The Art of Second Thought

- Communication and Cooperation Framework for European Research Project and FLE Research and Design Team

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This final thesis project deals with creative work in groups and teams. The context where the design work has been carried out is a large European research and development project and one research and design team working in the project (FLE team). The work presents design solutions for communication and cooperation of these partially overlapping, communities.

The theoretical framework of the study is based on philosophy, sociology and psychology emphasizing communal working and problem solving in creative processes. The theoretical framework is setting aims for the ways of working, which the communication and cooperation tools should offer for the users.

The work introduces some traditional methods of creative working. These traditional methods have guided the design work and can be recognized from the later solutions.

The methodological approach of the design work is based on action research and participatory design relaying on qualitative interpretation of the research groups and teams working activities. Most of the design work has been carried out in a dialogue within the group and team.

The main design solutions for the European project's communication and cooperation framework are a combination of web-based, email and shared virtual workspace -tools, and processes designed for the project. The solution for the research and design team contains several online tools, as well, and physical spaces for communication and cooperation. Especially in the case of the research and design team, the shared processes and physical space have been seen as crucial component for creative working. Furthermore, based on the traditional methods of creative working, one design concept, called Mobstorm is introduced to complement and show some further directions in the area of combining mobility and computer supported collaborative creative work.

Keywords: computer supported collaborative work (CSCLW) and learning (CSCL), group and teamwork, creative work.
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1. Introduction

1.1. Background

This study report describes my MA in New Media final thesis project carried out in the UIAH Media Lab’s Learning Environments for Progressive Inquiry research group. This research group carries out research, design and development in the use of New Media in the field of human learning. The main focus of the group is to explore new and alternative learning methods and practices responding to the challenges of information society. Within the new methods of learning the group has been designing and developing an Internet accessible groupware called Future Learning Environment (http://fle2.uiah.fi) designed to support collaborative knowledge building\(^1\) and progressive inquiry\(^2\).

During the last two years I have been working as the team leader (with the official title of project manager) of the Learning Environments for Progressive Inquiry research group. My main job has been to tutor highly talented, creative and skillful individuals that work in the projects set-up by the research group itself. The group has always been highly self-organized, setting up its own aims and ways of working under supervision of the Research Board and the Director of the Media Lab. With a background in Educational Sciences my attempt to lead and guide - two to six (depending on the time) - young experts coming from different fields such as design and software engineering has been a major challenge.

My leadership strategy within the research group - based on my personal beliefs that all humans are fundamentally rational and have good will - has not always been successful. The group has suffered many frustration and problems related to partnerships, team members’ personal mastery and lack of resources. However, our research group has been doing well enough to keep itself able to continue its work and to get further funding year after year. As trying to be rational and one with a good will myself; I have tried to create an environment that encourages the team members to constantly find out and develop new ways of working.

\(^1\) Knowledge Building will be discussed more in the Chapter 3.5.
\(^2\) Progressive Inquiry is a pedagogical model for conducting scientific inquiry in schools. Progressive inquiry is a sustained process of advancing and building of knowledge characteristic of scientific inquiry (Lakkala, M., Hakkarainen K. 2001)
My final thesis project was based on the aspiration to develop our research group’s ways of working. While working with this final work I have noticed that it is also related to a wider context than just how creative research and design group could do a good job, enjoy their work and possibly do things more efficiently. This wider context includes such major questions as the direction of information society, the development of civil society, how a person could be more free and full human and, how do we and others value our work?

This final thesis project was also inspired by the discussion on creativity carried out mainly in the late 1990’s literature and writings of management, organizations and human resources. In these writings creativity and innovation have been seen as one of the main forces of the so called New Economy and information society. In the United States of America, creativity in the context of new technology and economy has even been one of the main themes of several relatively successful new business magazines (for instance Wired, Fast Company).

1. 2. Inspiration and Foundation

This final work project deals with creative work in groups and team. Even that it would be more fashionable the principle interest is not to study how creativity may generate profit in business organizations or increase national export. The purpose of the project was to explore and discover areas of creative team work in learning organization to benefit our research groups working processes. At the same time I have been studying and designing processes and information and communication technology (ICT) solutions that may help research projects and smaller research and design teams in their activities.

The proposed design alternatives are primary aiming at solutions empowering people to take part in creative processes and only secondary, if possible, helping a group of people to generate new solutions. The approach of the project is that being creative is seen as a value itself. Being creative is good for people.

Creativity is seen valuable even when final results of creative working will not be anyhow useful. Creativity is understood as a process similar to the process of making art where financial gain and efficiency are not the principal intentions of action.

Commonly creativity is seen as a mystic process that requires some special inborn gifts. My approach to ideas and creativity is very similar to the one presented by Viktor Papanek (1971):

“I feel that ideas are plentiful and cheap.”

Another background idea of the work is that any thought, idea or even theory is never ready or finished. This means that anyone (or any
group) may always end-up to better results than someone before. The process of creation is endless and infinite.

The approach of the study is community-based action research. With this I mean that as a member of the research and design team I have tried to provide several new means to do our creative work. All the means provided has been ‘created’ in dialogues within two separate groups of people. In these groups I have been the node person taking part in both groups creative processes. The groups have been:

1. The research and design team I am daily working with (introduced in the section 6.3.1)
2. The group helping me to generate some of the initial design concepts presented in this study. (introduced in the section 6.3.6.)

The process of action research can be described as an interacting spiral and loop of looking, thinking and acting. (Stringer 1996). The main purpose of this final theses project has been to pay attention, make discovery and raise up discussion of our groups methods of working and develop them further within the group. In my daily work as a team leader of the group I am deeply involved in looking and thinking how we do our work, including the creative part of it. Based on this we have started some action in side the group to improve our practices. This action is presented in this study report.

It cannot be emphasize too much that this final work is primary design work. The design is understood and defined in its most wide meaning. Even thought this final thesis is borrowing methods from social sciences and even from social psychology, the study is not trying to answer any of the specific questions that are generally in the focus of these fields. The methods borrowed have been used to benefit the design work.

This mean that the project has been a design process where some selected background theories and study methods has been used to serve the process, concept and product design. However, most of the intellectual work has been carried out simply by on-going dialogue about the proposed design concepts with tens of different people and by iterating the design during the process.

This report part of the final thesis contains seven chapters. The next two chapters introduce the conceptual framework and theoretical approach of the study. The theoretical framework is setting the foundation for the further work. The forth chapter deals with the questions of using computers as a tools to aid group and teamwork. This chapter is also introducing some traditional methods of creative teamwork. The fifth chapter introduces the design methods used to carry out the actually design work which is presented in the sixth
chapter. The seventh chapter sums up the work and discusses about the never ending story of thoughts - the art of second thought.
2. Design Task and Objectives

“All men are designers. All that we do, almost all the time, is design, for design is basic to all human activity. The planning and patterning of any act toward a desired, foreseeable end constitutes the design process” (Papanek 1985)

The design task of this final work is to explore new and alternative methods and practices that could help both the general research project's and particularly our design and research team's creative working processes. This task and the study problems are focused on the conditions of one specific design and research group. Even though the project is not trying to solve any universal problems, the results can be useful among and implemented in other similar kind of teams, projects and situations.

The design team is working for large European research and development project. From this perspective the final work is considering and presenting many design solutions related to this research project. The position of being part of European research project is effecting on our teams ways of working. Correspondingly ways of working and solutions developed originally for our team have influenced the design solutions developed for the European research and development project.

From the context of being a final work for the MA in New Media, it was decided that the work will also inquire on how latest digital information and communication technologies could be used to support and carry out creative working process. The role of digital technology in all activities of the team is already crucial. From all the work carried out most takes place in and though information and communication technology.

The focus is, however, to improve the human based creative processes of one specific research and design team - the one I am leading - and to develop communication and cooperation framework for European r&d projects, more than to design any "new technology". It is not believed that technology itself may solve problems related to the group’s creative working processes. It is recognized that most of the problems related to group work of humans are rather cultural than related just to the lack of suitable technology. Nevertheless, it is believed that technology may push the cultural change forward, and the cultural change may develop suitable technology. It is assumed that the technological and cultural change should go hand in hand.

In this case technology is not seen as the only answer. From the very beginning it has been clear for me that the challenges related to our teams' creative processes are mostly cultural which can be improved by changing our daily ways of working. The technology must then be
adapted to these working practices and developed according to them. This means that my final thesis project was trying to have an effect on team's and projects working culture.

The design tasks can be formulated to be:

- What are the main challenges of carrying out creative working processes in multi-disciplinary and multi-cultural research and design teams?
- How the creative work process could be improved by taking it under serious consideration and systematic analyses?
- What kind of working methods and digital tools could benefit research and design team's creative processes?

The purpose of the study and design work is not to answer the above problems. The problems have been set to guide my inquiry process. The main intention of the final thesis project was to carry out analytical and systematical intervention in the group's creative processes. It is assumed that the intervention itself is going to improve the processes of both the larger European research project and our own team.

The main objective of the final thesis has been to develop a communication and cooperation framework for two different communities. The first community is the large European research and development project with 10 institutional partners and more than 100 people involved with it. The second community under consideration of this final thesis project has been the research and design team I am leading in the Media Lab. These two communities are not separate from each other. The Media Labs research and design team is working for the European research and development project.

The frameworks developed for these communities are trying to offer open and creative environment for highly motivated researcher and designers working together. The framework is also trying to represent my own values and ideas of development, which can be achieved only though open cooperation, sharing our knowledge and ideas and dialogue.
3. Theoretical Framework

3.1. Introduction

The present chapter introduces the main concepts and the theoretical approach of this work. The chapter starts by both introducing and combining several theoretical and philosophical approaches related to the phenomena. The purpose is to use different theories, partly coming from very different traditions, as a design tool. By presenting connections and links between different traditions I am building my own design framework. I argue that connecting theories, thoughts and ideas that do not have explicit or unambiguous connection, is important part in any creative process.

The method is closely related to eclecticism, a philosophical approach that tries to select from the existing philosophical beliefs, the doctrines that seemed to be most reasonable, and out of these constructed a new system (The Internet Encyclopedia of Philosophy). In this chapter my attempt is to construct a new system, not only to have a new construction, but also to use it as a bases for design. The new construction is guiding the design process and the design decisions will be based on this construction.

Several people have criticized my approach by saying that I am not trying to understand deep enough the theories I am using, and that I am only "picking up" the parts suitable for my purposes (Mielonen 1998-2001; Tammi 2001). I admit the weaknesses of my approach. On the other hand it can be argued that the problems related to the method are also its strength.

When the ambition is to process a complex design task, the eclecticism is practical and efficient approach. The definition of design task, the selection of theoretical framework and the actual design work has been done coincident. Thus both the defining of design problems and the selection of theoretical framework has been taking place in interaction between each other. The purpose has been to find a suitable system for - “conscious and intuitive effort to impose meaningful order” – design (Papanek 1985).

A Common joke among some Finnish people is to start a speech with the words: “already the ancient Greeks”. This kind of starting carries such cultural meanings as the speech will be long and boring, and that the speaker probably does not have anything new to say. However, in this study it is not possible to start from any other starting point than the ancient Greeks Academy of Plato.
3.2. Plato's Academy and Dialogue

In about 387 BC Plato founded a new school devoted to research and instruction in philosophy and the sciences. Plato was disappointed by the Athens' public officers and politicians and thought that his Academy could prepare more bright men who could become statesmen for Athens. (Cambridge Dictionary of Philosophy 1995, Korkman & Yrjönsuuri 1998)

The Academy supported Plato's idea that no beliefs can conclusively be proved to be true, but some beliefs can be shown to be more probable than others. This insight of Plato's Academy can be claim to be the bases of western academic research tradition, where the community is itself evaluating and correcting its own work. (Cambridge Dictionary of Philosophy 1995, Korkman & Yrjönsuuri 1998)

Plato's input to education - its theory and practice - is shown by the ways the Academy was ran. The main working practice of the Academy was dialogues carried out within the participants. The on going reflection and evaluation of beliefs was thought to lead participants' critical and deeper understanding of the issues in concern. In the Academy theories or ideas where all assumptions, but in a dialogue some of them were evaluated to be better than the others. (Cambridge Dictionary of Philosophy 1995, Korkman & Yrjönsuuri 1998)

Plato's Academy function about 900 years, until 529 AD when Christian Emperor Justinian closed it down. However, the academic tradition of communal dialogue based self-correcting inquiry is currently living in many academic communities. (Cambridge Dictionary of Philosophy 1995, Korkman & Yrjönsuuri 1998)

In the last few years the academic tradition, based on going dialogue has also gone to Internet where hackers\(^3\) have "adapt" the idea to development of Open Source software\(^4\). The hackers' way of working

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\(^3\) The hackers' Jargon File maintained by Eric S. Raymond (http://www.tuxedo.org/~esr/jargon/) defines a hacker as follows: hacker n. [originally, someone who makes furniture with an axe] 1. A person who enjoys exploring the details of programmable systems and how to stretch their capabilities, as opposed to most users, who prefer to learn only the minimum necessary. 2. One who programs enthusiastically (even obsessively) or who enjoys programming rather than just theorizing about programming. 3. A person capable of appreciating hack value. 4. A person who is good at programming quickly. 5. An expert at a particular program, or one who frequently does work using it or on it; as in `a Unix hacker'. (Definitions 1 through 5 are correlated, and people who fit them congregate.) 6. An expert or enthusiast of any kind. One might be an astronomy hacker, for example. 7. One who enjoys the intellectual challenge of creatively overcoming or circumventing limitations. 8. [deprecated] A malicious meddler who tries to discover sensitive information by poking around. Hence `password hacker', `network hacker'. The correct term for this sense is cracker.

\(^4\) Here the term Open Source software is used as defined by The Open Source Initiative (OSI), a non-profit corporation dedicated to managing and promoting the Open Source Definition. See http://www.opensource.org.
has been shown to be based on the Plato’s Academy, scientific peer review and referee practice. (Himanen 2001)

The turning point in the development of Internet - already found in 1969 in form of Arpanet - was the introduction of the World Wide Web (WWW) in the beginning of the 1990’s by CERN, an international high energy physics research center near Geneva. New in the WWW was its openness and freedom. The WWW was the first time open platform for all computer users to share information and communicate through a computer network regardless of different computer platforms. The backbone of the WWW was very simple but powerful markup language for documents called HTML. Before the HTML researchers where sharing their documents in such a formats as TeX, PostScript and SGML. One crucial problem was that the documents were not referring to each other in such a way that one could follow through links to the original document or data on which the one was referring to.

When developing HTML and WWW the researchers of CERN wanted to improve their own processes of working with different computer systems. The design task was to simplify and speed up sharing and communication of scientific study results; to help research community to carry out open academic dialogue.

In a document dates around 1991 and 1992, one of the main developers of the World Wide Web, Tim Berners-Lee, describes the vision of the WWW, as following:

"W3 (WWW) was originally developed to allow information sharing within internationally dispersed teams, and the dissemination of information by support groups. Originally aimed at the High Energy Physics community, it has spread to other areas and attracted much interest in user support, resource discovery and collaborative work areas."

(Berners-Lee 1991/92)

It is not surprise that the WWW was invented in an academic environment. The researchers of CERN were both inspired by and very adapted to academic traditions of sharing discoveries and working together. Actually such collaboration of academics and hackers has produced the Internet itself, Linux operating system, Apache web-server and number of other useful technical solutions.

After Plato but before WWW many philosophers and academics have recognized the power of dialogue. In his book *On Dialogue*, philosopher, physicist and one of the leading quantum theorist David Bohm (1996) explains dialogues role in human thinking by referring to the original meaning of the word “dialogue”:

“‘Dialogue’ comes from the Greek word dialogos. Logos means ‘the word’, or in our case we would think of the ‘meaning of the word’. And dia means ‘through’ – it doesn’t
mean ‘two’. A dialogue can be among any number of people, not just two. Even one person can have a sense of dialogue within himself, if the spirit of dialogue is present. The picture or image that this derivation suggests is stream of meaning following through us and between us. This will make possible a flow of meaning in the whole group, out of which may emerge some new understanding. It’s something new, which may not have been the starting point at all. It’s something creative. And this shared meaning is the ‘glue’ or ‘cement’ that holds people and societies together.” (Bohm 1996)

With his book, The Fifth Discipline: The Art and Practice of The Learning Organization, Peter Senge (1990) brought Bohm’s idea of dialogue to the level of business management and daily team learning in organizations. Senge emphasizes that in a team learning process based on dialogue there should be willingness to consider each other as colleagues. In dialogue people feel that they are building something, a deeper understanding. Treating each other as colleagues and friends acknowledges the mutual risk and establishes the sense of safety when facing the risk. This means that there should not be hierarchy when having dialogue – hierarchy is antithetical to dialogue. Dialogue should also be playful in sense of willingness to play with new ideas. Playing is the activity where you freely present new ideas, examine them and test them. (Senge 1990)

Even thought there is no hierarchy, there should be a facilitator holding the context of dialogue. A facilitator is guiding the process: helping people to maintain ownership of the process and its outcomes and keeping the dialogue moving. He should hold deep understanding of the dialogue process: ability to balance his activity of being knowledgeable and helpful. For example when someone has made an observation the facilitator may point out and say, “that the opposite may also be true”. When team becomes more experienced and skilled in dialogue the facilitator may gradually become just one participant. In time dialogue can take place in a leaderless team of colleagues. (Senge 1990)

Dialogue is not group discussion. Discussion is a game where people are “batting” ideas back and forth. The object of the game is to win or to get points for yourself. In dialogue nobody is trying to win, or to gain points, or to make a particular view prevail. The idea is that when any mistake is discovered on the part of anybody, everybody gains. (Bohm 1996, 7). In team learning the balance of dialogue and discussion is crucial. In dialogue complex issues are explored. Different views are presented as a means toward discovering a new view. In a discussion decisions are made. (Senge 1990)
3.3. Sociology of Knowledge

When considering dialogue we easily isolate the process of knowledge construction from wider social and historical context. The sociological theory of knowledge has been trying to locate ideas and knowledge to a wider social context.

The sociology of knowledge attempts to trace the social location of different forms of knowledge by studying their origin in relation to specific social structural elements. Karl Marx was the first major social theorist who suggests systematic and analytical approach to the production of thoughts by emphasizing the relation between knowledge and different types of social groups. For Marx, economic theory, religion, political, and social ideas where all reflecting the values of specific groups. (Swingewood 1984).

In the essays and the books written in 1920 Karl Manheim (1924, 1925, 1926, 1929) presents his theory of sociology of knowledge. In these writings he introduced the concept of collective nature of knowledge. Mannheim’s claim is that knowledge is collective: any particular thinker does not express an individual thought but some collective standpoint. Same way as Marx also Mannheim recognized such styles of thought as bourgeois, proletarian, and conservative. Mannheim claimed that styles of thought are complex totalities, which are difficult to understand through quantitative means. From this point of view Mannheim presented his methodological principle that interpretation of cultural objects must work from above, from whole. This led him to an interpretative and hermeneutic standpoint where the main aim was “the analysis of meaning”. (Swingewood 1984)

Mannheim noticed that all different types of knowledge actually contain new and valuable insights into the nature of historical reality. For instance, Marxism emphasized the class structure, whereas Liberalism emphasized the importance of autonomous individuals. All different perspectives and styles of thoughts are under continuous interpretation and the whole can be understood only by taking all perspectives into account. (Swingewood 1984)

For Mannheim all thought is socially determined (except through mathematics and natural science based on formal language). In the area of humanities and social science the truth content of different perspectives lies in their relations with the wider historical context. The truth will not be recognized by history but by intellectuals. “Free-floating intelligentsia”, a group unattached to specific social interests and thus intellectually autonomous can understand historical reality in a deeper level than others. The structural and cognitive openness of intellectuals is making it possible to point out different perspectives. This is keeping on critical dialogue to develop an attitude of “fruitful skepticism”. (Swingewood 1984)
3.4. Constructivist Learning

In the area of psychology of education the theory of social constructivism has criticized practices of teaching and learning based on behaviorism. The main claim has been that behaviorism sees knowledge only as a collection of information, such as articles or goods, which can be stored and transferred in different ways. In behaviorism human mind has been seen as a one place to store this knowledge. The theory has lead to teacher and media centered learning practices where teacher is seen as the transmitter of knowledge to students. In this view the students’ role has been only to store the knowledge given from the teacher and the decision to teach students in groups has been based on economical factors. (for instance: Leinonen, Muukkonen, Hakkarainen, Mielonen, 2000)

The theory of social constructivism asserts that knowledge as such cannot be transmitted from teacher to students. To transfer knowledge from one mind to another is impossible because human mind is never ‘free’ from prior knowledge. For this reason new knowledge needs to be constructed based on prior knowledge. (for instance: Rauste-von Wright, 1994) Knowledge can be obtained only if the learners are actively constructing their own understanding of the knowledge under consideration of the community. Construction of knowledge can also be seen as a participation in shared learning activities (Sfard 1998).

The theory of social constructivism argues that, every human constructs unique understanding of the world by experiencing, evaluating and interpreting the world and by merging these interpretations with their earlier interpretations of the world. Constructivist learning practice is active and learner-centered rather than passive or teacher-directed. (for instance: Rauste-von Wright, 1994)
<table>
<thead>
<tr>
<th></th>
<th>Constructivist Approach</th>
<th>Behavioral Approach</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge</td>
<td>Knowledge is active, in process and situated in worlds</td>
<td>Knowledge is inert and stable</td>
</tr>
<tr>
<td>Obtaining Knowledge</td>
<td>Individuals construct knowledge with other individuals</td>
<td>Individuals are passive recipients of knowledge</td>
</tr>
<tr>
<td>Learning</td>
<td>Meaningful learning is build on the learners prior knowledge</td>
<td>Learning occurs with mechanical, programmatic and repeated activities</td>
</tr>
<tr>
<td>Teacher’s Role</td>
<td>Teacher’s role is coach, supervisor, mediator, co-learner</td>
<td>Teacher’s role is authoritative, directive</td>
</tr>
</tbody>
</table>

**Table 1: Constructivist and Behavioral Approach to Knowledge and Learning**

A constructivist approach in a learning practice implies that students make external artifacts that they can reflect on and share with others. By creating artifacts students are likely to create new ideas. Students may also have an effect on the learning environment they are working in. They may manipulate and develop the environment to fit better on their own purposes. (Bers 1998)

According to the theory of social constructivism learning is always communicative and therefore a social process. Learners are communicating by making their own interpretations of the information received in a communicative situation. The ‘communication’ can also be an individual and internal mental process, especially when using external knowledge artifacts. The learner is communicating internally with the author of the information, but also with number of other authors of different information by assimilating the information to her or his prior knowledge.
3.5. Knowledge Building

In the field of psychology of education the concept of knowledge building has been introduced by Canadian researchers Scardamalia and Bereiter (1989). Their main claim has been that classrooms of schools should be restructured into knowledge building communities. To advance classrooms to become knowledge building communities they have promote use of collaborative computer systems at schools. (Scardamalia & Bereiter 1989, 1993, 1996, Bereiter & Scardamalia 1993, Stahl 2001/2002).

The computer support for knowledge building communities can be offered with computer supported collaborative learning (CSCL) environment. The CSCL environment may provide students tools for knowledge production taking place in an interaction between the users (Scardamalia & Bereiter, 1993; 1996, Muukkonen, Hakkarainen & Lakkala 1999).

Kai Hakkarainen (2000) has written about Carl Bereiter's theory of knowledge building. Hakkarainen indicates and relate the new way of seeing knowledge to 19th century's scientific research communities and later high-tech companies which has been called by some researchers "knowledge-creating companies" (Nonaka & Taceuchi, 1995). The purpose of the industry is to produce, develop, purchase, and sell "knowledge". The goal of member of this kind of expert company is primary not to change their own mental state which many researchers considers equal to learning but to advance the companies communal knowledge. This requires that the core of the activity is solving problems and generating new thought and ideas. This kind of communal effort to advance the knowledge of the community Bereiter calls knowledge building (Hakkarainen 2000).

To show differences between several recent approaches and theories of knowledge in expert organizations Hakkarainen have made a table where different approaches are compared to each other. The following table is showing that, even thought the differences are slight, there is different between Nonaka & Taceuchi's model of knowledge-creative companies, the Senge's idea of learning organization (more widely introduced in the section 3.2), and Bereiter's theory of knowledge building.
<table>
<thead>
<tr>
<th>Approach</th>
<th>Nature of knowledge</th>
<th>Creating knowledge</th>
<th>Distributing knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge-creating company (Nonaka &amp; Takeuchi 1995)</td>
<td>Mental state</td>
<td>Interaction between tacit and explicit knowledge</td>
<td>Building cross-functional self-organizing teams</td>
</tr>
<tr>
<td>Learning organization (Senge 1990)</td>
<td>Mental state</td>
<td>Communication of individual learning among co-workers</td>
<td>Capturing, sharing and reusing formal and informal knowledge</td>
</tr>
<tr>
<td>Knowledge-building company (Bereiter, in preparation)</td>
<td>Knowledge object</td>
<td>Working for adding value of conceptual artifacts, individual learning as a by-product</td>
<td>Sharing and jointly working with conceptual artifacts, and explicating tacit knowledge by creating corresponding conceptual artifacts</td>
</tr>
</tbody>
</table>

TABLE 2: DIFFERENT APPROACHES ON KNOWLEDGE ORGANIZATIONS (HAKKARAINEN 2000).

Gerry Stahl (2001/2002 in press) has present interesting analyses of differences between the concepts of learning and collaborative knowledge building when considering the role of knowledge building in CSCL. Stahl claims that the term "learning" is problematic in the CSCL context because it refers to activity which may take place everywhere: "whenever someone engage in conscious activity". Second problem related to the term learning is that learning is never seen - only the results, the consequences of learning can be observed. For Stahl the concept of "collaborative knowledge building" seems more concrete because it cannot be applied everywhere. The knowledge building requires activity where new knowledge is constructed by group of people. The knowledge being build can also directly and empirically observed. This is because knowledge building always takes place in media, for instance in talking. Very often knowledge building produced also external knowledge objects or artifacts, which provides evidence and material for evaluating the process of knowledge building. (Stahl 2001/2002)
4. Information and Communication Technology in Teamwork

4.1. Introduction

The chapter starts by describing a brief history of computing where computers have become more and more cognitive tools helping people in their creative work, both individual and groups. The chapter introduced shortly the development of Computer Supported Collaborative Work and Learning.

The chapter presents selected traditional ideas of creativity, creative teamwork and discusses how different methods of creativity could be supported and made more efficient with computers.

4.2. Computing – from Calculation to Cognitive Tool

The pre-history of computing is closely related to the history of mathematics and calculation. To solve more complex operations, such as addition and subtraction of large numbers, humans have always used external objects. Groups of objects have been calculated by adding them inside a space drawn on sand or by putting them in a sack.

After the stones and sacks, the next step in the history of computing was the innovation of counting tables which are not only formalized the counting method but also contain the concept of positional notation. This means that objects are located in matrices which give new possibilities for calculations. The same method is still the core of modern computers. (IEEE 1996)

The first big name in the history of computing is said to be Tashkent cleric Muhammad ibn Musa Al'Khowarizmi who in 1300 AD developed the concept of a written process to be followed to achieve some goal. This method of following commands is nowadays called algorithm named after its inventor. The use of algorithm in computer programs made computer to be “reasoning” and logic machines – in a way machine helping human in decision making process. However, all the way from Al'Khowarizmi days, from 1300 AD to late 1960 AD computers were mainly made and used for calculating, making statistics and outputting and opening cryptology. (IEEE 1996)

In 1968 in California Douglas C. Engelbart and his group from SRI Augmentation Research Center, now SRI International held a public demonstration of their computer systems they had been developing since 1962. Engelbart's group of scientist thought that by demonstrating their system in real use the audience could get a better picture of their system than by reading an article about it. In some writings Engelbart is said to be the ‘mother of demos’. (IEEE 1996, Bootstrap Institute)

In the 1968 demo Engelbart presented for the first time working versions of the mouse, hypertext, chat, synchronized and a
synchronized working via computer network and word processing with such features as editing, cutting and pasting and drag and dropping (Bootstrap Institute).

Engelbart’s demo can be seen to be a turning point in seeing computers not only as a tool for computing but also as a tool to create and share your creative work. Engelbart’s main thesis, which was not said openly in the presentation, but demonstrated through the functionality of their computer system was that computers can be used as an external memory and processor helping humans in their daily activities.

What Engelbart was actually demonstrating was his research group’s own "computer environment" - the system they had been building to make their daily research work more enjoyable and productive. With reason it can be claimed that Engelbart and his team predicted, designed, and implemented most of the organizational computing of our time already in 1960’s. Unfortunately all the collaborative computer tools presented already in the 1968 demo are not in use, even today, in most of the organizations using computers.

4.3. Computer Supported Collaborative Work and Learning

After networking computers became more common, hundreds of applications have been developed to support collaborative work with computers. Computer Supported Collaborative Work (CSCW) is a concept that covers both methods and technical applications supporting people working together with computers linked through a network. The range of applications, which can be defined to be CSCW applications are wide: email, email groups, newsgroups, file sharing, online chat, teleconferencing, video conferencing etc.

The most common way to classify CSCW applications is to categorize them to synchronous and asynchronous applications. An example of synchronous tools are such applications as video conferencing and online chatting where users are using the system simultaneously where as email and newsgroups can be used asynchronously.

Also the World Wide Web was originally designed to be a CSCW platform for researchers to share their research results and to work together. The WWW was designed to be a system for collaborative work areas and from this approach it can be considered as an universal platform for Computer Supported Collaborative Work (CSCW).

After expanding the WWW has somehow lost its original purpose of being a platform for collaboration. In the first years of commercialization of the WWW, the media companies saw the Web mostly as a new broadcasting platform to reach customers.

In this final thesis project I have been trying to bring the original ideas of the web for the use of the research project and my team. The idea of
seeing systems working in though and in the computer network not only as a delivery media is a the leading sprit of the work.

In the recent years in the field of educational technology the most promising applications has been the computer supported collaborative learning (CSCL) tools. The main aim of a CSCL environments is to provide students advanced computer tools for knowledge production taking place in an interaction between the users (Scardamalia & Bereiter, 1993). In most of the CSCL systems (e.g. CSILE, Belvedere, Knowledge Forum, Fle2) the knowledge production happens in a shared working space where students may carry out discussions by writing notes (to each other). The idea of CSCL systems is to provide students a shared working space where students may post their knowledge products and interact with others through progressive discourse.

The role of CSCW and CSCL in this final thesis project is dual. Firstly the CSCL is the main focus of the research project and the team. Secondly the development work made for the research project is CSCW and CSCL itself. The communication and cooperation framework design is itself one kind of CSCW and CSCL system. The role of being CSCL is emphasized when the role of the research project and team is to explore, investigate and study, whereas the production work, also crucial part if the activities, needs more CSCW.

4.4. Traditional Methods of Creative Teamwork

Big part of the most well known methods of creative teamwork has been developed in business world, mostly for business purposes. The creative process has been modelled (tried to) by presenting steps and stages of working that could lead to new ideas for business.

Some of the earliest models were developed by Alex Osborn (1963 ref. in Moriarty & Robbs 1999). His model of creative problem solving contain seven steps:

(1) Orientation,
(2) Preparation,
(3) Analysis,
(4) Ideation,
(5) Incubation,
(6) Synthesis and
(7) Evaluation.
In the orientation step the participants are identifying the problem to be solved. Preparation and analysis means collecting of background information, which will be organized and categorized. In the ideation step participants are complaining a bank of alternative ideas. After this, the problem and the alternative ideas are left to incubate until there will be ‘illumination’. In the last steps of the process all pieces of information will be put together and evaluated by judging the resulting ideas. (Osborn, A. F. 1963)

Alex Osborn also developed probably the most well known technique for creative teamwork called brainstorming. Osborn developed the brainstorming technique in the 1930’s and 1940’s for the needs of his own advertising company. Originally this technique was developed to be used with his employees, in order to generate new ideas for advertising campaigns. However Osborn noticed that it could be used in many other kinds of problem solving situations, as well. (Moriarty & Robbs 1999)

A simple description of a brainstorm is that of a group process to enable idea generation. Different techniques of brainstorming consider many different guidelines of how brainstorming should proceed. Most of the guidelines highlights the following issues:

- The purpose of brainstorming is to get out as many ideas as possible.
- In the stage of producing ideas there should not be any kind of evaluation of ideas.
- No conformity - the team should produce different kind of ideas of the same topic.
- One topic in time - brainstorming needs a goal and something to focus on.
- There should be a time limit.
- Members should build on ideas produced by others and modify the ideas of others.
- All the ideas should be written down.
- After the idea production stage rank, evaluate and group the ideas into related categories for review.

Knut Holt (1996) has defined three different brainstorming methods (1) Classical Brainstorming; (2) Brainwriting where participants write their ideas on special cards that circulate within the group and gives this way more tome for thinking than traditional brainstorming; and (3) Computer-aided Brainstorming (CAB) where ideas are produced and spread in the group (if carried out in a group) though email or shared server in a computer network. (Holt, K. 1996)
All three methods can be used individually or in a group. Based on literature studies and his on experiments he has made a hypothetical raking of different methods. The methods are listed here according to their fitness:

- group computer-aided brainstorming;
- individual computer-aided brainstorming,
- brainwriting;
- individual brainstorming;
- classical brainstorming;

According to Holt’s study the benefits of the group computer-aided brainstorming are related its bigger openness for group association, sharing of ideas and possibility to defer judgment. Also the computer-aided working is improving communication, production of ideas in quantitative means and facilitates the paperwork. (Holt 1996)

Another well-known method of creative teamwork is the Six Thinking Hats framework developed by Edward de Bono in the early 1980’s. Many large business organizations such as IBM, British Airways and Polaroid use Six Thinking Hats.

The six hats used in the creative process represent six models of thinking. In this case the hats are used for directing the thinking rather than labeling it. This means that the hats are used proactively – and not reactively. The idea is that under one of the hats, people can contribute something even thought they support the opposite view. The hats encourage parallel thinking, full-spectrum thinking and separating ego from performance.

The six hat thinking is carried out by “wearing” one of the six hats at a time indicating the type of thinking used. When done in a team, everybody is wearing the same hat at the same time.

*White Hat* covers facts and information needs, and gaps.

*Red Hat* is used to present intuition, feelings and emotions.

*Black Hat* covers judgment and caution and is the most valuable hat.

*Yellow Hat* is the logical positive

*Green Hat* is the hat of creativity, alternatives, proposals, what is interesting, provocations and changes.

*Blue Hat* covers the overview and process - meta-cognition. (The Journal for Quality and Participation 1991)
It seems to be that in the filed of creative team work there is many methods and approaches which are not so far widely brought to computer environments. The benefits of network computers for creative team work are obvious. The network computers ability to bring people to work together "anytime and anywhere" is only one benefit.

My opinion is that in creative working, more important than the "distance working" benefit, is computers ability to handle large amounts of data and information (which is actually for what the computers were originally invented). The ideas produced in a creative working process can be organized, ranked, categorized and named in easy way if the computer system is designed for this purpose.
5. Methodology

5.1. Introduction

This chapter introduces the design methods used in this final thesis project. In design process the role of methodology is slightly different than when the objective is more traditional academic study work. In many cases traditional scientific study work's main purpose is to describe and explain the environment. Design work is always more prescriptive than descriptive (Lawson 1997). The aim is action and change.

The thesis project is about designing tools and processes for working groups. The design proposed and presented should help and support the users daily working activities and be enjoyable. In order to design good solutions I have done some study work about the project's ways of working. Also I have been studying my team's ways of working, attitudes and thoughts about creative working processes in general. In the situation where the solutions, processes and tools are actually enabling new way of working, the observation of traditional work processes does not necessarily give that much input to the design.

For this reasons I have select an action research and participatory design as my method of design work. These methods are used by reflecting them at the same time against the theoretical framework of the work. The theoretical framework is setting the background and ambition of the design work. The theoretical background is guiding the development work and showing the "right direction".

5.2. Action research

The term action research was introduced in the 1940's USA by social psychologist Kurt Levin. The original idea of action research was to reach interaction between theoretical research and social practice. For Levin action research meant groups joint development and activity influencing on the group itself. Essential concepts were democracy, participation and simultaneous influence on both the development of science and the social change. (Carr & Kemmis 1986; Cohen & Manion 1980)

The action research approach has been widely used in studies focusing on work, work communities and organizations (e.g. Kasvio 1990). Education is another area where action research has been very popular approach of research. Ulla Suojanen (2001) has explained the popularity of action research in educational sector in Finland by professional teachers demand a right to study their own work as they hold some knowledge of research methods as an result of their university education. (Suojanen 2001)
Action research is not a specific research method. Action research is mainly a way of approaching a research object. For this reason it is better call action research as a research approach than method. (Cohen & Manion 1980) The action research approach aims at influencing on developing practical activities in some community or group, increasing participants’ ability to understand their actions and developing the actual activity and situation of the community or group (Carr & Kemmis 1983).

The methodological approach of this design work is community-based action research. This means that as a team and as a research community we have took collaborative approach to inquiry and provide ourselves a means to take action to resolve specific design problems. The procedure of community-based action research can be described as an interacting spiral and loop of looking, thinking and acting (Stringer 1996)

In this design process the loop of actions research has contain:

1. Looking and recognizing the research group's and the team's communication and cooperation needs and special character
2. Thinking an analyzing the groups and teams activity and needs.
3. Acting by designing tools and processes for the research group and the team.

The design process has contained a lot of rapid prototyping activities, as well. The rapid prototyping is a process used in design process for problem solving, exploration and sharing of thoughts (Horton 1995).

5.3. Participatory Design

The roots of participatory design in information system development, can be found mainly in Scandinavia, were it has been developed over the last twenty years. Originally the participatory design approach was found in the 60's and 70's in cooperation between the Scandinavian trade unions, researchers and designers in such projects as DEMOS and UTOPIA (Boadker et al. 1993). The participation of workers in the design process started by active involvement of the trade unions and research projects doing assessment, design, and development of technological and organizational systems for different workplaces.

The basic standpoint of this approach has always been one of recognizing that the people who will be working and using the systems should have active involvement in designing and decision-making already when the systems are developed. The idea of participatory design is closely related to the action research, as well as the general understanding of “social construction”. More over it underlines one of
the first attempts to have a holistic view over the process of designing and not just the end results. (Ehn 1992).

At a very practical level the participatory design approach considers the move from rigid systems description and design briefs into the active use of mock-ups, prototypes, game-like situations and scenarios. The use of such resources involves stakeholders in the framing of the problems to tackle but also in concrete design decisions. Prototypes and mock-ups are built and developed by everyone, scenarios help to envision the ideas, and the design process is a research tool in itself. To recognize the social environment in which design takes place and formulate actions to establish meaningful interactions among all the ones involved and affected, a participatory design approach involves active reflection on the conditions of work situation and dynamics.

In this design work the participatory design approach has been used in all stages of development. The design task itself has not been such that game-like situations or scenario building has been seen as a reasonable method. However, the needs of the participants have been negotiated within the group. The discussions have been based on the participant's earlier experience of communication and cooperation tools in the community. The use of mock-ups has been realized in form of digital prototypes checked and discussed with the participants.
6. Design Solutions

6.1. Introduction

This chapter presents the design process and the solutions developed. The chapter starts by describing the wider context, the European research project, where our team has been designing its own working practices, processes and tools. The team has been responsible to design the communication and cooperation framework for the European research project in which it is working in. The task of designing communication and cooperation framework includes the implementation of working practices and information and communication technology tools used in this international research project.

The framework of European research project is effecting on our teams ways of working. The communication and cooperation framework of the team has been designed to fit the European research project. However, the characteristics of the team members and the combination coming out of the members have been the guiding principle of the design.

The chapter ends by describing one possible design concept, the Mobstorm concept, developed to carry out creative team work in such a design and research teams as ours.

6.2. Communication and Cooperation Framework for an European Research Project- Case: ITCOLE-project

Our research and design team is working in a large research project called Innovative Technology for Collaborative Learning and Knowledge Building (ITCOLE) (see: http://www.euro-cscl.org/site/itcole/)\(^5\). The project has started on the 1st of April 2001 and it will last until 31st of March 2003.

From the ten project partners, six are research institutions focused on education or learning science while two of the partners are software and technology developers. Our role in the project is to be the design partner and coordinator of the project. In addition to software development, pedagogical research and design partners there is one user-developer partner offering information and communication technology services and pedagogical support for schools in one European city. The user-developer is participating on the software development in participatory design terms.

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\(^5\) The project is funded by The European Commission in the Information Society Technologies (IST) framework; IST-00-III.2 ‘School of Tomorrow’.
Inside the Media Lab we have defined our role to be the glue between two different research traditions, designing and bringing meaningful solutions in meaningful package for the end users, the teachers and pupils.

ITCOLE project focuses on developing innovative pedagogical models, design principles and technology for collaborative knowledge building to be used in European education. The models and technology will be tested and disseminated throughout the European education landscape free of charge in order to help in building a coherent and unified network of participants that supports sharing of expertise, content, practices and tools. The ultimate goal is to build a network spearheading the use of collaborative learning technology by utilizing pedagogical best practices.

The main work of the project consists of creating software tools and pedagogical best practices, testing and refining them and eventually disseminating them throughout European education landscape.

1. The project has three key scientific and technical objectives:
   Develop pedagogical models of collaborative knowledge building for European education.

2. Develop a modular knowledge-building environment to support collaborative learning.

3. Evaluate, test and disseminate the environment in European schools in order to build meaningful pedagogical practices and to advance the use of collaborative learning technology.

The project aims to contribute to scientific and technical know-how about whether collaborative building of knowledge with the help of new technology could be used to facilitate better learning achievements and development of new cognitive competencies in European education. (ITCOLE Annex 1 - Description of Work)

Our research team's main responsibilities are functionality specification and user interface design of the collaborative software developed in the project. With in the software development our team is involved in several other work packages such as testing, support and dissemination. Personally for me the role of being coordinating partner is causing a lot of administrative work. However, our main purpose is to contribute to the software development.

6.2.1. Structure of the Project

The whole big picture and all the different partners and people involved in the ITCOLE research project and our research team is very complex. All together it can be estimated that our team is connected somehow more than 100 people working in more than 10 institutions in five
European countries. In the picture, I have tried to visualize the complexity and variety of different stakeholders somehow related to the ITCOLE project.

**Picture 1: ITCOLE Projects Different Stakeholders and Their Priority Connections to Each Other.**

The complexity of the project has required several arrangements for communication and collaborative teamwork practices. Many of the formal practices are described in the official project management book (steering group meetings, reports, etc.), but most of the real everyday ways of working have been designed and decided to take in use during the project. In the following I am presenting my and my team's solutions and tools designed for the communication and cooperation activities of the European research and development projects. The solutions were created and been developed based on the analyses of the complexity of the project and the need of the project participants.

The complexity of the project - the design framework - also means that the design solutions hardly can be simple. For design we often set requirements, which can be considered to be over and above what is possible to realize. All design should be intuitive, easy to use and enjoyable. Sometimes the things that the solutions should function are
just not simple or such that they do not need any studying and learning. As and example of this we may think an airplane cockpit. The function of flying tube weigh of several ton is a complex task. However, the controls can be considered to be "good design" even thought they hardly are intuitive, easy to use, enjoyable and such that one does not need to learn to use them if willing to fly.

The design solutions presented in the following section naturally are trying to be easy to use and enjoyable. In the situation of having as many stakeholders as we do in the European project, making the framework rather complex, the solutions are not such that they do not need people engagement and effort to study and learn how to use them.

6.2.2. The Project Website

The main electronic communication media for the whole project is the ITCOLE website at http://www.euro-cscl.org/site/itcole. The ITCOLE website is serving both the project’s internal communication (the group work needs), and external dissemination of the projects results.

![Picture 2: ITCOLE Project’s Website](http://www.euro-cscl.org/site/Wbck)
In order to serve two different but interrelated purposes; the dissemination for external audience and the internal communication and group work, the site has been designed around 2 sections:

1. Public Resources:
   - www.euro-cscl.org
   - Links
   - Public Deliverables
   - Download

2. Internal Resources:
   - Document Management
   - Mailing Lists
   - Test Environments

This structure helps to “collect” several tools and resources for the different groups of people involved in the project. Very importantly they give visitors an idea of the advancements of the project, the tradition in which is located, as well as access to the different resources we are offering.

6.2.3. Public Resources: A Brand for External Audience

In the public resources section the most important part is the www.euro-cscl.org -website\(^6\). Which is also located as the main URL access point.

The idea behind the existence of euro-cscl.org website is that when the ITCOLE project ends, the software developed, the best practices of using it and other activities started during the project will continue to live in this web site. The site is important part of our project's dissemination plan. In the end of the ITCOLE project the "brand" will be the euro-cscl.org and the project was set-up to build the "brand".

\(^6\) The euro-cscl.org was developed by using the following Open Source- software: (1) Zope - Copyright (c) Digital Creations (2) Squishdot - Copyright (c) Butch Landing; (3) Euro-cscl.org modification and design Copyright (c) Teemu Leinonen, Giedre Kligyte.
The aim of the euro-cscl.org website is described in the site's "about the euro-cscl.org"-page as follow:

"Euro-cscl.org is a community website that gathers and spreads the best practices of computer supported collaborative learning (CSCL) activities in Europe. The visitors of the website are the authors of the website.

The main target group of the website are teachers and researchers interested in CSCL. In the website you may browse and search good practices of CSCL used and tested in real courses and classes around Europe. You may also post a new article to the website describing good practice of CSCL carried out by yourselves. We believe that, as teachers and tutors, we will be more successful in our work when we cooperate and share our knowledge and ideas through open standards and modularity.

All articles posted to the website are moderated by experts in the field. The moderators are members of the ITCOLE project's pedagogical research community.

The euro-cscl.org will be as useful as we make it. Let's make the euro-cscl.org useful!" (http://www.euro-cscl.org/site/about)
The euro-cscl.org website contains for visitors such services as search engine to search for the project descriptions written by the teachers. Visitors may also browse the article database by "level of education": primary, secondary and university. For teachers there is user interface for adding articles to the database. The visitors may also comment all the articles written to the website.

For moderators there is another user interface for approving and editing articles. The comments are not moderated by they can be edited by the moderators though their user interface

Another public resources of the ITCOLE website are the Links connecting the project to the international CSCL community, Public Deliverables containing all the reports published by the project, and the Download section offering the software developed in the project for downloading.

6.2.4. Internal Resources: Project's Document Management and Online Cooperation

The section of Internal Resources contains a Document Management framework were we are using BSCW, a shared workspace system. From the project's shared BSCW workspace all project members are able to find, download, upload and maintain all project documents. The objective is to give all project partners one shared place to co-manage project documents.

The structure of the BSCW workspace was designed to refer directly to the project plan. In the workspace each work package have its own folder similar way as the work is dived in work packages in the project plan.

The use of BSCW workspace is making the progress of the project very transparent for all the partners. Between some of the project partners there is a saying that "if the document is not in the BSCW workspace it does not exist". This is a joke but contains interesting observation of CSCW - the CSCW can make working more transparent and may show out if someone is not doing his or her part of the work.

With in the work package folders the BSCW workspace contains such general folders as: ITCOLE Contract Documents (2001), ITCOLE IST Proposals (2000), Logos of the Project, Pre-existing Knowledge (Articles) and Recent papers about CSCL studies.

7 The BSCW system is a web-based workspace system which supports a joint storage facility that may contain all kinds of objects such as documents, tables, graphics, spreadsheets or links to Web pages. Once a workspace has been set up, all members can upload, edit or download documents to it. (http://bscw.gmd.de)
6.2.5. Internal Resources: Project’s Mailing Lists and Test Environments

The Mailing List section is describing and giving access to the different mailing lists used in the ITCOLE project. The members of the lists have been decided based on the work packages, tasks and responsibilities of the project partners. This means that all the people working in the project, are not members of all the mailing list groups. This arrangement was made to avoid people to get emails with irrelevant information for their tasks. Another reason was to give different expert groups some privacy to work in the list without fear of ending up to spend a lot of time to explain people coming from different background of expertise what they are talking about.

However, the mailing lists are very open environments for cooperation. Any of the partners may approach other group of experts by sending mail to “their” mailing list. This way the inquirer can be sure that the best experts of the area, working in the project and considering the question.
The *Test Environments* section is offering for the project partners easy and fast access to the environments developed in the project. In the development stage the test environments may be located to some servers which are available only by their IP-numbers (eg. 128.66.234.56). Straight links from the ITCOLE website are making it just easier to reach.

### 6.2.6. Structure and its Related Communication Tools

The different communication and cooperation tools and methods presented in the previous chapters have been designed from the bases of the projects general structure (Picture 1). The aim has been to offer all partners an easy to use channel to cooperate, but on the other hand protect different partners coming from different areas of expertise to get involved in issues, which are not useful for them. The framework is, however, very open for all to participants to edit and modify it. All the people taking part in the project may change their role and become members of some other sub-group or team.

![Diagram of communication tools and project structure](image)

*Picture 5: The ITCOLE project's communication tools and the project structure*
The framework can be seen to be "a bottle neck" -model in which one partner (UIAH Media Lab) is limiting the open cooperation and communication between the partners. The ways to communicate over and cross the framework are, however, not limited anyhow. All the partners are free to contact straight to other partners. The framework is only giving participants the possibility to focus on their task in privacy and filtering the flow of irrelevant information. For this reason I would rather call the model "a filter model" than "a bottle neck" -model.

For the software development process, one of the main tasks of the project, on which all the partners should take part in, we have designed a model that helps participants to locate their specific tasks, responsibilities and communication flows. This model is showing what each partner is contributing to the development work, explaining based on what kind of information the software will be developed and how the testing of the software is giving input for further development.

The communication and cooperation tools and methods has been selected and designed in such a way that the software development flow should be easy to carry out. However, the framework has been kept open for dialogue causing innovation. The framework is a trying to
find a balance between straightforward production and innovative dialogue and knowledge building feeding the production process.
PICTURE 7: ONLINE COMMUNICATION AND COOPERATION FRAMEWORK AND TOOLS OF THE ITCOLE PROJECT
6.3. Communication and Cooperation Framework for Research and Design Team - Case: FLE Team

The Learning Environments for Progressive Inquiry Research Group’s FLE team (Future Learning Environment) was found in 1997 to develop digital learning environments and services for the Media Lab. In 1998 the team set-up its first two-year research and development project, The project was named Future Learning Environment (FLE) project\(^8\) after the team.

During the first FLE project the team consist of two user interface designers and me (project manager). All the members of the team, however, did hold expertise in many other areas as well. For instance one of the other interface designers (code A) had been studying educational science as her major subject for several years, and the other one (code B) had been working as a top consultant of Internet and WWW technology and usability. In 1999 we recruited our first software developer (code C) to the FLE team.

From the original FLE team the interface designer B is still working in the FLE team. Also the interface designer A is still working in the Media Lab but no more in the FLE team. The software developer C is no more working in the FLE team or Media Lab. However, he has expressed his interest to contribute to the Open Source software development coordinated by the FLE team.

In June 2000 we started a new project called Future Learning Environment 2\(^9\). The project will last until December, 2001. Into the Fle2 project we recruited our second software developer (code D).

6.3.1. Structure of the Team

When the ITCOLE project started in April 2001 we were able to recruit more people to the team: interface designer (code E), software developer (code F) and project manager of software development (code G). Furthermore, In November 2001 the group recruited one more software developer (code H) who is doing his civil service in the Media Lab.

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\(^8\) The research partners of the FLE project were Department of Psychology and Media Education Centre of the Department of Teacher Education from the University of Helsinki. The industrial partners of the project were Sonera Ltd, Grey Interactive Ltd, Apple Computer Finland and WSOY Ltd. The project was funded by the Technology Development Centre, Finland and the partners.

\(^9\) Research partners in the Fle2 project are Department of Communication, Journalism and Computer Science, Roskilde University, and Centre for Research in Networked Learning and Knowledge Building, University of Helsinki. Fle2 R&D project is supported by NordUnet2 - Nordic Council of Ministers and by the Nordic Governments (Finland, Sweden, Norway, Denmark and Iceland.).
The Interface Designer B and Project Manager of Software Development G are working only 3 days a week in the FLE team and ITCOLE project. The situation of having two key persons of the team contributing only 60% of their working time to the project has been a big challenge for designing communication and cooperation means and practices of the team.

Another major challenge for designing the communication and cooperation framework for the team has been the heterogeneity of the team members. Especially the sub-cultures\textsuperscript{10} the members of the team represent have caused a lot of trouble when arranging the teams' daily ways of working and cooperation. The design solutions presented in this chapter are closely related to these sub-cultures.

<table>
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</tr>
<tr>
<td>B</td>
<td>Interface Designer</td>
<td>60%</td>
<td>&quot;Uncompromising expert&quot;</td>
<td>31</td>
</tr>
<tr>
<td>D</td>
<td>Software Developer</td>
<td>100%</td>
<td>&quot;Hacker with no formal education&quot;</td>
<td>20</td>
</tr>
<tr>
<td>E</td>
<td>Interface Designer</td>
<td>100%</td>
<td>&quot;Foreign student expert&quot;</td>
<td>24</td>
</tr>
<tr>
<td>F</td>
<td>Software Developer</td>
<td>100%</td>
<td>&quot;Hacker with formal education&quot;</td>
<td>27</td>
</tr>
<tr>
<td>G</td>
<td>Project Manager of Software Development</td>
<td>60%</td>
<td>&quot;Senior software project manager with formal education&quot;</td>
<td>30</td>
</tr>
<tr>
<td>H</td>
<td>Software Developer</td>
<td>100%</td>
<td>&quot;Young expert&quot;</td>
<td>26</td>
</tr>
</tbody>
</table>

\begin{table}
\begin{tabular}{|c|c|c|c|}
\hline
Code & Title                                      & Contribution (time) & "Sub-culture" \textsuperscript{3}                                      & Age \\
\hline
me   & Project Manager                           & 100%                & -                                                                      & 31  \\
B    & Interface Designer                        & 60%                 & "Uncompromising expert"                                                & 31  \\
D    & Software Developer                        & 100%                & "Hacker with no formal education"                                      & 20  \\
E    & Interface Designer                        & 100%                & "Foreign student expert"                                               & 24  \\
F    & Software Developer                        & 100%                & "Hacker with formal education"                                         & 27  \\
G    & Project Manager of Software Development   & 60%                 & "Senior software project manager with formal education"               & 30  \\
H    & Software Developer                        & 100%                & "Young expert"                                                         & 26  \\
\hline
\end{tabular}
\caption{FLE Team Members, Their Contribution to the Project (%), \textit{Sub-cultures} and Ages}
\end{table}

To understand better my team's thought of working practices and creative working I asked the members of the team to fill-up survey with some open questions (see Annex 1). The answers indicate the sub-

\textsuperscript{10} With the sub-cultures I mean youth cultures, lifestyle etc. One of the members of the team is foreigner (non-Finnish) and another represents a language minority of Finland. However, the biggest differences in ways of working and communicating are based more on the sub-cultures than the "real" cultures.
cultures living inside the group. For instance the Software Developer D answered to the question "0301 - How do you define 'creative teamwork'? What do you think it is?"

"Creative teamwork is like a bunch of hackers writing code, and when somebody gets something done, he commits the changes, and other see the changes are good, and are inspired by the change to be more creative."

And to the question "0401 - Are privacy and silence important for you when creating new ideas?" the same Software Developer D answered:

"I tend to listen to hardcore heavy or industrial music when being creative. Not to loud thought."

When the Project Manager G’s, who is representing rather mature and experienced professional attitude in our team, answer to the above questions was shortly "often yes", we understand more concretely how different sub-cultures are effecting our working environment.

The answers of the survey have not been analyzed in any proper manner. The answers have been used, however, as a starting point for dialogue inside the group. The answers of the participants have also helped me to build better picture of the challenges related to the teams communication and cooperation.

During the year, the team has been designing its own communication practices and tools by modifying and selecting suitable processes and some existing technologies for its own use. At the same time the team has organized the whole research group’s communication practices and agreed on several daily-working practices. One of the major agreements related to the daily-working practices was the "constitution" written together, printed and hanged to the wall of the team room11.

In the following sections I am presenting the current practices and tools used in our team. The design is on-going process where we are able to change things is very fast manner. In practice the design and development of communication and cooperation framework remains rapid prototyping. However, the following tools and practices can be considered to establish their role in the team - so far.

11 "The Constitution" goes:

Constitution

1. Working Hours:
   On their working days everybody is around in the Media Lab between 11.00 - 16.00.
2. If Not Then:
   If you are not able to be around between 11.00 - 16.00, drop an email to fle-crew@fle2.uiah.fi.
3. Monday Meetings:
   Every Monday, at 11.00-12.00 we are having meeting where we check what did we do last week and what we are going to do that week. If you are not able to be around, check the "if NOT then".
6.3.2. XP Software Development

The main task and responsibility of the FLE team in the ITCOLE project is the functionality and interface design for the CSCL system to be developed.

The functionality and interface design are carried out by programming usable interface prototypes. For this software development task we have adapted a software development approach, called Extreme Programming (XP). XP is an approach to software development emphasizing teamwork, communication, simplicity, feedback and customer satisfaction. (http://www.extremeprogramming.org)

The XP model was introduced in our team by interface designer B, and accepted by the other members of the team to be the development approach in our current software project.

We have tried to involve other partners of the project to adapt the most critical features of the XP model in their work, as well. One of the most crucial features of XP is the concept of User Stories. In a software project using the XP model users/customers are asked to write User Stories. The Stories are collected to get user/customer requirements, new ideas and feedback related to the system developed.

The User Stories are written by the users/customers as things that the system needs to do for them. The User Stories are similar to usage scenarios, except they are not only describing a user interface. The User Stories should describe the functionality of the system in high level. The Stories should be kept focused on user needs and benefits.

The Stories are used by the programmers to get an idea of the user/customer requirements, functionality needed and to make estimation how long it will take to implement each of the Stories to the system. If the programmers do not understand the User Story they will ask clarification for it from the writer. The decisions of those User Stories that will be implemented to the system are made in a meeting on which all stakeholders (developers and users/customers) take part in. In the meeting the programmers are presenting how long the
implementation of each story will take and the representative of the user/customer may then make a decision of the priorities.

The User Stories are made in the format of about three sentences of text written by the user in the users own terminology without techno jargon. The Stories should focus on user needs and not depend on any specific technology.

In the FLE team the interface designer B and me are responsible to write the User Stories for the designers and programmers. This way we are acting as the users/customers of the project. In the ITCOLE project I have tried to commit all project partners to write User Stories for the designers and programmers by offering them guidelines in how to write the stories.

In the XP model the next step after writing the User Stories is the Release Planning meeting. For this meeting all the User Stories are printed on paper. From the User Story papers the developers specify smaller programming tasks and give for these tasks their estimation of time and risk. From these programming tasks the user/customer (So far in released planning meeting I have act as the user/customer) may then choose which of them will be implemented in the next release.

After the Release Planning Meeting the developers take the task cards made from the User Stories and start programming the functionality described. All programming should be done by two people working together at a single computer (this has not happen all the time in our team). According to the XP model pair programming increases software quality without impacting time to deliver.

### 6.3.4. Communication and Cooperation of the Team

Five members of the FLE team are working in one shared team room. Next to the team room is another room, which I am sharing with one member of the team. The ideal situation would be that we could all work in one common team room.

The FLE team is using several different kind of channels and means of communication and cooperation. These include a Team Room's Wall, Concurrent Version System (CVS) with automatically generated announcement e-mails, Mailing List and Monday Meetings.

Within the "official" communication and cooperation means some informal event for collaboration has found to be extremely important for the team. These informal events include Coffee Breaks and something I have named to be Release Days' Hanging Together.

In the big FLE team room the developers and designers are using the Team Room's Wall to hang their design and architecture drawings. The
wall is definitely one important way for documenting ideas and communicating them for other member of the team.

**PICTURE 9: THE WALL OF THE FLE TEAM ROOM**

For developers one of the key communication and cooperation tools is the *Concurrent Version System* (CVS). CVS is an open source tool for managing source code so that all the developers can make changes on the same file at the same time, using a shared directory. After writing some new code the developers commit their changes back into the directory.

With the committed code the developers write a little note what did they change in the source code. With the CVS we are using announcement mails telling what has been committed to the CVS and who did it. The announcement mails are generated automatically by the CVS server. Currently we receive daily about 5 to 10 CVS update announcement mails. Here is one example of such a mail:
The announcement mail is communicating the stage of development in many levels. The developers are primary interested in what file was changed and what new files where added to the CVS, whereas I am only interested in the "log message". The log message, where the developer is telling in his own words why did he commit CVS, is giving me enough information to keep me on track of the development.

For general announcements and some discussions we are using one Mailing List. The list is mostly used for informing everybody about meetings, agendas and tasks. The list is also used to deliver User Stories for preliminary check and comments of the developers.

The team members are giving high priority for the list. This means that if something is said or agreed in the list it means that everybody knows about it and things will be done according the agreement maid in the list. Issues agreed in the list do not need confirmation in other forums. Here is one example of mail send to the teams Mailing List:

<table>
<thead>
<tr>
<th>Subject:</th>
<th>CVS Update: FLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date:</td>
<td>Thu, 8 Nov 2001 12:09:50 ()</td>
</tr>
<tr>
<td>From:</td>
<td>F Software Developer</td>
</tr>
<tr>
<td>To:</td>
<td><a href="mailto:fle-ui-commits@fle2.uiah.fi">fle-ui-commits@fle2.uiah.fi</a>, <a href="mailto:fle-commits@fle2.uiah.fi">fle-commits@fle2.uiah.fi</a></td>
</tr>
<tr>
<td>CVSROOT:</td>
<td>/cvs</td>
</tr>
<tr>
<td>Module name:</td>
<td>FLE</td>
</tr>
<tr>
<td>Repository:</td>
<td>FLE/ui/Note/</td>
</tr>
<tr>
<td>Changes by:</td>
<td>f@hilbert. 01/11/08 12:09:50</td>
</tr>
<tr>
<td>Modified files:</td>
<td>./: Note.py Thread.py</td>
</tr>
<tr>
<td></td>
<td>FLE/printers/: author_printer.dtml date_printer.dtml</td>
</tr>
<tr>
<td></td>
<td>trivial_tree_printer.dtml</td>
</tr>
<tr>
<td></td>
<td>FLE/ui/Note/: repr_tt.dtml</td>
</tr>
<tr>
<td>Added files:</td>
<td>FLE/ui/Note/: repr_author.dtml repr_date.dtml</td>
</tr>
<tr>
<td>Log message:</td>
<td>Each 'view notes by...' is now more or less working.</td>
</tr>
</tbody>
</table>
Lo,

I won't make the Monday meeting, so I've prepared just a few lines of question that I though I'd ask:

- Is the current workflow ok (who does what and who is dependent on that "what")? How to change if needed?

- Localisation (language version) when and how? Test first in one part or full-frontal-assault-implementation right away? :)

- When should B be present (same days with G or partially on other days)? Now if I'm MO/THU/FRI, then do all the work "Lag" because I'm not there TI/WED to do other things that people need to get ready before they can do their own things?

- How/who to bring user stories, UI designs up-to-date?
  + development discussions (who wants to do what and when/where)?
  + current and near future state of things (space, funding, etc)

I had something else on my mind as well, but it eludes me now...

Have fun. back on TU (probably at noonish).

cheers,

B

---

Every Monday at eleven our team is having *Monday Meeting* where we check what was done last week and what will be done this week. The idea of Monday Meeting is to be a short, less than one hour, checkpoint where things done and things need to be done are listed together. The listing of things done and will be done are made in an e-mail send to the team's mailing list and on a big paper hanged next to the door of the team's room. Next to the paper we are having a marker for updating the paper when needed. From the paper everybody should be able to track on what issues other member of the team are working on.
Every second or third week the Monday Meetings are also used to have a Release Planning Meeting. In the case of having Release Planning Meeting the Monday Meetings can be from 1 to 2 hours.

In the Release Planning Meetings we also generate workflow diagrams, which are hanged to the wall of the team room. Similar ways as the task list paper out side the FLE team room, the workflow diagrams are helping team members to keep in mind what should be done next and by whom. When the task list paper is made every Monday for the next week the workflow diagram is made for longer time period.
Even that most of the team is working in one common big room, using CVS and Mailing List making constant communication and cooperation possible, the Monday Meetings have become very important forum for coordination of the team work. The Monday Meeting, as an official weekly join event, which is documented to the task list paper and Mailing List, is structuring and giving backbone for the work.

Informal Coffee breaks are held in daily bases. The coffee break means that 2 to 4 team members are leaving the FLE team room to cafeteria to chat about the current stage of work and development. The coffee breaks are important informal sessions where discussion is not limited to be work related. Very often, however, the coffee breaks are used to make architectural and design decisions. This means that the people taking part in the coffee break are having paper and pen with them to draw and document their design. The coffee breaks are giving designers and software developers possibility to break away from the environment (the team room), which is mostly used for programming. This is giving the team members better possibility to see the big picture. More important than just to work together in another environment, the coffee breaks are building the team's mutual understanding of the meaning of the project.

As the team is developing software, the release days are giving rhythm for the work. At the moment the team is releasing a new version of its software every second or third week's Friday. The releases could be a good reason for party. As the member of the team are not very “party oriented” the release days have end up to be not any party but very peculiar combination of hard working and loose Hanging Together event. The team is naturally very busy on the last day of getting the
release package together. Party for this reason we are not having any special event except eating good selection of fruits (I bring the fruits) together in the team room same time when finishing the release package. For me the release days *Hanging Together* means that I am spending the whole day in the team room (or in a coffee break with some member of the team) chatting and watching how the next release package is getting ready. The role of the release days *Hanging Together* is to make it clear that the team have got something done.

Most of the issues related to the team members' personal plans and development goals have been carried out within informal discussions with me. As the team has been crowing, I have few months ago introduced for the team the possibility to start having "official" *Development Discussions* between each member of the team and me. The idea of development discussion has been clarified to be about one hour discussion, considering both administrative and financial situation of the research group and personal "goings-on", goals, aspiration and plans.

To carry out development discussions we have designed a *Development Discussion Form for Design and Research Teams Working on Short Time Funding*. The form is used as checklist for discussions and filled up together with the members of the team (see Annex 2).

The development discussion is based on idea of an open management where all members of the team know the actual financial situation and future direction of the team. When the plans and goals of the members are documented the team members gets a complete picture of the situation and can make rational decisions for their future plans. The development discussions are guiding and helping the team's self-organizing process.

### 6.3.5. Mobstorm Concept

The Mobstorm concept was designed particularly to support creative working processes. Currently the FLE team is not using any specific tool or method specifically designed for creative work. The creative part of the work has been (and is still) very embedded in the general working processes of the team described earlier. The Mobstorm concept is one possibility to support and engage our kind of research and design team in creative working. It is believed that a new tool may help the team to think, try and emphasize more the creative part of the work.
The Mobstorm idea was originally created in several informal meetings held with a group of friends. The core of the idea was brightened from another idea not related to brainstorming but using basically the same technology. The basic functionality of the Mobstorm application was simply discussed through in a few meetings and written down afterwards by me. The basic idea was actually so simple that it was not even necessary to share my notes with others.

The idea of the Mobstorm concept is to offer team members possibility to take part in creative brainstorming sessions with their mobile phones. A user scenario of "mobstorming" could be as follows:

The design and research team are having a Monday Meeting and notices that they should find more creative and descriptive name for one software module currently called "File Sharing Thingy". The team knows that the final user/customer is not going to understand what you can do with the module if it does not have a more descriptive name.

The team decides to carry out two days "mobstorming" -session to find better name for the "thingy". One of the team members opens a web based Mobstorm application and writes to the title field "Name for the File Sharing Thingy" and add team members to the session by selecting them form the database (the database contains some user information, at least name and mobile phone number). When the session is saved, the Mobstorm system is sending all members' mobile phones a sms-message:

Mobstorm Session:
Name for the File Sharing Thingy:
Number 050 - 351 67 96:
48 hours left

After this all members of the team may add their ideas and suggestions to the Mobstorm application by (1) calling to the phone number and dictating their idea, or (2) by writing and sending the idea as a sms-message or (3) by visiting the Mobstorm application in the web, or (4) by using the big touch screen available in the team room.

When the session is active, the system is sending every six-hour (or what ever has been set) an announcement sms-message for all the members of the team reminding about the session and telling how many ideas have been already saved to the system. The participants may organize and edit the ideas from different places: the web interface and the touch screen available in the team room. In both, the web user interface and the touch screen, the team members may organize the notes by grouping them, draw links between them, name them and delete them.

---

12 The group of friends is Petri Saarikko, Eerik Vesterinen and Ville Valorinta with whom I have been having informal "business plan brainstorming sessions".
After 48 hours of "mobstoming" the team members are having another meeting where they are selecting from the ideas available in the Mobstorm system a new name for the *File Sharing Thingy*.

**Picture 12: General Architecture of Mobstorm System (Elements of the picture by Petri Saarikko).**

To communicate the Mobstorm concept I first designed simple sketches with written explanations of the users interface (Picture 13). The sketches were made with a basic drawing program. The series of pictures was also one kind of storyboard explaining the functionality of the system in time.
Picture 13: The First Sketches of the Mobstorm
The first sketches were made to develop interactive demo of the system (Picture 14). The demo was worked out by Andrea Botero and made with Director program.

1. Starting Point: Tabula Rasa
2. One note in the Board
3. Four notes
4. Five notes
5. One "open text note"
6. Reorganized notes
7. Pie-view of the notes

Picture 14: The Interactive Shockwave Presentation of the Mobstorm.
Based on the Director/Shockwave demonstration and several meetings held with Petri Saarikko, he made new interface sketches where the Mobstrom is integrated to other Computer Supported Collaborative Work and Learning tools, such as Knowledge Building tool, Online Chat and File Sharing (Picture 15).

PICTURE 15: MOBSTORM INTEGRATED TO CSCW/L SYSTEM (PICTURE BY PETRI SAARIKKO).

The general concept design of Mobstorm system has been carried out in 2001. In the next step, a first prototype will be build for testing it in our research and design team. It is believed that Mobstorm system could offer both meaningful and playful environment for creative brainstorming. It is good to remember that Mobstorm will be only one communication and cooperation channel for some relative small use and can not replace any of the other communication means and tools used in the team.
PICTURE 16: COMMUNICATION AND COOPERATION FRAMEWORK AND TOOLS OF THE FLE TEAM
7. Conclusion

In the previous chapter I have presented several thoughts about the role of dialogue, knowledge and knowledge building in communities and teams. The leading thought has been that knowledge and innovations are born in teams and groups communicating and working together, while reaching a better understanding of the physical, social and psychological environment in which they are living. Or like Lev Vygotsky puts it in one sentence:

"All higher [mental] functions originate as actual relations between human individuals." (Vygotsky 1978)

What the community, group or team ends up in their collaborative reasoning efforts, is always only something which the community sees to be most probable and reasonable at that stage. This means that there is always reason to think again and reconsider the "better understanding already reached". This activity of rethinking, reconsidering and redesigning can be called art of the second thought.

Individuals doing creative work (all humans) should always be sensitive and alive to all new thought and ideas - think them, present their own interpretations of them and this way take part in the dialogues. Any new observation or idea can make the theory a little better than before. The perspective should be wide and pluralistic. The beauty of openness towards different ideas and thought requires that the person is no trying to explain, but understand the observations made. The desire to understand is a virtue.

Such a position in which intellectual worker, researcher or designer, aspires to understand rather than to explain some phenomena, ties-up him or her to implement his work in real world setting. The activity, the real world setting, may then correct the earlier interpretation made. I see this very much related to the concept of -reflection-in- action presented by Donald Schön (1983), who is interested in the development of an epistemology of practice in which practitioners do not separate thinking form doing, and are able to reflect in the broader commitments and implications of their actions, and where their experimentations are integral part of the inquiry (Shön 1983).

The digitalization of information (maybe even knowledge objects) makes it more possible to practice the art of second thought. Actually, more difficult than letting the world know that you have changed your mind, is to change peoples' attitudes towards an understanding that different thoughts at different times are natural for human development.

In some digital areas the art of the second thought works very well. As an example for a hacker, engaged in developing software with others, the art of second thought is reflected in this kinds of situation:
"...bunch of hackers writing code, and when somebody gets something done, he commits the changes, and other see the changes are good, and are inspired by the change..." (Software Developer D)

Conversely, the software industry has adapted for the art of second thought. Nowadays, when most of their customers are connected to the Internet, software companies are publishing rather draft versions of their software products and then updating the software progressively through the network. When starting the software it may ask you if you want to update your version, with some new patches that probably offer some new features. However very often they are basically correcting some of the mistakes (bugs) found from the earlier version.

**Picture 17: "Download the new software".**

It seems that the digitalization is pushing us to the world of second thoughts. We are probably nowadays allowed more to rethink and correct our thoughts and design.

Even that it seems to be clear the art of second thought is related to the digitalization we may still ask ourselves if is it really something new, which didn’t exist before? My answer to this question is no.

My explanation is that for many years of industrialization and mass-production, the idea of second thoughts has been widely forgotten. The living art of second thought in the past can be illuminated with an example. The ground plan of my mother’s wooden home house, build in 18th century (nobody knows the exact year) has been changed approximately 20 times. In last three hundred years the building has been changed based on both the needs of the people living in the house, and the fashion of the each time. An astonishing thing is that after all these changes, made by the people whose main profession have not been that of designing or renovating houses, the house still looks a house.
The art of the second thought exist in this final thesis at lease in three levels. Firstly, the communication and cooperation framework has been designed to be an environment where participants of the project and the members of the team are free to carry out the art of second thought. The framework made for collaborative research and design should offer possibility to "change your" mind if the situation has changed. Secondly, the actual design solutions presented are themselves "second thoughts". Hardly any of the ideas presented are unique. The solutions presented are just interpretations of the users needs and one combination of existing tools and processes for communication and cooperation. Thirdly, the idea of action research and participatory design means that any of the solutions presented are not " carved in stone". The community is anytime free to present "second thought" of the solutions and redesign the framework.

In the field studied and designed in there is still many open questions and challenges. The real use of the frameworks is still in very early stage. The tools have been used now about 6 months and so far we do not have good enough picture how they will function in the project and the team. Naturally, some more structured study of the use could offer a lot for the design. The need of second thought has been recognized.

From an industrial societies point of view one may ask that if there is always possibility for a second thought, when the things we are designing and developing will be ready? When things are done? To these questions we may answer with another question: why things should be ready? Should things be ready for us to be ready to die?

My argument is that in all good creative work there is always space and time for a second thought. To give space and time for second thought does not mean that things are not finished. All ideas, thought and design should always be, however, well augmented and reasonable. They should always represent the best possible thoughts, ideas and design of its time.

Maybe we need a patio to the house - what do you think?
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The Internet Encyclopedia of Philosophy. Founder and General Editor James Fieser, University of Tennessee at Martin - http://www.utm.edu/research/iep/.

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