

Collaborative Media Choice Processes in Virtual Teams

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Abstract – Virtual teams have become a common form of organizing work. A vital part of virtual collaboration is the process of choosing appropriate media and subsequently adopting it. Up to now, research has mainly focused on giving guidelines for or predicting media usage in virtual teams ignoring how teams come to use their media. Furthermore, only the individual media choice is analyzed whereas the collaborative use is hardly studied. The goal of our study therefore was to understand how virtual teams collaboratively choose their collaboration and communication media. Media choice theories that explain media choices and media behaviors served as a theoretical underpinning. We conducted a case study with fifteen teams (33 participants in total) taking part in an international virtual seminar. Qualitative data were gathered from presentations held by the seminar participants, from field notes taken by the researchers as well as from semi-structured interviews, conducted with seven participants. Following an adopted grounded theory approach, we derived seven theses, which we structured according to the categories (1) criteria for media choice, (2) the media choice process, and (3) overcoming the deficiencies in virtual collaborations. This case study gives a rich description about the media choice process in virtual teams as well as factors influencing it.

Keywords: *virtual collaboration; media choice; media choice theories; case study*

I. MOTIVATION

Virtual teams are more and more becoming a widely used mode for today's work – be it in education or in the business world. This is on the one hand driven by the needs of increased globalized work and on the other hand by the achievements of modern technology rendering such collaborations possible. In the last years it has become rather the norm than the exception for employees or students to have access to multiple communication and collaboration technologies, and to use these to work at different locations and with different distributed co-workers [1]. Thus, an important success factor for virtual cooperation is the media that are used for communicating and exchanging information as they have to overcome the shortcomings induced by the lack of face-to-face communication or shared social context [2]. Sometimes, the combination of media that virtual teams use is defined by e.g. the management of a team or the organization. However, in many cases, the team members are

free to choose their collaboration and communication media on their own.

The selection of media in virtual teams has been a topic of interest for many years – even at the time when most of today's media were not even thought of (cf. study of [3]). It is addressed by a lot of research areas like media choice and media acceptance theories (see e.g. [4], [5], [6], [7]). Researchers have mainly concentrated on giving design guidelines for media use in virtual teams or how managers can support media choice, but the joint process of media choice is hardly subject to research especially concerning teams that choose media on their own. An increasing number of employees work collaboratively with others on different tasks in different locations. Thus, we believe that there is a critical need for understanding the process of media choice in virtual teams, how they can be best supported and what factors influence the collaborative media choice. The present study is a step in this direction. Hence, we strive to answer the following research question:

RQ: What are the peculiarities of collaborative media choice in virtual teams?

As this process is hardly investigated empirically and as the theoretical related work is partially contradictory, we start with an explorative case study for approaching this field. In our early stage of research we conducted semi-structured interviews with seven groups of students and analyzed field notes as well as student presentations. The students had to work on a task in a team of two to three with other students they had never met in person before and would not meet during their collaboration. The media choice for their virtual collaboration was left up to them. The gathered data suggested several interesting characteristics, which we clustered in a set of theses according to the factors influencing media choice and the media choice process in virtual teams. These theses have to be subject to further analysis. Several other empirical studies have been conducted in educational settings with students in short-term teams (several weeks to six months) working on realistic tasks (for an overview see [8]). Our case is, however, particularly interesting because students from different countries work together in short-term teams with other students they have never met before on a completely virtual basis.

Our paper is structured as follows: In Sections II and III the related work for this field of research concerning virtual teams as well as media choice theories is outlined. Afterwards we will describe our research methodology including the case study setting, our data collection as well as the data analysis. Our findings in the form of derived theses are presented in Section V. Those theses are then taken to develop implications from our findings for designers of collaborative tools (Section VI). Section VII summarizes our findings, lists the limitations of this study, and draws attention to the need for future research in this domain.

II. VIRTUAL TEAMS

For our definition of virtual teams we take the traditional stance of [9], who state that virtual teams are groups that are geographically and/or organizationally dispersed, are linked by telecommunication and information technology and rarely, if ever, meet face-to-face. In addition, we see virtual teams as self-managed work teams, formed to accomplish a certain goal in a specified period of time [10], [11]. There is no consensus in the literature about the extent to which virtual teams rely on technology to communicate and collaborate. For some researchers, virtual teams exclusively interact through electronic media. For others, virtual teams sometimes meet face-to-face [12], [13]. Most scholars advance the view that as long as most of the communication takes place via electronic media, one can describe the team as “virtual” [14]. According to [15] the recent focus on the degree of virtualness [14], [16] is “an attempt to move beyond the potentially unsolvable problem of what is or is not a virtual team”. This stresses the ubiquity of virtual interactions since nowadays one can rarely find a team that solely meets face-to-face [17], [18]. The increase of virtual team work and the use of technology has two reasons: (1) changing business environments, the globalization of the market and growing inter-organizational co-operations have accelerated the need for organizations to work across geographical, temporal and organizational boundaries [19], [9], and (2) the rapid development of communication technology supports the transfer of knowledge across time and space.

Communication is essential for virtual work and organizations [20] and virtual teams can choose from a range of technologies to supplement or replace face-to-face interaction [15]. Commonly used technologies to support virtual teams include email, phone, instant messaging, video conferencing, file sharing, electronic bulletin boards, group decision support systems, and online calendars. Virtual teams have to decide to which extent they use which media. This specific media choice as well as influencing factors are the focus of our present study.

Recent studies provide an overview of the activities in virtual teams. [21], for example, analyze how virtual learning teams develop and find both remarkable similarities to face-to-face teams as well as significant differences. Like in ‘offline’ teams, virtual teams run through the same group developing phases forming, storming, norming and performing. Unlike

with face-to-face teams, however, the leadership in virtual teams is shared among different members of the group. [22] conduct an exploratory study to investigate the effect of virtual team communication training on group interactions. They conclude that teams that receive such training more easily build trust and perform more efficiently than those without communication training.

III. MEDIA CHOICE THEORIES

Media choice theories deal with the influencing factors for a specific media choice, the impact on the communication process, and the result of the communication process. Thus, media choice theories are concerned with the choice of communication and collaboration technology. “Given the choice, which medium or media would one choose to accomplish a certain task?” [23] Media choice has a long tradition and has been the focus of studies and theories for decades. Basically, one can differentiate between three schools of thought: *rational media choice* approaches, *collective media choice* approaches and *subjective media choice* approaches. Rational media choice theories assume that the media choice is based on the match of media properties with the requirements of the task. The Media-Richness-Theory [4] presumes, that the media choice depends on the complexity of the task. The user chooses e.g. a rich medium for a complex task. Media richness in the understanding of [4] is the ability of a medium to carry information, i.e. a face-to-face conversation is an extremely rich medium since the conversational partners can convey a lot of information. The Media-Synchronicity-Theory [6] is a further development of the Media-Richness-Theory and presumes that, instead of tasks, communication processes are the foundation of the media choice. The Social-Presence-Theory assumes that the media choice depends on the required social presence for a communication situation [7]. Thus, rational media selection theories are the result of a consideration and matching of media characteristics and a communication situation.

Collective media choice approaches acknowledge that media choice is influenced by social factors. The Social-Influence-Theory by [24] e.g. proposes that media perception and selection is influenced by the social context of individuals and groups. Another and rather more complex relation between media selection and social factors has been assumed by the Adaptive-Structuration-Theory [5]. It states that the success of media use is dependent on a set of complex relationships in a social context and that communication media are often used in unexpected ways. The main contribution of those collective media choice theories is that they acknowledge the impact of social factors on media choice in addition to rational media choice decisions.

Subjective or experience-based media choice theories state that the media choice of an individual is influenced by individual experiences and attitudes. King and Xia (1997) also state that habit and experiences in media usage can increase the likeliness of use.

While all these different theories shed light on the factors influencing media selection, they are often very coarse-grained and generic. Furthermore, they focus on several, often isolated and very different variables for explaining media choice [25]. To cope with this set of problems, newer approaches see media choice and media use as a kind of routine and growing social practices over time [26]. This does, however, only apply to established groups. Furthermore, media choice theories do not explicitly look at media choice in *virtual* teams but are often based on *traditional* work teams. An approach that tries to close this gap is the Behavioral-Complexity-Theory for media choice in global virtual teams proposed by [23]. Their empirical research showed that media choices in virtual teams often cannot be explained by either rational or social approaches. Thus, their theory assumes ambiguity and complexity of the media choice process in a nonlinear and holistic way. The Behavioral-Complexity-Theory understands that media choice (A) is context dependent, (B) is a decision making process that can be done at the individual, dyad or group level, and (C) is not merely a linear and rational process, but an iterative process. Thus, to sum up, one has to take all factors of those different explanatory approaches into account because media choice can hardly be explained by one theory alone and it often depends on several rational and social factors.

IV. RESEARCH METHODOLOGY

In the course of this research we try to understand how virtual teams choose their collaboration and communication media, how they adopt it and how they deal with the potential shortcomings of virtual collaborations. Hence, we have to investigate which factors influence their media choice. Thus, our research is about documenting the experiences of practice within a setting where the context is of vital importance. It is about analyzing a phenomenon in its natural environment where the boundaries of the phenomenon are not clearly evident at the beginning of the research project [27–29]. Therefore, the case study methodology is deemed appropriate for the purpose at hand.

A. Research Setting

An international virtual seminar (Master level) with 33 students from six different universities in six different countries (Germany, Liechtenstein, Italy, Netherlands, UK, Switzerland) provided the case for our descriptive, contemporary, single-case study. This particular seminar was chosen for the following reasons:

First, the students had neither met before nor did they meet during the seminar, i.e. there was no face-to-face interaction at all and they had to completely rely on communication technologies for accomplishing their task of collaboratively writing an academic paper. Second, they worked in small teams of 2-3 team members, 15 teams in total, within a limited time frame of one semester. Third, the students had to decide on their way to communicate and collaborate beforehand and had to disclose their media choice

at the virtual kick-off meeting of the seminar. They did not get any input concerning the media choice (e.g. no platform that they had to use). The only media choice that was predetermined was that they were provided with the email addresses of their team members prior to the seminar. Table 1 gives an overview of the students' backgrounds concerning the country of origin, their aspired master degree and the gender distribution.

TABLE 1 COMPOSITION OF THE VIRTUAL SEMINAR

No of Students	Country	Aspired Master degree	Gender
7	Germany	Master of Science in Information Systems	6 male 1 female
15	Liechtenstein	Master of Science in IT and Business Process Management	11 male 4 female
1	Netherlands	Industrial Engineering and Business Information Systems	1 female
1	UK	Master of Business Administration	1 female
7	Italy	Master in eBusiness Management and Consulting	4 male 3 female
1	Switzerland	Master of Science in Information Systems	1 male

B. Data Collection

Data were collected by means of a multi-method, qualitative data generation approach (see Fig. 1). All teams had to disclose their mode of collaboration in the virtual kick-off meeting, which took place as a video conference. In turn the teams presented their topics and their planned modes of collaboration and communication. The data stem from the slides of the presentation as well as field notes taken by the researchers during the virtual kick-off meeting. In order to get a deeper understanding on how the students decided on the presented media channels, we conducted topical, semi-structured, open-ended, face-to-face interviews with seven students from seven different teams. Those students with three different nationalities were chosen out of pragmatic reasons because they were in close geographical distance and we could manage to set up face-to-face interviews, which we favored over phone interviews, without having to travel far. Thereby, we were able to get deeper insights into the decision process of half of the teams. Thus, we adhered to [30], who recommends that interviews and supplementary material should be the main data sources for case study researchers.

The interview sessions took between 17 and 41 minutes. The interviews were tape-recorded and an interview guide gave structure to the sessions by listing the general topics we were interested in and giving potential questions of inquiry. We structured our interview guide according to three general topics, namely (1) media bundle & media functions, (2) the collaborative decision process (factors affecting successful collaboration) and (3) evaluation of the decision process and media choice (perception of collaboration). Those topics were then broken down into specific interview questions and more

detailed follow-up questions. We placed particular emphasis on understanding the media selection process. Our goal was also to identify influencing factors. All researchers took part in the interviews and were taking field notes. After the interview phase, the taped interviews were transcribed into text files.

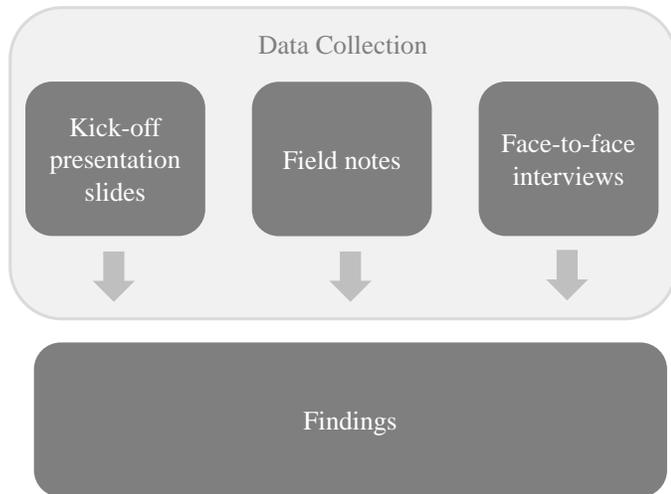


Figure 1 Multi-Method Data Collection

C. Data Analysis

The data (stemming from presentation slides, field notes, and interview transcripts, see Fig. 1) was analyzed regarding the evidence of recurring patterns. Two researchers were involved in the analysis process. We applied an adapted grounded theory approach, i.e. we separately coded the transcripts of the interviews and came up with nodes, which we then merged to categories [31]. We compared our coding, discussed the differences and finally agreed on the categories. The mode of data analysis taken in this research study reveals several advantages. In our case study evidence was obtained from multiple data sources such as interviews, presentations and field notes. The application of various sources allows for triangulation, which provides greater support to the researchers’ conclusions [28]. The association of several researchers analyzing the data also furthers the quality of the research results. Multiple researchers have the advantage of enhancing the creative potential in the research process, and the convergence of observations from multiple investigators enhances confidence in the findings.

V. FINDINGS

We gathered a huge amount of data, yet, through multiple coding rounds, interesting findings emerged. We were particularly interested in the media choice process in virtual teams as well as influencing factors. This section presents our first findings from our initial analysis. It has to be mentioned that the citations below present only a sample of the collected data. Because of page restrictions we sometimes

provide only one or two examples even if we declare “several interviewees” stated something. From analyzing and clustering the data, three main aspects emerged, which we use as categories to structure our findings and which mirror our interest in influencing factors and the media choice process in virtual teams. We labeled them: (1) criteria for media choice, (2) the media choice process, and (3) overcoming the deficiencies in virtual collaborations. According to those categories we formulate theses that condense our perceptions. Before discussing the three categories and the corresponding theses, we give a short overview of the interviewees, their virtual team experience and their media choices for certain tasks.

All of our interviewees had worked in virtual teams before and generally had a lot of experience with virtual collaboration tools. One interviewee stated “it is part of everyday communication. [...] it is just a natural extension of the channels we use otherwise.” This widespread use of virtual collaboration tools might be due to the fact that the participants in our study are IS students, who have to accomplish a lot of assignments in teams and who might generally be regarded as IT savvy. However, our participants were not used to the situation of never having met their team members in person before. It is rather striking that all seven virtual teams that we interviewed more or less use the same tools for their collaboration. All of them use Skype, email and Dropbox (a web-based file hosting service). At least six groups use Mendeley, which is a reference manager that can be used collaboratively. Three teams work with GoogleDocs, two use separate chat software, one group uses phone, one has established a Facebook group and one team has worked with a mind map tool. All interviewed teams employ their media for rather similar tasks. Skype is generally used for exchanging information with regard to content, for discussing open issues, and for planning how to proceed. In contrast, email is mainly used for coordination tasks like setting up dates, for issues that have a low complexity or are not time-critical, and for giving short feedback on the status. Two groups use email for detailed conversation as well. However, this is due to the fact that at least one of the team members has a full-time job and thus does not have the time for long Skype meetings. Our findings are in line with the Media-Richness-Theory stating that the more complex a task is the richer will be the ideal medium to fulfill the task. However, as can be grasped from Section III, there are not only rational factors that influence media choice. In the following, we present our three categories that emerged from the data and the corresponding theses that we derived.

Criteria for media choice

- 1) *Media choice is based on personal experiences of the team members.*

According to King and Xia (1997) experiences in media usage can increase the likeliness of use. We can support that assumption since, asked for their criteria for selecting their collaboration tools, all interviewees stated that they chose the tools because they already had experiences in using them. One interviewee stated “I thought about, what I know, what I

worked with before, what makes sense”¹ and two others answered “we were already acquainted with the usage” and “we basically chose what we know, what we successfully used so far.” Another aspect, however, is that it is not only individual experience but also the experiences of the team partner that guides the decision. One interviewee stated that he would have preferred to use another tool but his partner did not know it. Thus, they decided on a tool they both know and he concluded “there shouldn’t be a big learning curve and it [the media choice] should be the common denominator of all project members”. It became clear from the interviews that several teams did not make use of all technologies that were available to them because at least one team partner did not know it and did not have the time to learn how to work with it. Thus, the media choice of all teams that were interviewed was primarily a subjective and collective media choice than a rational task-media-fit consideration.

Another aspect that emerged from our data concerning the experience in using a tool is that in groups, which actually decided to use a specific tool but in which one or all team members had only little or no experience with it, it became apparent that the tool fell into disuse even if the team had agreed on using it in the first place. One interviewee stated “we set up a Mendeley folder but we actually do not use it very much. Since now we manage all our literature in our Dropbox,” and later during the interview “we both don’t know Mendeley very well [...] but I can imagine it would be easier using it.” Thus, even if teams had decided that a tool would be adequate for a specific task, they acted otherwise and sometimes created a complicated workaround to accomplish the task. This became apparent in another interview, where the interviewee stated that they decided to use Mendeley after other teams had presented the tool in the virtual kick-off meeting. Hence, none of the team members had experience with the tool and he was surprised about the development of the actual usage in his team. They a priori agreed that “it looks convenient, let’s use it, but now I am the only one who uses it even though we decided that it is convenient and that we want to use it.” His team partner uses spread sheets instead, which is probably not the best media choice for the task but something he has experience with. Hence, we assume that experience as well as “non-experience” influences media choice in virtual teams.

2) *Media choice is based on media that are considered as standard.*

Apart from the experiences with the tools, all interviewees stated that they decided on tools they considered as established. “All media were known to us [...] we directly found a consensus and could virtually start right away.” One interviewee stated that the media choice for virtual collaborations is just an extension to channels, which one uses anyway. Virtual collaboration is nothing that one actively approaches but rather an extension of the communication portfolio. This goes hand in hand with a statement of another

interviewee, who stated “one basically has a certain repertoire [...] and I think that there is a reason, why certain tools have come out on top.” The students all pointed out that there is a certain consensus at their university, concerning the use of tools like Skype, Dropbox and email for seminars and projects and they assumed that this is similar in other universities. This assumption can be confirmed when looking at the media choice of the teams, disclosed in the virtual kick-off meeting: 14 out of 15 teams stated that they use Skype for synchronous communication, 13 teams stated that they use emails and all teams stated that they use Dropbox for file exchange and archiving. One could assume that the two teams that did not mention emails explicitly did not think about it as a specific collaboration tool but rather as standard, which they did not have to mention. This assumption can be backed up by one statement of one interviewee: “Everyone can be reached by phone, followed by email, at least in the context of information systems, whereas with proprietary networks [like e.g. Skype] one cannot be 100% sure, if the other one is accessible. Email is thus the only real infrastructure.” However, the data shows that students, regardless from which country, decided on the same tools they considered as standard regardless of the fact if it was proprietary or not. One student said “Skype, Dropbox and email is just something obvious, I guess, [...] the first thing that pops up in your head” and another one stated “well, I don’t really know which alternatives exist for Skype [...] it is just something that is commonly used, I would say,” and yet another one concluded “those are, I think, the most common. There is nothing, which is as widely spread, there isn’t anything else.” Thus, we assume that the fact that some selected tools are proprietary does not influence media choice if they are considered as standard.

Media choice process

3) *The selection process is not realized as a conscious step and is not reflected upon.*

Another interesting topic that emerged from the interview data was the selection process, i.e. how the teams decided on their media use. We assumed that the students would discuss about the media they would use but they all described a rather smooth decision process. Interestingly though, they themselves did not expect that: “That was a little bit, I don’t know, strange because we proposed completely the same tools from the very beginning you know. And then we said [...] my propositions are identical to your propositions so we kind of have consensus.” The typical decision process was that one team partner proposed a set of tools and the other one agreed on that choice without further discussion. One interviewee described that he created a Dropbox folder and his partner created a GoogleDocs account during their first Skype meeting to record their thoughts and that this procedure “did not need further consultation.” Interestingly though, this process seems to have taken place more or less unconscious. One student did not know why they chose Skype over other Instant Messenger or VoIP software, “I don’t really know if he has ICQ or not but I think he uses Skype more often.” Similarly one student

¹ Five of the seven interviews were conducted in German and quotes taken from those interviews were translated from German to English.

reflected “I proposed ICQ as chat program but that was kicked out. She didn’t like it and then I didn’t like it anymore either.” Thus, the selection process was a process all teams intuitively ran through with nearly identical results.

- 4) *Email is used as a first icebreaker. After that, synchronous media are favored.*

The students were provided with the email addresses of their team members and thus, the initial channel was predetermined. We wanted to find out if the students would have preferred to contact their partner via another channel first. The overall consensus was that, although they preferred to communicate via VoIP software during their project work, they would all have chosen email as the initial channel. The reasons for that were quite different: Several students stated that email is appropriate for the first contact since it is more formal than contacting via VoIP software. “Email has a certain importance for me. If I get emails I normally read them right away”, or “email is better because it is more polite and formal, I think. If someone contacts me via Skype then I don’t know who that is at first. Or he tries to call me, that is even worse. I would be really surprised and I would like to be prepared for a first meeting via a richer channel like phone. When writing an email, I have time to think about what I write. I think email is much better.” Being able to prepare the initial contact and properly introduce oneself was mentioned as another reason by several other students as well. “With email, with the first letter, you can already describe yourself.” A third reason for choosing email as the initial channel was availability. One student stated “for Skype one has to wait until the other one is online and this it is, I think, better or easier to suggest a date via email and both are online at the same time so one does not have to wait for a coincidence” and another one said “I know from myself that I am often not online in Skype, I don’t know how other people handle that but I know that emails are sent and received”. However, after the initial contact via email, all teams switched to Skype within several days. They did introduce themselves, exchanged Skype contact dates and scheduled a phone conference right away. “It was clear for both of us that the text-based channel is not sufficient and that we, because the other one is an unknown person, that we need language. Thus, after the start we directly switched to phone.” Taking all those answers into account we assume that email is the best initial contact channel because it does not invade the privacy of the team partner. One can reflect on what to write, how to introduce oneself, one does not surprise the other one with a contact where a direct response is needed and one can schedule a meeting in a richer medium and be prepared for that.

Overcoming deficiencies in virtual collaborations

- 5) *Several media are used in parallel to get as close to face-to-face collaboration as possible.*

A striking pattern that six interviewees mentioned is the parallel use of different collaboration media. Almost all students stated that when talking to each other via phone or VoIP, they use complementary media to overcome the

deficiencies of a non-personal meeting. “When we use Skype, in most cases we have also opened Googledocs.” says one interviewee. Another made it even clearer “[My partner] showed me the slides for the kick-off meeting via screen sharing and then we have talked about them and in parallel, we had opened a file from Dropbox to talk about it.” From these observations we assume that in virtual teams where complex tasks need to be fulfilled, team members try to imitate face-to-face meetings because the latter form of collaboration is seen as the perfect one as one interviewee stated “I always prefer personal meetings”. Another one mentioned “[face-to-face] would have been more convenient, of course. It is because you can directly talk things over.” We hypothesize that for tasks which are assumed to be fulfilled more efficiently in personal meetings virtual teams try to create an environment that approaches the feeling of face-to-face collaboration. This is achieved by combining several virtual collaboration tools.

- 6) *In collaborative media which lack communication or collaboration features, other functions are reinterpreted as such.*

For managing and sharing related literature, many teams used Mendeley. Although Mendeley offers community features like shared folders that can be synchronized among its members or the possibility to exchange messages, it lacks some functions that would be desirable for jointly working on the stored literature. For instance, there is no intuitive way of showing who has already read which document. Interestingly, the groups who needed such a feature simply used other functions to exchange information: “we use this ‘favorite’ star, which you can set to show ‘I have already handled this’, so that the other one does not need to have a look at it anymore.” Another group used Mendeley’s notes functionality: “and then we also use notes. You can synchronize notes [...] to send messages to the other one.” It is noticeable that instead of using other channels which are explicitly used for communication purposes, like email or Skype, our interviewees looked for functions in the collaboration software that could be used to overcome the deficiencies. From this we derive the thesis that in communication or collaboration media that miss certain desired functions, other features, which originally served another purpose, are reinterpreted in order to take on the role of the missing function.

- 7) *The barrier of switching from one communication channel to another grows with the increasing richness of these channels.*

Almost all interviewees stated that they would have preferred face-to-face meetings especially at the beginning of the collaboration. This is in line with earlier findings of [32] and [33]. Especially the creation of a common goal as well as getting to know and being able to rate the other team members, was mentioned several times by our interviewees: “I believe this is always good for getting to know the other one and for talking about which goals one is pursuing”. Other interviewees stated “when you are face-to-face, you have the advantage of building a personal relationship more quickly” or “well, the best medium, of course, would always be when you somehow sit in one room and work there”. However, as this is

not possible in the current scenario, one could assume that teams would use rich media which emulate the face-to-face situation as best as possible, like video chat. However, this is hardly the case. There is one group that mainly uses Skype chat for communication, most use Skype for phoning and only two groups regularly use Skype’s video functions. When we asked our interviewees why they had never used video phoning, most of them were rather astonished and could not even name their reasons. “I don’t know. We could actually try it. There is no reason why we decided against it. It was just like that.” In contrast, one group that once had tried the video function ‘by accident’ appreciated its value of creating a personal atmosphere: “I think we have talked a bit more informally not as factual as it has been before.” We believe that the higher the richness of a medium, the higher is the barrier to use it voluntarily. There seems to be a hurdle from chatting to phoning as one interviewee in whose group mainly the chatting function of Skype is used stated: “Chatting is easier. The barrier is lower and you don’t have to focus completely on the talk, you can do something in parallel, you can send something and the other one can consider what he wanted to reply. [...] [When phoning] you have to interrupt everything that you are doing”. It seems that with a richer medium like phoning you are pulled out of your daily environment and you have to somehow prepare for your dialogue partner. Such a barrier also seems to exist in the step from phoning to video phoning. Out of all options, video phoning is still the best way to come as close to personal meetings as possible: “when we have face-to-face conversations, [Skype] is a much richer channel and sometimes my partner is trying to be polite and saying yes, I agree to that but I can see in his facial expression that this is just politeness talking”. Nevertheless, this is hardly used by our interviewees. This might be due to the fact that with video phoning the visual focus lies directly on the participants’ face. Unlike in the normal environment, where other sensations like smell or the visual impression of the surroundings might attenuate the importance of the dialogue partners’ outward appearance, concentrating solely on the partner’s face within a camera rectangle might appear too intimate. This rise in adoption barriers with increasing media richness opposed to the favored face-to-face communication being the richest communication channel of all is schematically depicted in Fig. 2. Taking into account the hurdle from phoning to video phoning and from chatting to phoning, we believe that looking deeper at the barrier steps between media of varying richness is worthwhile.

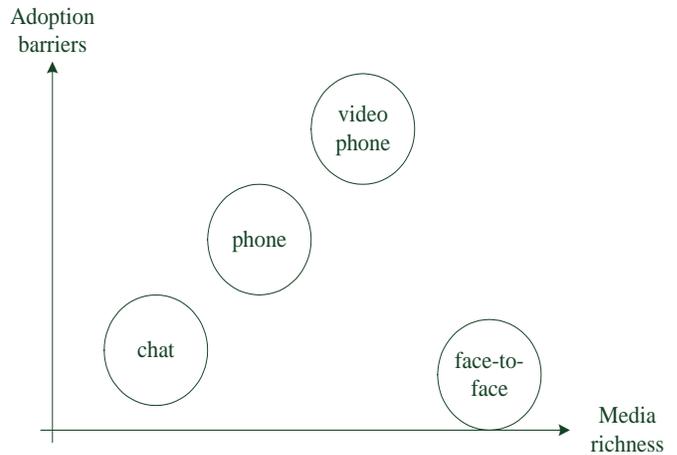


Figure 2. Assumed relationship between media richness and adoption barriers of communication media.

VI. IMPLICATIONS FOR TOOL DESIGN

Taking those first findings and the derived theses into account, several implications for the design of tools can be given. Thus, collaborative technology designers can benefit from the findings and use them as a starting point for improvement considerations in new tool designs. Concerning the criteria for media choice (theses 1 and 2, *experience/non-experience* and *standards*) one could argue that tool designers for collaborative tools should keep in mind that users tend to use tools and features they know, whether they are proprietary or not. This may influence the designer’s decisions regarding certain features of newly developed tools or regarding the usage of new tools that should be similar to already existent tools to foster user acceptance.

Concerning the media choice process (theses 3 and 4, *unconscious decision process* and *email as first icebreaker*) tool designers can consider that in virtual team work, the first “formal” contact often happens via email and then communication and collaboration proceeds via synchronous media. Thus, designers may e.g. think of new features for enriching emails to transport more information while still being a formal channel for the first contact. In addition, designers could think of e.g. integrating an email channel into a collaboration tool.

The last aspect that emerged from our data and which we labeled *overcoming the deficiencies in virtual collaborations*, comprises the theses 5, 6, and 7 (*parallel media usage*, *reinterpretation of features to support communication collaboration*, and *barrier of switching to a richer channel*). Here, several implications for tool designers can be given: First, tool designers should think about how to better integrate different tools, e.g. combining VoIP functionality with a fully functioning word processor, a mind map tool or any other kind of notice board in order to support a virtual team meeting. Second, as stated in the findings, the comment functionality of the reference manager Mendeley was used as communication

tool by several students. Thus, the students were missing some kind of communication and collaboration feature in the original tool and found their own work-around by reinterpreting other functions. This deficiency may be easily overcome by integrating some kind of communication feature into the reference manager. Finally, it became apparent that the barrier for using richer communication media like telephoning or video conferences was much higher than writing emails or other forms of text messages. Designers should respect this reluctance to use richer communication tools (in the beginning of a virtual collaboration project) e.g. by always integrating lower media richness options in a system, i.e. allowing for texting or phoning even in a tool that offers video communication.

VII. CONCLUSIONS, LIMITATIONS AND OUTLOOK

The purpose of our study was to gain insights about the characteristics of the media choice process in virtual teams as well as possible influencing factors. We chose an international, completely virtual seminar as an exemplary setting for our work. The study was conducted with 33 Master students in information systems from 6 different countries. One limitation of our study is that the students' familiarity with communication media and their willingness to try new media may be higher than that of other students. This inherent bias limits the generalizability of the findings. Furthermore, we did not consider the multicultural aspects that might have influenced the media choice process in our study. As a last limitation, the presented study is only a single-case study within a special context (virtual teams in a learning environment). Extending our research to different groups of people like employees would provide further insights into the joint media choice in organizations working with virtual teams. However, communication and collaboration media that was used in this study, i.e. email, Skype, Dropbox etc., is omnipresent in today's learning and working environment irrespective of the field of study. Nevertheless, future research with students from other fields of study as well as employees is necessary to corroborate our results.

We condensed our findings in theses, which we clustered in three categories: (1) criteria for media choice, (2) the media choice process, and (3) overcoming the deficiencies in virtual collaborations. Criteria are predominantly the experience with the tools as well as the fact that the used tools are considered as standard without alternative. The media choice process was not regarded as a conscious step and not reflected upon. Furthermore, during the media choice process, email was used as an icebreaker but all teams switched to VoIP tools instantly. Email was regarded as more formal and polite and ideal for the initial contact. We assume that this coheres with the fact that it does not invade the privacy of the team partner but in order to create trust and a mutual understanding of the task, VoIP tools were regarded as the best choice. In order to overcome the deficiencies of virtual collaborations, we found interesting characteristics. Six teams stated that they often use several media in parallel. We assume that this is a good way to get as close to face-to-face meetings as possible. Furthermore,

while using collaborative media which lack communication or collaboration features, the students used other functions and reinterpreted them as such. Instead of using explicit communication channels like email or Skype, our interviewees altered functions in the collaboration software and used them for their specific needs. A last interesting thesis we formulated is that there is a barrier of switching from one communication channel to another and that this barrier grows with the increasing richness of these channels. Certainly, more empirical research with a larger sample is necessary to confirm our theses.

This research provides several contributions to the study of virtual teams. It is a rich description about the peculiarities of media choice in virtual teams and factors that influence it. Furthermore, our study discloses that media choice in virtual teams cannot be explained with the existent media choice theories presented above. Media choice often depends on several rational, social and contextual factors that are not included in present media choice theories. Thus, further theories will have to consider findings like ours to strive towards a unified theoretical framework for explaining media choice in virtual teams.

Our results are a first step to understand the media choice of virtual teams and which factors influence it. Since most teams today have some degree of virtualness [15], it might be fruitful to compare our findings concerning completely virtual teams to the results of other virtual teams' studies to examine how the extent of virtualness affects the team work.

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