

## Title page

### Dialogue Design - With Mutual Learning as Guiding Principle

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# **Dialogue Design**

## **- With Mutual Learning as Guiding Principle**

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### **ABSTRACT**

The paper describes a large European R&D-project on Multimedia And Network In Co-operative Research And Learning (MANICORAL) from point of view of the participating HCI-researchers. The project developed the methodology of Dialogue Design, drawing on two sources: Participatory Design and Dialogue Research. Action Research is understood as the historical basis for the two strands, where Participatory Design has focused on research in working life, and Dialogue Research has focused on living conditions. However, Dialogue Design as a methodology differs

from the above in a number of aspects In Dialogue Design the carrying principal is mutual learning, focus is on working life of high resource groups, and these users are themselves developing parts of the technologies. The techniques applied and the role of the HCI-researcher as mediator creating fora for dialogues are introduced and reflected upon, and Dialogue Design is discussed within the theoretical concepts of communication and learning.

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## **1. INTRODUCTION**

MANICORAL (Multimedia And Network In Co-operative Research And Learning) was an international R&D-project, involving six European nationalities. It was organised as an interdisciplinary project with participants from four scientific disciplines: the Natural Sciences, the Social Sciences, Technology and the Humanities. The duration of the project was two years supported by the European Union's 4th Frame program: Telematics for Research (1996-1998).

The aim of the project was to develop a Distributed Collaborative Visualisation system (DCV) for a dispersed group of European scientists. The users were researchers from different disciplines within the area of Natural Sciences. The system developers were experts in visualisation and collaboration systems and the HCI-group had its background within the Social Sciences (sociology) and the Humanities (communication and psychology). With basis in the expert user group, this paper presents and discusses the perspective of the HCI-participants.

## **1.1 The Expert Users**

The users were a group of geophysicists investigating the use and exploitation of Radar Altimetry Data, and their project on Altimetry for Research In Climate And Resources (AFRICAR) was supported by the European Space Agency. The scientists were located in Holland, Austria, Italy, Greece and Denmark and had collaborated for many years through conventional technology and face-to-face meetings. Their research aim was (and is) to utilise methods of measuring distances from satellites to the ocean surface or to the ice surface. Change of the altitude of the ice cap may indicate climate change. Studying the variations of ocean currents and eddies may contribute to a basic understanding of climate change, and the observations are also used for calculation of the gravity field.. This is important for mapping resources, e.g.

oil and for understanding/predicting e.g. earthquakes. (Nielsen, Lindgaard, Dirckinck-Holmfeld, Vendelø, Danielsen & Georgsen, 1997).

Though all the domain experts were geophysicists, they belonged to five different research communities with each their individual expertise: theoretical mathematicians from Italy; specialists in ocean tides and circulation from Denmark; satellite position and orbit experts from Austria and Holland, the latter also being experts in computer generated scientific visualisations and imations (image and motion). Greece represented the community of application experts and a Danish University community supplied the gravity experts.

## **1.2 The Human Computer Interaction Group (HCI-Group)**

The HCI-group had a number of tasks in the project. One of which was to contribute to the development of a methodological and theoretical framework for investigating collaboration between knowledge workers in a distributed context. The group was also responsible for studying – on a long-term basis – the constitutive influence of the technology on collaboration, and on the local communities. The EU only supplied funds for two years of the initial four years of the project proposal. Due to the lack of funding, the project ended and the long term studies had to be given up although the core group of HCI-researchers (the authors of this article) have continued a low key research co-operation.

As the basis for the project, the HCI-group had the role of mediators. They were responsible for initiating interaction among participants, creating room for dialogue, ensuring procedures for collaboration and acting as scribes – keeping track of the development. The challenge for the HCI-researchers was, as indeed for all MANICORAL-participants, how to get this very interdisciplinary, inter-cultural,

international and distributed community - constituted by many different groups - to work together and to design a distributed visualisation tool. With such diversity not only between scientific disciplines, nationalities and cultures but also within the domain groups, it became essential to reach a common ground.

*Figure 1:* Illustration of the interdisciplinary and the international dimensions of MANICORAL

"FIGURE 1 INSERT HERE"

A multi-cultural project requires very careful consideration. Our concern was how to ensure co-operation and communication so that the participants would be able to work out solutions together, build on each others' ideas, become visionary and design together. But, more than anything, the important questions to be considered were how to ensure that they would:

- come to understand each other and develop mutual respect?
- come to trust each other?
- engage in mutual learning processes?
- share knowledge and understandings?

Looking back, it was a very complex process, like most large European design projects are. However, MANICORAL resulted in a first step in the direction of answering the above questions. The project became rooted in the methodology of Dialogue Design (DD) in which the carrying principle is mutual learning. In the

following, the methods applied will be introduced and reflected upon, initially by placing them within the frames of Action Research.

## **2. SETTING THE SCENE**

Action Research is traditionally traced back to the first half of the 20th century and to the classic organisation studies in the 20ies of the Hawthorne factories under Western Electric in Chicago. During the 2nd World War, the German-American social psychologist Kurt Lewin (Lewin, 1975) conducted Action Research in the U.S. on a series of projects on poor and minority groups. Historically, Action Research became connected with underprivileged groups. The research findings would (ideally) serve as basis for contemplation and actions of decision makers; politicians, managers, researchers, etc., and the aim was to improve the conditions of these low resource groups.

During the 70ies, there was a substantial increase in documentation of living conditions and we find a variety of approaches, from anthropologically inspired documentary studies of working life (Terkel, 1972) to action research documentaries (Herzog, 1972), based in, or inspired by, ethnography. Ethnography has also found its way into the Participatory Design tradition and has enhanced system development since the 80ies. (Blomberg, Giacomi, Mosher & Swenton-Wall, 1993).

The Scandinavian approach to system development has been dominated by Action Research methods since the early 70ies. The approach had its basis in the Scandinavian tradition of collaboration and negotiation on the labour market where goals were developed in co-operation with Union representatives. During the 90ies, new participatory methods have evolved focussing on the design of technologies that would respond to the lived practice of the users. Today, "developing with users" and



"knowing your users" are becoming competitive factors and ingredients in the business strategy. This is not only true for the new Web-industry, but also for IT-companies developing more traditional, administrative systems.

During the same period, there has been some major changes in the basis for design. The focus of the application has changed, and systems are not only developed to automate low-order skills and routine work. On the contrary, knowledge work is targeted and the aim is to integrate technology to support and develop complex and very advanced working processes. The business IT-strategy has changed, and systems which radically alter the structure and the organisation are being developed and implemented - a development which may result in radical changes in the value chain. The technologies have become more complicated and integrated. Stand-alone systems have changed into integrated, co-operative, distributed and networked systems. Simple text-based interfaces have become complex, multi-modal symbolic representations integrating multimedia and 3D, and as systems become more complex and complicated they require the inventive and the intelligent co-operation of the users.

Within the system design research community, this development raises questions about the methods which evolved during the critical era of Action Research and Participatory Design. Can the same methods be used when the overall aim for the work as well as the user groups (or domain experts) are changing? What can we bring with us from the history of Action Research and what requires further development? Which specific techniques and tools may be used, and equally important, how should they be organised? And how may we theoretically conceptualise the design methods we are using?

We try to deal with these questions based on the experiences gained in the MANICORAL-project. We do this by taking a closer look at the tradition of Action

Research in working life and in everyday life. This will allow us to determine the differences in:

- the roles of the action researchers
- the methodological approaches
- the roles of the participants

Based on the findings, we will then turn to the methodological framework and the techniques and tools used in MANICORAL. We suggest Dialogue Design as a unifying concept and approach, which reflects the needs of a project such as MANICORAL. The presentation of the methodological framework will allow us to describe the initial three phases in the project and the techniques and tools we applied to enhance dialogue. In a final paragraph, we will conclude by reflecting on and discussing the theoretical conceptualisation of Dialogue Design.

### **3. FROM ACTION RESEARCH TO DIALOGUE RESEARCH AND PARTICIPATORY DESIGN**

Action Research started in Norway and seriously gained ground in the Scandinavian research world in the late 60ies and early 70ies (Nygaard & Bergo, 1974). Through close collaboration, the method was adopted in other Scandinavian countries. Gradually, it became a refined and powerful political tool in the hands of progressive researchers co-operating with weak resource groups. Despite the fact that the borderlines are fuzzy, one could say that Action Research took two roads in the 70ies. One was Action Research in working life aimed at professional resource building (Bansler, 1987), and the other concerned broader aspects of living and working conditions of the workers. (Danielsen, Drewes & Nielsen, 1995)

### 3.1 Working Conditions

Action research projects with focus on work sites gradually developed the aim of empowering the workers, through education of the union representatives. The belief was that technology - if not based on critical reflections on consequences - would render the professional qualifications obsolete, and threaten jobs. Behind this approach of professional *resource building*, was the understanding that the workers could become qualified players in the technological power game if empowering their representatives through knowledge and understanding.

During this period of political awareness, co-operation between unions, researchers, computer scientists and students increased significantly. Unions funded research and supported a wide range of academic projects. However, many of the projects within the professional resource building strategy were defensive in relation to the impetuosity of data technology. Gradually, a new strategy of *alternative technology* evolved. The aim of this strategy was to develop tools for and together with the workers. The underlying agenda was technology design which would enhance the workers' professional qualifications and even enhance living conditions. In Great Britain, the alternative production as conducted by Mike Cooley, a former engineer at Lucas, became prototypical. In Denmark, the strong movements in alternative technology, e.g. the UTOPIA-project, where computer scientists and typographers worked together, are examples of this. (Cooley, 1987; Ehn 1988)

Prototyping strategies were developed and resulted in a close co-operation with users. This also ensured an offensive and critically constructive approach, and alternative technology became a transition concept from action research to *participatory design*. (Greenbaum & Kyng, 1991). During the 90ies, Participatory

Design went through several transformations, and one direction seems to be towards functionalistic action research, where the primary focus is on systems which "must" work. (Kensing, Simonsen & Bødker, 1998). This change is also due to the technological development from simple data processing to multimedia, netbased communication, etc. It challenges R&D within system development and design, where new methods for user participation, new tools and a new theoretical foundations have to be developed.

### **3.2 Living Conditions**

The basic approach in *Dialogue Research* appeared from a focus on, and belief in, a dialogue between experts and laymen at so called dialogue conferences. The laymen saw experts as resources. Through questions to and discussions with expert panels, the laymen would acquire sufficient understanding and knowledge to unfold their own recommendations to local politicians, administrators, governments, etc. concerning a given policy. The slogan was: This is much too complicated to hand over to experts. Future workshops (Jungk & Müllert, 1986) and scenario workshops were among the techniques used, and the laymen group was composed to represent the population of a given community: officials, politicians, citizens, school children, people from supply companies, entrepreneur enterprises and the financial sector, etc. (Ruus, 1984; Remmen, 1990).

The conception of the process was dialogue understood both as the fundamental tool, and as the process through which mutual understanding can be reached. The role of the researcher was to act as midwife for the process, to help with co-ordination, to set up dialogue workshop and communicative ethic rules so that the participants could

discuss and negotiate between them. S/he also had to act as a critical partner (expert) in the project but without taking control.

Dialogue Research as a method is also embedded in *proactive technology assessment* - not as a traditional product evaluation but as a dynamic process assessment taking place during the course of a project. This implies that the researcher is in a continuous dialogue with the acting participants, and it also includes a continuous presentation and discussion of findings to ensure that the acting participants are able to influence and guide the process. The locus of control and of influence is in the hands of the acting participants. In Denmark, the production of windmills can be seen as a very concrete example of proactive technology assessment. It has become a profitable business and has developed a stronghold position on the world market.

A dialogue researcher does not participate in the experimental work but observes the processes and reports the observations to the actors - as opposed to the action researcher who takes action together with the actors. One could say that the role of the researcher is that of a scribe keeping record, and that of a storyteller recounting the ongoing process. This is the very essence of Dialogue Research. The methodology was, however, also a deliberate attempt to mark a distance to the critical action research, which was criticised for being too little research and too much action (Aagaard Nielsen, 1996). Setting up fora for dialogues and acting as negotiator for the different interests within a project became a task for the researcher. In this work, the ethical principles of discourse in *Communicative Actions* (Habermas, 1991), became the epistemological inspiration for the approach. (Duelund, 1991).

*Figure 2:* General outline of the development of Action Research from the 1970ies to the 1990ies.

"FIGURE 2 INSERT HERE"

Figure 2 illustrates the two directions of Action Research in the early 70ties and how the two strands: Participatory Design and Dialogue Research have developed and have been brought together again in Dialogue Design in the late 1990'ies. (Danielsen, 1997).

In MANICORAL, the process of developing and testing tools and techniques which would enhance dialogue and mutual learning alternated in a dialectic process with the development of the methodological framework of Dialogue Design. In this paper, we have chosen to communicate this very complex process by introducing the methodological framework of Dialogue Design which also embeds the principle of mutual learning. This presentation will allow us to move directly to the description of the three phases and to the techniques and tools applied during the course of MANICORAL.

#### **4. DIALOGUE DESIGN**

As MANICORAL evolved, it became clear to us that in order to open for and enhance co-operative processes, we had to put special effort into the communicative acts and into the processes of mutual learning among participants. It had to be reflected that the project represented a special kind of action research due to the fact that:

- It was a truly international, inter-cultural and interdisciplinary project between equal groups

- All participants were knowledge workers and high resource groups with regards to educational and technological skills
- The design should support the practice of researchers from the Natural Sciences collaborating on complicated research - and themselves being expert programmers

Our answer to this diversity became methodological – drawing on Participatory Design (PD) and Dialogue Research (DR). In DR, it was the fundamental understanding of *dialogue* as a dynamic process unfolding during the course of a project which became essential for the communicative actions and for experimenting with different prototypes in MANICORAL. In PD, the aim of understanding practice is fundamentally tied to informing and creating *design*, and to do this together with users. This understanding became essential with the aim of developing a DCV-system together with expert users. The approaches were further enhanced through our focus on *mutual learning* as a necessity in a multi-cultural group. The unifying concept - which also became the methodological frame - was Dialogue Design (DD) and the techniques and tools evolved from the day-to-day work in MANICORAL.

However, the methodological framework of DD differs from the above in a number of essential ways. Where Action Research historically favoured the underprivileged groups, DD has to support knowledge workers. As domain specialists, they are high resource groups (regarding educational level, technical skills, job positions, etc.), and are themselves developers of new technology – they have a history of writing their own software. They are not “typical” users. On the contrary, there was a symmetric relation between all the actors involved in this design process: The users, the HCI-researchers and the technical experts. They all had academic backgrounds and were involved in research, and they were all experienced users of

technology. Besides, they had defined the project, joined it by own wish and received economic support to cover part of their participation.

The implication of the above statement is not that only academic players may participate in Dialogue Design projects. Our understanding is that a methodological framework may serve many different projects but the techniques and tools must be iterated through careful understanding of the client, the users, the organisation, the task, etc. And sometimes the understanding acquired may lead to refutation of the framework. There is no "one-size fits all". Projects differ significantly, users differ significantly, clients differ significantly, the conditions under which the system is to be developed differ significantly, the economic situation differs, etc. Each new system project requires careful reflection and investigation before decisions are made and the decisions cannot be final. The process is iterative, participatory, and the aim is a functional and pragmatic design which responds in a visionary way to the daily work practices of knowledge workers.

#### **4.1 Dialogue - A Mutual Learning Process**

The concept of dialogue is, like the concept of Dialogue Research borrowed from Jürgen Habermas and his theory of communicative action, (Habermas, 1991). The communicative action is understood as a true dialogue between “rational arguing” participants in terms of *comprehension, truth, rightness and trustworthiness*. Ideally, there are no hidden agendas, and the participants meet with open minds and with the understanding that the best argument will win.

*“The concept of communicative action refers to the interaction of at least two subjects capable of speech and action who establish interpersonal relations*



*(whether by verbal or by non-verbal means). The actors seek to reach an understanding about the action situation and their plans of action in order to co-ordinate their actions by way of agreement (ibid. p.86).*

*.... An actor who is oriented to understanding in this sense must raise at least three validity claims with his utterance, namely:*

- *That the statement is **true** .. and that the content mentioned is in fact satisfied*
- *That the speech act is **right** with respect to the existing normative context ..., and*
- *That the manifest **intention** of the speaker is meant as it is expressed" (ibid. p.99, our accentuation).*

The ideal communicative action requires that the dialogue process is a learning process. In a "true" dialogue, participants will challenge each other's fundamental understandings of truth, norms and trustworthiness, because of conflicting perspectives and experiences. As such, dialogues are the means to rearrange, renew, and reorganise fundamental assumptions. Learning is therefore fundamentally embedded within communicative actions.

*"The concept of argument is closely connected with the concept of learning .... Rationality is only rational as long as it is not coupled with the ability of learning from mistakes, learning from the confutation of hypotheses and the failure of interventions". (Habermas, without year, p. 44, own translation).*

This implies that when participants challenge each other's basic understandings through various dialogue techniques and reorganise the fundamental assumptions and

perspectives, then mutual learning takes place. Mutual learning is therefore the other key concept in Dialogue Design. Argyris (Argyris, 1977) makes a distinction between single loop and double loop learning, which seems to correspond to the distinction Piaget (Piaget, 1992) makes when he speaks of assimilative and accommodative cognitive processes. Single loop learning and the assimilative cognitive process means that the learner adjusts and corrects, yet does not challenge her/his fundamental understandings. Instead, new information is transformed and fitted into already established schemes and understandings. Double loop learning and accommodative cognitive processes, however, truly challenge the established understandings, and change the learners' basic assumptions. Thus existing schemes and understandings are accommodated to fit the new insights. Moreover, double loop learning and accommodative processes embed the cognitive qualifications, which make critical reflections (and self-reflection) possible. Here, we enter into triple loop learning which may be explained as thinking about thinking. Where single loop learning is reflection *in* action, double loop learning is reflection *on* action and triple loop learning is reflection *on reflection* on action.

*Figure 3: The triple loop learning model*

"FIGURE 3 INSERT HERE"

Dialogue Design, as a method, aims at double loop and triple loop learning processes. The ability to reflect and accommodate own understanding and goals in the project to those of the other groups has already been pointed out. But also the ability to reflect on own scientific understandings and Weltanschauung - triple loop learning

- is a must in multi-cultural projects like MANICORAL. The participants came from eight different countries, they each had their own language, cultural heritage and customs. At the same time, they carried with them the very different understandings and world views embedded in their scientific disciplines. Accommodation to new insights as well as meta-reflection was necessary if the project was to succeed. But triple loop learning processes were also required because the design had to be oriented towards an unknown future - towards that which is not. It had to be visionary and the challenge was to re-assess the conditions for the design, to imagine what did not yet exist and to adapt to new ideas and visions.

## **5. PRACTICES**

With the presentation of the methodological framework on which the work of the HCI-group became based, we now move into describing how opportunities for dialogue, interaction and mutual learning processes were designed in the project. We do this by providing a general introduction to three phases in the project and by presenting different techniques applied during the different phases. Methodologically, the projects may be divided into three practice phases:

- Ethnographic and qualitative methods to *understand practice*
- Constructive design methods in order to produce a *vision for practice*
- Negotiation of design options in order to reach *decisions about practice*

### **5.1 Understanding Practice –Baseline Data**

The design of the DCV-system had to be closely integrated with everyday research practice of the domain experts, and had to build on their experiences.

Requirements must derive from a deep understanding of practice and this understanding cannot be acquired primarily through detached contemplation. To acquire understanding of life, it must be lived and experienced before its depths can be contemplated. This is the essence of the ethnographic approach (Høystrup, 1983), which has also found its way into design, where a general framework served as inspiration for our work (Blomberg et al., 1993; Trigg, Anderson & Dykstra-Erickson, 1993). This was elaborated with a critical hermeneutic approach (Nielsen, Dirckinck-Holmfeld & Vendelø, 1996) because doing research, not merely through detached contemplation but also by living life, means that we, as researchers, are emerged in interpretative work. Designing investigations, applying theory, collecting empirical data, and expressing them in symbolic representations are all processes of interpretation. However, interpretations need to be made objects of detached contemplation and critically reflected upon, and methods and techniques for validation must be applied.

The field studies were conducted using different techniques such as field observations including video recording, still life photography transformed into photojoiners, informal interaction techniques, semi-structured interviewing techniques and document collection and analysis. The focus was on the following activities and practices:

- Mutual interviewing among all participants on the understandings and goals related to the project
- Field studies of daily practice in the different local research communities within the AFRICAR-community
- Studies of physical meeting cultures in the AFRICAR-community
- Studies of virtual meeting cultures in the AFRICAR-group mediated by CSCW-tools

- Mind tapes to reflect on the experiences from and the observations of the virtual meetings
- Mutual teaching sessions

To enhance mutual learning and dialogue, the study results were reported to the participants in the project using various dissemination techniques: presentation and discussion of data at project meetings, discussion sessions where video sequences from virtual meetings were replayed for the user group, and finally, mind-tape sessions with users (Nielsen & Christiansen, 2000). The function of these were to enhance understandings, to validate or refute interpretations, and to help identify communication problems and co-operation needs.

These baseline studies contributed to an understanding of:

- the other participants' motives and goals related to the project
- the different cultures among the main groups in the project
- the potential conflicts and interests in the project

The studies also fertilised the ground for the growth of:

- trust and respect for each other
- establishment of a common ground between the participating groups regarding ways of working and main methodological approaches
- evolving consciousness and acceptance of the scientific and cultural differences in the groups

Finally, these techniques also contributed to:

- a grasping of the experiences of the domain experts

- a transferral of requirement captures from the domain specialists and the HCI-researchers to the system designers
- the evolving of a mutual learning culture based on an interest in learning from each other

A central task was transferral of requirements. We found that video techniques may be used constructively and push transfer between the users, the HCI-specialists and the system developers and programmers. (Dirckinck-Holmfeld, 1997).

Traditional requirements capture is focused on validating and documenting the existing practice in written documents. However, video recordings may be used as documentation and as material for communication, and as “teaching material” regarding critical design issues and may also be used to create stories and scenarios for design. For the time being, these possibilities have not been further explored and documented but it is quite clear that visualisation enhances understanding and easily promotes discussion of critical issues.

## **5.2 Visionary Practice – Forays of Dialogues**

Developing a CSCW-tool and a DCV-tool for a group of domain experts means developing for an unknown future. Rich visions about that future are important, as there are no straightforward solutions. Therefore, a number of scenarios was constructed. This scenario process continued over time allowing for more focused visions of the domain experts. The process of working with scenarios is very essential as borders of the possible/impossible in technology are pushed and the visions also gain by gradually becoming clearer.

Requirements capture without opening for visions among the domain experts may result in requirements that are too conservative. As such, we see the HCI-researcher as a sort of change-agent, and the approach as basically a change-methodology - changing the present for a possible future.

In order to be able to produce rich visions and to share the visions in the group, we used different techniques:

- Mind mapping (used in the initial phase of conceptualising the project)
- Mutual interviews in order to grasp the dreams and visions of all the participants
- Future workshops to formulate the first visions for the project
- Training sessions to learn about the possibilities within the new technologies and to learn about human communication and collaborative strategies
- Experimental sessions: implementing and trying out the CSCW prototype with the users in their natural research setting
- Scenario design sessions

These visionary practices contributed to an understanding of:

- the many different visions for the project
- the different expectations to the future collaboration among the local user groups
- the difference between virtual and physical face-to-face interaction

The studies further enhanced the growth of:

- "Wild" ideas
- Trust in and respect for each other
- The common ground between the participants and the diversities
- The accept of different priorities and different interests

- The willingness to compromise and to fight

Finally, the techniques also contributed to:

- the opening of discussions among the domain experts regarding different kinds of co-operation (conveyer-belt as opposed to dialogue)
- narrowing in the ambitions for the entire project
- closer collaboration between users and technicians
- the continued evolvement of the mutual learning culture

### **5.3 Decision Techniques – From Requirements to Specification**

In the MANICORAL project, we wanted the requirement specification to be a result of a mutual dialogue between the different actors: The HCI-group, the users and the technical experts. In other words, the specification really had to be a melt between the different perspectives and possibilities but with the users' needs and visions as a driving force. This was a very difficult process. We were dealing with very sophisticated choices to be made between different groups which were experts in each their field: in communication and co-operation, in the geophysical domain, and in CSCW-supporting technologies. Each group had acquired profound knowledge within their field, and were able to point to problems and suggest solutions. But they needed the knowledge of the other groups in order to come up with really viable solutions. Hence none of the groups were in a position where they could make decisions independently, or on behalf of the others. The choices to be made had to be founded on “the better argument”. In order to assist that process, we were inspired by different approaches to decision making (Enderud, 1976), and the basis became:

- Reports and analyses of findings



- Participatory design sessions building on scenario design
- Dialogue and decision meetings

The overall aim was to implement some techniques and tools in the design and in the development process, which supported all the participants in the central decisions regarding the project. Different techniques may be used to throw light on which decisions to be made but they also offer alternative ways for making decisions. Our participatory approach ensured that the design reflected the experiences, the visions and the needs of the domain specialists and that the solutions were worked out together across disciplines with due understanding of the communicative needs in a virtual co-operation and of the limitations that technology imposes.

The most important tool was the participatory design sessions building on scenario design (Carroll, 1995). The point of departure was general scenario descriptions of typical collaborative sessions. These descriptions were developed from the empirical analysis of physical meetings, from interviews and field work, from the imaginative visions produced, and also from the analysis of virtual meetings. A typical scenario was drafted and then iterated a number of times in close collaboration with the domain experts. Once there was agreement to the general scenario, it was analysed for more specific design implications.

One focus point in the decision process was: Communication and Co-operation. Should the design be such that speaker control was in the hands of the host of a meeting, or were other solutions possible, e.g. developing a new meeting culture among the AFRICAR-researchers, with new ways of interacting? Should the design allow for all participants to be able to change a shared image or should it only be the owner of the document? Scientific aspects were also essential issues in the design decisions, e.g.: What was the consequences of not being able to share hand written

mathematical notations. And finally, also technical aspects were in focus, such as: Was it possible to develop the system in such a way that the DCV-tool was seamlessly integrated with the different databases to which the geophysicists needed access?

These data together with the general scenario were then divided into design issues, which were presented at a design workshop where the participants discussed possible decisions in interdisciplinary groups. The decisions of the different groups were presented and discussed at plenary sessions, and general agreements concerning the design were then taken.

The data material was handed over to the group in charge of the development. This group consisted mainly of system developers and programmers but two geophysicists from AFRICAR and two HCI-people also participated and met on regular basis to discuss progress and problems (Nielsen & Lindgaard, 1997). This approach allowed for very visionary wishes to be juxtaposed with actual practice and related to virtual experiences and equally important to the technological possibilities and constraints.

The above mentioned types of methods and techniques (Nielsen, Dirckinck-Holmfeld & Vendelø, 1996) made up the basic structure within Dialogue Design. To the HCI-researchers, the richness of techniques and tools as well as the way in which the methods were structured were very productive for a visionary design. The richness ensured that a phenomenon was worked upon from many angles but built on the experience of the domain experts. However, the different communication techniques also challenged the domain experts on how to communicate and collaborate and this stimulated an expansion of their ideas and visions for the distributed collaborative visualisation system (DCV). Sometimes far more than the system developers could technically comply with.

Before we move on to the discussion and contemplation of our methodological framework, we want to give an example of how dialogue and mutual learning constituted the basis. The following account is drawn from the initial phase of *understanding practice*, and we describe the creation of a forum for mutual learning processes based in the communicative act.

## **6. MUTUAL INTERVIEWING AS A TOOL FOR DIALOGUE AND LEARNING**

The beginning of the MANICORAL-project was an invitation to a meeting to four research communities (Natural Sciences, Social Sciences, Humanities and Technology). They all sent members to participate in a two-day workshop, the aim of which was to explore the possibilities for a joint CSCW-project, and the possibilities for establishing funding within the EU (European Union, R&D-programs). Through presentations, and by using Mind Mapping as a tool for generating ideas and extensive discussions, the project was conceived, and a rough framework defined. A committee with representatives from each of the four sciences participating was then established and was responsible for writing the proposal. They were also, each of them, responsible for updating and discussing the progress of the proposal within each their research community.

Once the proposal had been sent to the EU, there was a long waiting period and many of the reasons for the finer arguments or specific paragraphs put forward in the proposal were forgotten. Also the technological development and the research within the different scientific groups had developed in different ways, and many things had changed. When the invitation to go to Brussels to meet with the EU-officers finally

arrived, more than a year had passed since the initial workshop. At the meeting, the EU reduced the project costs with 50%, and the project proposal had to be rewritten and changed into a contract – in accordance with EU-regulations for R&D-proposals under the 4<sup>th</sup> frame program.

The contract was eventually signed, the administrative procedures implemented at all the participating institutions, and the project could finally begin. But, by now, more than 18 months had passed since the workshop where the project was conceived and the engaging project description had been reduced to a contract of formalities – unrecognisable and incomprehensible to many. Even the authors of the proposal were in need of re-interpretations in order to understand the text. Besides, the local research communities originally participating in the initial conceptual phase, were “the old boys and girls” who all knew each other. When the project started, however, newcomers, PhD-students and assistant professors, had joined, neither of who had participated in the conceptualisation phase.

The HCI-researchers' solution to this diversity was to start off the first meeting by asking the participants to interview each other. First, the members from each of the four research fields worked together on their understanding of the project, and on specifying what they were going to do in the project. Then the disciplinary groups were split up and interdisciplinary groups were formed. Each researcher now represented his/her research field and the task s/he had was to interview the other representatives regarding their understandings of and their goals related to the project. Finally, the interdisciplinary groups had to reach an agreement and present their definition of the project and common goals and goals of local groups at a plenary session.

Though the HCI-researchers expected some degree of diversity, the extent of the diversity came as a surprise to everybody in the project. However, the exercise proved

essential for getting the participants to participate in a dialogue about the specifications in the contract, their perception of the project goals, related to those of their individual research groups and to the goals of others. The discussions and reports immediately made it clear that a balance had to be reached and identification of common tasks and goals became a must. But more than anything, the interdisciplinary mutual interviewing and the process of prioritising ensured that all participants became aware of the importance of listening to the others, of asking questions and of following up on answers in order to ensure constructive thinking in MANICORAL as a whole, as well as within individual groups. The important goal of the exercise was to demonstrate the diversity and to assist the first steps towards developing common ground and to allow for the development of ownership.

This technique applied at the very first meeting also set the agenda for the following meetings. Though we did not initially realise the cultural impact of this technique on the project, it quickly became an accepted approach that extensive dialogue and the need to listen carefully to the others was the way of reaching agreements in MANICORAL. This is not to say that the process was easy and smooth, on the contrary. Listening is not the same as understanding, and the second approach in the project, that of mutual teaching almost suggested itself. Creating forum for the different groups to "teach" each other, to present their research, to explain to others the what, why, how of their field, and to discuss with researchers from other disciplines established a space for learning in the dialogue. .

## **7. DIALOGUE DESIGN AS MUTUAL LEARNING – SUMMING UP ON THE PRINCIPLES**

On the basis of our experiences gained in the MANICORAL-project, we can summarise the principles for Dialogue Design in the following statements:

- The fundamental tool in DD is the dialogue and a basic competence within mutual learning
- DD is fundamentally a mutual learning process between equal professional groups who have distinctly different tasks to perform and different roles in the design project
- DD, at present, focuses on the following three phases: 1) understanding practice, 2) create visions for practice 3) negotiate decisions about practice
- Communication, learning processes and decisions take place within a field of many different life worlds and practices. This complexity of cultural, scientific and methodological differences should be thematically approached during the design process
- Dialogue is not only about finding the “common denominator”. The process must be critical of the system and self-critical in relation to own practice
- The communicative process demands that fora for dialogue and mutual learning processes are constructed, and multiple communicative codes are ensured enough space

Participating in an R&D-project, where dialogue and mutual learning processes are the fundamental principle, challenges the HCI-researcher. In the design process, the role of the HCI-researcher is, generally speaking, to act as midwife for the complicated process of communicative action and mutual learning. The HCI-researcher needs:

- to establish different types of fora for dialogues and mutual learning using different modes of communication and interaction

- to have a deep understanding for different discursive communities
- to seek a mutual understanding of the design by trying to capture the “ways of reasoning” behind the competing views – without devaluing or excluding a priori
- to acquire insight into the task domain
- to establish communicative legitimacy to reconstruct and to present the interests of the different partners
- to be able to mediate the negotiation process between conflicting interests

## **8. REFLECTIONS ON THEORETICAL FRAME**

The principle of Dialogue Design is an ideal. It is based on the normative premises that it is possible, through the ideal of communicative action, to critically process and exceed the power relations and cultural boundaries that exist in interdisciplinary, intercultural, cross-national, cross-generational and cross-gender groups as in MANICORAL. Or to voice it differently: Because of the heterogeneity of the project it is essential to focus on the dialogue and the conditions for mutual learning in order to bring out new design. But it is very hard work to reach design agreements.

The basic premises for Habermas' dialogue and learning concepts is rationality, as the organising principle in the communicative action. To a large degree, we accept this ideal as it points, in its utmost consequence, towards a vision full of hope. The better argument takes precedence and a future of peace, a society where dialogue, not war and weapons, is the tool for solving conflicts truly shows a (very high) level of cultural development. However, every day reality – also Dialogue Design processes–

show that this is a very idealistic approach. People are not always rational, they have different agendas, they are also emotional and they react in affective ways. Besides, the conditions for communication without domination are not often present. In the case of MANICORAL it was, however, necessary to establish an ideal about communicative action. Partly because research is about seeking the truth, and partly because of the *very interdisciplinary* nature of the project: How can we decide between the different interests in such a project without leaning on the better argument?

In Habermas' communicative action, the basis is the rational discourse in which explicit verbalisation is embedded. However, in DD, the visionary work is important: to imagine the impossible. In order to come up with something really new, one has to move beyond the structuring rationality and the rational use of language. One has to open for other ways of seeing and discovering - one has to allow for the “wild” imagination and for the tacit knowledge to take over, and not be constrained by symbolic representations such as language (Nielsen, 1996). As a consequence, the communicative dialogue is in itself insufficient. Other ways of knowing (Polanyi, 1968) and a multitude of communicative forms must be included when dialogue researchers wish to construct dialogue workshops that may open for new possibilities and “move” the design process. In the methodological frame in DD, we have taken this into consideration in several ways. We have worked with vision techniques, used different aesthetic and kinetic communications means, used photography as a way of documenting cultures. We have "mis-en-scene" non-verbal interactions among participants as a tool for creating awareness and used cartoon drawings as a way of explaining things, which could not otherwise be made explicit. However, it is beyond the scope of this paper to document all the techniques, this is for future work.



## NOTES

*Acknowledgement:* In the beginning of the project, the technological experts from Rutherford Appleton Laboratories sweetly pointed out to us that “these projects always end in tears”. Yet, we never cried. By the end of the project, the geophysicists pointed out – with a warm and apologetic little smile - that the project had taught them that “what social scientists and humanists do is also science and research”. In return, we thank you all for opening the wonderful world of your scientific fields for us, for the good dialogues, the good fights, the patience and the many laughs – we could not have wished for better partners.

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figure no. 1

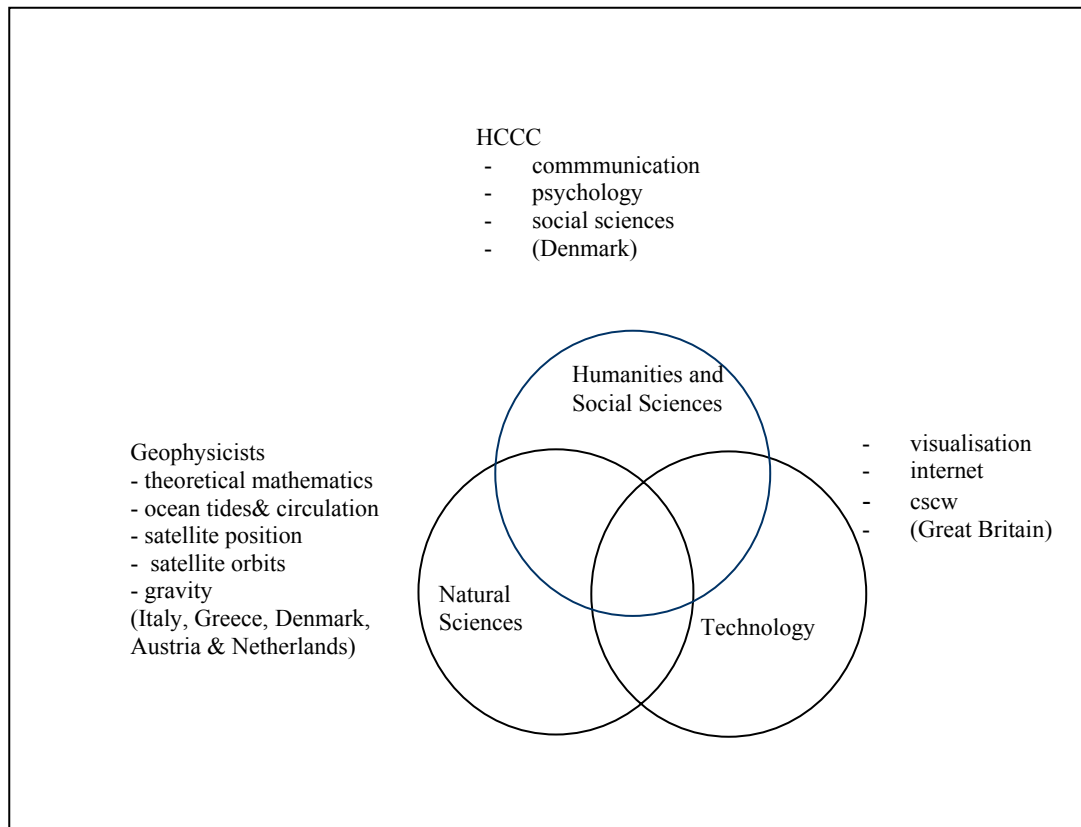


Figure no. 2

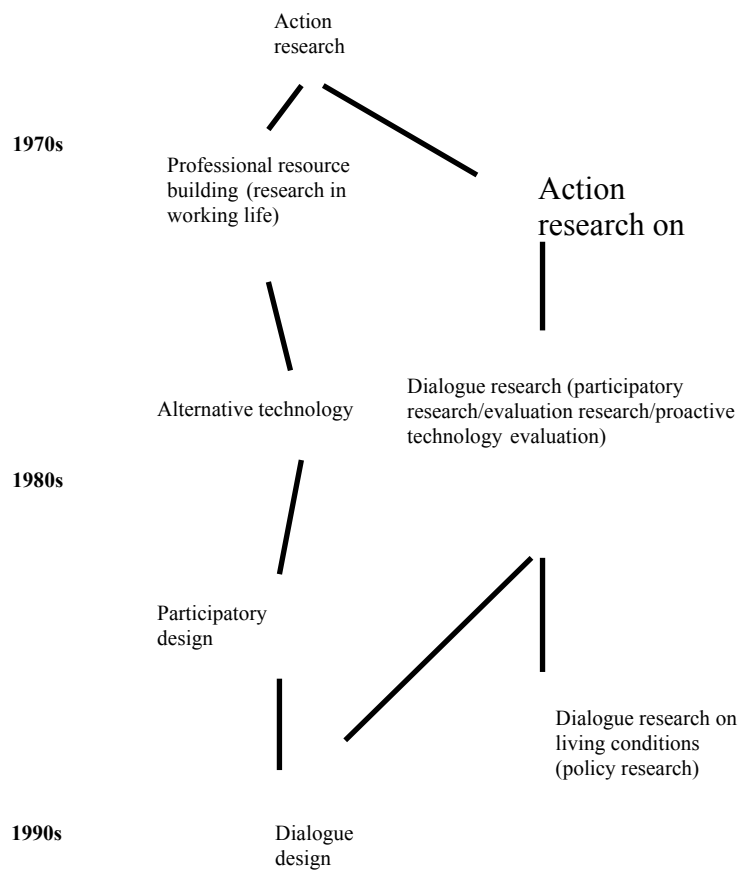




Figure no. 3)

