2004).

Kock's psychobiological model (2004) was designed as a set of propositions that are, in contrast to most other theories on media selection, independent from the type of task that should be completed through communication. The first proposition is that of **media naturalness.** This term means that the higher the degree of naturalness of a medium, the less the cognitive effort necessary to use the medium to solve a task. Naturalness of a medium here refers to the degree to which a medium is supported by the functioning of the human brain and body, with face-to-face communication being the most natural medium available. The naturalness of a medium can be estimated by the extent to which it supports the following aspects of face-to-face communication:

- Co-location (being at the same place)
- Synchronicity (being able to exchange messages in real time)
- Conveying and observing facial expressions

- Conveying and observing body language
- Conveying and listening to speech (Kock, 2004).

The second proposition is the **speech imperative proposition.** This proposition states that a medium's ability to support the transmission of speech is more important than its ability to transport facial expressions or body language, and strongly influences its naturalness. This point is based on the argument that language development required the larynx to be capable of supporting the language, which placed a high evolutionary cost on humans. Evolutionary cost in this context refers to a negative effect that one must endure to access certain benefits. In the case of the larynx, the cost was an increased mortality rate because of the chance of choking on food or liquid. For people to be willing to pay such a cost, the benefits gained must be highly valuable in terms of evolution. By contrast, the costs associated with facial expressions and body language are far smaller (Kock, 2004).

The third proposition is the c**ognitive adaption proposition.** It focuses on the ability to adapt to new forms of communication and to reduce the cognitive effort as adaptation increases. This proposition of the psychobiological model is similar to the main thesis of Carlson and Zmud's channel expansion theory (1994; 1999).

The final proposition is the **schema alignment proposition**. This proposition states that the individual schemata that people learn for processing communication can differ from person to person. The more similar the schemata are between communication partners, the less cognitive effort is necessary to process the communication. By working together on collaborative tasks, individual schemata are likely to adapt to one another (Kock, 2004). A similar concept is again noted in Carlson and Zmud's channel expansion theory (1994). They identified experience shared by communication participants as a moderating factor in communication richness, since shared experience increases the probability of shared cognitive schemata.

The proposition of **media naturalness** sounds somewhat similar to the concept of richness in media richness theory and that of social presence in the theory of social presence. However, these concepts do differ. The first main difference is the focus of the theory. While media richness theory and social presence theory focus on the communication medium, the psychobiological model focuses on the human senders and receivers of messages and their biological communication apparatus (Kock, 2004). Second, the psychobiological model does not directly connect the degree of naturalness of a medium with expected behaviour. It merely states that cognitive effort increases if the degree of naturalness is too high or too low, which might result in certain actions. However, this is not inevitable, if the communication partners are willing to bear the increased effort (Kock, 2004).

The third difference is the scale of the central attribute of communication media (i.e. social presence, media richness and naturalness). Media richness theory and social presence theory classify media only by their inherent features, and additional features are viewed as desirable or superior. By contrast, the psychobiological model views face-to-face communication as the most natural form of communication and posits that additional features actually decrease the level of naturalness, which in turn increases the cognitive effort needed because of information overload (see Figure 17). Media richness theory and social presence theory imply, instead, that adding further features to a face-to-face medium would make it even richer and therefore increase productivity in equivocal tasks (Kock, 2004).
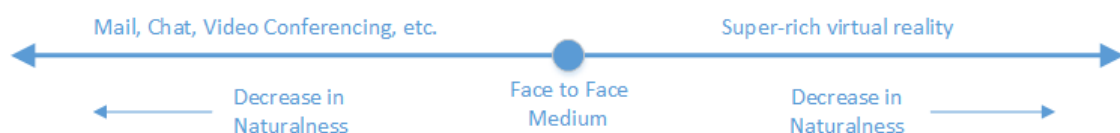
Figure 17: Media naturalness scale (Kock, 2004)

2.2.7. Cognitive-based View

Robert and Dennis (2005) introduced their cognitive-based view to explain empirical studies in which media richness theory or social presence theory were not supported and contradicting results were found. They based their approach on media synchronicity theory, of which Dennis was an original author, and added cognitive aspects (Löber, 2008).

As in social presence theory, Robert and Dennis categorized media by their level of social presence along two dimensions: spatial presence and timely presence. Media that require the participants to be at the same place at the same time are likely to have the highest social presence, whereas media that allow for spatial or timely distance are likely to have a lower social presence (Robert & Dennis, 2005).

Their work was based on the **elaboration likelihood** model by Petty and Cacioppo (1986), which states that attitudes are formed in two ways. The first is through using considerable cognitive effort to really understand and evaluate information; this is known as the central route. The alternative is to use little energy and simple methods to cope with new information; this is known as the peripheral route.

The main elements in choosing a route of information handling are motivation and the ability to process information. If a person is motivated and able to process the information, they will analyse the information, evaluate it, combine it with already obtained knowledge and gain new insight, which might result in predictable and enduring changes in behaviour. This pattern describes the central route. In this case, elaboration likelihood is high. If an individual is unmotivated or unable to process the information, they will not apply effort to the tasks and will not integrate the new information with their existing knowledge. In this case, the elaboration likelihood is low, and behaviour changes would be unpredictable and unstable if they even occur. (i.e. peripheral route). In brief, the more elaboration one invests in a task, the better the outcome will be (Robert & Dennis, 2005).

Another central aspect of the cognitive-based view is **attention**. Attention is defined as "what receivers pay to consume information and convert into knowledge" (Robert and Dennis 2005, p.13). Attention is viewed as a prerequisite for communication. The higher the social presence of a medium, the more the attention is required from the receiver of a message. Because attention can be seen as a form of payment made in exchange for information, media that require much attention can be seen as costly. To use such media, a receiver must be motivated and willing to pay the high "price". Following this line of argumentation, it can be said that media that are high in social presence also require strong motivation from the receivers of a message (Robert & Dennis, 2005).

If the receivers are motivated, they also need the **ability to process** the message in order to elaborate on it. One characteristic of media that strongly influences the processability of information is reprocessability, a term from media synchronicity theory. The more reprocessable information is, the more able recipients are to handle the information. Generally, media that are low in social presence allow for high levels of reprocessability, whereas media high in social presence do not allow receivers to compute information at will, as quick feedback is usually expected (Robert & Dennis, 2005). If one is presented with too much or too complex information, without the chance to process it – as is the case with high-social-presence media, information overload occurs. This is typically handled by either delaying the response, rejecting the message or using peripheral cues (e.g., trust in the source). Therefore, for transferring plentiful or complex information, a medium that is low in social presence should be preferred (Robert & Dennis, 2005).

The tenets of the cognitive-based view discussed above illustrate a paradox: "Media that allow the receiver the highest ability to process may not garner the attention and motivation of the receiver. Ironically, there appears to be an inverse relationship between attention and motivation with the ability to process" (Robert & Dennis, 2005, p.16). To cope with this dilemma, senders of a message need to balance attention and motivation with the ability to process the message at all times. Because this cannot be achieved using only one medium, Robert and Dennis suggest switching media

throughout the communication process. The same suggestion appeared in Dennis and Valacichs' media synchronicity theory (1999).
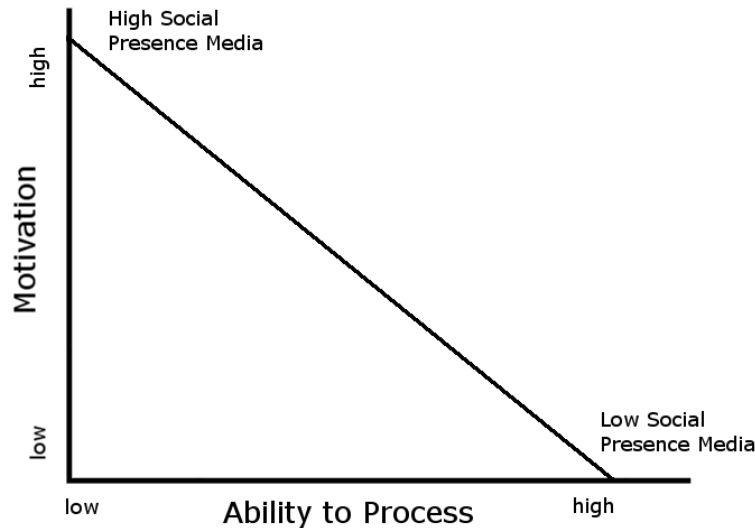
Figure 18: Inverse relationship of message processing (Robert & Dennis, 2005)

2.2.8. Media Fitness Theory

Media fitness theory was introduced by Higa and Gu in 2007 to "try to answer the simple question: why choose this medium but not that one[?]" (Higa & Gu, 2007, p.46). Media fitness theory is founded on the idea of the suitability – fitness – of a medium for a specific task.

The most important aspect of media fitness theory is that "media selection is decided by the fitness of the media with the communication task needs, the communication user and user group and the supporting environment in which the media being utilized" (Higa & Gu, 2007, p.47). As evident in this definition, the theory includes ideas from the task technology fit theory and media richness theory (i.e., the fit between task and communication medium), social presence theory (i.e., influence of the users' view and the surrounding group) and environmental factors. A difference between media fitness theory and other theories is that media fitness theory considers the people who use the

medium, together with the communication task, integrally, when assessing the media fitness. Another difference is the added environmental factors (Higa & Gu, 2007).

Higa and Gu (2007) identified three groups of factors that influence the fitness of a medium for a task. The first group contains properties of the task, the second contains properties of the user and the user group and the third group contains environmental factors (Higa & Gu, 2007). **Properties of the task** include the following factors that influence fitness (Higa & Gu, 2007):

- *Response time:* This refers to the time in which a response to a message is expected. This property is similar to media richness theory's speed of feedback (Daft & Lengel, 1986).

- *Security:* This property was introduced to address concerns about data security in computer-mediated communication.

- *Sharing:* Sharing describes whether the exact same information can be shared later with a third party. This property is somewhat oppositional to Daft and Lengel's (1986) concept of personalization, because the more personalized a message is, the less it can be shared without further clarifications.

- *Retrieval:* This property describes how easy or hard it is to retrieve information that was transmitted, for later use.

- *Multiparty:* The term refers to how many participants in a communication can interact with each other using the same medium.

- *Expressive Power:* Expressive power is related to media richness theory's concept of language variety and the multiple-cues characteristic. It describes which types of expressive power are required by the task. The four basic expressive powers discussed in media fitness theory are text, picture, voice and video.

Higa and Gu (2007) saw the **user / user group** as relevant for fitness:

- *Skill of using media:* This aspect describes the degree of mastery that most of the user group displays. This property was derived from Carlson and Zmud's channel

expansion theory (1999). As Carlson and Zmud found, a high degree of mastery in a lean medium allows users to solve rich tasks using the medium.

- *Preference for media:* This property describes the personal preferences of the group members regarding communication media. Colleagues' preferences influence one's own preferences and are thus also important (Schmitz & Fulk, 1991).

- *Group lifespan:* This aspect refers to how long a specific communication group exists. Group lifespan influences the skills in using a medium as well as media preferences.

The **environmental factors** that are mentioned in media fitness theory are as follows (Higa & Gu, 2007):

- *Availability:* Availability describes the most basic environmental factor regarding whether the medium is accessible to users**.** Availability is usually restricted by time and space. If different members of a group have different levels of availability, the lowest level must be considered.

- *Bandwidth:* This property describes how much bandwidth is allocated to a communication medium. Bandwidth is measurable only for computer-based media and must be estimated for other media. Again, the lowest level is the level that must be considered.

- *Cost:* Cost describes the amount of money that can be provided for a medium. Here, initial and running costs should be considered.

In their 2007 paper, Higa and Gu also presented a media fitness framework to calculate the degree of fitness between a task and a medium. They assigned a measurement scale to each of the above described properties, which can be used to identify the needs of a task and the characteristics of a medium. Higa and Gu also described methods to calculate a level of fitness for each of the three groups, and another formula to calculate the fitness of a medium for specific tasks overall. They tested their framework in three

Japanese companies, using six communication media: fax, telephone, email, video conference, face-to-face, scheduler and the file transfer protocol (FTP). Managers were presented with 12 tasks and were asked to describe what media they would use for each task. By comparing the "ideal" medium according to media fitness theory and the actual selected media, Higa and Gu found support for their framework (Higa & Gu, 2007).

In 2009, Gu and Higa conducted another study with a larger sample, namely 11 Japanese and seven Chinese companies, and more tasks – 72 tasks. They re-evaluated their media fitness framework. As in their first empirical study, they used six predefined media, but found that other media were also widely used to communicate. Gu and Higa reported that both objective and subjective selection criteria were important and mutually influenced each other. Experiences with objective, rationally chosen media influenced the perception of a medium; this perception in turn influenced future media choices and supported or contradicted the objective, rational choice. They found that it is likely that the primary medium choice following group one properties (task properties) is the same as for group two (social properties).

According to Gu and Higa (2009), social influences were the main factor in choosing a primary communication medium. If a complementary medium was chosen as well, rational aspects (task properties) were the main influencer. However, rational and social aspects influenced people's media choice only within the boundaries of environmental factors. That is, an unavailable medium would not be selected (Gu & Higa, 2009).

Another empirical study on the media fitness framework was conducted by Gu, Higa and Moodie in 2011. While the results were quite similar to prior studies, this time the authors compared media suggestions that were based on the following three models: media fitness framework, media richness theory and the social influence model. Gu et al. examined how often the suggested media selection (according to each theory) matched the media actually selected by participants. They found that their media fitness framework predicted actual media choice in more cases (61 of 72) than did social

influence theory (57) or media richness theory (48). They stated that the media fitness framework was more accurate because it allowed for choosing more than a single medium for a task (Gu, Higa & Moodie, 2011).

It should be mentioned that media fitness theory was developed and empirically tested only in Asia, mainly in Japan and China. The empirical results might therefore be biased (Higa & Gu, 2007; Gu & Higa, 2009; Gu, Higa & Moodie, 2011).

2.2.9. Critical Mass Theory

Critical mass theory is based on the premise that a **critical mass of users** is necessary for a communication medium to become relevant for the majority of people. The term "critical mass" is borrowed from the field of nuclear physics, where it describes the minimum amount of radioactive material necessary to start an ongoing nuclear fission. If there is less material than the critical mass, the atomic reaction will end soon after the process is initiated (Markus, 1987).

Critical mass theory was introduced by Oliver, Marvel and Teixeira in 1985. However, it was Markus who adapted the theory for interactive media, which is the focus of this study (Oliver, Marwell, & Teixeira, 1985; Markus, 1987).

In the field of communication, a medium becomes more useful the more people within a community can be reached by using it. In this case, a community can be any group of individuals communicating with each other regularly, such as a company or a family. If everybody in the community uses a specific medium of communication, this medium yields the highest benefits because no other form of communication is being used. The opposite scenario would be where only one person uses the medium and gains no benefits from doing so. Critical mass lies somewhere between these two extremes. It refers to the minimum number of users that is the necessary to grant the medium a widespread across the community (Markus, 1987).

Usually, when a new medium of communication is introduced, there are early adopters; they obtain benefits by being innovative – such as satisfying their need for innovation or receiving monetary benefits from a manager who wants to promote the medium. Other people in the community observe these early adopters and follow them if they perceive enough benefits for themselves to compensate for the costs of learning to use the new medium. With every additional user of the medium, the benefits for others increase. Therefore, it becomes likely that additional people will decide to use the medium as well (Markus, 1987).

While early adopters influence their followers, followers also influence early adopters through their choice to use – or not to use – the medium. In the beginning of using a new medium, the costs of usage for early adopters are rather high compared to the obtained benefits. To justify these costs, early adopters need reinforcement from additional users, because with every user, the benefits increase for them (Markus, 1987). This type of influence is called "reciprocal influence" (Thompson, 1967). If, after some time, the early adopters realize that nobody else is using the new medium, they will probably also stop using it. Their benefits are too small because nobody else is reachable through the medium (Markus, 1987).

Markus (1987) listed factors that can influence the development of usage. Examples are the requirements for skill and effort needed to use the medium, and how the community is supported through training or additional budgets to enforce the introduction of the new medium (Markus, 1987).

To summarize, critical mass theory broadly explains why some communication media fail, but it does not adequately explain the selection of a best-fitting medium for a specific task. It can eliminate certain media that might exist but are not used, but does not enable evaluating media once they reach their respective critical mass (Löber, 2008).

2.2.10. Task Closure Theory

In 1998, Straub and Karahanna proposed the concept of "task closure", which was said to exert a considerable effect on the choice of communication media. Task closure in this context means that for one segment of a specific task, the sender of a message wants to discharge their responsibility on the matter and does not want to have a sense of incompleteness regarding the task.

Task closure theory alone is insufficient to explain media choice because it does not give any guidance regarding the communication medium to select for certain tasks. It can rather be seen as an addition to existing theories; it adds another perspective to the topic of media choice. This perspective is the **availability of the recipient**, which – according to task closure theory – strongly influences media choice (Straub & Karahanna, 1998).

Face-to-face communication is viewed as weak in task closure, because the sender of the message cannot control the completion of the communication; communication is only terminated when all participants agree to this. Face-to-face communication can only occur when all participants are available (Straub & Karahanna, 1998).

Media such as e-mail, by contrast, are high in task closure because the sender has control over the communication and the closure. The availability of the recipient has almost no influence on media such as e-mail (Straub & Karahanna, 1998).

Straub and Karahanna found empirical evidence that the senders of a message felt a strong need to close their communication tasks when the recipient of the message was not available. They therefore chose a medium that was strong in task closure (Straub & Karahanna, 1998). When the recipient of a message is unavailable, the sender has two choices. First, they can repeat their attempts to reach the recipient to resolve the feeling of incompleteness; in highly urgent or sensitive cases, this might be the only option available. This option is chosen when the task requires high social presence, which

would render a change in communication medium unfeasible. An example is annual appraisal interviews (Straub & Karahanna, 1998).

The second choice for the sender to reach the recipient is possible for tasks that could be executed with a lower level of social presence. The sender can close the task by suppressing their need to choose an ideal-fit medium (e.g. selected according to media richness theory or task technology fit theory). This allows them to switch to a medium that is high in task closure (Straub & Karahanna, 1998).

The empirical findings of Straub and Karahanna indicate that "inability to bring task closure results in increased stress for message initiators" (Straub & Karahanna, 1998, p.172). Not being able to close a task also leads to fragmentation of work, because different tasks continue to occupy the person's mind concurrently, which also causes stress (Kirmeyer, 1988).
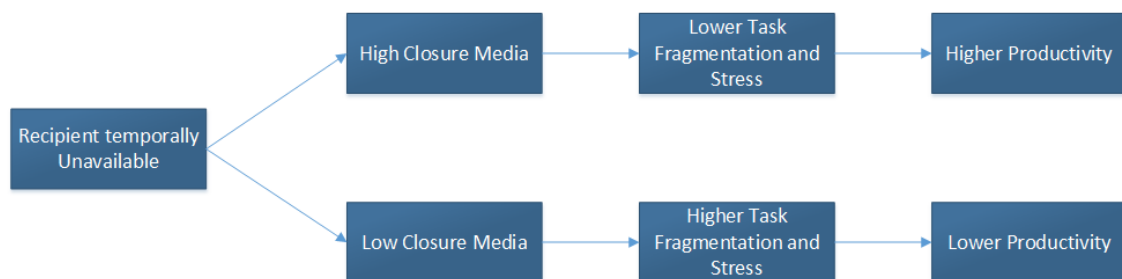
Figure 19: Task closure model (Straub & Karahanna, 1998)

2.3. Overview of Theories: Commonalities and Differences

In Table 2, all theories that were described in earlier chapters are summarized to provide an overview of the main tenets of each theory.

Theory, Author and Year	Main statement of the Theory
Focusing on the medium and its inherent qualities	
Social presence theory Short, Williams & Christie 1976	Medium is classified by its ability to transport the social presence of the sender (e.g. facial expressions, gestures, clothes and pitch of voice). Face-to-face communication has the highest social presence while formal print media have the lowest. Communication is efficient when the level of social presence of the medium matches the required level of social presence for the communication task.
Media richness theory Daft & Lengel 1986	Media richness theory is based on the social presence theory of Short, Williams and Christie. Information is processed to reduce uncertainty and resolve equivocality, and communication is a part of information processing. Uncertainty here means the absence of information, while equivocality means the existence of conflicting interpretations of a situation. A specific situation can be high/low in uncertainty and high/low in equivocality, thus creating four types of communication. Media have inherit media richness, which is determined by four factors: feedback, multiple cues, language variety and personal focus. The richness of the medium and the equivocality of the task or message should match, to ensure effective communication. (i.e. low equivocality → lean medium, high equivocality → rich medium) Media richness theory does not account for changing levels of equivocality during a communication. Empirical findings on media richness theory were mixed. As a result, researchers developed new subsequent theories on media selection.
Symbolic interactionist perspective Trevino, Lengel & Daft 1987	Three variables influence media choice in organizations: message ambiguity, symbolic cues and situational constraints. Message ambiguity is similar to media richness theory's equivocality. The term describes how ambiguous messages can be interpreted. Ambiguous messages call for rich media.

	Symbolic cues define what meaning is carried by the selection of a specific medium. This meaning must support the meaning of the transmitted message to be effective.
	Situational determinants define constraints such as geographical distance or time pressure, which also influence media selection.
Media synchronicity theory Dennis & Valacich 1999	The central concept is media synchronicity, which is defined as the extent to which individuals work together on the same task at the same time.
	Media synchronicity is influenced by five characteristics of the medium: immediacy of feedback, symbol variety, parallelism, rehearsability and reprocessability.
	There cannot be one richest or one leanest medium, as some of the five characteristics are contrary to others (e.g. rehearsability and immediacy of feedback). A ranking of media is therefore not practical.
	There are various strategies for sense-making in groups. These focus either on conveying (gathering and spreading) new information or on convergence of information. The latter term refers to finding shared meaning in the conveyed information.
	Low synchronicity is preferred for conveyance tasks. High synchronicity is preferred for convergence tasks.
	While media richness theory sees a task as either conveying or converging, media synchronicity theory challenges this view. It posits instead that each task has phases of conveyance and phases of convergence, and the amount of time spent on each might differ.
	In media synchronicity theory, instead of communication tasks, micro-level communication processes are observed. The reason is that tasks are too high-level as a construct.
	In summary, media synchronicity is a three-dimensional model It examines five media characteristics to support conveyance and convergence of information across three group functions.
	As no single medium can support conveyance and convergence equally, media switching may be the best approach to media selection.
Focusing on the perceived qualities of the medium	
Social influence model Fulk, Schmitz & Steinfield 1990	Perceptions about the characteristics of a communication tool are influenced by personal experiences and views as well as the social environment. (e.g. colleagues and supervisor experiences and stories, vicarious learning, company culture), i.e. media evaluation
	Social influence is limited when personal experiences are available. Media evaluation matches a task with the best-fitting media, within the

	limits of situational factors. The best fitting media should be chosen to fulfil the task.
	Social influence is not specific to media evaluation but influences task evaluation too.
Technology acceptance model Davis 1986	The technology acceptance model deals with the acceptance of modern technology in general, not just communication media.
	Perceived ease of use refers to how much effort is needed to use a medium. Perceived usefulness refers to how job performance will be enhanced by using a specific medium. These are the two main influences on media selection.
	Perceived usefulness has a stronger link to media usage than perceived ease of use. The influence of perceived ease of use decreases over time.
	TAM2 (Venkatesh & Davis, 2000) extended the technology acceptance model to incorporate external variables. These include social norms, experiences and job relevance.
Task technology fit Goodhue 1995	The theory deals with usage of modern technology in general, not only communication technologies.
	A technology must provide a perceived good fit for the task to be completed, in order to be chosen. That is, the functions must support the user in their tasks.
	Task technology fit is a subjective estimation based on the user's knowledge and experiences.
	Dishaw and Strong (1999) integrated the task technology fit with technology acceptance model to provide a stronger model for media selection.
Fit appropriation model Dennis, Wixom & Vandenberg 2001	The fit appropriation model attempts to integrate different theories from • the decision theorist school (task technology fit) • the social technology school (adaptive structuration theory)
	The crucial characteristics of a medium are its social structures and structural features. Social structures include communication support, information processing support and process structure or appropriation support.
	Task technology fit influences communication but is moderated by appropriation.
Channel expansion theory Carlson & Zmud 1994	Experiences change the perception of the richness of a medium over time.

	In contrast to media richness theory, media richness is seen as the perception of the user, which is based on experiences and familiarity with the medium.
	In contrast to the social influence model, experience is not a determinant of media richness but a moderator thereof. Other moderators are experiences with other participants and experience with the topic.
Psychobiological Model Kock 2004	The psychobiological model is based on Charles Darwin's theory of evolution. It focuses on the humans communicating, not on the media. The model incorporates a set of propositions that are independent from the type of communication task. • Media naturalness proposition – the higher the degree of naturalness, the less the cognitive effort to use a medium • Speech imperative proposition – transport of speech is much more important than transport of other signals • Cognitive adaption proposition – focuses on the ability to adapt to new communication forms over time • Schema alignment proposition – schemata used in processing communication differ from person to person; similar schemata between communication partners make communication easier. Media can become "too rich" (i.e. less natural) and this may produce information overload.
Cognitive-based View Robert & Dennis 2005	Two strategies to process information are defined: • the central route – using real effort to understand and process new information • the peripheral route – using little energy and simple methods for new information The choice between them is based on motivation and ability to process the information. Attention is another key aspect of the cognitive-based view. Attention refers to the price to consume information and is a prerequisite for communication. Media with a high social presence require much attention and are therefore "costly". Reprocessability is important to allow the processing of information. To transport plentiful or complex information, a medium with low social presence should be selected. To balance attention and motivation with the ability to process information, Robert and Dennis suggest media switches throughout communications.

Media Fitness Theory Higa & Gu 2007	Media fitness theory is based on the idea of the fitness of a medium for a task. It includes ideas from task technology fit, media richness theory, social presence theory and others. Unlike those theories, media fitness theory considers people and tasks integrally. It also considers environmental factors. Three groups of factors influence the fitness of a medium: • properties of the task (e.g. response time, security or sharing) properties of the user (e.g. skill of using media, group lifespan) • environmental factors (e.g. availability, bandwidth, cost) The media fitness framework was introduced to evaluate media fitness for a task. The framework was tested in later studies. These empirical tests showed that social reasons were the main influence in choosing a medium.
Critical Mass Theory Markus 1987	For a medium to become a relevant choice, a critical mass of users is necessary. There are different types of users, such as early adopters and followers, who influence each other. Critical mass theory explains why some media fail to become relevant. It does not explain the selection of a best-fit medium; when critical mass is reached, the medium is not evaluated further. Therefore, this theory merely extends other theories about media selection.
Task Closure Theory Straub & Karahanna 1998	Task closure theory focuses mainly on the sender of a message. The ability to close a task refers to the sender wanting to discharge their responsibility for the current transmission segment of a task. This ability has considerable effects on media choice by the sender. The availability of the recipient is another key determinant in media selection by the sender. Face-to-face communication is low in task closure as the sender cannot control completion of the communication. For example, all participants need to agree. By contrast, e-mail is high in task closure because the sender can control the communication. If the recipient of a message sent by a low-task-closure medium is not available, the sender has two choices to resolve their feeling of incompleteness: • Repeat the communication attempts until the recipient becomes available • Choose another medium with higher task closure, even if it is not the best medium according to other theories of media selection (e.g. media richness theory)

Table 2: Overview of theories on media selection

To conclude, a wide range of theories have been developed regarding media selection for group communication. The intent of most of them is to provide guidelines and rules for selecting a medium and what should be considered when making this decision. However, not all of the inputs can be used in empirical studies. The empirical results have sometimes contradicted each other or are based on different schools of thought.

For the empirical study in this thesis, I drew on several theories and selected aspects that have been described by diverse theories. Most theorists agree that there are different types of communication. For example, media synchronicity theory mentions conveyance tasks, which share information with the recipients of a message; and convergence tasks, which help a group of users to find shared understanding of received information. A similar concept appears in media richness theory. However, here, the types of communication are categorized into tasks that aid in decreasing uncertainty and tasks that help in reducing equivocality.

Another concept that is widely accepted is that there needs to be a fit between the communication task at hand and the medium chosen to complete the tasks. Some theories – such as social presence theory and its successors – state that this fit can be objectively rated and measured. However, most current theories state that the fit can only be estimated subjectively, through comparing perceptions regarding the communication task and perceptions regarding the medium. The perceived qualities of the medium differ depending on who estimates the fit, and these perceptions – and thus also the perceived fit – may change over time. This point is important because for practical purposes it means media selection must be re-examined constantly to account for possible changes.

As the fit appropriation model states, appropriation can help to compensate for a poor fit, over time. The users of a poor-fit medium can potentially develop strategies to cope with and overcome the poor fit.

3. Empirical Study

Using a pre-existing survey conducted in an Austrian-based company. I aimed to answer the following research question in my thesis:

> *How does adequate media usage influence the communication quality of the communicating parties for different types of communication tasks?*

Based on the literature review presented in Chapter 2, I conclude that communication quality is influenced by the selection of media. When a medium and the communication tasks to be completed are perceived as a good fit, this fit increases the communication quality.

Given the vast number of media for employees, I focus only on the most relevant ones. The German Digitalization Consumer Report by Roland Berger Consultants reported that in 2014 in Germany, 35% of professional communication was digital. Hence, 65% were still analogue conversations (vor dem Esche & Hennig-Thurau, 2014). In another survey conducted by the University of Münster and Roland Berger Consultants, telephone and e-mail were the two most used forms of professional digital communication; face-to-face communication was not included in the survey. The results showed that 41.7% of respondents used telephone for professional purposes daily, and 35% stated the same for e-mail. The third most used media was traditional letters, at 9.7%, which illustrates the gap in media usage and the importance of telephone and e-mail (Nutzung von Kommunikationskanälen in Deutschland, 2012).

Cognisant of these results, the methods of communication analysed in this thesis are traditional face-to-face communication, on the one hand, and telephone and e-mail on the other. Face-to-face represents analogue communication, whereas telephone and e-mail are the most important forms of professional digital communication. A central idea of media synchronicity theory (Dennis & Valacich, 1999), namely the categorization of

communication tasks into conveyance or convergence tasks, was used to test each medium for these two types.

Another central aspect in most theories on media selection, such as task technology fit (Goodhue, 1995), is the fit that users of a medium perceive regarding the medium and a communication task. This fit describes the subjective match the user perceives between the task and the medium. "Adequate media usage" describes the fit between actual media usage and the perceived fit; hence, these two factors need to be set into relation to be able to find their relationship to communication quality.

I assumed that the better the fit between actual usage of media and the perceived fit for the task, the better would be the communication quality. I thus derived the following hypotheses:

(H1) The fit between actual face-to-face usage and the perceived fit of face-to-face communication for (a) conveyance tasks and (b) convergence tasks is positively related to communication quality.

(H2) The fit between actual e-mail usage and the perceived fit of e-mail communication for (a) conveyance tasks and (b) convergence tasks is positively related to communication quality.

(H3) The fit between actual telephone usage and the perceived fit of telephone communication for (a) conveyance tasks and (b) convergence tasks is positively related to communication quality.

3.1. Method

3.1.1. Procedure

For the empirical part of this thesis, a quantitative method was used. The reason was that quantitative methods are more suitable than qualitative methods for testing hypotheses (Paier, 2010).

A questionnaire that had already been developed at the department through which this research was conducted was used for data collection. The questionnaire was prepared for online completion using Unipark (www.unipark.com) as the survey platform. To ensure understanding of the questions, the tool was constructed in German because the survey was to be conducted in a German-speaking company.

The survey consisted of various pages and its estimated completion time was 15 minutes. It began with an introduction and general questions about the working environment of the participants. Then the frequency of media use was probed, followed by two pages of detailed questions for each medium (face-to-face, e-mail, telephone, short messages, video conferencing and chat). These detailed questions were shown only if a participant answered the item about frequency of media use with a rating higher than "rarely". The reason for this filter was to obtain only relevant data and to shorten the survey for the participants, where possible.

After the survey was prepared and available for gathering information, the data collection was conducted. This period lasted a couple of weeks in June and July 2015. Participants were all employees at an Austrian company with multiple locations across Germany, Austria and Switzerland, with teams in all of these locations. At the beginning of the survey, every employee received an e-mail with an invitation containing the link to the survey. Employees were encouraged by the board of directors to participate.

In total, 413 invitations were sent out to employees, of whom 314 started the survey (76%). Among these employees, 247 completed the survey, resulting in a response rate

of nearly 60% (59.81%). Only the responses of participants who finished the entire survey were used in the analysis. The data of participants who returned the complete questionnaire were checked for significant short response times, but no such cases were found.

3.1.2. Measures

In the following section, only the items analysed for this thesis are presented. The survey contained additional questions that were beyond the scope of this thesis.

Frequency of media usage. Participants were asked to rate the frequency with which they used various media, namely face-to-face, e-mail, telephone, short messaging, video conferencing and chat. The response scale was a Likert scale ranging from "very rarely" (1) to "very often" (7). The most widely used medium was face-to-face, with 94.74% using it at least occasionally ($\bar{x}$ = 4.30, SD = 0.96). The second was e-mail, at 89.88% ($\bar{x}$ = 3.78, SD = 0.99); telephone was third, at 80.17% ($\bar{x}$ = 3.51, SD = 1.13). These findings are in line with the results of Vor dem Esche and Hennig-Thurau (2014) and the University of Münster and Roland Berger Consultants (Nutzung von Kommunikationskanälen in Deutschland, 2012). They appear to confirm the media selection of this thesis.

Actual media usage. For each medium that was used occasionally or more often, participants were presented with three items. These items evaluated media usage in the context of conveyance, which refers to the gathering and sharing of information. An example was "How often is the medium in your team used to forward messages?" ("wie häufig wird in ihrem Projektteam das Medium benutzt, um Nachrichten weiterzugeben?"). These items were rated on a 5-point Likert scale from very rarely to very often. The number of responses to these items, their reliability scores and details of the combined items for each medium appear in Table 3. As shown in the table, Cronbach's alpha for the different media was at least 0.82. This meant the individual items could be combined into a single new item that reflected conveyance processes for each medium.

	# of surveys	Cronbach's α	x̄	SD
Face-to-face	234	0.84	3.79	0.80
E-Mail	222	0.82	4.15	0.76
Telephone	198	0.88	3.55	0.91

Table 3: Means, standard deviations and reliabilities of items on media usage for conveyance

Nine items were used to evaluate media usage in the context of convergence, which refers to finding a shared meaning. These items were rated on a 5-point Likert scale from very rarely to very often. The number of responses for these items, their reliabilities and details of the combined items for each medium appear in Table 4. As shown, Cronbach's alpha for all items was at least 0.91. This meant they could be combined into one new item that measured convergence processes per medium.

	# of surveys	Cronbach's α	x̄	SD
Face-to-face	234	0.91	3.82	0.72
E-Mail	222	0.92	2.67	0.86
Telephone	198	0.92	2.86	0.82

Table 4: Means, standard deviations and reliabilities: media usage for convergence

Perceived media fit. Again, participants were only asked about their perceived media fit if they used a medium at least occasionally. Perceived media fit was rated with the same items as actual media usage, but the items were rephased to evaluate the perceived fit. An example was "How fitting do you believe the medium is to forward messages?" ("wie passend empfinden Sie persönlich das Medium, um Nachrichten weiterzugeben?").

The items for perceived fit were rated on a star scale ranging from one star ("not suitable at all") to five stars ("very suitable"). All details, such as reliabilities, means and standard deviations are shown in Table 5 for conveyance processes, and in Table 6 for convergence processes. The reliability in all cases allowed for combining the individual items into one new item per medium for conveyance and one new item per medium for convergence.

	# of surveys	Cronbach's α	x̄	SD
Face-to-face	234	0.88	3.67	1.00
E-Mail	222	0.83	4.30	0.82
Telephone	198	0.87	3.90	0.93

Table 5: Means, Standard Deviations and Reliabilities of perceived media fit for conveyance

	# of surveys	Cronbach's α	x̄	SD
Face-to-face	234	0.87	4.40	0.59
E-Mail	222	0.92	2.25	0.86
Telephone	198	0.92	2.72	0.92

Table 6: Means, Standard Deviations and Reliabilities of perceived media fit for convergence

Communication quality. Communication quality was measured using four items, based on the relational coordination scale (Gittell, Beswick, Goldmann, & Wallack, 2015). An example was "In our team we communicate regularly" ("Bei uns im Team wird häufig kommuniziert"). All items were rated on a 5-point Likert scale from "completely disagree" ("trifft gar nicht zu") to "completely agree" ("trifft völlig zu"). The high Cronbach's α (0.79) meant they were combined into a single measure (x̄ = 3.59, *SD* = 0.68).

3.1.3. Results

The software IBM SPSS 25 was used to prepare and analyse the data. After the completion of the survey, all responses were exported from Unipark and imported into SPSS. As a first step, the data were prepared as described in the next sub-section, after which descriptive statistics were calculated. The hypotheses were then tested using polynomial regression with response surface analysis.

Data Preparation

To prepare the data for analysis, several steps were followed. First, irrelevant information – such as participants' browser versions and data entries that were mostly incomplete – were eliminated. Next, the variables were renamed to make them easier to handle in the following steps. The datatypes of the variables were checked and corrected where necessary. If Cronbach's alpha allowed, the individual items that investigated the same topic were combined into one scale by summing the means of the items.

Descriptive Statistics

Descriptive statistics were calculated for data about the participants and their occupations, such as their tenure and the gender of their supervisor. The participants' ages ranged from 20 to 63 years ($\bar{x}$ = 39.45, SD = 10.92, Md = 38). Among the 247 participants who returned a completed questionnaire, only 68 were female (27.53%) whereas 179 were male (72.47%). More than half of the participants were employed in Austria (60%) and about a third (32%) in Germany, with a few (7%) in Switzerland.

The tenure of the participants ranged from 1 to 35 years, with 1 meaning a year or less in the company ($\bar{x}$ = 7.27, SD = 7.82, Md = 4). The number of working hours according to their contracts ranged from 8 to 55 hours per week ($\bar{x}$ = 39.11, SD = 6.39, Md = 40). Only 24 employees (9.7%) were working fewer than 38 hours and could therefore be considered part-time employees; hence, most participants (90.3%) had a full-time contract. In addition to the contracted working hours, the estimated real working hours were evaluated as well. The result here ranged from 2 to 75 hours ($\bar{x}$ = 44.37, SD = 11.44, Md = 45). Thus, most employees were working considerably more than what was defined in their contracts. The company held various contract types with its employees, with 18 employees (7.29%) having fixed working times, 213 employees (86.23%) having flexible time schedules with core working hours and 13 employees (5.26%) having flexible time schedules without core working hours.

Almost half of the participants were managers (n=110, 44.5%), whereas just over half were not in any leading position (n=137, 55.5%). As already noted, gender distribution was unequal at the participant level and this imbalance was even more pronounced for the gender of the participants' supervisors. Among the 247 participants, only 15 had a female manager (6.07%), whereas 232 had a male manager (93.93%). The participants were also asked to give the estimated age (unless known precisely) of their supervisor; the range was from 28 to 64 years ($\bar{x}$ = 48.72, *SD*=6.31, *Md* = 50). Most employees (n=218, 88.26%) stated that their manager had held the position for some years, while 29 employees (11.74%) stated that the supervisor was new in the position.

Means and correlations for all scales that were relevant in the context of the hypotheses are listed in Table 7. Regarding the means and standard deviations, the analysis yielded various findings. Face-to-face communication was used for conveyance tasks ($\bar{x}$=3.79) and convergence tasks ($\bar{x}$=3.82) to the same strong extent. The perceived fit of face-to-face and actual media usage was strong in the context of conveyance ($\bar{x}$=3.67). For convergence, face-to-face was seen as more fitting than the actual use implied ($\bar{x}$=4.40). Therefore, an early guess that can be drawn is that face-to-face should be used more widely for convergence tasks.

Face-to-face was used for conveyance and convergence purposes to the same extent. E-mail was used mainly for conveyance, with a mean of 4.15, and was less often used for convergence, with a mean of 2.67. Regarding the perceived fit of e-mail, the participants evidently believed that e-mail should be used even more for conveyance ($\bar{x}$=4.30) and even less for convergence ($\bar{x}$=2.25).

The mean for actual usage of telephone for conveyance purposes was 3.56, compared with desired usage at 3.90. This indicates that the telephone should be used for conveyance even more at present. This finding was unexpected as telephone is generally a one-to-one communication, whereas most theories value media that allow for multiple participants at once, preferably with rehearsability.

Strong correlations were found between actual face-to-face usage for conveyance tasks and the perceived fit of face-to-face for conveyance (r(234)=0.43, ρ<0.01). Similar strong correlations were noted for actual e-mail usage for conveyance and the perceived fit of e-mail for conveyance (r(222)=0.37, ρ<0.01), and for actual telephone usage for conveyance and the perceived fit of telephone for conveyance (r(198)=0.54, ρ<0.01). While the correlations differed among the selected media, all correlations for actual use versus perceived media fit were at least moderately strong. The reason could be that when a medium is used for a type of task, it must be seen as fit to some extent; a medium that is seen as unfit will not even be selected.

Strong correlations were noted between communication quality and actual face-to-face usage for conveyance tasks (r(234)=0.43, ρ<0.01), and between communication quality and actual face-to-face usage for convergence tasks (r(234)=0.55, ρ<0.01). No such correlations were found for e-mail or telephone.

face-to-face only has very few, rather weak correlations with other media. By contrast, e-mail and telephone had many correlations between them, of which some were strong. This might indicate that if a person uses e-mail for convergence tasks, they might also tend to use telephone (and probably other media) for convergence tasks. and deem it to be a fitting choice for this type of task. Another implication of these correlations is that face-to-face communication has different qualities compared to other media.

		$\bar{x}$	SD	1	2	3	4	5	6	7	8	9	10	11	12	13
1	F2F – Usage – Conveyance	3.79	0.80	1	.43**	.61**	.25**	-0.04	0.10	-0.12	0.01	.15*	0.12	-0.02	-0.11	.43**
2	F2F – Fit – Conveyance	3.82	0.72		1	.14*	.39**	-.17*	-.16*	0.07	0.06	-0.04	0.10	0.05	0.04	0.12
3	F2F – Usage – Convergence	3.67	1.00			1	.37**	0.09	0.10	-0.04	-0.05	0.13	0.08	0.10	-0.07	.55**
4	F2F – Fit – Convergence	4.40	0.59				1	0.04	0.07	0.02	-0.11	-0.03	0.13	-0.04	-0.04	.16*
5	E-Mail – Usage – Conveyance	4.15	0.76					1	.37**	.46**	0.11	.19**	0.10	.22**	.18*	0.03
6	E-Mail – Fit – Conveyance	2.67	0.86						1	-0.06	.23**	.19*	.28**	0.03	0.12	0.04
7	E-Mail – Usage – Convergence	4.30	0.82							1	.50**	.18*	-0.02	.47**	.35**	0.01
8	E-Mail – Fit – Convergence	2.25	0.86								1	.17*	.15*	.34**	.56**	0.07
9	Telephone – Usage – Conveyance	3.55	0.91									1	.54**	.47**	.31**	0.13
10	Telephone – Fit – Conveyance	2.86	0.82										1	.15*	.25**	0.05
11	Telephone – Usage – Convergence	3.90	0.93											1	.67**	0.10
12	Telephone – Fit – Convergence	2.72	0.92												1	0.04
13	Communication Quality	3.59	0.68													1

F2F, face-to-face communication

** Correlation is significant at the 0.01 level (2-tailed)

* Correlation is significant at the 0.05 level (2-tailed)

Table 7: Inter-correlation matrix with mean and standard deviation

Evaluation of Hypotheses

To test how the match between actual media usage and perceived media fit was related to communication quality, the method of polynomial regression with response surface analysis was chosen. This approach was selected because response surface analysis can provide insight into three important aspects of fit (or misfit) between two predictors. First, it enables testing the relationship between, on the one hand, agreement between two predictor variables and, on the other, the dependent variable. Second, it enables testing the relationship between the degree of discrepancy between two predictors and the dependent variable. Third, it allows for testing the relationship between the direction of discrepancy between two predictors and the dependent variable (Shanock, Baran, Gentry, Clever Pattison, & Heggestad, 2010).

To conduct this analysis, first the predictor variables were scale-centred to assist interpretations and to reduce the potential for multicollinearity (Aiken & West, 1991). Second, a polynomial regression was conducted hierarchically. In the first step of the hierarchical analysis, the variables of gender, age and tenure were entered as control variables. In step two, actual media usage was entered. In the third step, the nonlinear and interaction terms were entered. Actual media usage was added in a separate step to check for the possibility that effects of the nonlinear and interaction terms (step three) might have occurred only because of the actual usage component of the media (Shanock et al., 2010).

After processing the polynomial regressions, the results of the regression were further analysed using response surface analysis. This was necessary to check whether there was a significant increase in the explained variance (Shanock et al., 2010).

Hypothesis 1 – Face-to-face communication

To test the first hypothesis, the relationship between 1) actual face-to-face usage versus the perceived fit of face-to-face communication for conveyance and convergence tasks

and 2) communication quality was analysed. For this, a polynomial regression analysis was conducted. Results are shown in Table 8.

	Conveyance Tasks (a) β	Convergence Tasks (b) β
Step 1		
Gender	-0.004	-0.004
Age	-0.005	-0.005
Tenure	0.018**	0.018**
Step 2		
Actual Usage	0.396***	0.514***
Step 3		
Perceived Fit	-0.128*	-0.250
Perceived Fit²	0.103*	0.098
Actual Usage x Perceived Fit	-0.019	-0.132
Actual Usage²	0.022	0.108
Step 1: ΔR²	0.029⁺	0.029⁺
Step 2: ΔR²	0.202***	0.282***
Step 3: ΔR²	0.029⁺	0.015
R² Total	0.261	0.326

***$p < 0.001$; **$p < 0.01$; *$p < 0.05$; ⁺$p < 0.10$

Table 8: Polynomial regression analysis predicting influence of face-to-face usage on communication quality

In the first step of the regression, only the control variables were tested. In the second step, the actual usage of face-to-face communication for conveyance tasks and convergence tasks was added to the regression model. Adding actual usage resulted in significant increments in the explained variance for both types of communication tasks (conveyance: $\Delta R^2=0.202$, $p<0.001$; convergence: $\Delta R^2=0.282$, $p<0.001$). The regression weights for conveyance tasks ($\beta=0.396$, $p<0.001$) and convergence tasks ($\beta=0.514$, $p<0.001$) indicated a positive relationship between the use of face-to-face communication for each type of task and communication quality. Therefore, the use of

face-to-face communication had a positive influence on communication quality, regardless of the communication focus. That is, the relationship was evident whether the communication was intended to inform people or to reach consensus on a topic.

The next step of the polynomial regression tested whether the perceived fit of face-to-face communication for conveyance and convergence tasks and the relationship between actual face-to-face usage and the perceived fit of face-to-face communication increased the explained variance. As shown in Table 8, step three did not explain additional variance for either of the communication tasks (conveyance: $\Delta R^2=0.029$, p=0.069; convergence: $\Delta R^2=0.015$, p=0.302).

These results imply that the use of face-to-face communication had a positive effect on communication quality for both conveyance and convergence tasks. The perceived suitability of face-to-face communication for the type of task did not influence the results. This finding was supported by the correlations between 1) actual face-to-face usage for conveyance and convergence tasks and 2) communication quality.

Because the fit between actual face-to-face usage and the perceived fit of face-to-face communication was not related to communication quality for either conveyance or convergence tasks, hypotheses 1a and 1b were not supported. Nevertheless, actual face-to-face usage was positively related to communication quality.

Hypothesis 2 – E-Mail communication

For hypothesis 2, the relationship of fit between actual e-mail usage and perceived fit of e-mail communication and communication quality was analysed. Again, polynomial regression analysis was performed; the results appear in Table 9.

In the first step of the polynomial regression, only the control variables of age, gender and tenure were included in the model. In the second step, actual e-mail usage was added to test whether it influenced communication quality (for both conveyance and convergence tasks). For e-mail usage, no increase in the explained variance was noted.

This means the actual use of e-mail for communication had no significant influence on communication quality.

	Conveyance Tasks β	Convergence Tasks β
Step 1		
Gender	0.031	0.031
Age	-0.005	-0.005
Tenure	0.011	0.011
Step 2		
Actual Usage	0.042	0.021
Step 3		
Perceived Fit	-0.269**	-0.027
Perceived Fit²	0.113+	-0.093
Actual Usage x Perceived Fit	0.102	0.224**
Actual Usage²	-0.060	0.056
Step 1: ΔR²	0.013	0.013
Step 2: ΔR²	0.002	0.001
Step 3: ΔR²	0.034	0.069**
R² Total	0.049	0.082

***p < 0.001; **p< 0.01; *p < 0.05; +p < 0.10

Table 9: Polynomial regression analysis predicting influence of e-mail usage on communication quality

In the third step of the polynomial regression, the perceived fit of e-mail for conveyance and convergence tasks were added to the models. In addition, the relationship between actual usage of e-mail versus perceived fit of e-mail was added to the models. This step did not increase the variance explained for conveyance tasks (ΔR^2=0.034, p=0.116). However, the increase in explained variance for convergence tasks was significant (ΔR^2=0.069, p=0.004). Therefore, response surface analysis was performed to examine the relationship in more detail.

The surface chart for the response surface analysis is displayed in Figure 20. The surface parameters for the lines of interest were calculated and are presented in Table 10. To interpret a surface graph, two lines in the graph are of interest. The first is the line of perfect agreement, where X=Y (the solid line at the bottom of the graph); the second is the line of incongruence, where X=-Y (the dotted line at the bottom of the graph) (Shanock et al., 2010).
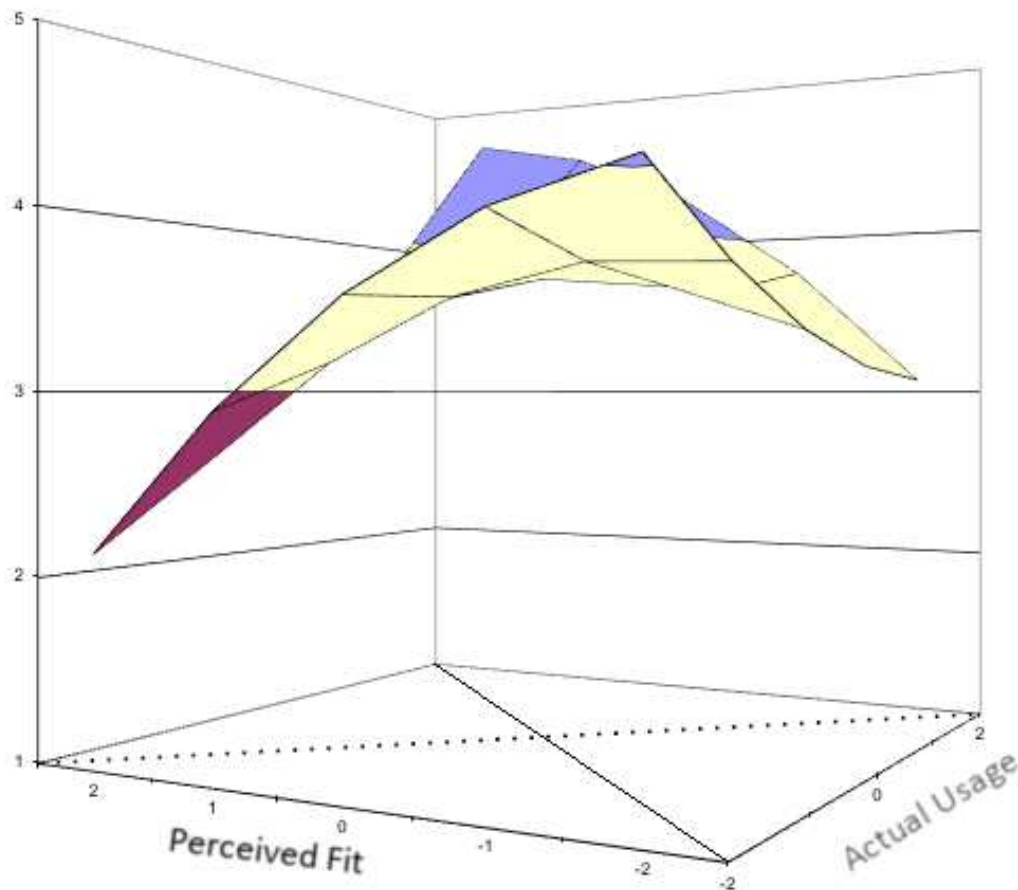

Figure 20: Surface chart of e-mail communication for convergence tasks

To interpret how agreement of actual usage versus perceived fit were related to communication quality, the line of perfect agreement (fit line) was analysed. The line of incongruence was analysed to find the effects of discrepancy. On the line of perfect

agreement, the actual usage of e-mail for convergence tasks and the perceived fit of e-mail for convergence tasks showed a perfect fit. On the line of incongruence, the opposite was true; actual usage and perceived fit had opposing values (Shanock et al., 2010).

The shape of the graph can be described by the surface parameters a_1, a_2, a_3 and a_4. The terms a_1 and a_3 represent the slopes, whereas a_2 and a_4 represent the curvatures of the fit line and the misfit line respectively. As shown in Table 10, only a_2 was significant. A significant a_2 indicates a nonlinear relationship between the predictors and the dependent variable. In our model, this relationship was between the match between actual e-mail use for convergence tasks versus perceived fit of e-mail for convergence tasks on the one hand, and communication quality on the other hand. Furthermore, as a_2 was positive, it indicated a convex surface (Shanock et al., 2010).

As illustrated in the graph in Figure 20, communication quality had the highest values at both ends of the line of perfect agreement. This suggests that communication quality is highest when e-mail is perceived as a good fit for convergence and actually is used for this type of task. Communication quality is also high when e-mail is perceived as a poor fit for convergence tasks and is actually rarely used for these tasks.

Around the centre of the fit line, actual usage and perceived fit of e-mail are at moderate levels. In this case, communication quality tends to be lower than at the ends of the line. These results indicate that a strong opinion in favour of or against e-mail usage for convergence tasks must be present to influence communication quality.

While the graph also suggests that along the misfit line communication quality is reduced, the further the discrepancy between e-mail usage and perceived fit of e-mail for convergence tasks, increases, the surface parameters a_3 and a_4 are not significant and therefore no such relationship can be assumed.

A polynomial regression model with response surface analysis showed that the agreement between actual e-mail usage and perceived fit of e-mail for convergence

tasks was related to communication quality. No such relationship was noted for conveyance tasks. Therefore, hypothesis 2b was supported, whereas hypothesis 2a was not supported.

a_1	$b_1 + b_2$	0.18
a_2	$b_3 + b_4 + b_5$	0.19**
a_3	$b_1 - b_2$	0.23
a_4	$b_3 - b_4 + b_5$	-0.26

b_n are the beta coefficients of the polynomial regression
** $p < 0.01$

Table 10: Surface parameters for e-mail communication for convergence tasks

Hypothesis 3 – Telephone communication

To test the third hypothesis, the relationship of fit between actual telephone usage and the perceived fit of telephone communication on communication quality is analysed. As with face-to-face and e-mail communication, a polynomial regression analysis was performed. The results are listed in Table 11.

The first step of the regression model again contained the control variables of age, gender and tenure. In the second step, actual telephone usage was added to the models for conveyance and convergence tasks respectively. No increase in explained variance was noted. Therefore, it was concluded that simply using telephone for either type of communication task did not influence communication quality.

In the third step of the polynomial regressions, the perceived fit of telephone for conveyance and convergence tasks as well as the relationship between actual usage of telephone and perceived fit of telephone were added to the models.

This model did not increase the amount of variance explained by telephone communication for conveyance tasks ($\Delta R^2=0.004$, $p=0.949$). However, for convergence tasks there was a significant increase in the explained variance ($\Delta R^2=0.057$, $p=0.022$). To further analyse the model for convergence tasks, another response surface analysis was

conducted; the resulting graph is shown in Figure 21 and the surface parameters are listed in Table 12.

	Conveyance Tasks β	Convergence Tasks β
Step 1		
Gender	-0.022	-0.022
Age	-0.009[+]	-0.009[+]
Tenure	0.013[+]	0.013[+]
Step 2		
Actual Usage	0.100[+]	0.083
Step 3		
Perceived Fit	0.038	-0.055
Perceived Fit²	-0.042	-0.234**
Actual Usage x Perceived Fit	0.070	0.346**
Actual Usage²	-0.009	-0.078
Step 1: ΔR^2	0.021	0.021
Step 2: ΔR^2	0.016[+]	0.009
Step 3: ΔR^2	0.004	0.057*
R^2 Total	0.041	0.087

***$p < 0.001$; **$p < 0.01$; *$p < 0.05$; [+]$p < 0.10$

Table 11: Polynomial regression analysis predicting influence of telephone usage on communication quality

In Figure 21, the line of perfect agreement (solid line) and the line of incongruence (dotted line) have been added to the graph to aid interpretation. For the line of perfect agreement, neither surface parameter a_1 (slope) nor a_2 (curvature) were significant. Therefore, no relationship between the fit between actual telephone usage for convergence tasks and the perceived fit of telephone communication for convergence tasks can be assumed. This finding was congruent with the surface pattern along the line of perfect agreement, as almost no change in communication quality was noted at different points of the line.
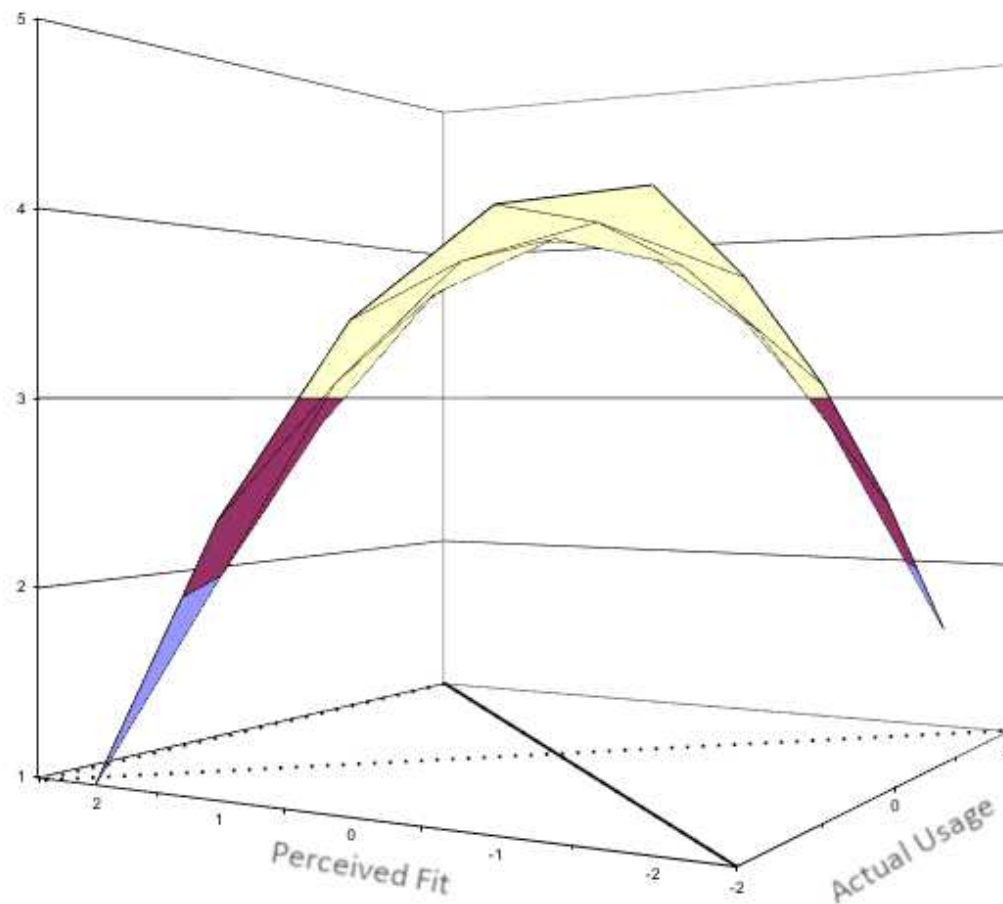
Figure 21: Surface chart of telephone communication for convergence tasks

For the line of incongruence, different results were evident. As shown in the graph in Figure 21, there was a steep curve along the misfit line. Surface parameter a_4 is used to interpret how the discrepancy between actual telephone usage and perceived fit of telephone for convergence tasks was related to communication quality. According to Shanock et al. (2010), a significant and negative value for a_4 indicates a concave surface along the misfit line. This means that communication quality decreased more sharply as the discrepancy between telephone usage and perceived fit increased. Hence, there was no significant change in communication quality when actual use and perceived fitness of the telephone were close to each other. However, communication quality decreased

markedly as the discrepancy between the two grew larger. Therefore, the agreement between actual telephone usage and the perceived fit of telephone communication for convergence tasks was positively related to communication quality. This finding supports hypothesis 3b. For hypothesis 3a, no such support was found. This means that if people use the telephone heavily for convergence tasks – despite deeming it to be an unfit medium for such communication tasks, the quality of the communication is poor. Similarly, if people believe that telephone is a fit medium for convergence tasks, but they are unable to use the telephone, communication quality will also be low.

a_1	$b_1 + b_2$	0.05
a_2	$b_3 + b_4 + b_5$	0.03
a_3	$b_1 - b_2$	0.16
a_4	$b_3 - b_4 + b_5$	-0.66**

b_n are the beta coefficients of the polynomial regression
** $p < 0.01$

Table 12: Surface parameters for telephone communication for convergence tasks

4. Discussion

The purpose of this thesis is to provide insight regarding the beneficial effects of adequate media selection on communication quality. These effects are interesting for the scientific community but also for managers who need to select from a range of communication media. Also, professional communicators in companies or teams in a company may benefit from the results of this thesis, as they indicate how to support high communication quality. High quality of communication is important in every team, as it influences the performance of the team by enabling efficient communication. It also influences the job satisfaction of team members and helps to establish relationships of trust between the members, which in turn makes communication more efficient.

4.1. Summary

In the first part of this thesis, an overview of historically important and current theories about media selection was provided, and the different schools of thought were highlighted. Many theories have been developed regarding media selection and most of them can be categorized into one of two groups. The first group consists of theories that focus only on the medium and its inherent characteristics and posit that these characteristics can be objectively measured. The second group shifts the focus to the subjective perceptions that the users have of a medium.

In both groups, the concept of fit between the medium and the communication task is important. In the first group, this fit is calculated using an objective process; in the second group, fit refers to a subjective rating by participants in the communication, based on their perceptions of the medium and the task. The most important aspects in various theories 1) are the concept of media fit, which means that a medium must be perceived as a good fit for a task by the users; and 2) the classification of communication tasks into two types, namely conveyance and convergence. Conveyance describes the gathering and sharing of information, and convergence describes the finding of shared

meaning in prior conveyed information. These aspects form an integral aspect of the empirical part of the thesis.

In the second part of the thesis, the empirical study is presented. A survey on communication habits that was conducted in an Austrian company was evaluated to answer the research question. The analysis examined the influences of adequate media usage on the communication quality among participants.

In an online survey, participants were asked questions about media usage, media fitness for certain tasks, communication quality and their socio-demographic details. Based on these data, descriptive statistics – including correlations between the items of the survey – were calculated. Three media were selected for further analysis. These media were face-to-face communication (as an analogous form of communication) and e-mail and telephone (as the most used forms of digital communication). For each of these media, two polynomial regression models were calculated, one in the context of information tasks and another for convergence tasks. Where the regression models showed significant increases, a follow-up response surface analysis was conducted. These results enabled interpreting the relationship between fit and communication quality.

For face-to-face communication, a positive relationship between actual usage and communication quality was found for both conveyance tasks and convergence tasks. No significant relationship between 1) the agreement between actual usage and perceived fit and 2) communication quality was found, for either type of communication tasks. These findings indicate that the use of face-to-face communication positively influenced communication quality, regardless of whether the participants deemed it to be fit for the type of communication.

For e-mail, no relationship was noted for communication quality and agreement between actual usage and perceived fit, for conveyance tasks. By contrast, such a relationship was noted when e-mail was used for convergence tasks. The response

surface analysis found a non-linear relationship between communication quality and the fit between actual e-mail usage and the perceived fit of e-mail for convergence tasks. Communication quality improved in two scenarios for convergence tasks: 1) when e-mail was deemed fit for convergence tasks and was indeed used; and 2) when it was deemed unfit and was not used for such tasks. For moderate levels of use and a perceived fit that lay between the two extremes, communication quality was also likely to be high – but not as high as at the extremes.

The response surface graph also showed a decrease in communication quality when there was a poor fit between actual usage and perceived fit of e-mail for convergence tasks. However, the surface parameters did not support the graphical interpretation. Hence the decrease shown on the graph was not statistically significant. It might be interesting to conduct further empirical research on e-mail usage for convergence tasks. Such research could clarify the decrease in communication quality when actual usage and perceived fit of e-mail for convergence tasks were in poor agreement.

The analysis of telephone usage also showed a relationship between communication quality and the match between actual usage and perceived fit of telephone communication for convergence tasks. No relationship with communication quality was found when telephone was used for conveyance tasks. The response surface analysis showed a steep decrease in communication quality along the line of incongruence. This finding means that the further apart are the actual usage and perceived fit of telephone for communication tasks, the stronger the negative relationship with communication quality. For example, if someone believes that the telephone is a bad fit for convergence tasks but is required to use it for such tasks (e.g. because of situational constraints), communication quality is likely to be low. Communication quality can also be expected to be low if somebody would like to use telephone because they think it is a fit medium for convergence tasks, but they cannot do so (e.g. because of situational constraints).

Along the line of perfect agreement, almost no changes occurred in the level of communication quality. This means that as long as actual usage and perceived fit of telephone for convergence tasks are aligned, communication quality does not change.

4.2. Limitations

Like any other empirical study, this research had certain limitations. First, the survey was conducted within a single company. This company was based in Austria and conducted most of its business in the DACH region (Germany, Austria and Switzerland). Therefore, the results of the survey might have been biased by the company culture and by regional culture.

Another limitation could be the demographic characteristics of the participants. Only 27.53% of the participants who returned a completed survey were female. This is likely not a representative population for central Europe.

Furthermore, the measures for hypotheses testing were based on self-reports and did not include objective data. Therefore, the data might have been biased by the perceptions of participants; people sometimes tend to rate themselves differently than an objective evaluator would.

Another important issue in using surveys is social desirability bias. This can lead participants to give answers that are not a true reflection of their opinions but are rather what they think other people expect them to say. That is, people might try to provide a positive or socially desirable image of themselves (Goodwin, 2010).

Finally, new communication media are constantly being developed and disseminated, whereas this research was based on a single "snapshot" in time. Instant messaging, for example, has almost certainly grown in importance since the survey was conducted, and this medium could play a more prominent role in future studies.

4.3. Conclusion and Implications

The following directions and implications for future research in the field of media selection can be derived from this thesis. First, some of the limitations should be overcome by using a broader group of participants from multiple companies. When enlarging the group of participants, a sample that reflects the demographics of the whole population, especially in gender terms, would be desirable.

For this empirical study, three forms of communication were selected for analysis because the responses regarding other media were rather low. It would be interesting to broaden this view to include additional media in the analysis. A larger group of participants should help to obtain sufficient responses to do so.

The inclusion of further media is of interest because this study showed similarities for e-mail and telephone regarding their relationship with communication quality, whereas face-to-face communication showed a different pattern. It would be interesting to test whether additional media, such as instant messaging, would show similar results to those of e-mail and telephone. It would also be interesting to examine whether different groups of media might behave in similar ways.

Regarding the response surface for e-mail usage for convergence tasks (Figure 20), a decline in communication quality was evident when actual e-mail usage and the perceived fit did not match. Nevertheless, the calculated surface parameters did not show significant results to confirm this interpretation of the graph. Therefore, no relationship was evident in the case of a mismatch. The surface graph results highlight the need for a follow-up study to examine this relationship further.

From a practical viewpoint, a fit between actual usage and perceived fit of a medium influenced the communication quality for convergence tasks. Therefore, in convergence processes, it is important to use communication media that are considered suitable. This study also indicates that the use of suitable media influences the quality of communication in a team. Adequate usage is particularly important when using

telephone or e-mail. The influence of media selection must be kept in mind and awareness regarding the importance of this point should be increased.

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