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Changing face-to-face communication

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10 Conclusions

One can and must communicate; it is a useful and easy way to contribute to the peace of others and one's own, because silence, the absence of signals, is in its turn a signal, but it is ambiguous, and ambiguity generates anxiety and suspicion.

Primo Levi¹

The research that is described in this thesis goes into two major topics: one of practical nature and one of more methodological nature. The first topic had to do with the objective of the research: the development of two collaborative tools that facilitate face-to-face discussions. These tools mediate and regulate part of the communication so that it becomes easier for the group to elaborate on the knowledge that is shared by its members. A central question that guided the research was how that support should look like in order to be effective.

The second topic of methodological nature had to do with the research approach that provided us with the rationale to intervene in an existing learning situation in a scientific manner. The research that is discussed in this thesis was governed by a design-based approach. This approach can be characterized by the development of interventions that aim to improve a group discussion for the better. In our case, the approach exploits the design of a collaborative tool as a means to develop a deeper understanding of mediation and group discussions. The issue that we faced at the start was how such a design-based research approach will look like in practice.

Both issues are addressed in this concluding chapter. First, we reflect on the changes that have been observed during a discussion that has a verbal *and* a digital component. Next, we discuss our experiences with the design-based research approach.

¹ Primo Levi (1986). The drowned and the saved.

10.1 Mediated Face-to-Face Communication

In this thesis, we focused on small-group discussions in the classroom. These discussions enable students to develop a better understanding of the knowledge domain. A productive discussion in terms of learning outcomes puts some demands on the communication that the group has to display. The *first research question* (Q1) addressed this issue. In chapter 4, we formulated four criteria for a constructive dialogue. These criteria stem from prior research into group learning. These studies focused on performance differences and related these differences to group communication. The first criterion states that the communication must be oriented towards *effective task performance* because learning is associated with task performance. Secondly, the group members have to *participate fairly equally* so that they are able to share their knowledge with the group. Thirdly, the communication must be *coherent* in the sense that a contribution relates to other contributions. Finally, a discussion should show frequent knowledge *elaborations* whereby several speakers contribute to the discussion.

The teachers that participated in the studies reported that a discussion is sometimes controlled by one or more dominant students. In chapter 6, we argued that these observations were confirmed by previous research. The citation of Robert Bales (2002) at the beginning of chapter 6 makes this eloquently clear. *Interpersonal dominance* is one of the ineffective communication patterns that the *second research question* (Q2) aims to identify. The study in chapter 9 returns to this issue of control. Results from this study indicate that the direction of control varies from group to group. Interpersonal dominance could result in a discussion that is governed by interpersonal conflict, by unbalanced task-related communication or by a strong tendency to ask for help from the teacher. Characteristic for all these forms of an unbalanced discussion was that the sharing of knowledge was hampered.

We traced the issue of interpersonal dominance back to the way that the verbal exchanges are patterned. In chapter 6, we argued that frequent violations of the *turn-taking rule* – like interruptions or abrupt topic change – make a verbal discussion seemingly irrational. This analysis provided us with the ground for answering the *third research question* (Q3) that aims to indicate the relationship between the ineffective communication patterns and their underlying cause. The underlying cause can be

typified as an issue of coupling.

Coupling

Face-to-face discussions can be characterized by multiparty talk that is episodic in nature (Schwartzman, 1989). The episodic character implies that the utterances of the group members are only loosely coupled. A sequence of individual talk becomes a meaningful dialogue when the group manages to organize the exchanges into a comprehensible whole. A meaningful *verbal* discussion, for example, refers to the course of actions enacted through turns-at-talk to create coherence, order and meaning (Schegloff, 2007). Coherence, order and meaning should not be taken for granted. Group members have to follow certain principles and rules for *coupling* to make their individual actions into a productive discussion.

A central premise of this thesis is that each medium for communication provides specific rules for coupling. These rules do not only determine what can be expressed and how, they also affect the behavior of the group as an interacting system. In our case, we compared verbal communication with computer-mediated communication. The two modes of communication were associated with different rules for coupling: turn taking and adjacency pair for the verbal part of the communication and parallel access and global coherence for the computer-mediated part of the communication. This sets the direction for answering the *fourth research question* (Q4) that aims to find out how the collaborative tools change the group communication for the better. In chapter 6, we further specified this question by a set of expectations or hypotheses about how the face-to-face communication will change. These hypotheses guided the tool design.

Parallel Access as Floor-control Mechanism

The orientation taken by the research – computer-mediated communication that *parallels* verbal communication – provides an alternative perspective to the study of networked learning. Usually, educational researchers set face-to-face discussions apart from online discussions. The two situations are incompatible with distance as an essential characteristic. A number of studies compared face-to-face with digital communication (see e.g. Meyer, 2003; Jonassen & Kwon, 2001; Marttunen & Laurinen, 2001). This is mainly done at a general level: the two situations are described in general terms with access to information as the determining factor. Such a perspective was of no help in our case. The computer-mediated communication that is

described in this thesis is *also* face-to-face. So overcoming distance is not an issue for support. This drew our attention to the characteristics of face-to-face communication.

Face-to-face communication offers many opportunities for collaboration and learning. It has been with us from the beginning and it is something that we have in common with our closest relatives. Face-to-face communication among primates, for example, seems exceedingly complex: monkeys and apes *integrate* each message with previous and ongoing actions, so that not only the detailed structure of the call, but also its context contributes to the eventual meaning (Jolly, 1999). Still, as we stated in chapter 6, face-to-face discussions have some drawbacks that relate to the way humans communicate verbally. We argued that these difficulties could be traced back to the coupling of individual utterances to generate order, coherence and meaning.

We identified interpersonal dominance as an ineffective communication pattern that hampers the sharing of knowledge. This verbal communication pattern was further described by the rules that unify individual speech into a meaningful discourse. The rules for *sequential organization* that characteristic for verbal exchanges are turn taking and adjacency pair. Turn taking refers to the rule that only one person talks at a time and the frequent changes between speakers do occurs. Adjacency pair or “nextness” is a basic unit for sequence construction whereby the meaning of an utterance relates to the preceding utterance. This relationship is central to the ways in which *talk-in-action* is organized and understood (Schegloff, 2007).

Unequal participation

At the start of the research, we identified unequal participation as one of the drawbacks of a verbal, face-to-face discussion. Unequal participation means that not all the group members are able to participate fully in the discussion. Some group members have fewer opportunities to share their knowledge with the group. This hampers the performance because the group does not make full use of knowledge and skills available. We traced that communication problem back to characteristics of the medium, i.e. human speech. Unequal participation was associated with interpersonal dominance that manifests itself by talking out of turn. Talking out of turn was further described in terms of the turn-taking rule that organizes the sequence of *verbal* exchanges. A group member is able to control a verbal discussion by frequently taking the turn through interruptions, repeatedly taking turns and simultaneous speech.

The attention for turn taking as underlying cause brought us to “product

blocking”, another ineffective communication pattern that is associated with verbal communication. Product blocking refers the principle that only one group member speaks at the same time. This prevents other group members to share their ideas with the group. The delay that these members experience hampers the free exchange of ideas. An idea that is not verbalized directly will fade into the background due to a shift in attention or because the topic of the discussion changes.

The direction of change

We expected that parallel access as floor-control mechanism would counteract the negative consequences of interpersonal dominance and product blocking. Parallel access became one of the basic properties of the collaborative tools. Parallel access makes it possible to put forward a contribution without any interruption or delay because all the group members have unhindered access to the discussion. *We expected* that parallel access affects the process of control that has to do interpersonal dominance that emerges when a group collaborates. The study that is discussed in chapter 9 evaluated the effects of parallel access. The digital part of the discussion that uses parallel access showed an even pattern of participation. This finding indicates that the digital medium allows students to share their ideas freely with their peers. Parallel access changed the pattern of group communication in several ways: students worked at their own pace, they focused on a topic of immediate interest, and they expressed their thoughts without being interrupted.

Equal participation in the digital workspace did not expand to the verbal part of the discussion. Some group members who participated much in the digital part of the discussion, hardly contributed to the verbal discussion. Dominance was still clearly visible during the verbal discussion. From these findings, one can conclude that the medium reduces or stimulates certain individual behaviors on the level of the group.

Parallel Access and Global Coherence

Turn taking as floor control mechanism is closely associated with adjacency pair as unit for sequence construction (Schegloff, 2007). Adjacency pair works less well for parallel access because there is no clear time frame. Text-only communication like chat shows a high degree of disrupted adjacency, overlapping exchanges and topic decay (Herring, 1999). Online chat-rooms, for example, constitute a communication environment where these basic rules and assumptions of conversation do not hold (Greenfield &

Subrahmanyam, 2003). We observed the same problem. The study that is discussed in chapter 7 showed that the shared digital workspace became crowded with contributions that lacked a clear relationship. To solve this issue we developed some additional guidelines:

- a shared digital workspace that is divided into functional spaces,
- associate the functional spaces with a macro structures that is associated with the problem or the task, and
- the possibility to link a new contribution to a contribution that is already present in the shared workspace.

The three properties mentioned above are the *elementary sequential units* for the computer-mediated part of the communication. We *expected* that they would create coherence, order and meaning in a shared digital workplace. The properties organize a digital discussion based on a global structure of coherence. Global coherence refers to a *macro structure* that is based on topics or themes in a discourse (van Dijk, 1985). Such a macro structure was implemented in the collaborative tools whereby we took in mind that the digital medium had spatial properties. The two-dimensional character of the shared workspace was used to break through the temporal limitations of verbal talk. The digital communication does not only reflect a temporal ordering, it also displays spatial relationships that are based on a macro structure and graphical relationships:

- categories and connections for the Threaded discussion tool, and
- meaningful areas and for the Graphical tool.

The studies of chapters 8 and 9 show how such a macro structure affects the discussion. Several discussion lines occurred in parallel and most of them remained active during the whole discussion. These discussion lines addressed specific topics that had a direct relation with the macro structures, i.e. categories or meaningful areas. A *global model of coherence* – for example, various topics that are displayed by different categories – became more apparent. It seems that such a macro structure broadens up the discussion, i.e. they gave the students more freedom to follow their own lines of thinking.

In chapter 6, we explicitly distinguished local coherence from global coherence.

They are associated with the two forms of communication, i.e. verbal and computer-mediated. In practice, a verbal discussion also displays some form of global coherence. A problem-solving discussion, for example, usually follows a general sequence like problem analysis, idea generation, evaluation and selection. However, such a structure is not that self-evident as in the case of the collaborative tools where they are implemented as representational aids.

Mediated Communication as an External Representation

Licklider and Taylor published an article in 1968 that discussed the use of computers during face-to-face meetings. Computer support according to their view could help participants to align their mental models. This stresses the *modeling function* of the computer: the computer could be used as an “interactive, cooperative modeling facility” (Licklider & Taylor, 1968). The authors presented an example where a speaker shares more detailed information about the topic by means of the computer. Listeners who have a question can check that information without interrupting the speaker. The examples that Licklider and Taylor provided in their article differ from the kind of collaborative activities that has been addressed in this thesis. Still, the modeling function is an important aspect of the computer support. The students in our studies constructed a shared representation of their digital discussion that remained visible for the whole time. The contributions that are put forward in the shared digital workspace had a sense of permanence. As a result, they could be revisited continuously. The students frequently reflected on what was written down digitally. Their reflections about what they read in the digital workspace were done digitally but also verbally.

Task-related communication

Results indicate that only the task-related communication was represented in the shared digital workspace. This part of the communication mainly addressed issues of uncertainty that are caused by ignorance or imprecision of a shared interpretation. The information that was shared digitally enabled students to form a more precise interpretation.

The students worked relatively undisturbed within the digital workspace. They experienced less influence from their group members when they expressed their thoughts into words. Working with the collaborative tools seems to stimulate cognitive freedom *within* the context of the group. Consequently, the contributions that were

placed in the digital workspace diverged much more. This made the students aware of their differences in thinking. The group solved these differences verbally. One can conclude that “convergence of meaning” (Roschelle, 1992) happens verbally rather than digitally. The collaborative tool seems to be a less appropriate medium for the alignment of individual cognitive models into a group product. The tool stimulates differences in thinking but these differences are identified and discussed verbally.

Changing Group Dynamics

The different ideas that exist within a group form the basis of the collaborative learning. It creates a situation where elaboration, interpretation, explanation, and argumentation are integral to the activity of the group (Webb & Palincsar, 1996). The existence of different ideas does not necessarily mean that the group will assess their viewpoints critically. The tension between the individual and the group, between unhampered thinking and conformity may affect the learning potentials negatively. Beneath the surface of most groups flows an undercurrent that pushes the group together, towards greater consensus, uniformity, homogeneity or conformity (Forsyth, 1990). Janis (1972), for example, introduced the concept of “groupthink” for cohesive groups in a stressful situation who avoid disagreement and insufficiently use relevant information for decision-making. Groupthink promotes quick compromises in group decision-making (Hollingshead et al., 2005).

The collaborative tools keep the discussion open. The students become more aware of their differences in thinking. There is also a current in the opposite direction towards *conformity* that is visible in the verbal part of the communication. The group members align their cognitive models verbally.

A Concluding Remark

The design-based orientation of the research determines the process of fact-finding. It drew our attention to the communication problems that can be facilitated by a collaborative tool *and* that would improve learning. In that sense, we adopt a rather pragmatic approach. Theoretical insights were mainly used to set the direction for change. The quest for performance improvement led to adjustments of initial expectations. These adjustments made the tool more appropriate for its context of use. The research findings can only be placed within that perspective which makes any general conclusion conditional.

10.2 The Design-based Research Approach

In chapter 2, we presented the design-based research approach that guided the research activities. The approach exploits the design process as a means to develop an understanding of small-group discussions in the classroom. It involves systematically engineering a learning environment in a way that allows the researcher to improve and generate evidence-based claims about learning (Barab & Squire, 2004).

Practical problems *and* expectations about solutions are the basis for the design-based research approach. Communication problems are the immediate cause for research. Subsequently, the solutions for these problems are based on clear expectations about how the collaborative tools will change the pattern of communication. These expectations were presented as a set of hypotheses that describe the direction of change. They were translated into a set of empirical verifiable design guidelines that lay down the basic properties of the collaborative tools. These guidelines define the changes that the tools will bring about. Therefore, an evaluation of the collaborative tools becomes an evaluation of the guidelines, and hence an evaluation of hypotheses and the theoretical framework that constitutes the design. In practice, it took us a number of cycles of research to make the envisioned solutions more applicable. Initial research led to a refinement of the design and a readjustment of the hypotheses.

To summarize, the design-based research approach could be characterized by a process of understanding and integration. Understanding increases because the approach continuously connects problems with solutions, practice with theory and design with usage.

Three Different Research and Design Cycles

The research approach as it has been described in chapter 2 has a strong theoretical basis. The theory-based research cycle is only one part of the story. In practice, there are two additional cycles that emphasize the close relationship between tool design and practice (Figure 10.1). The three cycles are:

1. usability studies, and
2. a practice-based research cycle, and
3. a theory-based research cycle.

Usability studies

Several usability issues were addressed during the tool design. These issues referred to the ease by which the students used the collaborative tools. Usability included issues like the layout of the tools, information provided to the user, and the sequence of actions that users carried out. These issues can be very annoying for users. They may prevent the effective use of the tools. It meant that these issues were solved before any educational research could be carried out.

The usability studies took place before the collaborative tools were introduced in the classroom. Findings from these studies did not change the collaborative tools fundamentally. They led to improvements of the user-interface.

Practice-based Research and Design

The tool design was also guided by observations in the classroom that led directly to the specification of requirements. For example, the CoFFEE system has a Quick Communication Service to allow students to communicate with the teacher. The Quick communication service is a chat tool that enables students to ask questions to the teacher. This service mirrors a classroom activity: raising one’s hand to ask a question to the teacher. To conclude, some classroom activities were directly translated into an activity that is supported by the software system. This practice-based cycle is an

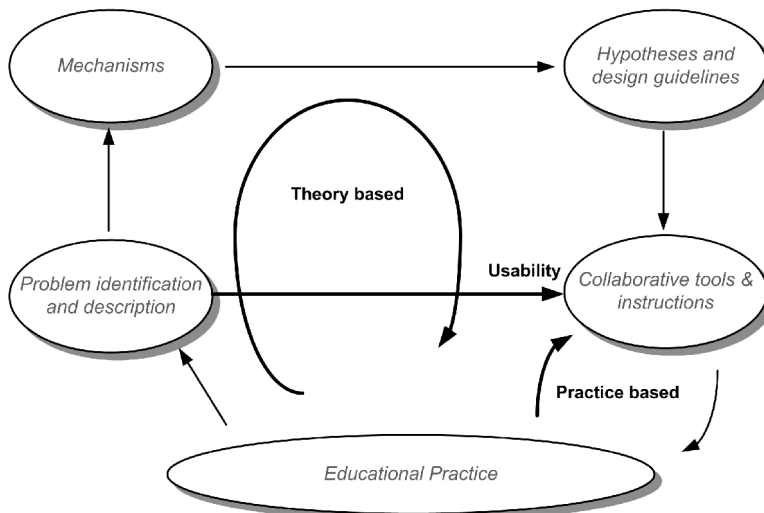


Figure 10.1: The three developmental cycles of the research approach.

adaptation of the initial research approach. It means that the robustness of the tools stems from: 1) theoretical framework that relates communication problems to solutions, and 2) empirical observations that directly fed back into the design.

Theory-based research and design

The design-based research approach can be typified as a modeling mode of inquiry in which theory, operationalization, and data patterns are treated simultaneously (Poole, McPhee & Canary, 2002). This mode can be contrasted with the hypothetical-deductive approach and grounded modes of inquiry. The hypothetical-deductive approach sets theory prior to data collection and hypothesis testing, and these steps are strictly separated. Within a grounded mode of inquiry concepts, hypotheses and theoretical propositions are generated directly from experience with the data (Poole, McPhee & Canary, 2002).

The role of theory

Scientific studies usually begin with a more precise specification of the problems that give rise to the research. These research problems can be internal to a theory and arise from criticism of that theory (Popper, 1999). This criticism leads to more fundamental research that aims to test the theory. The researcher formulates hypotheses or tentative answers to test relationships. These relationships are usually studied through experimentation where the researcher creates an artificial research environment. The researcher systematically manipulates some features of the environment and exercise great control on the other features. To test hypotheses, the researcher observes or measures the effects of the changes (Singleton & Straits, 2005).

In our case, the research problems were not associated with a particular theory but originated from practice. This had important implications for the research. We did not start with a clear theory from which we could generate research questions and that would guide the subsequent research activities. We did not opt for a normative approach that is based on a general theory about how students learn. Such an approach would deduce design guidelines from a general theoretical framework. Instead, we adopt a rather *pragmatic approach* that includes a search for theoretical insights that could help us to understand the communication problems that triggered the research. Theories, according to psychologist and philosopher William James (1907) become instruments, not answers. Theories operate at a *micro-level*, in the sense that they are used to *create* specific processes. They create the phenomena of interest, not simply

understand or explain them (Argyris, 1997).

Hypotheses

Hypotheses in the design-based research have a specific objective. They have less to do with a logical statement that is tested through carefully controlled experiments. Instead, the hypotheses indicate an expectation about a direction of change that is only rudimentary expressed at the beginning of the research. Research enables us to come up with more accurate expectations that display a deeper understanding of the phenomenon under study.

Characteristic for the research approach was that we did not focus on the artifact as a whole. Rather, the impact of the artifact was reduced to a limited set of propositions and hypotheses that lay down the relationship between the basic properties of the tool and their intended effects. Narrowing down the artifact to a limited set of hypotheses had strong implications for research. We carried out research on a micro level. We did not come up with extensive cases descriptions that gave a comprehensive account of the new situation. Rather, we restricted the analysis mainly to the communication processes and focused on the relationship between the two media and the communication that occurred in these media.

A concluding remark

When we look back at the beginning of the research project, we may conclude that we only had a rudimentary notion of how a collaborative tool could change the face-to-face communication for the better. That notion, incomplete but appealing, served as an important objective for research. A further elaboration of the initial idea made us aware that the reality of groups is much more complex. Our research can be typified by a constant struggle to master that reality. A clearly formulated research approach helped us to overcome these hurdles.