How to support and enhance communication
- In a student software development project

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Abstract
This report, in which we have put an emphasis on the word communication, is based on a student software development project conducted during spring 2002. We describe how the use of design tools plays a key role in supporting communication in group activities and to what extent communication can be supported and enhanced by tools such as mock-ups and metaphors in a group project. We also describe a design progress from initial sketches to a final mock-up of a GUI for a postcard demo application.

Key words
Communication, design artifacts/tools, mock-up, metaphor, language-game, GUI, future workshop, participatory design, information, community of practice, usability test.
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## Glossary

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<tr>
<td>BTH</td>
<td>Blekinge Institute of Technology</td>
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<tr>
<td>GUI</td>
<td>Graphical User Interface</td>
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<tr>
<td>HCI</td>
<td>Human Computer Interaction</td>
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<tr>
<td>ie</td>
<td>Informationsekonomi - higher education in business administration with focus on the new economy</td>
</tr>
<tr>
<td>iPac</td>
<td>A handheld pc produced by Compaq</td>
</tr>
<tr>
<td>mda</td>
<td>Människor Datateknik Arbetsliv (People, Computers and Work) - higher education in work science and computer science</td>
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<tr>
<td>mock-up</td>
<td>A prototype of the demo GUI made of paper, in power point and html</td>
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<tr>
<td>pt</td>
<td>Programvaruteknik - higher education in software engineering</td>
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<td>Short Message Service</td>
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1. Introduction
This report is about a student software development project at Ericsson AB in Ronneby. The project, conducted during January through May 2002, was a large software development project, for third year undergraduate students, within the education for software engineering, pt, at BTH. Besides involving ten pt-students, the project, called Casper, also involved three students from the higher education in business administration with focus on the new economy, ie, as well as ourselves, Catharina Ahlström and Kristina Fridensköld, from the educational program People, Computers and Work, mda. The aim of the project was to develop a trust platform where a major goal was to create a feeling of trust and control for end users when using different mobile applications.

As mda students we¹ have, through our education, a wide focus upon people, computers and work, where the emphasis is on the study of work practice, the actual use of IT and how people communicate at work. However, in this project we have focused our work on creating a GUI, which should provide a feeling of trust and control for users, when using a mobile demo application. In this work we have made mock-ups² of different GUIs for demo applications as well as performed usability tests with a number of test users. We have also tried methods like creating fictive personas and user scenarios, even though, in the end, we found that these last methods lacked relevance for our work.

We have put effort into finding methods to create a common language and a common understanding of the project context. In order to succeed with this we have focused on the communication within the group as well as the communication with future end users and our customer, as it is our belief that the result of a project partly depends on how well the communication works. Our purpose with this report has therefore been to see to what extent communication could be supported by different kinds of design tools, such as e.g. mock-ups and metaphors, which proved to be ideal ways to communicate visually with other members of our group, as well as with representatives for our customer, Ericsson AB, and test users.

¹ When using the word we in this report we refer to ourselves, i.e. Catharina Ahlström and Kristina Fridensköld, unless anything else is stated in the text.
² When using the word mock-up in this report we do not make any clear distinction between mock-ups and prototypes. In the Casper project a mock-up could be anything from a simple sketch to a more advanced, partly implemented, software prototype used for usability tests.
In the beginning of the project, we also used future workshop as a tool to create a common understanding of what to develop, as well as to create a common language within the project group.

1.1. The project
The Casper project aimed to develop a trust platform, which was going to be demonstrated in different demo applications on a mobile phone, a pc and an iPac. An important aspect for these applications is the ability to give the end user a feeling of trust and control when using a service provided by a business company. The platform should give the user an opportunity to create a personal policy\(^3\) for each business company, that the user finds an interest in using. The user’s operator handles the user policy. The advantage of this is that the user has the possibility of deciding whether or not a company will be allowed to prompt the user in order to offer a service, or kind of services, e.g. positioning and charging, and to what extent. All payments can be made via the user’s operator if the user decides to do so, which we found through the analysis of our usability test increases the sense of trust and control for the user.

The project group shared a project room at Ericsson AB in Ronneby, where we had access to computers, telephones and other equipment necessary for our work. Our customer representatives were located at Ericsson AB in Karlskrona, while meetings with them were usually held in Ronneby. Besides this, we communicated with each other by sending e-mail or by telephone calls.

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3 A user’s personal policy shows which business companies that the user has allowed being prompted by, and to what extent they will be allowed. It is the user who sets the conditions for each business company. The policy is only accessible for the user him/herself, and if a business company wants to prompt the user, e.g. ask if the user agrees to be charged for a service, the business company has to check with the operator if the user’s policy allows it to pose this question to the user.
Our work in the project started with conducting a future workshop\(^4\). The reason for this was a need to create an understanding and a common language between different groups in the project, as well as for the product being developed. The next step was to create fictive personas\(^5\) and user scenarios\(^6\) (Cooper, 2001) in order to find out what kinds of services could be of interest to develop. This we did partly together with the ie-students, and the work gave us insights about the huge number of potential end users, with different needs and interests, who could be target groups for the product.

During the first seven weeks in the project we also participated in the work with the pt-students to come up with a design proposal. In this phase the project group was divided into two groups, according to guiding principles for the project, where each group had to present their proposal for a technical solution on a quite abstract level. One of the proposals was chosen and accepted by the management of the course and the customer. This proposal showed a possible technical solution for the system being developed and met the requirements from the customer. When the design proposal was settled, the work with the requirement specification followed. In this work we had the responsibility for the requirements regarding users and the policy.

In order to understand the idea of the policy, we made a paper mock-up of the GUI of the policy, using paper, pencils and post-it notes of different colors and sizes. This creative work gave us an understanding of the complexity of the policy and how it was possible to deal with it. The next step was to create a mock-up of a GUI, intended for an application on a pc, for a postcard service provided by a fictive business company, and where the policy requirements were fulfilled. We worked with this in an iterative way (see fig 2 below), with evaluations from both pt-students and our customer, until we had a mock-up that could be used in a usability test.

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\(^4\) See 6.3. Workshop - getting a common view, page 36 in this report.
\(^5\) A persona is a user archetype that is possible to use to help guide decisions about product features, navigation, interactions and even visual design.
\(^6\) A user scenario, here, is a persona description, which is a narrative that describes the flow of someone’s day, as well as his or her skills, attitudes, environment and goals.
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Fig. 2  With this figure we try to visualise the different evaluation and iteration steps we experienced during the design phase of the GUI for a postcard service demo, starting with an initial sketch and ending with a power point version of a final mock-up presentation of a proposal, handed over to the pt students for implementation.

Our initial sketch of our vision of a GUI for a postcard service demo.

First attempt to make a mock-up of our GUI.

A second version of our mock-up is posted on the wall of the project room.

In the third version of our mock-up we used different background colors for steps hosted by the operator or the service provider.

Final power point version with lesser steps, according to comments from customer

Power point version given to pt-students and customer

Html version for usability test

Paper mock-up on different backgrounds

Paper mock-up posted on wall

Initial sketch

First paper mock-up

Paper mock-up posted on wall

Html version for usability test

Paper mock-up on different backgrounds

Initial sketch
The usability test was performed with an html mock-up of the postcard service demo user interface, and with both formal and informal interviews. The test showed how the users interacted with the mock-up, what problems they had and their opinions about the different steps in the mock-up. The interviews gave important information about aspects that the users found significant. The assessment of the usability test showed important aspects, which we will discuss later in this report, to take into consideration regarding the continued work with the design of the demo user interface.

On the basis of the assessment of the usability test and the evolving mock-up, we designed mock-ups of the postcard service demo user interface intended for applications on a pc and a mobile phone. These mock-ups, which we created in power point, underlay the implementation of the demo applications. In the design we had to consider requirements and opinions from the customer, i.e. Ericsson AB, which sometimes did not comply with our thoughts of usability.

Fig. 3
These are two of several steps in the power point version of the postcard service demo intended to be displayed on a pc. The different backgrounds aim to give the user a feeling of who is responsible in the different steps, yellow for the operator and green for the service provider.

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7 See 7.2. Involving the users through usability test, page 42 in this report.
1.2. The outline of the report
In this report we have put the main emphasis on how communication can be improved in a system development project by using various kinds of tools. Therefore we start with how we understand the word communication, which is a complex notion consisting of many aspects, and we discuss communication from different points of view. We continue with the concept of information, which is closely related to communication, and bring up the problems with the “flow of information”. In the next part we bring up problems related to communication in our project. These problems evolved in different ways during the entire project and between different parties.

In the following section we describe how to gain entrance to a community of practice where a common language is of importance for the community to develop. We discuss how our project, with its particular circumstances, became a community of practice.

Communication is an important aspect in the design process, where the final product depends on to what extent the communication has succeeded. Artifacts can facilitate communication, and we discuss the use of different tools such as mock-ups, metaphors and future workshop in order to support communication in design processes in general, as well as in our project.

Then we continue with participatory design which aims to develop a product that will meet the users needs in a better way and where communication constitutes a significant part. We give an account of the usability test that we performed in the project as a way to involve the users in the design work.

Finally, we give a conclusion of the report, which is followed by a concluding reflection where we reflect upon some experiences, which we found worth considering, such as why sitting physically close to each other in our project room did not contribute to make communication easier among project members.
2. Communication
As we put a major emphasis on the word communication in this report, we feel a need to further explain our comprehension of this word. According to the Swedish National Encyclopedia, communication is “transference of (intellectual) contents by means of a certain type of mediation”\(^8\) and communicative competence means the ability to communicate with others. According to our opinion, communicative competence is a condition for having meaningful communication between people, which is to a large extent of crucial importance in our lives. Humans are social and we need to communicate with people in our surroundings to survive. Communication is important at all levels in our society, and maybe even more important in the society of today, where new technology can affect how to communicate. How well the communication works between people in a group depends on many factors. Communication also depends on all parties involved having an interest in participating and an interest of reaching a common understanding of some sort.

Communication, as we comprehend it, is a complex notion with a lot of factors involved that affect the advancement of the communication. The words we use when we speak have different meanings depending on for example context, pronunciation and intentions. It is also dependent on how the listener interprets what is said, which means the context and the rules of conversation must be familiar. What people say, write or do is always a result of a complex interplay with the specific situation, and does not necessarily express what they think. It is the interplay between our actions, the social context and the situation that matters if our communication with each other is to succeed.

We will discuss this further from a linguistics and social context point of view. We will also discuss language games and the speech act theory. Even if this last theory belongs to cognitive science, we find the speech act interesting, as we consider this to be a situated and context dependent act.

2.1. Speech act
When people speak with each other it is possible, through the perspective of cognitive science, to consider this kind of interaction in terms of speech act theory. According to Edwin Hutchins and Tove Klausen (1998), who are referring to Austin

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\(^8\) Our own translation of: “Överföring av (intellektuellt) innehåll med hjälp av viss typ av meddelsemedel.”
1960 and Searle 1969, speech act theory considers utterances as simultaneously being several kinds of acts at once; the locutionary act, the illocutionary act and the perlocutionary act. The locutionary act is what a speaker actually says. The force of what is said is the illocutionary act, and the intended effect is the perlocutionary act. For example if someone says, “could you please hand me the towel”, this has the locutionary force of a question - is the person capable of handing the towel? But the person asking does not really want the answer to this; the illocutionary force of the utterance is an indirect request for the towel to be passed. The perlocutionary act is an enticement to lead the other person to hand over the towel. The answer to the question asked does not have to be a verbal answer but in this case instead a physical act such as handing over the towel, or shaking the head for a no (Hutchins Klausen 1998, p. 23). Even though the speech act in itself is built upon the theory of cognitive science, we find it interesting that this interaction is situated and depends on the context in which it is taking place. There is a need for the people involved to construct a shared understanding of the specific situation. If the people involved enter this situation with shared prior knowledge about how things are supposed to go, or typically go, then it is likely that the communication will work more smoothly. However, there are many other interesting perspectives when dealing with communication such as e.g. linguistics and social context.

2.2. Linguistics and social context

Speaking is often the most profound way of communicating but just as important are mimics, gestures, the intonation of spoken words and the rhetorical function of our language (Evard, 1996) (Hoberg, 1998). One similarity between these is that they are all used for promoting communication between people and for conversation. Languages are different in different cultures, but the purpose of the use of language is the same. Our languages for communicating are rich and complex. Not only may words bear different meanings in different contexts (Ebersole, 1972), the way we put words together, the way we pronounce them and how we express them, with what emphasis we use them, have an influence on how we interpret words and their meaning.
What people say, think and do, always depends on the social context, which is the fundamental assumption in a social cultural perspective (Säljö, 2000, chapter 1). The language an individual speaks and thinks with, is the language that the individual has acquired through communication with other individuals in a specific culture. To learn a language is to learn to think within the limits of a certain culture. Our thinking is a kind of conversation, which we have by means of our language inside ourselves, and the language is the link between communication and thinking. We think and act in a situated way in social contexts (Suchman, 1987), and we learn how to act within the limits of social practices. This is how we acquire the concepts of the world that underlie our thinking and communication.

From this point of view (Säljö, 2000, chapter 5) it is possible to say that thinking might be a collective process, something that is going on between people as well as within them as individuals. For example, in a conversation we know the implicit and common rules and how we can give and take meaning according to these rules. Rules for making conversation or behaving socially are not something obvious that we know exactly how we do, we just do it. This is probably the secret to their success. It is a bit like the vision of ubiquitous computing as Mark Weiser expresses it: “The most profound technologies are those that disappear. They weave themselves into the fabric of everyday life until they are indistinguishable from it.” (1991, p. 78) This is how the technique of everyday language works.

Communication is a dynamic and partly unpredictable situated action, where we negotiate with each other about sense and meaning. To reach this sense and meaning presupposes a familiarity with how the relevant language-games are played in the specific situation. (Lynch, Collins, Hirschauer and Winch, 1994)

2.3. Language-game
Language-game is a concept originating from Wittgenstein in his *Philosophical Investigations*. Ehn (1993) makes the following interpretation:

“Language-games, like the games we play as children, are social activities. To be able to play these games, we have to follow rules, rules that are socially created but far from always explicit.” (ibid: p. 64)
These rules are embedded in a given practice, and a participation in a specific language-game demands that these rules have to be followed. This means the ability to act in a way that others in the language-game can understand. Language-game implies that there is a relation between language and practice, and the words that are used become meaningful through their use in a special situation, related to a specific context. To understand a language-game means that we must be able to master the practical rules, and to act in an effective way with the people in this practice. (Ehn, 1993)

A language-game consists of many actions that cannot be explicitly described in formal language, what do people know that they cannot explain? Propositional knowledge is when you can describe what you know in words but the practical understanding, which refers to the skill in using tools, defies formal descriptions (ibid). Therefore, tools play an important role in many language-games because they are signs of what is possible to do with them in a certain language-game.

In the participatory design work, it is understanding the language-games of the use activity, that makes it possible to design artifacts which are useful to people. Design tools, such as mock-ups and prototypes, support the participatory work including communication with the users, by bringing earlier experiences to mind which are reflected upon through the practical use of the mock-up or prototype. In the UTOPIA project (Ehn, 1993, p. 56) the designers developed a method called design-by-doing (ibid: p. 70) to improve communication between workers and designers. With this method the interplay between different language-games was supported by the use of design tools such as mock-ups, prototypes and scenarios.

The possibility of understanding each other despite different language-games depends on the family resemblance, which serves as a mediation between various language-games. This means that in the beginning one understands a new language-game only from what is already understood in another language-game, which depends on the family resemblances. By using design tools such as mock-ups and prototypes this could be supported as well as the user will be able to express practical understanding by the means of the tools. (ibid)
3. Information

Information is, according to the Swedish National Encyclopedia, “the meaningful content that is transferred by communication in different ways.” It is also stated that it is only when a receiver interprets a message that information develops. From this point of view, we think it is interesting to consider that we often talk about information as something that you can choose to take part of, and that it is possible to offer information without anyone receiving it. Sven-Eric Liedman (2001), who refer to the interpretation in the Swedish National Encyclopedia, says that information also can be viewed as a material (ibid: p. 62) for most types of knowledge. This implies that information remains as information even if there is not anyone who receives it. However, according to Liedman, information is the result of other people’s knowledge, which is given to the surrounding world as information ready for anyone to take part of.

Our comprehension of information is similar to Liedmans interpretation. However, we believe that a person can share information with other people without the receiver understanding the information in the way the informant intended. By this we mean that the receiver may misinterpret the given information without realizing the error. This we noticed in our project where we e.g. at one occasion were given information about what we thought was the postcard service demo, when in fact we were informed about another demo, demonstrating only a small part of the system developed. The information given was still the same, however, and we had received the information, but had applied the information in the wrong context. This may have been an error committed due to problems we had when deciding what information that was relevant for us in the project and what information that was not.

3.1. Flow of information

Our opinion is that the flow of information that surrounds us is a dilemma. We do not need to know everything that is going on. However, we often believe that we do. The flow of information also increases continuously. We get all kinds of information, all the time, through television, radio, the Internet, by fax, e-mail, telephone, newspapers etc. The huge amount of information makes it impossible for us to take part of everything that is offered and it is also difficult to sift out what might be

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9 Our translation of: “Det meningsfulla innehåll som överförs vid kommunikation i olika former.”
important. In many workplaces, as well as in the process of system development, the documentation of several different kinds of information constitutes an important part of the work. Taking part of given information is often a condition for meaningful communication with others in a workplace. At meetings, for example, it is assumed that the participants have received the information that underlies what will be discussed. An important aspect is that the information can be interpreted in various ways. Different people interpret the same information in various ways depending on a lot of factors such as their educational background, the social practice they belong to, their interest in the information etc.

With the continuous development of technology, we constantly get new opportunities through which we can collect even more information. Also, it is not only the flow of information that increases. The speed of spreading information also increases with the aid of technology and the human capability of adapting. There is actually an investigation that shows that politicians in the 1990’s talked approximately 50% faster than their colleagues in the 1940’s (Hylland Eriksen 2001). With the aid of a more extensive and faster flow of information, people of today get more and more problems with handling it, though, as some information tends to confuse more than it provides meaningfulness for the collector of information. An escalating need to develop an ability to prioritize and sift among the information is therefore occurring. The saying that “less is more” might be appropriate in this case, as it seems that with a more limited amount of information people are more capable of making sense of it and can use their energy to concentrate on how to act upon it.
4. Communication and flow of information in the project

We had a feeling of confusion when we entered the Casper project, and a feeling of not really understanding either what to develop or what was expected from us. We found it difficult to understand the information given by our customer, and we noticed we were not the only ones in the project that had this kind of problem. As we realized there were problems with communication and interpretation of information within the project group as well as with the customer, we decided to focus on how communication could be supported and enhanced.

Many of the problems that occurred in the project, concerning communication, were due to the fact that the members of the project group did not have the same prior knowledge when entering the project, i.e. we did not have an intersubjective understanding. When discussing intersubjectivity in chapter two of the book *Cognition and communication at work* (Engeström and Middleton 1998, p. 22-23), where Hutchins and Klausen refer to Rommetveit & Blakar (1979) and Wertsch (1985), Hutchins and Klausen say that:

“Intersubjectivity supports efficient kinds of communication. It is what permits human actors to intend and find meanings in many nonverbal behaviors and in the aspects of verbal behaviors that go beyond the literal locutionary force of the utterance”.

An example of this was when, due to our different prior knowledge within the project group, the information given by the customer was interpreted differently. After our first meeting with the customer, it was obvious to us that we did not have a common understanding of what to develop. There were different opinions within the group about e.g. what the platform contained, which technical solutions could be possible to use and how the policy should be treated.

The members in the project group represented different practices and we did not have the same educational background. The social context was not familiar to the group, even if some members had more experience from similar kinds of design practices than others, which resulted in different understandings of the meaning of the words when talking to each other. We also had difficulties understanding what each other’s practice should contribute to the project. This concerned mainly mda- and ie-students as the pt-students already had roles to fill according to guidelines of the course.
The different practices represented in the group had their own language-games, which contributed to communication problems, especially in the beginning of the project. The problem we experienced was how to communicate with each other in a meaningful way that everyone in the group could understand. The project group also had more or less difficulties in understanding the language-game of our customer, which surfaced when we were discussing the content of the information given and it turned out that we, within the group, had different opinions of the meaning. According to family resemblances between language-games, we think that the difficulties in understanding and communicating between various practices were experienced on different levels. Some language-games were closer related to each other than others were, which contributed to a common understanding between these in an easier way. E.g. as mda-students we experienced some problems when discussing the demo, as we did not have the same understanding of the word demo as the pt-students and the customer. While we thought that the word demo represented our demo for a postcard service application, the customer and the pt-students were talking about smaller demos that would demonstrate crucial actions in the system developed. It was not until late in the project that we realized that our demo was the “full demo” and that there were several other minor demos as well. For us it seemed as if the pt-students and the customer were involved in the same language-game, but we were not.

In order to create an understanding concerning the different practices involved in the project and to create a common understanding concerning the system being developed, we spent several hours in meetings and discussions where we negotiated with each other about sense and meaning. Gradually we constructed a shared understanding of the situation and slowly we began to develop a social practice. However, we think this development was supported by the use of various artifacts as tools. The use of design tools is important in the participatory work of design; where they support communication, and therefore we think the use of these tools has an important role in supporting communication between all the different practices that are involved in a design process, as well as communication with customers and organizations.
Some of the tools we used in order to support communication were mock-ups and metaphors. From our point of view, it was obvious that they promoted communication a lot. We found it easier to talk and discuss about abstract things, such as the policy, when using a concrete mock-up or metaphors. In the beginning of the project, the metaphors provided us with, to some extent, a common understanding of the information given by our customer. It also happened several times when we were discussing for example a requirement that we used the mock-up to show what we wanted to express verbally. When doing this we noticed that we understood each other in a better way when having something visual to relate to in our discussions. We could also solve some misinterpretations such as e.g. that we did not have the same understanding of what the conditions really meant in the policy. In our mock-up we had visualised some written conditions. When some of the pt-students saw this in our mock-up they explained their interpretations and view of these conditions, which differed from our. Another interesting experience was that when we delivered what we considered was our final mock-up; the customer came with more, creative opinions and demands on the GUI than before. We rendered this action as a confirmation of our belief in the mock-up as being a suitable tool for supporting communication, i.e. not until there was something visual to discuss around was it possible for the customer to be fully aware of our thoughts and visions of the postcard service demo.

It was not always clear to the project group what the customer meant or wanted in different situations in the project. Some of this we have related to the fact that we, in the beginning of the project, continuously met with several different representatives from our customer. As these different persons had different roles at Ericsson AB, they did not, according to our opinion, always share the same ideas, interests and understanding of our project. Due to this the instructions we got from the customer was not always unambiguous and effort had to be put into considering the information collected. After some time though, we decided within our project group, to let only a few people from our project meet with only a few representatives from the customer. In this way we diminished the confusion and the risk of getting too much contradictory information and instructions from the customer. Even in this communication it was obvious that the mockups and the metaphors supported the language-game our customer used. The tools made it easier to communicate without too many misinterpretations as they had already partly contributed to a common understanding and a common language.
The project group also put a lot of effort in the organization of the work, because we believed that if everyone was up to date with what was going on in the project, the communication would be improved. However, the aim of keeping everyone informed about what was going on proved to be a difficult task. It was made a bit easier when we created a poster where a photo of each project member showed what role and responsibility he or she had. The progress in the project, with deliveries, deadlines and other important events, was also visualized on a white board and made it also a bit easier for the members to keep up to date. All these were posted on the walls of the project room, which was a space the project members shared.

![Fig. 4](image)

This is the whiteboard used for displaying progress information in the project. In front of the whiteboard is a poster we created for knowing “who’s doing what”. This poster was originally posted on the wall beside the whiteboard. The poster contained several movable photos of all project members as well as movable headings. In this way project members could put their own photos under the headings appropriate. This could be headings for different roles in the project or different tasks such as for example “risk analysis”, “quality assurance”, “test” etc.

However, as time went by and the work in the project ran more smoothly, this poster and the progress on the white board seemed not so important for the members in the group. This was noticed by the fact that there was no updating of the poster and the progress, and no one seemed to miss it. The reason of this was presumably that the project work became more organized in time.

4.1 Problems in the project due to flow of information
In the Casper project, the constant flow of information, especially in the beginning of the project, was many times more confusing and disturbing than of any use at all. Some information even made us feel even more unknowing, not to say stupid, as we
did not have the right tools to interpret the information. Despite this, all the members in the group participated in all the meetings in the beginning of the project. As mda-students, we did not have the same difficulties with understanding technical issues as for example the ie-students experienced. Even so, there were times when we also experienced problems understanding the issues. This of course affected the communication in a negative way. Age, gender, different interests and educational backgrounds were all issues that together built invisible barriers in the communication between project members. After some time, the problems occurring became visible to us, and we decided to have only a few members participating in different meetings.

An interesting reflection was how we felt in the very beginning of the project before the local network and server were installed. At this point of time we could not share documentation and information with each other, other than by e-mail. This was both frustrating and difficult. We really looked forward to the network and the server, and how it would facilitate information and communication within the project. However, this feeling of being in control of information did not last very long. Instead, we found it difficult to know what we were supposed to take part of and what was relevant for us among the huge amount of documentation and information that was produced within the project.

We also discovered how important it was to have a project leader who was well informed and who could delegate information to those parties who were affected by, or in need, of specific information. It was a relief not having to spend time in meetings where the information given felt irrelevant or hard to understand. A lot of time was in this way freed for a lot of project members, time that could be spent on tasks relevant for each member. In this way the confusion was diminished and most project members started to work in a more effective way, and also seemed more at ease. The feeling of chaos slowly disappeared and was replaced by a feeling of everyone knowing what to do and what to focus upon. However, there was a loss of the intuitive feeling of knowing what was going on overall in the project for some of us.
Through this experience we feel that one of the most important things in a student software development project, is to develop routines for how general information should be spread among project members in a way that will make the members feel as participants, and not just as receivers of information, at the same time as the flow of information should be kept as low as possible. If the project group succeeds in doing this, we believe that the communication in the project will also be more successful.
5. A community of practice
Being part of a project is also being part of building a community of practice. To get entrance into a community of practice there must be a legitimate reason for participation (Lave & Wenger, 1991). Often in communities a new member enters in the peripheries of the community activities. As time goes by and the new member becomes more and more involved in the activity of the community, and the skills increase, the member begins the journey towards a more central appearance, or rather participation, in the community (see fig. 2 below).

![Diagram of community of practice]

Fig. 5
*This is how we picture the activity in a community of practice. A new member enters in the peripheries of the activity. As the member becomes more involved in the activity he/she moves from the peripheries towards a more central participation.*

All communities have their specific common language. The vocabulary may be the same as in many other communities but it is one thing to give a general definition of a lexical item and quite another to understand the particular sense these terms have when used in a particular context (Lynch, 1994) i.e. the same words may bear totally different meanings in different environments and situations. To become a full member of the community, the member has to be able to handle this common language. Also, rational use of terms presupposes a familiarity with this context and the rules within it. In time, people also develop a skill to “read” their environment. Intuitively they notice small differences and details that make a difference of how a situation is interpreted (Rönby Pedersen, 1997), people develop awareness (Falk, 1998) in different contexts.
There is a safety and sense of comfort in following the examples of earlier and more experienced members of a community. Even if you do not agree about everything, at least it is easier to form an opinion if there is already an ongoing discussion or an accepted practice to start from. In a student project, like Casper, the complexity of the community building increases, as all members are new at the same time.

In our project group there was no common vocabulary to start with. There were no unspoken, hierarchical roles to begin with, no norms to follow. All this had to be created from step one. As this project initially was a pt project performed in the course pac004 at BTH, there were guidelines and requirements for the roles of the pt-students. As this was not the case for the ie-students, the members in the project group, including the ie-students themselves, experienced some difficulties in understanding what their role was in the project. Even the customer was uncertain of the scope of their participation. When leaving the project, after fulfilled hours, it was still not clear to all project members how their participation had affected the project in reality. As mda-students, our role in the project was initially not clear either, and we experienced some problems when trying to communicate to the rest of the group what we wanted or thought we could achieve in the project. After some time though we grew into our role in the project, even though our work sometimes felt more like a side path to the project in large.

An example of how our roles and the ie-students roles were not clear for the customer initially in the project, was their suggestion that we together should work with user scenarios to get started. This work started with a meeting with business representatives from Ericsson, who seemed not to be involved in either the idea of the Casper project nor what the ie-students or we could contribute with. This meeting gave us a feeling of confusion, but also some ideas of how we could work together. However, as we had not worked with user scenarios before, and the ie-students were unsure of their participation in this work, we felt this was a kind of work we were not familiar with and we were uncertain of what it could contribute to our approach.

This was an awkward situation and it was very hard, not to say almost impossible, to create a community of practice where all members were new at the same time in the community. There were a lot of challenges to address. The community grew out of rules and guidelines, which had to be stated ad hoc, and the members tended initially
to be in a state of uncertainty. It was almost as if we felt threatened and all our senses were alert. There was a fumbling effort to develop norms, rules and a hierarchical structure within the group. A lot of this uncertainty was projected on our project leader, whom we faced with our request of stating norms, rules and structure. We all believed that it was his role to put these pieces together and present us with a ready solution. Afterwards we understood that this was an impossible demand, both because he was as new to the group and the situation as the rest of us, and also because rules and behaviors in a new group cannot be forced.

After some time in the group, however, we learned to interpret and understand each other's behaviors and habits, we learned what to expect from different situations and we developed rules, a common vocabulary etc. Through this process we started to relax and began to wear our roles as pt-students, mda-students and ie-students more comfortably in the project, which in turn let us concentrate on the purpose of action instead of on the action itself.
6. Supporting communication in the project

“The perspective of design as communication takes on particular importance because communication is difficult. By and large, the participants in the design process don’t understand one another.”

(Erickson, 1995, p. 44)

The important role of communication in the design process is highlighted by Erickson (Erickson, 1995) in the chapter he writes in the book *Scenario-Based Design*. The design process is to a large extent “a social process in which communication plays a critical role” (ibid: p. 56) and it is “a process of communication among various audiences” (ibid: p. 39). There are different audiences depending on the nature of the product being designed, but Erickson talks about three audiences: The design team, the intended users and the organization within which the design takes place. The design team is an extremely diverse group of people from different disciplines and they might not have worked together before. The users are the intended users of the final product and they must understand the nature of the product being designed in order to provide useful feedback to the designers. The organization “plays a fundamental role in shaping the nature of the design process” (ibid: p. 41), because it determines who the audience is. The audience of the organization is usually quite heterogeneous. These three audiences correspond to the different groups within the Casper project, where we can identify ourselves as belonging to the design team together with pt-students, our test users as being the intended users, and our customer, Ericsson AB, as the organization.

In order to support communication between the various audiences, Erickson points out the notion of “design artifacts”, which “play a key role in mediating and catalyzing this communication” (ibid: p. 56). These design artifacts are constructed or collected during the design process and consist of for example prototypes, scenarios, analyses of user interviews and requirements documentation. When a specific design artifact is used depends on the stage of design, the goals of the design team and the audience being addressed. It is the characteristics of the various stages that

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10 The design process in e.g. a large, product development organization differs from the process in a design consultancy.
11 Erickson speaks of a design lifecycle with three stages: Exploration, refinement and transition. The stages are likely to have considerable overlap.
determine which one of the several artifacts that will be suitable to use, which implies that different stages of design need different design artifacts.

Bürkle, Gryczan and Züllighoven (1995) view system development “as a learning-and-communication process” (ibid: p. 294) and introduce a methodology for object-oriented system development where their approach is based on the professional language of the users in the application domain. Central to this approach is that the professional language constitutes the core of the development process. They use metaphors to improve communication between developers and users and to increase the understanding of the languages used in the application domain. People understand something new by explicit association with other things that are already understood, and this is how metaphors work. This common understanding of a metaphor by the designers and the users constitutes a sound and valuable basis for mutual learning processes (ibid: p.310).

Kensing & Halskov Madsen (1991) point to the combination of Future workshop with the use of metaphors as a linguistic tool, which can stimulate seeing things in new ways. They point to the fact that metaphors are a natural part of everyday language and constitute a possibility to talk about one thing in terms of another.

6.1. Using mock-ups
Our various mock-ups that we have used in the project have served as excellent tools to support communication. We have found that the creation of the mock-ups has been an easy, cost-effective and not very time consuming way to visualize our ideas among ourselves, to other members in the project group as well as to our customer and to the prospective users involved.

The notion of design artifacts, as Erickson (1995) says, refers to many kinds of prototypes that range from crude, noninteractive ones to partially implemented versions of the product. They are all essential for the design process because they are used in different stages of the process and play different roles in order to support communication. In the exploratory stage, a vision prototype is used to capture a high-level picture of the design. The purpose of this prototype is to communicate what the gist of the design is, and to focus the design-team on the high-level issues
about the product being designed. In the refinement stage, a *working prototype* is used to represent details of the design and to explore solutions to design problems. The aim of this stage is to fill in the details after having determined what the design will do in the exploratory stage. The working prototypes “serve as a medium for team collaboration and as a means for eliciting input from users and from other designers within the organization” (ibid: p. 42).

In a design process there are different practices involved, which means there are different language-games as well. The use of various tools plays an important role in many language-games, because by using design tools, such as mock-ups and prototypes, the possibility of understanding each other increases (Ehn, 1993). It is easier to express practical understanding, which refers to the skill in using tools, by the means of the tools. For a designer it is important to achieve the understanding of a user’s practical understanding, and this is possible only by participating in the language-games of use of the tools. However, the tools used in the design process do not aim to give complete and explicit descriptions of the users’ demands, but to serve as reminders for the reflection on future computer applications and their use. “The meaning of a design artifact is its use in a design language-game, not how it mirrors reality” (ibid: p. 66).

### 6.1.1. Vision prototypes

Our first mock-up, which can be compared to Erickson's (1995) idea of *vision prototype*, was created when discussing what aspects we wanted to display in the postcard service demo GUI, intended for a pc, for the system developed by our project. While discussing this application, we began to make simple sketches on paper of the steps we considered necessary. In the Casper project there was a requirement specification with detailed requirements, listed by the project group and approved by the customer. As mda-students our main aim was to present a GUI which in one way or another demonstrated the requirements concerning usability. We began by listing possible choices in the GUI and then we started to draw simple sketches by hand of each step in the application.
In this work with the first mock-up, the mock-up of the policy was also included. As we were responsible for the requirements regarding the policy, and as we found the policy idea difficult to grasp we had to do a special mock-up of the policy. The policy should, for example, give the user the possibility of deciding on what levels\textsuperscript{12} he/she allows different business companies to prompt him/her. It should also be possible for the user to set certain conditions for when and if to be charged, positioned etc. We found the mock-up to be a good tool to use in order to get a grip of the complexity of the policy, and later on in the participatory work with test users, it proved to be a very useful tool.

The work with these first mock-ups proved to be an effective tool for us to inform each other about our visions and thoughts of the future demo. We also used these mock-ups to communicate our vision and thoughts to the rest of the project group. Through this we received a large amount of comments and feedback, which were mostly related to technical aspects and limitations that we had not thought of, but which were important for us to consider in the design process. An example was how different levels in the policy should determine what questions the user would have to answer, e.g. if the user has chosen “always allow” for positioning, the user should never be prompted to confirm his/her allowance for this. We had then consider try to understand how this can be done technically. This resulted in a shared understanding of the problems that had to be solved and proposals for solutions.

\textsuperscript{12} The levels could be e.g. always allow, never allow, allow for a certain period of time etc.
We were also positively surprised by the interest our simple mockups awakened in the project group. As one of the pt-students expressed it: “We ought to work like this, instead of starting to program at once.” After redesigning our paper mock-up a couple of times, we put it up on the wall in our project room. This not only gave us more comments and feedback from the project members, but also brought comments from the customer when visiting our project room. The mock-up in its simplicity was suddenly used as a tool to communicate, not only our thoughts and visions to the group and the customer, but was also a tool to communicate thoughts back to us.

![Mock-up Image](image)

**Fig. 7**

*When we had created a simple mock-up, which we ourselves thought contained all necessary steps, we posted it on the wall of the project room. This gave the pt-students as well as the customer an opportunity to comment the mock-up ad hoc when passing by. In this way we gathered creative comments, which we discussed, evaluated and applied in a new mock-up.*

In this communication we discovered some steps where we did not have the same opinion or even where we had misunderstood each other. For example, when visiting our project room, the customer noticed that we had included a log-in procedure in our demo mock-up. This did not meet with the idea the customer had of the log-in procedure as they wanted a one-time log-in for users on a daily basis. According to our way of designing it, the user would need to log-in each time he visited a new service provider. This we had to reconsider in our next mock-up. An important aspect of *vision prototypes*, as Erickson puts it, is that the prototype has to give a realistic depiction of the product and at the same time it should be apparent.
that it is a product concept. We think that our paper mock-up served the purpose to capture a general picture of the design.

6.1.2. Working prototypes
The next step was to develop the paper mock-up into a working prototype that could be used as a medium for interaction among users, as well as among the others in the project group and also with the customer. Our aim was to conduct a usability test as a way to involve the user in the design process. Taking the paper mock-up as a starting point, we decided to create a prototype of the GUI in html, as we found this an easy and rapid way to do it. According to Erickson (1995), a working prototype should have two properties for being effective as a medium for interaction: accessibility and roughness.

Accessibility means that the prototype should be able to be modified by any member in the design team, i.e. it should be easy to add functionality, adjust dialogs and feedback etc. without being a programmer. The purpose of not letting the programmers implement new ideas is that the designers should not lose the ability to quickly and iteratively explore multiple design paths. A problem is the limited environments that support this kind of interactions. However, Erickson argues that the creation of physical mockups, e.g. using foam core, cardboard, note cards and stick-on notes, can be an alternative, especially in the early stages of design. In our work with the prototype intended for use in the usability test, we found that html, despite its limitations, could be a suitable tool. Another limitation with html was our limited experience and skill in working with it in combination with the limitation of

<table>
<thead>
<tr>
<th>Specification of costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positioning:</td>
</tr>
<tr>
<td>Postcards:</td>
</tr>
<tr>
<td>Vykort 1</td>
</tr>
<tr>
<td>Vykort 2</td>
</tr>
<tr>
<td>Total costs:</td>
</tr>
</tbody>
</table>

Send more postcards
Go to checkout
Delete postcards

Fig. 8
This is one step of many in the html demo of the postcard service, which was used in the usability test. We have not put effort in the graphical layout. Instead we focused on what information had to be displayed to provide the user with a feeling of trust and control, here when dealing with the cost for the service used.

Accessibility means that the prototype should be able to be modified by any member in the design team, i.e. it should be easy to add functionality, adjust dialogs and feedback etc. without being a programmer. The purpose of not letting the programmers implement new ideas is that the designers should not lose the ability to quickly and iteratively explore multiple design paths. A problem is the limited environments that support this kind of interactions. However, Erickson argues that the creation of physical mockups, e.g. using foam core, cardboard, note cards and stick-on notes, can be an alternative, especially in the early stages of design. In our work with the prototype intended for use in the usability test, we found that html, despite its limitations, could be a suitable tool. Another limitation with html was our limited experience and skill in working with it in combination with the limitation of
time. Later on in the iterative work with the prototype, we used Power Point when we wanted to visualize new ideas for the GUI. This meant limitations as well, but we think it was an easy and rapid tool to use, even if interactions were not possible.

Erickson’s definition of roughness is “that the conventions of the prototyping medium are relaxed.” (p. 54). The rough prototype creates ambiguity, which makes it a source of ideas because different designers may resolve the ambiguity differently. It leaves openings for discussions and ideas, and it also seems easier for users to give feedback more readily because they criticize something that is obviously rough.

The html prototype of the GUI that we used in the usability test was both accessible and rough. Even though we had made this prototype in html, which might give the users a visual feeling of the demo as being “finished”, we had purposely made the layout free from unnecessary decorations so as not to give the html prototype a look of being finished. Also we had not implemented all actions. This meant that users trying different possible choices in menus and scrollbars soon discovered that this was not a finished product. Interestingly, though, we noticed that mistakes we had made unintentionally enhanced the feeling of roughness of the prototype, and provided us with confirmation of the importance of the trust and control aspect in our demo. An example of this was the specification of cost in our postcard service prototype where we had put two static inputs of purchased postcards to demonstrate a possibility to see a specification of all charges.\(^{13}\) In the usability test the users could purchase a postcard and then go to the checkout after approving this specification. When doing this one of the first test users reacted very strongly when he was asked to approve a cost for two postcards when only having ordered one himself. He said “I am extremely suspicious when it comes to things like this, I check

\(^{13}\) See the picture on page 31 in this report.
how to support and enhance communication – in a student software development project

Everything”. Also several others of the test users noticed our mistake with the specification. Another mistake was that we on one html page had written the cost for postage separately and in another html page we had included it in the total amount. This was discovered by several test users and made them very confused as they thought that the price including postage was comparable to the amount on the other html page were it was excluded. These mistakes from our side gave us valuable feedback of how important the aspects of trust and control is for users when dealing with money, no matter how small the amount is.

We also got other valuable feedback from the test users, as they were able to communicate their thoughts, visions and opinions when they interacted with the prototype. Examples of this was using icons instead of text strings, adding a visible counter of the amount spent and changing the formulation of one of the conditions in the policy from “allow once” to “must ask”.

![Fig. 10](image-url)

Two of our test users communicating their thoughts to us, during the usability test, with the aid of body language. We found that when test users had something they wanted to make us aware of they stopped using the prototype, leaned back and supported their verbal expressions with gestures as well as established eye contact with one of us. In the cases above the users are trying to explain their comprehension of the policy to us.

With this feedback in mind, we began the work with making a power point prototype of the GUI, which should be the basis for the implementation of the demo application for a pc.

14 See appendix 1a, pages 6-12.
15 See appendix 2.
We worked with this in an iterative way with evaluations mainly from the customer, but also from the members in the project. The communication with the customer was unfortunately mostly through a third party, but still, it was quite easy for us to understand what they meant as we had the prototype as a common picture. We felt that the communication between us improved a lot and we started to understand the requirements from the customer in full, e.g. that they wanted us to limit the number of web pages as much as possible. At this point in time, the customer expressed a desire for a prototype of the GUI adapted to a mobile phone. This prototype was created quite fast, due to our time limit, and we could only work with it in a couple of iterative steps. We also discovered that there were technical limits of what it was possible to do when using wap technique. E.g. it was not possible to use icons or linked pictures. Nor was it possible to use different fonts. Therefore we believe that this prototype\textsuperscript{16}, even if fulfilling the usability requirements stated in the Casper requirement specification, would not meet the expectations of the user in reality.

6.2. Using metaphors

In our project, we have sometimes used metaphors in order to understand specific issues in the project better. We used metaphors when communicating within the project group as well as with our customer. We also used metaphors to explain some issues to test users, participating in our usability test.

6.2.1. In the communication with the customer

In the very beginning of our project, the whole project group met with three representatives from Ericsson AB, our customer, in the Ronneby office. The purpose of this meeting was for the customer representatives to introduce themselves and explain what they expected us to design in this project. We all sat down in a couple of sofas in front of a whiteboard. After introducing themselves, one of the representatives started to talk, while drawing on the white board. He was talking about operators, service providers, enablers, core and access. It was obvious to us that it concerned some sort of platform, but as much of the information given was entirely new to us, it was a bit hard for almost everyone in the project group to grasp.

While explaining, he noticed that some of us did not really understand what he was trying to explain. This was when he started using metaphors. He began to talk about players and how the ambition was to let a player keep the control of a group of

\textsuperscript{16} See appendix 3.
services. He talked about a “wall garden”, i.e. a garden surrounded by walls. He explained that in the garden there were services available, although these services were not available from the outside. He continued explaining how the Internet is beginning to tear holes in the vision of this wall garden. He also talked about how operators, until now, had been able to sell availability to different “wall gardens”, but now they wanted to enable operators to sell availability to specific services. And he went on like this.

Also, when talking about the whole platform, he referred to this as being a jar, calling it “burken”. For many days, the project members referred to our project as “burken”. We even named the project “burken” before deciding on the name Casper. However, at a meeting, a week after meeting the customer in Ronneby, it became obvious to us that even if we had understood the overall description that the customer had given us of the “jar”, we did not have a common understanding within the project group, of what the “jar” really contained. If this had been a jar of marmalade it was as if we all knew that it contained marmalade but not what the actual ingredients were. This we had to find out with the aid of a Future workshop.

6.2.2. In the communication with test users
A major issue with the platform was to provide the user with a feeling of trust and control when using different services. For this, there was a need to let a user maintain the control of personal information while using a service. To be able to support this, there was a need for a policy. This policy would keep track of what information a user had agreed to share with specific service providers and what he/she had decided not to share without confirming it beforehand. Before performing the usability test, we felt a need to explain to the test users what we meant with this policy. We started to explain but soon realized that the purpose of our policy was not clear to some of the users. Instead of continuing to explain with words we used the paper mock-up of the policy, which we had made earlier to understand the issue better ourselves.

![Fig. 11](image)

This paper mock-up of the policy document was used for explaining the purpose of a policy in the postcard demo, to test users during the usability test. It also served as a tool when discussing the policy within the project group.
Even if the policy in reality was more like a database with collected information, we explained the policy as being a paper form, which the user filled in with their personal information. Via this form they could make explicit what information they wanted to share with whom. This seemed to be a better way to make the users understand the idea of a policy. One user confirmed his understanding of the policy by applying this thinking in other situations of life, where he felt it would be appropriate. In this way, we found that using metaphors was a way to facilitate an understanding of issues that are complex.

6.3. Workshop – getting a common view
In the initial stage, all members within the project group had problems giving a concrete form to what to develop and to express it in words. A lot of things had to be understood and a lot of problems had to be solved. During meetings and discussions, it was obvious that all project members had different approaches to what to develop, what techniques to use, and there were significant problems with the communication within the group because of different backgrounds among the project members. Erickson (1995) talks about the design lifecycle with different stages, and the exploration stage is characterized by confusion. Nothing is settled and there are often new technologies and some sort of deadline for formulating a design proposal. It is important for the design team “to understand the usage domain, define the problems being addressed, and develop a high-level vision of the product being designed.” (ibid: p.42)

6.3.1. Use of Future workshop in the project
In order to create an understanding of what the platform, called the “jar”, really contained, and to create a common language so we could talk about it, we held a Future workshop (Kensing & Halskov Madsen, 1991) where all project members participated. The purpose with this kind of workshop in system development is “to shed light on a common problematic situation, to generate visions about the future and to discuss how these visions can be realized” (ibid: p.156).

We tried to use the concept of Future workshop and metaphorical design as a starting-point for our workshop, and adapted it to the problems the group experienced. Our problems in the group concerned mainly how to understand what
to develop, how to make it visible on a high level\textsuperscript{17}, where everyone in the group could take part of it, and to develop a common language that made sense for all project members. As mentioned earlier, Kensing & Halskov Madsen (1991), point to a combination of Future workshop and metaphorical design, which has an orientation toward helping the users to take an active part in the design process by the possibility to communicate in everyday language. This in turn can help to solve the “right” problems, because it makes it easier for the users to enlighten their common problem situation, to generate visions for the future and discuss how these can be realized. As we considered the project group both as future users as well as members in a design team, we thought it was possible to refer to the concept of metaphorical design. We seemed to notice that the use of metaphors in the workshop contributed to the development of a common language and understanding, because we used much the same metaphors as our customer had done, which the members in the group already were acquainted with. The metaphors also supported communication between the different social practices that were represented within the project group.

Every member in the group had his/her own interpretation of the situation, and this contributed to the confusion we felt. Even the purpose of the workshop did not have the same meaning for all project members, which meant that, initially, we tried to create a common understanding of this. This was, at first, not shared by the pt-students, who had some problems understanding what a future workshop was and what the purpose of it would be, but like the ie-students, they agreed to participate.

During the workshop, we tried to keep the discussion on an abstract level, even though many of the pt-students would rather discuss detailed, technical solutions. In our effort to keep the discussion on a more overall level, one of the pt-students showed his resentment by turning his back to the whiteboard, sitting with crossed arms, not wanting to comment the situation. After a while, however, he turned towards us and began to participate in the discussions.

Our practical work in the workshop consisted of trying to identify expectations, possibilities and problems regarding various parts involved in the development of the platform. Everyone in the group wrote his/her opinions on post-it notes, which we put

\textsuperscript{17} A high-level picture of the design does not show technical solutions.
on the white board where they were grouped. This was followed by a lot of discussions, and we had difficulties with developing a vision on a high level, as we had different starting points, depending on our different roles and practices in the project. As we mentioned above, it was difficult for some participants not to be too specific about technical questions at stake, which other participants did not understand at all. An example of this was when one of the pt-students wanted to discuss different possible technical solutions of using a wap gateway for a specific task in the platform, which was not of any interest at all for the ie-students or for us. However, the workshop resulted in the formulation of several specific questions about the major problems from our point of view, such as what the “jar” was and contained, what the platform could contribute to the different actors involved, if the policy should be handled by an operator or a service provider, etc. These questions came to serve as the basis for continuing discussions with our customer.

Fig. 12

After the first step in the workshop, we sorted the post-it notes in different categories. The categories were then prioritised and given numbers representing most prioritised to least prioritised. In this picture you can see piles of categorized post-it notes containing different suggestions for matter of importance subjects, given by project members.

In the end, we believe that through this workshop we came a bit closer to developing a common view of our project and a common language. We also found that this workshop was of importance for us, being mda-students, as well as for the ie-students, since we were given an opportunity to understand the purpose of the project without having to focus on technical details, of which we did not have the same prior knowledge as the pt-students.
7. Participatory Design

“Recommendations to involve users in the interaction design process and to explore user profiles and future contexts of use have been widely accepted, because conventional product development often matches customer needs poorly.” (Buur, Binder & Öritsland, 2000)

Thus say Buur, Binder & Öritsland in their short paper **Reflecting on Design Practice: Exploring Video Documentary of Designers in Action**. Participatory Design (PD) is an approach toward computer systems design in which people destined to use the system play a role in designing it. The reason is that computer applications need to be better suited to the people using the systems, and therefore it is important to have an effective communication with the users during the design process.

If the power of a technology is to be unleashed, users need to be the creators and not merely the consumers. If the users are let in on the design process, they will hopefully help the designers to produce products that better meet the customers’ needs. That is, as long as designer's do not only talk to their existing customers and users, but also to those that are having problems and those who do not buy the product at all (Norman, 1998, p. 246). One should not forget that there is a huge difference between those who buy new technology for the sake of the technology and the great number of people who buy the technology only if it might make their daily activities run a bit smoother. However, if users are let in on the design process, it is important that they participate from the initial design process, as it might otherwise be too late to do anything about problems discovered when the product is almost finished.

In system development projects of today, the aim is often to follow an evolutionary development process with several iterations. As this process lets the design team re-evaluate its process over and over again through each iteration, it also makes it possible to bring users into the design work early on. By letting users participate in usability tests, they get a possibility to affect the design at an early stage. In our project, the limitation of time only allowed us to perform usability tests with test users...
at a certain stage of the design, but as the members in the project could all be possible future users of the system, we have also taken into consideration their knowledge and ideas around the design of the GUI for the postcard service demo.

When users are participating in a design process it is important to truly take their opinions and proposals in consideration when completing the design. Otherwise they might feel letdown and not important if the design team decides to do their own thing despite all the effort the users have put in. This we saw when analyzing video recordings from a project led by Buur and Pedersen, where the users were very actively involved throughout the whole design process and participated in all steps. In the end though, when they were presented with the final prototype, the users seemed confused, as some of their ideas and opinions were not reflected in the final design. We believe it is important always to evaluate the opinions of the users even if these will not be reflected in the final design. However, if the final design differs much from what is proposed by the users involved, it is important to consider the reasons for this. A discussion with the users might lead to new insights for both parts, which in turn may be valuable for the design process. Also, in this discussion and explanation process, more concrete evidence and support for the users’ ideas and opinions may surface and result in better design solutions.

7.1. PD methods

In the work with supporting user-involvement in systems design, several techniques have emerged from within participatory design. The Scandinavian approach (Ehn, 1993) to systems design, where democratic participation and skill enhancement are emphasized, shows how the user participation improves when using mock-ups and other prototyping design artifacts. This approach has led to the development of methods, tools and techniques used in the field of PD research. As mentioned previously in this report, the designers in the UTOPIA project, developed a participatory method called design-by-doing (Ehn, 1993), where the interplay between different language-games of the users and the designers was supported by the use of various design tools. The tools, e.g. mock-ups and prototypes, served as a way to bridge the gap between the users’ and designers’ language-games.
However, there is no need for fully understanding each other in playing language-games of design-by-doing together.

“As long as the language-game of design is not a nonsense activity to any participant but a shared activity for better understanding and good design, mutual understanding may be desired but not really required.” (Ehn, 1993, p. 71)

Kensing and Blomberg (1998) give an account of the development of PD methods, tools and techniques by referring to different PD researchers in order to promote cooperation between workers and designers, and they point out that there is not a single participatory method to be used. Tools and techniques that are used in system design, according to Kensing and Blomberg, are scenarios, mock-ups, future workshops and different kinds of prototypes. The authors refer to Ehn and Kyng (1991), who suggest the use of mock-ups in early design explorations because they are inexpensive, easily understandable and allow a degree of hands-on experience.

Andy Crabtree (1998) identifies central problems with those techniques, which are used for user participating in work-oriented design, and particular with the technique of prototyping. According to Crabtree, there is a danger of “tunnel vision” (ibid: p. 94), which can lead to the development of a perfect technological solution to the wrong problem. The reason for this is, that the prototype is dependent on how the current practice, where the system is supposed to fit in, is understood. An ethnographical method (ibid: p. 96) that allows observing the practice as it is performed in the workplace, is of utmost importance, says Crabtree. But incorporating ethnography into participatory design has proved to be problematic because of the problem of “linking its findings to system specifications” (ibid: p. 98). One ethnographic approach that is suggested to support the formulation of concrete design solutions is the notion of the language as methodological solution, and its relationship to the performance of the work. According to Crabtree, “to understand a language-game is to understand a distinct organization of work” (ibid: p. 99), and by achieving an understanding of a working practice, this allows identifying practical problems of work. Crabtree’s conclusion is “that participatory design relies on obtaining an adequate understanding of the language-game of the use activity.” (ibid: p. 103)
7.2. Involving the users through usability tests

In the Casper project, we have used usability tests\(^{19}\) as a way of involving the user in the design work. In this way, possible future users have been able to communicate their thoughts, visions and opinions of a product that is not yet developed. This in turn may hopefully lead to an end product that meets the needs and expectations of future users. A product that is considered usable is also of importance for the producer, as it will affect the potential of the product’s survival on the market. Unfortunately, we could only conduct one usability test because of the limitation of time, and therefore we also had to consider ourselves and other members in the project as users, when we needed to evaluate the mock-ups that were developed after the assessment of the usability test.

The purpose of our usability test was to investigate how the test users interacted with a demo prototype, what problems they experienced and their opinions about the different steps of the prototype. We were also interested in the test users’ opinions about what they considered important concerning trust and being in control, as these were major issues stated in the Casper project requirement specification.

Nine people, of various ages and with different educational backgrounds, participated in our usability test. Two of the test users were women, the rest were men. The age of the test users varied between the age of 13 and approximately 60. All of them use a computer in their daily activities and all persons have their own cellular phone, although their computer skills varied. Our intention was to choose test persons that agreed to the fictive personas\(^{20}\) that we made initially in the project. However, we found that the test persons did not fit with one of the personas, but rather with a mixture of them. This made us doubt if a created persona could reflect reality in a trustworthy way. As we had never used the method of creating personas before, we also felt uncertain if we did this in the right way, and also what the personas could contribute to in our work. With this uncertainty, we found the work with personas not suitable for our approach.

The time for the complete test took about 45 minutes per person. The test was held in the project room. This was due to practical reasons, as we had the prototype

\(^{19}\) See appendix 1a and 1b.
\(^{20}\) See appendix 4, pages 14 to 25.
locally stored in one of the computers. It was also convenient and time saving for us to be in our working place.

7.2.1. Test methods

The methods we used during the user tests were video recording, observations and interviews. The reason for video recording was so we would not miss some details by only observing what was going on. If needed, it also made it possible to look closer at sequences of interest and to listen to comments made by test users during their interaction with the prototype. However, when watching the film, we did not notice anything new compared to what we had been made aware of during the usability test. During the interaction with the prototype, which was made in html, informal interviews in the form of conversations were held about different matters that came up during the test. These informal interviews gave important information to us about aspects that the test users found significant. An example of this was the importance a user felt of knowing that a business company existed physically and not only virtually, which is sometimes the case with companies providing their services only through Internet. He said “I feel much more safe if using a company that has an office which I can visit [physically] or call, if needed”. This, he said would strengthen his feeling of trust for the company involved.

As a complement to the test, and in direct connection with it, the users also answered a questionnaire. The questionnaire contained questions about their use of cellular phones, pc:s. as well as their attitudes toward giving information about themselves to others and what they considered as important concerning this.\[21\] This questionnaire was also handed out to and filled in by the Casper project members.

7.2.2. Communication with the test users

During the usability test, we realized how important the language is for supporting communication. The test users had to understand English, which caused problems for some of the users, and they had to understand our language-game of design, which was new for most of them.

\[21\] See appendix 1b, pages 4-7.
Before performing the test, we explained briefly to the users what the policy was about. As we have described earlier in the report, we used the paper mock-up of the policy together with the metaphor of a paper form, as tools when explaining the policy. By using this way of explaining, we noticed that the users understood the idea of the policy when interacting with the html prototype. The proof for this understanding was when users applied the policy concept in their own examples, to see if we approved of their interpretation. This we see as a confirmation that we had created a common language and an understanding for the abstract idea that the users had to grasp.

During the interaction with the html-prototype, the test users were told to comment on what they did, what they found strange, difficult etc. As the prototype was rough and obviously only a prototype, it did not seem difficult for the users to criticize and to comment on the design. We could see that some of the users were unsure of themselves because of the new environment, and of the language-game which they were not familiar with. E.g. one of the test users had problems understanding the meaning of the word positioning. He said, "I have to get used to the word positioning, it is difficult". Another user said, “You have found a stupid person here”, meaning himself when first trying to understand the policy. However, the prototype and the mock-up of the policy in combination with metaphors that the users were familiar with, seemed to reduce this insecurity.

![Fig. 13](image)

Test users in action, performing usability tests of the postcard demo application.

We got valuable feedback from the users when talking about what they experienced when they interacted with the prototype. In this conversation, we noticed several

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22 See 6.2.2. In the communication with test users, page 35 in this report.
problems due to language and the language-game of design. One example was the misinterpretations of the abbreviation "SEK", which we thought was common knowledge, as an acronym for "Swedish Krona", but several of the users interpreted it as "seconds" even if the English abbreviation for this would be "sec". The reason for this interpretation was probably that they did not understand what "positioning" actually meant, which in this case was about being charged for being positioned.

We also noticed, that some of the users easily missed specific details, often something written, in the prototype during the first time they went through the application. The result of this was that the users did not understand what they were doing, although they thought they did. Next time they went through the application, and after we sometimes had given them a hint, they realized their mistakes, which often resulted in a new way of reflecting upon the application. On these occasions, the prototype improved communication when we explained our purpose with the application.

It was obvious that some of the users had problems with understanding English, although no one admitted this. A reason for this could be that it was in combination with the language-game of design the difficulties came up. They were not familiar with all specific expressions, as for example "positioning", which contributed to difficulties in understanding. In order to explain expressions like that we used metaphors, in this case transmitter, compass and map, as we did not have any mock-up for this. Metaphors were also useful when we were talking about the whole idea of the application and the policy.

The usability test also included a questionnaire, as we mentioned above. Initially, we were going to ask these questions verbally, but due to a very tight time schedule, we handed out the questions in written form instead. This proved not to be a very good idea, as when summarizing the answers in the questionnaires it became obvious to us that some answers were misleading, probably because of the users' misunderstanding of one or several questions. As they did not ask for an explanation, we did not have the opportunity to talk about the problem, which easily could have been solved by way of direct communication.
Fig. 14

This is an example from one of the questionnaires where a test user did not understand one of the questions properly. Instead of asking for an explanation, he chose to express his confusion in writing. In this example it was obvious to us that he did not usually use ICQ. However this made us conscious of the importance of asking questions verbally, to be able to correct misunderstandings or misinterpretations directly.

Another problem with the questionnaire was that some users left out answers to certain questions, which did not provide us with any feedback at all of their thoughts on these questions. E.g. several users chose not to answer the question “Would you allow personal information about yourself to be shared if controlled by certain restrictions? If yes; to whom and in what situations?”. Also some chose not to answer the question “If you could wish freely, without thinking of technical or economical aspects, what would be useful for you to make your everyday tasks easier?”

We also made the mistake of placing two questions in one sentence “Would you consider it good or bad, not having to confirm charges under a certain amount presupposed that the charges are necessary to perform a task which you have chosen to perform on the Internet, and if yes, under what amount?”. This made almost all users only answer the first question, missing to write under what amount, even though their answer to the first question was yes. If we had done this interview verbally, we might have been able to get some answers for these questions. As it was, we did not notice the missing answers until we started to analyse the gathered questionnaires.

23 The translation of the example is: “Do you use ICQ?” “What is that?”
8. Conclusion
The purpose of this report has been to see to what extent communication can be supported and enhanced by different kinds of tools in a student software development project. We have tried to reflect on how communication in our project has worked out, and to what extent the tools that we have used have improved this. In our communication with other members in the project group, with our customer and test users, we have mainly used different kinds of mockups and metaphors in order to facilitate communication. In the beginning of the project we also used future workshop as a tool to create a common understanding of the situation as well as to create a common language within the project group.

We have put a major emphasis on the word communication, which is a complex notion with a lot of factors involved. The words we use when communicating with each other have different meanings depending on context, situation, pronunciation, intentions etc. The social context and the rules of conversation have to be familiar for optimal communication of intended information. It is the interplay between our actions, the social context and the situation that matters if our communication with each other is to succeed. The flow of information that surrounds us does not contribute to support and enhance communication, on the contrary, it sometimes seems as if it makes communication more difficult. It is difficult to sift out what might be important, among the huge amount of information, and the interpretation of the given information depends on the receiver. This means that different receivers can understand the information in different ways.

Being part of a project is also being part of building a community of practice. All communities have their specific common language, and to become a full member of the community it is necessary to have the ability to handle this language. The vocabulary may be the same as in other communities, but the same words may bear totally different meanings in different environments and situations. It is a question of understanding the language-game within a practice, if communication is to make sense for all parties involved. By using design tools, e.g. mock-ups and prototypes, the understanding of a language-game could be supported as well, as it is easier to express practical understanding by the means of the tools.
The design process is to a large extent a social process, where communication plays a critical role. It is important that various groups of people involved in the process understand each other. The use of design artifacts plays a key role in supporting communication between these groups. These design artifacts consist of, among other things, several kinds of prototypes which are all essential for the design process because they are used in different stages of the process and play different roles. The design process can also be viewed as a learning-and-communication process where the use of metaphors improves communication between all parties involved. The advantage of using metaphors is that people understand something new by explicit association with other things that already are understood.

We have experienced that the use of different kinds of mock-ups, metaphors and future workshop have contributed to an improved communication between different groups involved in our project. The use of metaphors was especially important in the beginning when we had difficulties in understanding the language-game our customer used. It was also important in the participatory design work with test users because using metaphors was a way to facilitate understanding of complex technical issues.

The future workshop contributed to an understanding of the situation and to a start of the creation of a common language within the project group. In the beginning, we did not have a common vocabulary, no unspoken hierarchical rules and no norms to follow. The problem was not only within the group but also toward our customer. We think the reason for this was mainly that we belonged to different social practices, which resulted in different understandings of the meaning of the words when talking to each other and with the customer.

The various kinds of mock-ups that we used in the project have served as the most important tool in order to support and enhance communication. The mock-ups have been an effective tool for us when we wanted to communicate our visions and thoughts to the rest of the project group and to the customer, as well as for them to communicate thoughts back to us. We have used mock-ups when communicating with each other in order to understand the complexity of some of the requirements.
They also served as an efficient tool in the participatory design work, where test users were able to communicate their thoughts, visions and opinions of a product that is not yet developed.

The creation of the mock-ups has been an easy, cost effective and not too time-consuming way of working. It has been easy to work with the mock-ups iteratively and adjust them to the feedback we got from other members in the project, the customer and the test users. As a mock-up is easy to understand, the risk of misinterpretations is limited, which contributes to a shared understanding when communication is about abstract, not yet developed products. On several occasions, the mock-ups served as an aid to express something that was difficult to explain verbally.
9. Concluding reflection
Apart from what we have discussed in this report so far, we have reflected on some other experiences in the project that we found interesting to bring up. One of them concerns the problem of communication, which we think could have affected the communication among the members of the project and with our customer. At the same time, it is a reflection that concerns the use of the technology of today. The other experiences concern our work with the approach concerning usability, which is a significant part, from our point of view.

During the work in the project, all members in the group were physically close to each other in our project room. Should that not contribute to making communication easier among the members? Yes, it should, but unfortunately we think this did not matter to a greater extent. The reason is that we noticed, at several occasions, that we sent e-mail to each other in the group instead of talking to each other face to face. Also, a lot of information from our project manager, customer and others was sent by e-mail, which is an ordinary way of spreading information at workplaces today. We think this implies a risk of complicating the communication. When getting e-mail or other written messages, it is often not possible to ask the sender what he/she means with the information given if the receiver is in doubt about the interpretation. Even if it is possible to do this, the receiver may not be aware of that the interpretation he/she decides upon could be wrong, i.e. it is not what the sender means. This risk of misinterpretation is obvious and, according to our opinion, quite common. Using e-mail, even though it is an excellent means for many occasions, can prevent communication face-to-face or talking to each other by telephone. When talking to each other, the conversation is situated, which implies that we talk about things we did not plan to talk about. E.g. if misinterpretations occur it is easy to explain and establish a common understanding. It is impossible for us to say if the common use of e-mail in our project group affected the communication in a negative way, but we believe that it has not always contributed to decrease communication problems.

However, what we think might have supported communication in a better way would have been having short, informal meetings on a daily or weekly basis, e.g. general coffee breaks. In the Casper project, we did not have regular coffee breaks together. As we all sat nearby each other, we took our coffee with us to our working places. Afterwards we have realized that sitting near each other only provided us with a false sense of knowing what was going on in the project when in fact many times we did
not have a clue. The occasions when we got the most information were when we happened to eat our lunch at the same time as the pt-students. Maybe if we had taken regular coffee breaks together, we would have got a better sense of knowing what was going on in the project?

In the beginning of the project, we worked with the creation of fictive personas and user scenarios. The reason for this was, that the customer had asked us to create user scenarios together with the ie-students. The ie-students in turn had found information about some user archetypes in a marketing document created by Ericsson AB. This gave us the idea to try to create our own personas for the project. The purpose of this was that we wanted to identify possible target groups and a representative for each group, which would serve as guidance when we needed to find suitable test users. In our continuing work, when we tried to find test users, we realized that in reality, there did not exist people comparable to the personas. The test persons we found did not only fit with one of the personas, but with a mixture of them. We also realized how easy it is, in the creation of the personas, to transmit generalizations of different kinds, e.g. middle-aged women are not interested in technology, which we suppose young men to be. We doubted if the creation of personas was a trustworthy way to reflect reality, and felt we were not impressed with the idea of creating personas instead of using real, live human beings.

Our work in the project with the design of the postcard service demo GUI, has mainly been focused on the GUI intended for a pc. In the end of our participation in the project, the customer decided that they wanted a demo application that could be displayed on an iPac, or a mobile phone supporting wap, as well as a demo for a pc. As we had not used either an iPac or a mobile phone with wap before, it was difficult for us to know how to design our GUI. We started to design the GUI for this new demo in accordance with our analysis of the user test, which had been performed on a pc. After talking with the pt students and using a mobile phone with wap, we discovered technical limitations which made some functions, desirable from a usability perspective, impossible to implement. We therefore had to find a solution for the GUI that was “good enough”.24 Through this experience, it became clear to us how important it was to be familiar with the specific context for which we were designing and also, to understand enough about the technology, to be aware of some of its limitations.

24 See appendix 3.
9.1. Final point
Based on our experiences in the project, we think it is possible to support and enhance communication by using various kinds of tools. In order to do this, it is important to understand why communication problems emerge, which in turn implies how they can be solved. We believe that the tools we used contributed to an understanding of the purpose of the project, to the creation of a language that everyone in the project group could take part of, to support communication within the project group as well as with our customer and the test users, and to some extent avoid communication difficulties. Together with the others in the group, we tried to organize the work so everyone in the group would know what was going on in the project, through the creation of a poster showing different roles and responsibilities. This, together with the progress in the project visualized on a white board, contributed partly, at least in the beginning of the project, to a feeling of knowing what was going on. We also tried to reduce the information that was given, both from our customer and within the project, by having only a few members participating in different meetings. The feeling of confusion that we felt in the beginning of the project disappeared, but after a while we had an intuitive feeling of not knowing what was going on.

Our final conclusion is that it is almost impossible to fully succeed with communication, but we are convinced that it is possible and necessary to support and enhance communication in software development projects with the aid of different kinds of tools.
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Appendix

Appendix 1a: Analysis of Usability Test

Appendix 1b: Enclosure to Analysis of Usability Test

Appendix 2: PC final power point version of the GUI for the postcard service demo

Appendix 3: iPac final power point version of the GUI for the postcard service demo

Appendix 4: Usability Assurance