Video conferencing in a transregional research cooperation: Turn−taking in a new medium

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1. Introduction

Compared to more common media of communication such as telephone or e−mail, video conferences (VCs) provide further communicational resources for the interactants by allowing for visual cues that are suspected to play a major role in discourse management, cognitive and affective processing. Video−conferencing furthermore has a number of practical advantages compared to real meetings, such as the reduction of travelling time and costs, and the maximisation of the use of resources (e.g. guest lectures). New media however also present new problems to interactants.

In this paper, we address the problem of turn−taking in VCs. We will first present the framework in which our research is carried out in order to illustrate our particular perspective on the issue. Then, we analyse the interactional achievement of turn−taking practices in the first VC session in the preparatory phase of a transregional research cooperation. These results will be discussed on the background of previous results, focussing on the relation between negotiation and adaptation on the one hand and the influence of the medium on the other.

2. Perspectives on Video−Conferencing

2.1. Background: Aims and expectations

The background of our investigation is the preparation of a transregional research center in the research area of **Spatial Cognition**, which will be located at the universities of Freiburg and Bremen. In this connection much organisational and scientific cooper−ation and negotiation has been necessary. After years of well−established and efficient scientific and organisational cooperation between the interactants via telephone, email, and occasional meetings in person, our group decided to improve the contact by including VCs in the agenda. The obvious expectation leading to such a decision is that communication functions even more smoothly, and that the exchange of information is

improved nearly to such an extent to resemble meetings in person, thus diminishing the need for expensive and time−intensive travels through Germany. If the research center is funded, the VCs will also be used for scientific discussion. It is expected that video conferencing, as a supplement to the previously well established interaction media, will enable the research cooperation between Bremen and Freiburg to be very close and fruitful.

Besides intuitive ideas about the usability of videoconferencing, these expectations are being fed by reports like Goddard (1995) who concludes that video conferencing is "the next−best medium for interaction where face to face contact is not feasible". Similarly, on WWW pages dealing with the VC medium such as the "Videoconferencing Cookbook" at http://www.videnet.gatech.edu/cookbook//, it can be found that the medium is described as enhancing the familiarity of meetings in much the same way as actual physical presence would do, as the following citation exemplifies:

> For meetings that already regularly take place and require face−to−face communication, videoconferencing can substitute for the actual physical presence of remote participants. (...) Frequent and/or ad hoc meetings that might not have been scheduled due to travel costs and timing can be enabled via videoconferencing and enhance the sense of teamwork among people at different locations but working on the same project. Videoconferencing provides remote participants with much of the face−to−face familiarity that comes with physical presence, including elements of facial expression, body language, and eye contact.

In our context, the expectations emerged in spite of the fact that the technical equipment available to us is not entirely satisfactory. More precisely, our VC equipment is a point−to−point ISDN−based, high−end system (Sony PCS5100plus Videokonferenz (Bremen); Polycom Viewstation fx (Freiburg)) with a transmission rate of 128−384kb/s. Application sharing is not possible. Because of the limited bandwidth, a delay of about half a second occurs in the transmission of both audio and video signal. Furthermore, the current system (to be replaced soon) employs half−duplex audio which means that while one participant is speaking, the others cannot be heard in case they produce sounds below a certain threshold level. In other words, no two speakers from two different sites can be heard at the same time; the direction of transmission switches automatically. Figure 1 illustrates the setting up of the technical equipment.

Figure 1: Setting; with Picture in Picture

Although our equipment thus does not meet the highest technological standards available, an analysis of the implications of such a situation is nonetheless useful. First of all, the employment of imperfect, but available equipment will remain the normal, rather than the exceptional case in scientific contexts for the upcoming years. Secondly, the more general results obtained in this paper are to a large degree independent of particular technical conditions. While other research shows that even up−to−date technological equipment is far from capable of solving all problems related to the smoothness and effectivity of interaction in VCs, our analysis of the role of turn−taking in VCs will

illustrate the more general problems to be overcome in video−mediated communication.

2.2. Objectives

In order to support the academic and practical interests of a transregional research co−operation, we decided to study the VC activities of the researchers involved. In accordance with our general research goals on negotiation and the parameterisation of strategy selection in spatial interaction (cf. Freksa 2002), we are going to approach the video mediated interactions held with four objectives:

- the analysis of the interactive achievement of discourse managing strategies in the new medium video conference,

- the documentation of peculiarities, necessities and strategies particular to scientific research cooperations,
- the analysis of the consequences of the medium using a spatial cognition perspective, in line with the subject of our transregional research cooperation in which VCs are employed, and
- the development of moderation strategies.

2.2.1. The Interactive Achievement of Discourse Strategies

How conversational processes evolve and are interactively established is an important research area in semantics and discourse analysis. More recently, researchers have begun to understand language usage in context not as the employment of the off−the−shelf inventory of a language, but as governed by negotiation processes as a collaborative effort. The employment of lexical resources in context thus depends not only on the correct reference of the term used to the concept to be expressed, but on the (assumed) knowledge about the communication partner (e.g. Schegloff 1972), on collaboration (e.g. Clark & Wilkes−Gibbs 1986) and on alignment (Garrod & Anderson 1987, Garrod & Pickering, forthc.). Furthermore, ideas about language, the environment, and the complexity of the task play a decisive role in linguistic strategy selection (Fischer 2002, Moratz, Fischer & Tenbrink 2002). Word meanings are even interactively negotiated (Spranz−Fogasy 1993, Deppermann & Spranz−Fogasy 2002).

Similarly, interactants jointly establish particular discourse management strategies. For instance, Schegloff (1982) shows that even a multi−unit turn is generally the product of an interactional negotiation process. Analysing how participants react to new problems posed by the use of a new medium provides us with a unique opportunity to study how strategies are interactively negotiated. Off−the−shelf solutions are not available if the medium poses previously not encountered problems to the interactants. Solutions to discourse management tasks then need to be established, which cannot be done by individual speakers, but needs to be interactionally achieved and ratified.

2.2.2. Video Conferencing Uses Particular to Transregional Research Cooperations

Transregional research co−operations may pose very special constraints on video−conferencing that have not yet been sufficiently documented. Previous research has mainly concentrated on distance teaching or business cooperation. The possible uses of VCs are in general not finally established, and the particular uses in scientific cooperations will have to be investigated. For instance, it is possible that the requirements particular to scientific contexts require a redefinition of the goals of VC sessions, as proposed by, e.g., Whittaker (1995).

While VCs seem already to have achieved some tradition in education and industry contexts, there has not been much experience in coordinating scientific exchange with the help of this medium. In contrast to education and industry, scientific contexts usually involve written texts to a high degree: the exchange of rough ideas is often handled via email, more complex issues involve manuscripts and publications; other common methods are short face−to−face conversations between people who happen to be close−by, and larger meetings such as workshops and conferences that are usually stretched over a period of several days in order to justify longer journey times. The tasks for the researchers are thus mainly the exchange and discussion of ideas, but also the close cooperation in text−production for which additional applications may be required (cf. Lander & Burns 1998). However, also organisational issues play an important role in the collaboration in a transregional research center. Some of these tasks may be fine to settle on the phone, some by e−mail, and it will have to be seen for which uses the researchers involved in the research center will prefer VCs.

2.2.3. Analysis of the Medium under a Spatial Cognition Perspective

The transregional research cooperation in which the VCs are being held centers around questions of spatial cognition. Part of this research is the analysis of negotiation strategies and linguistic choices specifically in interaction situations involving spatial configurations. Therefore, to investigate the communicative challenges in VCs from the point of view of the conceptualisation of the spatial configurations involved is a natural product of our research interests. Just as the spatial position of an instructor and their

communication partner in real space influences, for instance, the perspective taken (e.g. Schober 1998), the spatial position and representation of the interactants in VCs necessarily influence the linguistic properties of the interaction. Using a spatial cognition perspective in the analysis of the challenges and problems encountered in the new medium promises new insights in the nature of the problems to be overcome.

2.2.4. Development of Moderation Strategies

Another aim is to identify possible dangers of the new medium and take precautions as far as possible. For instance, many results point to undesirable solidarity effects among interactants on each side and to stigmatisation of the other party as slow and unresponsive (Schulte et al., 2001). In cases where there are groups of people at each location, specific effects on ’group sensation’, related to the perception of ’social presence’, arise (O’Malley et al., 1996, Herrmann & Meier, 2001). The effect seems to be such that at each location, the participants feel that they are closer to each other than to the others who are felt to be far away. Moreover, because of the time delay often encountered, ’those others’ react too slowly, they do not show the expected mimics and gestural reactions at the expected times, etc. Such subconscious impressions may even lead to aversion towards the remote group.

Moderation may overcome such problems (cf. Meier, Herrmann, Hünecke 2001, Herrmann & Meier 2001, Meier 2002); in our group it was explicitly demanded by the interactants (see below).

3. Turn−Taking in a New Medium

In the following, we will exemplify our procedure and research perspective in the discussion of one particular strategy relevant in VCs: turn−taking. We will show how the exchange of speaker roles is managed in our setting and how the participants interactively negotiate and finally settle upon a particular strategy useful under the present technical conditions. On the basis of these results, we will discuss the relationship between negotiation and the impediments of the medium, arguing that an approach to the problem from the viewpoint of spatial cognition can be very useful.

The exchange of speaker rights in ordinary face−to−face communication has been shown to be a complicated, but well−established system consisting of a system of rules that apply in a particular order, supported by the signalling and recognition of non−verbal, para−linguistic as well as verbal cues that indicate so−called transition−relevance places (Sacks et al. 1974, Ford, Fox & Thompson 1996). The effect of this system of rules and cues is that usually only one speaker speaks at a time, and that transition is smooth, with few occurrences of overlap or pauses. In the following, we describe how the participants learned to cope with the impact of the VC medium on this interactional system.

3.1. The Interactive Achievement of Turn−Taking Strategies

Within our first VC, a strategy for the exchange of the turn under the particular technical conditions was jointly achieved. This interactional achievement became necessary after a number of unsuccessful attempts to exchange the turn with conventional means. That is, attempts to get the turn by self−selection at a transition relevance place, using methods that are usually successful in face−to−face conversations, such as intake of breath, leaning forward and starting to speak (Duncan 1972), turned out not to be useful.

This is in line with reports on turn−taking in VC situations involving imperfect technical equipment, such as time−delayed signals. Gestural movements and mimics, for instance, cannot be interpreted correctly for two reasons: First, there is the temporal delay of half a second, which makes reactions seem unnaturally delayed. Backchannel signals that are perceived only belatedly have been shown to have a more unsettling than affirmative effect on the speaker (Schulte et al., 2001). Second, as in our case, for technical reasons the transmitted picture may not be clear enough, or may get disturbed with transmission problems due to movements on either side. Thus, "video is relatively ineffective in conveying the visual cues that speakers find useful in face−to−face interactions" (O’Malley et al., 1996: 190). This fact seems not to surface in the participants’ awareness: "While users treat video interactions like face−to−face conversation, non−verbal information in gestures and gaze do not appear to have the same impact and are often ignored" (Heath and Luff; 1991; cited in O’Malley et al., ibid.).

These problems can lead participants to avoid natural movements of head or hands while speaking or listening. In our case, one of the participants even asked those on the other side not to move in order not to disturb the picture. Paralinguistic signals that are usually absorbed and interpreted correctly without any awareness of either participant, are now inhibited or disturbed. As a consequence, the recognition of transition relevance places, i.e. those moments in a conversation when the smooth exchange of the speaker role is possible, is impaired.

Accordingly, in our VC session first attempts to employ self−selecting strategies that are successful in face−to−face interactions resulted in longer stretches of overlap, which were then supplemented with an explicit strategy: "May I interrupt?". Similarly, intake of breath by a speaker at one site was perceived by the other speaker who interrupted himself. However, before the other person could react to this break in the conversation because of the time−delay, the previous speaker continued speaking, interpreting the other's failure to react as a turn−yielding strategy.

Figure 2: Hand−rising strategy

After this, raising of the hand as in chaired meetings was used to get the turn. Figure 2 shows the first, successful, use of hand raising as a turn−taking signal after two unsuccessful attempts to get the floor by means of verbal cues. Perceiving the signal, the current speaker interrupted himself again and asked "yes?". The hand raising strategy was then regularly employed, usually successfully, although in some cases hand raising lasted for several seconds before it was perceived. This turn−taking procedure was thus re−used

and established throughout the interaction. In the discussion after the ’official’ part of the meeting hand raising as a useful strategy for getting the floor was explicitly ratified by the participants. However, the participants noted that for this strategy an increased level of attention was required: "both sides need to be attentive in order to recognise each others’ intentions". It was also suggested that moderation would be helpful.

3.2. Negotiation and the Influence of the Medium

The previous section has shown that participants interactively negotiated the turn−taking procedure with the result that they succeeded in accustoming to the particular technical conditions and established a commonly accepted set of strategies. Can we conclude that the medium VC, even if it does not allow turn−taking in the same way as in face−to−face interaction, does not hinder communication because people find functionally equivalent substitutes and interactively settle upon them?

First of all, short comments from the participants reveal a general uneasiness in all participants. Furthermore, we can observe unusually long stretches of speech compared to unmediated conversations, i.e. a tendency to monologues rather than interactive dialogues − in spite of an explicit commitment on the part of the head professor who declared in the beginning that he wished the VC to be as interactive as possible. On the "listener" side, there was a tendency to obvious passivity. Most of the participants were not involved at all; only one more dominant person on the "listener" side managed to gain speaker right from time to time (using the hand raising strategy after it was established). The others (on both locations) only talked when explicitly assigned speaker rights, e.g., when addressed by name. Thus, in spite of the fact that speakers had interactionally agreed upon turn−taking mechanisms useful under the particular technical conditions, they suspected afterwards that "research cooperation may not be possible at all in this way" and that "telephone communication works better". However, interactants also admitted that this could be due to the fact that "we are not used to it". Thus, in spite of the successful interactional achievement of solutions to the new tasks, the interaction itself was not perceived as very successful. What are the reasons for this discrepancy?

Sellen (1995) carried out a number of studies especially designed to investigate the effect of the medium on discourse management activities, such as turn−taking. She

focussed on two research questions, which she investigated comparing four conditions (same−room, audio−only, and two different video systems): the effect of video−mediation and the effect of the availability of visual cues on conversation management. In Sellen's experiments, contrary to expectations, there was significantly more overlap in the same room condition than in the different video conferencing conditions (1995:423), but more explicit turn−exchange related cues were used in the video−mediated and the audio−only situations (1995:427). However, no differences regarding turn numbers, turn distribution, and turn duration (neither between same room and video−mediated conditions, nor between video−mediated and audio−only settings) could be found (1995: 422). Sellen sums up her findings as follows: "there were fewer differences between same−room and video−mediated conversations than predicted and a complete absence of differences between the two video systems. No problems in regulation of conversation in the video conditions and no significant effects of selective gaze were evident in these measures" (1995: 429). Similarly, her results regarding the effect of the availability of visual cues show that "the presence or absence of a visual channel had no effect in terms of number, duration, or distribution of turns in a conversation. One inference is that, as expected, a lack of visual cues caused no significant problems in the regulation and synchronisation of conversation" (1995:432). That is, like our results her results suggest that conversation management is not hindered by the medium VC.

While interaction has in general been found to be highly dependent on the particular technical equipment (cf. Lander & Burns 1998), video conferencing as a medium thus appears to be not significantly different from face−to−face or telephone conversation regarding discourse management tasks, such as turn−taking: Interactants seem to develop new ways for fulfilling these tasks that are different but functionally equivalent to those used in natural face−to−face communication.[1]

However, there seem to be a number of problems with the medium after all. First of all, conversation management provides only one out of a spectrum of tasks interactants

[1] This is in accordance with Schwittalla's (1996) findings in his analysis of communication problems in telephone conversations as they are represented in movies from a time when the telephone constituted a new and unfamiliar medium. He reports that there are only very few problems represented that are related to the characteristics of the channel, and thus that the medium itself did not constitute a big problem.

have to address in conversation. For instance, O'Connail et al. (1993) found significant differences between face−to−face and video−mediated communication regarding task completion: the same−room condition was significantly faster than the mediated conditions. That is, even though conversation management seems to be adapted to the circumstances, task completion is severely influenced by the particular conditions. It has even been shown that, in collaborative problem solving, video−mediated communication can be less effective than audio−only interaction (O'Malley et al., 1996). Furthermore, in a questionnaire study, Sellen investigated the interactants' attitudes towards the different conditions and found significant differences between the same−room condition and the video−mediated settings regarding discourse control, interactivity, shared attention, and the possibility to selectively attend to particular co−participants (1995:428).[2] Thus, a negative user attitude towards the medium stands in contrast to the above−mentioned lack of measurable differences in turn numbers, distribution and duration. Sellen's (1995:430) solution with respect to this discrepancy is that her findings call into question the assumption that measures such as interruptions, simultaneous starts etc. indicate problems in discourse management. Rather, she suggests that they are indicators for the degree of interactivity and spontaneity of the conversation: thus, the prevalence of overlaps in the same−room condition reflected the greater degree of interactivity as compared to VCs. She concludes that "the attenuation of cues through mediation leads to increasingly less spontaneous, more formal, and more socially distant discussions" (1995: 430). However, she assumes that "familiarity among participants could eventually override any distancing effects of the mediating technology" (1995:431). In line with this, Goddard (1995) finds that listeners of speeches held via VC state that it is difficult to sustain interest; lecturers, on the other hand, feel that the listeners are disinterested.

We can conclude then that although conversation management, ultimately, is not hindered by the medium video conference (even in situations in which temporal delay is involved do people negotiate a practicable solution), there are good reasons to assume that there are nevertheless negative consequences on the smoothness and interactivity of a conversation. This is true in spite of results in the literature showing the absence of

[2] It is important to note at this point that in neither of these experiments there was a time delay. Video and audio quality were good, so these factors can not have influenced the communication − unlike in our case described in the previous section.

differences, as evidenced by measurable cues, between various conditions, and it seems to be true even under conditions of unintrusive (without time delay and with high quality pictures) technical equipment. Thus, something inherent in the medium itself obviously influences the fluency and effectivity of interaction in a VC. To approach this phenomenon, we will now adopt another, spatial, perspective on the VC situation.

3.3. The Conversational Space

That space is an important issue in video communication has been generally acknowledged (e.g. Whittacker 1995, Sellen 1995, O'Connail et al. 1993). Sellen et al. (1992) developed for this purpose a particular system (*Hydra*) that accounts for the fact that speakers in real conversations occupy particular spaces by assigning a particular location to each participant as though they were sitting at a round table, allowing selective gaze. Sellen (1995) expected that the fact that people could attend to individual speakers, that attention to a particular speaker would be visible for all other speakers, and that also the different voices could be easily identified by the different directions they were coming from would have a great influence on discourse management. These expectations were not fulfilled, but in the questionnaire study, the users rated the *Hydra* system significantly better for speakers' knowledge about who was listening and paying attention. User satisfaction was also much higher for *Hydra* than for other systems. Thus, in spite of a lack of influence on the structural properties of conversation management, the spatial arrangement of the communication partners had some effect on the interaction.

One aspect in which space plays an important role in video mediated interactions is the relative distance between each other perceived by the interactants on the basis of the size of the image. This fact becomes obvious in the following request, issued in the first VC meeting that we have recorded:

> könnt Ihr Euch ein bisschen heranzoomen, dann muss ich nicht so schreien
> [*can you zoom a bit closer, then I don't need to shout so loudly*]

This utterance indicates that VCs constitute a very peculiar common space of interaction in which the size of the images transferred to the co−participants is interpreted in line with the spatial distance co−present people would occupy if their

images were perceived in this size. That means that communication partners appear spatially very distant in video−mediated communication if only small images of them are transferred.

Spatial distance however is directly correlated with social distance (Lakoff & Johnson 1981). For instance, many metaphorical expressions relate spatial distance to interpersonal distance: *a close friend, a distant relative, near to my heart*, etc.; evidencing the close relationship between these two domains.

Continuing this line of argumentation, also in the domain of discourse management itself spatial concepts are used. Thus, the turn−taking system (Sacks et al. 1974) has been described as a set of procedures to manage the conversational *floor* (e.g. Oreström 1985). That is, taking, holding or yielding the turn is often used synonymously with taking, holding or yielding the floor, *floor* being a spatial term used for the relative distribution of speaking time between the participants. The sheer fact that there is a system regulating the interactional space such that, for instance, usually only one speaker speaks at a time, and that turn−exchange is possible at every transition relevance place (TRP), that is, at the end of each turn−constructional unit, that these rules are generally attended to and can be claimed by the co−participants, indicates an interpersonal significance of floor distribution − the so−called cocktail party effect shows that more is at stake than that it is easier to understand each other if only one person talks at a time (cf. Clark 1996, Krauss & Fussell 1996).

Similarly, Fischer (2000) has shown how so−called turn−taking devices, such as *well, um, oh*, or *so*, do not, as it has been widely suggested (Duncan 1972, Oreström 1985, Schiffrin 1987, to mention but a few), function by supporting the turn−exchange system itself: the system functions perfectly without the use of particular signals (cf. Sacks et al. 1974). Instead, these devices serve to *motivate* the individuals' turn−taking activities by providing information about, for instance, why a particular speaker takes the turn. That is, speakers feel the need to account for their turn−taking activities, which shows that taking, holding and yielding the floor is interpersonally relevant.

Final evidence comes from effects reported by Meier, Herrmann, Hünecke (2001), Herrmann & Meier (2001), and Meier (2002) regarding the interpersonal relationship between the participants in video−conferences. They show that in video−conferencing

strange effects can be found such that people on each conference site develop feelings of solidarity at the expense of the other, distant, video−mediated group. These authors relate these effects to the fact that in situations of time−delay, the communication partners' responses are perceived as withheld as they are transmitted with delay, and that the spontaneous negotiation of attitudes in face−to−face communication is impossible because of the lack of time synchronisation between the communication partners. While these factors are very likely to have an effect, Sellen's (1995) and O'Connail et al.'s (1993) results indicate that the negative effects observed are not only caused by the time delay, but occur also in situations without any delay.

What is thus proposed here is that although the turn−taking strategies interactively developed under the new VC conditions may yield a structurally similar result with respect to turn number, distribution and duration, these strategies are nonetheless not functionally equivalent to turn−taking strategies observable in face−to−face conversations. The main difference lies in the way the common communicative space is divided up between the participants: In face−to−face conversation space is shared and divided into equally accessible portions that resemble an equal relationship between the participants. Exchange of speaker role is fluent and unproblematical, the fluency resembling the unproblematic interpersonal relationships between the interactants. In contrast, in VCs, the communicative space is not shared unproblematically, participants appear spatially distant, and the communicative floor has to be negotiated explicitly and with great effort, or even moderated. Thus, although effective, the turn−taking strategies developed in VCs do not regulate the interpersonal relationship between the participants in the same way as in natural conversation. The explicit procedures developed indicate a problematic, non−fluent relationship between the communication partners.

4. Conclusions

In this paper, we have demonstrated in an exemplary analysis how VC participants develop new interaction strategies to overcome medium−related communication problems. In spite of the fact that such strategies may ensure fluent discourse management, there are still negative effects on the fluency and efficiency of the

interaction, related to the interactivity, spontaneity, and informality (Sellen 1995, Goddard 1995) of the communication. Adopting a spatial cognition related perspective, we propose that such effects can be traced back to the specific spatial arrangement present in VCs, resulting in a disturbance in the representation and interactional negotiation of interpersonal relationships between the participants: no common interactional space is shared, video−mediated communication partners are represented as distant, and explicit regulation of the turn−taking procedures, as adopted by our VC participants (and reported in Sellen 1995), does not allow a similar unproblematic interpersonal balance as strategies available in face−to−face communication do.

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