

Case Studies of User Orientation in Working Life

Jan Gulliksen

Center for human-computer studies (CMD)
Uppsala university
Lägerhyddsvägen 18
SE-752 37 Uppsala, Sweden
+46 18 471 2849
Jan.Gulliksen@cmd.uu.se

Inger Boivie

Enator AB

Kronborgsgränd 1
SE-164 87 Kista, Sweden
+46 8 703 62 00
inger.boivie@enator.se

Ann Lantz

Center for user oriented IT-design (CID)
Royal institute of technology
Lindstedtsvägen 5
SE-100 44 Stockholm, Sweden
+46 8 790 6817
alz@nada.kth.se

Fredrik Winberg

Center for user oriented IT-design (CID)
Royal institute of technology
Lindstedtsvägen 5
SE-100 44 Stockholm, Sweden
+46 8 790 6817
fredrikw@nada.kth.se

ABSTRACT

Despite all the research and development that have taken place on user centered methods, techniques and tools, the actual user influence in the development of their own work situation shows to be rather limited. User involvement is regarded as time consuming and tends to receive low priority in working life development projects. This often results in systems with severe usability defects. Questioning the usability is still a novel approach that has not yet been incorporated into the software development life cycle.

These six case studies show that there can be no general approach to usability engineering and user oriented work. The characteristics of an in-house development domain varies significantly from product development, consultants work and, especially, from development for users with special needs. Methods techniques and tools must be adjusted to the development characteristics.

Keywords

Usability, management, organization, design, requirement

INTRODUCTION

This paper reports a case study where methods, attitudes and problems when performing user oriented development in six different development environments are in focus. The major goal for every professional involved in user interface development should be to develop systems that are *usable*. Usability can be defined as the extent to which a product can be used by specified users to achieve specified goals with efficiency, effectiveness and satisfaction in a specified context of use [ISO 9241-Part 11]. To be able to reach these goals user centered methods are preferable, whereas there is no guarantee for usable systems with a user centered method.

It is extremely rare that companies adopt a fully integrated user centered design approach in one strategic shift.

Rather, companies tend to adopt user centered design practices and methods in stages or adopt a particular method or practice only when a complex set of factors align to create readiness [Dray & Siegel, 1998].

The problems achieving a well functioning user centered development methodology are due to facts outside of the actual system development project. It has been known for several decades [Leavitt, 1958] that changing the information technology support can not be made without an effect on the organization, the work activity, the human being and his/her competence (Figure 1). In fact, they all influence one another so that an attempt to change either of them inevitably will result in needs to change the others. It is important to be aware of these changes in advance, to be able to meet them with appropriate actions.

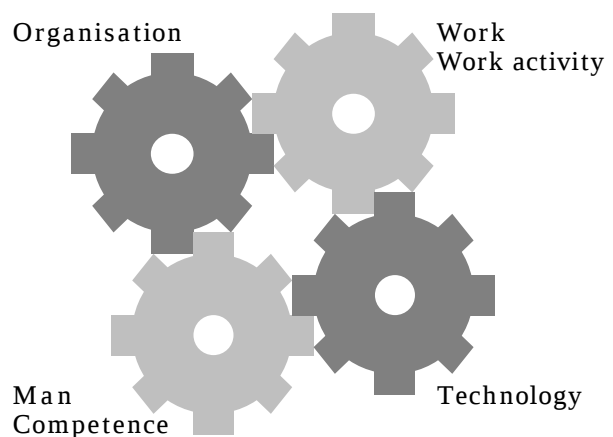


Figure 1. A mutual perspective on Organization, Competence (Man), Technology and Work (Activity). By turning one of the cogwheels, all others are affected.

If the information technology development could be regarded as a motor in this development process we

believe that a lot could be gained.

The purpose of the case studies were to gain experience from people working in the field with user centered design. Do different work activities influence the working user centered process or what problems are experienced when adopting user centered design?

THE STUDY

To study how user centered design is performed in practice we selected cases with varying work activities and repertoire for user centered design.

Several interviews with representatives of different organizations were conducted. They have all participated in different Swedish development projects in different ways. The respondents skills or work roles were; software developers and project managers from in-house development organizations, technical writers and modeling consultants, usability engineering consultants, researchers and developers from a research center and employees in an organization promoting user oriented development for users with special needs.

Each respondent was interviewed during 60 - 120 minutes. Notes were taken during the interview and the transcribed interviews were reviewed by the respondent so as to minimize misconceptions and errors. All interviews were performed on the basis of an interview guide (see Appendix 1). The interviews were performed during 10 weeks during the spring 1997. The six cases are described below.

CASE 1

The first case is an ergonomics and usability consultant mainly working with long term relationships with their clients, e.g. two year contracts. The services that they perform are laboratory tests and quality assessment. A lot of the work tends to take place on the field, usability equipment is brought to the clients. But, this generally means a lot of side effects.

Unfortunately, according to this company, focusing on the product is much more common than focusing on the process. The problem so far has been that usability related activities are introduced too late in the development process. But, the tendency is to try to become introduced into projects at an earlier stage.

Usability Maturity

One of the main issues for successful user oriented work is the degree of usability maturity in the company. This company cooperates within the European cooperation network INUSE (Information Engineering Usability Support Centers). INUSE has derived a scale for rating "Usability Maturity Assessment":

- Ignorance: "We do not have any problems with usability!"

- Uncertainty: "We don't know why we have problems with usability"
- Awakening: "Do we always have to have these problems with usability?"
- Enlightenment: "Through Management commitment and improvement of human-centered processes we are identifying and resolving our problems."
- Wisdom: "Usability defect prevention is a routine part of our operation"
- Certainty: "We know why we do not have problems with usability"

Generally the degree of usability maturity with the clients is low, but one of the main issues for the company is to increase the usability maturity of their clients. Ideally they seek clients with a high degree of usability maturity. That is when the best results are achieved. The level of usability maturity is actually a management question.

The company judges methods for cost- and time-justifying usability as an academic discussion that does not lead to any positive usability improvements.

ISO 13407 - Human Centered Design

This company also analyses the user centered methods within companies in order to derive a checklist to analyze to what extent user oriented work is adopted, and to guide the clients in their user centered work.

User orientation is generally better than user centering. The users should not participate in the entire development process. Users are soon ruined and the work does not become efficient.

Generally they tend to follow the structure for user centered development that is outlined in the ISO/DIS 13407 - Human centered design process of interactive systems [ISO, 1998] (Figure 2). A framework that is about to become an ISO standard is easier to sell to a client.

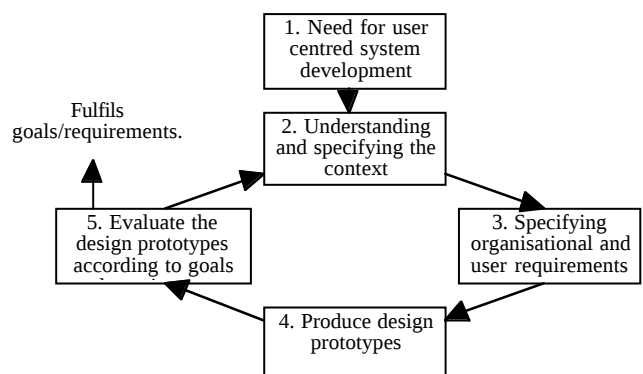


Figure 2: The principle from ISO/DIS 13407 - Human centered design process for interactive systems.

The company offers support and help for project

management. Their experiences are that individuals with a human factors background often turn out to be good project managers. If introduced as quality assessment you could more easily be interpreted as a threat than a support in the development process.

Success Factors and Obstacles

One of the key factors for the success is that the users feel confident and feel that they contribute to the development. At the same time as they contribute with interesting views (e.g. concerning efficiency, professionalism, contents, accessibility, long response times, etc.) an important change of attitude is taking place. But, still the main obstacle to iterative work according to the ISO-structure above is *time*.

Usability Testing

Typically three different types of tests are offered, and the resulting aspects can be grouped according to the following problem categories:

- Wrong dialog style (Metaphor, Tab groups, Spreadsheets, etc.)
- Navigation and structural problems
- Detail problems; Fields, Combo boxes, etc.
- Achievements relating to time. (Mainly through DRUM and MUSIC [Daly-Jones, Bevan, & Thomas, 1997])
- Subjective experiences (Mainly through SUMI)

SUMI - Software Usability Measurement Inventory [Maguire, 1997]. SUMI is a method that combines a semi structured interview with a survey. The results of the survey is quantitative and gives global judgments as well as values concerning efficiency, affect, helpfulness, control and learnability.

The company regards traditional systems analysis models that claims to address HCI issues, such as the DELTA model [Carlshamre, Löwgren, & Rantzer, 1994] as a method for technical writers, not for usability experts. Practically, a waterfall model is used for requirements engineering, with a few iterations on the end. For the DELTA-model to work, it needs to be run completely, which is difficult to accomplish in practice.

As mentioned before, the company mainly works with long term client relationships. But, the goal in the project is contradictory, i.e. to eliminate oneself. The role then changes from a consultant to a resource. The most important goal is knowledge transfer. Usability becomes integrated into all development work.

Finally they recommend "Usability by walking around", that is: Be there! Walk around! How does it work?

CASE 2

User oriented work when working with disabled people.

This second case describes some experiences from an organization promoting usability adaptation for users with special needs.

The most common situation when developing or adapting products for disabled people is to make them fit one specific user. After this is done, the solution is generalized to fit more users.

In development projects there is often a member who either is disabled or have a relative or a friend who is. In that way the user orientation is often a very natural way of working.

Assistive Technology

The most important differences between work with assistive technology and other system development are:

- the specification is very important
- the user group is very limited. It is very easy to generalize from a specification
- almost none of the products on the market are adapted. A lot of work is spent on enhancing existing products.

Since much work has been in an ad hoc nature, there is not so much written on user orientation in this area. One of the few references is the Userfit handbook on user centered design for assistive technology [Poulson, Ashby, & Richardson, 1996]. There is a clearly stated goal that the end-users should participate in the development, but no one really knows how. Often the users tend to stick to the old concepts and just suggest small detailed changes. There is a problem in creating new ideas.

This organization did an evaluation together with a usability evaluation company. This was an evaluation of an encyclopedia with regards to the access of blind users. This evaluation revealed some problems when using "old" methods of recording a test session, the video cameras that were used were of little help since very little of the interaction is as visible as when a sighted user interacts with a screen and a mouse.

CASE 3

This describes user centered work in a larger governmental public service organization in Sweden. The organization has about 15.000 end users, 400 simultaneously running applications, almost every commercially available development tool. Software development is mainly performed with their own in-house development organization, that claims to be one of Sweden's largest software developers with about 1.000 employed. The organization has ambitious development plans and a comparatively high usability maturity level. Unfortunately, in such a large organization it is always difficult to gain support for usability related work from the entire organization.

In-house Development Characteristics

As any governmental institution this organization suffers from not being able to keep their personnel within software development, mainly because they cannot keep up with the levels of salaries that this category requires. This puts even greater demand on the methods, techniques and tools that are used, since they can not possibly rely on the human skills and resources.

A few observations have been made during five years of cooperation with this organization.

Software development follows a rather traditional systems analysis approach; quite extensive modeling and analysis producing data models, conceptual models, routine sketches, process models, etc. Too much time is spent modeling and analyzing. Years of full-time work of dozens of people can take place before any prototypes can be seen.

Our observation is that the enormous amount of documentation that is created from this modeling and analysis phase is never really used in the development work. Another problem is that the specific characteristics by every modeling leader greatly influence the results of the modeling session. With the same set of users and two different modeling leaders one will arrive at totally different designs of the resulting system.

User Centering with Object Orientation

The development models have undergone rather a lot of modernization during the last years. Previously they used traditional dialog modeling methods that produced quite fragmentary GUIs with several Windows overlapping each other. Recently they have started to incorporate object oriented methods and use case nodding according to rational ROSE [Booch, Rumbaugh, Jacobsson, 1997]. But still the problem is that none of these methods produce descriptions that actually give any support in the user interface design process.

With this observation we participated in the development of different methodological steps to be incorporated into their development framework. Such methods are e.g. User interface modeling [Lif, 1997] analysis of information utilization [Gulliksen, Lif, Lind, Nygren & Sandblad, 1997]. To aid the user interface design process a corporate style guide [Gulliksen & Sandblad, 1995] was developed with concrete design advice and interface objects. Unfortunately several of these methods were difficult to get to be used after we had left the project.

Project Organization

The project organization had several effects on the result of the projects as well. The project leader is a central person for usability related issues. Mainly the project leader was recruited from the work activity, and that person almost always had a background as a user in the organization. Another important individual in the project was the person responsible for the technical development. This person could easily be in control of the project due

to his/her knowledge of the tools and the lacking tool knowledge of the project leader. We saw numerous examples where the technical development forced project decisions that were not in their actual interest, e.g. forcing the project management to cancel usability evaluations because it would disturb or delay the release of the software.

Another problem in the projects were the contacts between the project members and the actual users. What we usually refer to as the "My baby-syndrome" occurred constantly. This occurs when members of the project present the design to user representatives in the field when they constantly tend to defend their solutions rather than acquiring knowledge about potential usability problems. This tended to be as frequent when it was project members with a software engineering background as project members with user background.

The organization can, however, be regarded as having a relatively high degree of usability maturity. Resources are invested in establishing a functioning user centered development approach in all steps. Currently the work is focused on trying to establish a corporate user centered methodological framework, with the possibility of acquiring knowledge on; how to select user representatives, how to form a well functioning user centered project group, when and how to approach the users, etc. The focus of the activity is to get general knowledge on how to work efficiently in a user centered way in an in-house development organization. Knowledge that might be possible to generalize to other types of development.

CASE 4

This describes user centered work in one of the largest software consulting companies in Sweden. Their method for user-centering and usability is designed so that it can be combined with ordinary system development methods - that is, it supplies activities for involving users and working with usability.

The Handbook as Requirement Specification

Originally, the main idea was to start a project by writing the handbook for the system - together with end users. This approach provided a means for the end users to express their work and needs in familiar terminology. The handbook writing activity is performed in seminars with a group of user representatives. The participants should all be real end users, assertive and interested in developing their work routines. IT experience and skills are not required. In parallel with the development of the handbook, a prototype is developed visualizing the verbal descriptions of tasks and needs.

The method has since been further developed to include typical HCI activities, such as prototype evaluations, measurable usability requirements, etc.

Typically, it would require somewhere between 7 and 10

seminars, to cover the whole area of work which would be supported by the handbook and prototype. To start with - the roles involved were a session/method leader, a system developer, a technical writer and the end users. An HCI expert has since been added to organize and lead the HCI activities.

Representatives of the management should participate in the initial seminar (only) - in order to demonstrate managerial support and add significance to the process.

The task of the users is to describe all aspects of their work - this includes being responsible for changing and developing new work routines. This means that the responsibility of the group of end users is more extensive than just describing existing routines and evaluating the future system.

The method leader, system developer, technical writer and HCI expert all have the responsibility to interpret the users view of their work - and to supply knowledge about new technology and the possibilities it offers. Ideally, these people move on to the implementation project, the method leader assuming the role of project manager.

The Role of the Requirements Specification

Originally, the idea was that the handbook and prototype should replace the requirement specification, describing what the system should do, but not how. The system developer was supposed to add the how. This did not work in practice. Firstly, because the system developers found it hard to work with the handbook and prototype as the only representations of the requirements - they wanted a proper requirement specification.

Secondly, because system developers tend to describe how in a way that does not correspond to how the routines are to be performed. In reality, the handbook and prototype complement a traditional requirement specification.

Ideally the method should be used all the way through the development, but it can be used module by module. Using the entire model in the project has yet not been possible to do.

Several obstacles to this way of working have been encountered. One example failed because there was no immediate need for a new system, no real will to change the situation and no managerial support for the project. Naturally, the project failed.

CASE 5

This describes user centered work in another large governmental public service organization. This is also a very large organization with northern Europe's biggest database. They have about 13.000 employees. The organization has suffered quite a lot of minor scandals recently partly, due to malfunctions of their computer systems.

The project we studied was an effect of a mutiny against

traditional software development projects. After having had to rely on external consultants as modeling leaders, the organization decided to educate a large number of project managers recruited internally from the company. This seemed very promising and the project leader we met decided to ignore prevalent methods and control the project from the heart.

Project Leaders

For practical reasons 2 project leaders were appointed, one from the work activity and one from the development team. One was aware that the new application to be developed would decrease the efficiency, but nevertheless new systems would have to be designed in order to keep up with the maintenance problems with the older systems.

The project organization was the following:

- The project leader was responsible for the rules, deriving the functions and writing the technical support. Previously, she had extensive field experience.
- 1 user from the field worked in the project full time.
- 3 software engineers worked with programming and modeling (systemeering)
- 1 person was responsible for the database
- 2 users from the field were used for occasional efforts.
- 1 external consultant worked with user support.
- 1 main project leader from the overall organization.

The aim was to convert the old alphanumeric mainframe systems where one erroneous key pressing could lead to enormous consequences. These were to be converted into graphical user interfaces. Dialog modeling was performed by an external consultant and the inexperienced personnel were educated in the method. Understanding the work activity was performed by paper modeling sessions together with the users.

Testing a Prototype

An interactive prototype without any proper functionality was designed and a successful evaluation with potential users was performed at a corporate fair. Appointed users were notified in advance to come and test the prototype and to fill in an evaluation survey. For this they were given a small reward. The users rated the prototype as very good to excellent and the organization decided to go on and implement it in such a fashion.

The project was a pilot for user support and education. But, one of the major problems is to be able to keep up with the education. Despite the advantages with using new and modern multimedia, this is often neglected. Planning the launching of the system they performed a survey to determine the users background knowledge and experience of users handling computers and GUIs. The survey showed that the average computers skill was high.

This result proved to be totally wrong later, when the actual system was released.

User tests were performed in a real context but unfortunately not fully. The intention of the system was support to provide calculations when consulting a client. Because of the single tests that were made the users had the time to prepare the cases that they were to discuss in real time with clients prior to the immediate contact with the clients. This would not be the case when interacting with the system under normal conditions. Then the users would develop the cases directly, in front of the clients, without any possibilities to prepare.

Other planned projects within the organization are mainly focused around the project 2005, that is renew everything until 2005, which in itself will be a formidable experiment.

Obstacles to Usability Work

One of the major obstacles to usability related development activities within an organization of this kind is the fact that such software development projects can not be delayed. New laws are almost always effectuated without considering the time and resources needed to develop an appropriate computer support for changes in the work activity. Due to this, software development activities have to start based on preliminary laws and in many cases totally change when it comes to the actual decided laws. There is actually no possibilities of controlling when the laws are to be effectuated based on when a new system supporting them can be in use.

Another problem relating to this is that because of the work activity development taking place simultaneously during the process of implementing the system, the requirements on the system constantly changes.

Several problems occurred while training the users. In phase one 60 users were trained who in their turn were to train other users. At this point a CD with the education material was distributed, but unfortunately this proved to be difficult to install and use. And, if they managed to use it, they could not take the time from their normal work to learn the system, rather they had to do this in their spare time, why it was not done until it absolutely had to be used.

CASE 6

This describes user centered work at one research and development laboratory that has an aim to invent new technology for all users. A number of interdisciplinary projects are working in a user oriented way. The participants have background in system science, sociology, computer science, industrial design, mathematics, film, drama and psychology. All the projects have a group of users in mind but all projects have not been actively taking contact with the groups. After two years of initial work in the project an interview with the project leaders were performed. The results

showed that the projects worked with testing ideas, field studies, explorative interviews, experiments, different kinds of evaluations and also tests of design via prototypes. There were also projects not contacting users at all. This shows that no structured user oriented process was used.

Who are the Users in Innovative Research?

Sometimes the group of users were not even defined. To express one self or trying to push technical borders are interesting ways to work but that does not mean that it is performed in a user oriented fashion.

Take for instance an industrial designer who is developing a new product. This product is developed by studying peoples' needs and desires. The idea as well as more or less rough prototypes of the product are evaluated with a presumptive user group and also put into the right context.

By changing the role of the computer designer and sometimes even the researcher we might be able to get closer to the role of constructing things to serve the people who have a need or a desire that we can support by inventing new technology. The role of the user interface designer should be regarded as a service role rather than an artist, with the aim of helping others rather than expressing themselves.

According to Olson & Olson (1997) we can, while studying how groups or organizations behave, focus on several kinds of factors: progress of the task, communication process and interpersonal process such as role taking. They all seem relevant concerning the discussion above.

Gould & Lewis (1985) defined that the basic techniques for developing useful, usable software used should be: early focus on users, iterative design, continual user testing, and integrated design. Grudin and Poltrock (1998) say in a tutorial given at CHI '98 that this traditional user centered design view may sound easy to apply but it is in fact difficult to apply, especially for groupware.

DISCUSSION

These case studies show that the approaches to user centered development varies. This can depend on the type of work activity, the development setting and the user population. Standardized methods can be very useful in some development settings but not in others. The organizations all tend to have problems; in the communication process with the users, or problems getting the possibilities to perform real iterative work or usability related activities. The only exception to this rule is the consulting firm in case one, but on the other hand they reported that they only chose mature clients.

Organizational Support

Usability maturity tends to be one of the major issues when studying our different cases. Unfortunately the level

of usability in development projects around the world varies. Swedish organizations can be judged to have a relatively low usability maturity today, compared to countries where user interface design is a work activity maintained by a specific work role. Everybody involved with usability related work in Sweden today spends quite a lot of time as a missionary, regardless of development setting. As a consultant from a well reputed firm, without very much competition, the ability to attach the market is different. Usability is marketed on a managerial level at the client. As a researcher the role becomes to influence from the bottom up. For successful usability work in an organization you need to work on the organizational support from the bottom up as well as from the top down.

Who and Where?

The case studies show that the presumptions for user centered work vary depending on 1) who performs the work, and 2) where the work is performed.

- 1) Who performs the work? - depending on who is responsible for the actual user contact (user representatives, project managers, system developers, usability engineers, HCI experts, design consultants, etc.) the nature of the work and the approaches to user centered design varies greatly.
- 2) Where the work is performed? - if the work is performed in a design laboratory setting other methods, techniques and tools can and should be used than if it is performed in the field.

The goal must be to influence the system developers in their work role. In an in-house development situation or as a consultant in interface design and development one needs to regard the software engineers as providing services to a user community, only with the issue of turning a design of a prototype into a functioning system.

Domain Adaptations of the Methods

Existing methods must be adapted and adjusted to the characteristics of the user population, to the nature of the competence performing or promoting the user centered work, to the work context and to the development tools. It is not uncommon that usability engineering methods are erroneously used, due only to the limitations of the methods that are not expressed in the definition of the method. For example, it is not appropriate to use a video recording of a blind user interacting with a prototype, it does not capture the aspects relevant for disabled users.

Design

One of the main issues in the success of user centered work is the approaches to the user interface design process. Still the role of the designer in the user interface development process is vague and you cannot, more or less, find a professional user interface designer that merely deals with user interface design.

Several methods exist for modeling and analysis according

to e.g. the waterfall model, that produce large amounts of documentation. This is today mainly the stage in which communication with the user takes place. Fewer methods and established work practices exist for the process of user interface design. The design of a system is something that is expected to occur automatically, without any dedicated efforts, without user involvement, without any specified skills and in almost no time. This should be compared with the fact that almost 80 % of the program code concerns the implementation of the user interface. The user interface design process mainly takes place with software engineers and with a minimum amount of communication with the user.

User Centered Design vs. Requirements Engineering

One of the more practical problems that occur is to everyone involved in system engineering and design according to a human centered approach is the apparent contradiction between iterative design and frozen requirements specifications. The requirement specification is a very important document in every practical system development project, it is the basis upon which a contract is awarded to a consultant, it is the basis for project planning in an in-house or a consultants development work. Iterative design with continuous analysis, design and evaluation until a specified goal is achieved is more or less impossible to achieve without breaking the time limit. Usability related work tends to be scheduled to the end of a project. At the end of a project, the primary focus is often to get the system to work at all, leaving a minimum of time to usability related work.

Cementing old Design Solutions

One of the reoccurring problems with user centered design in practice is that the users tend to "cement" old solutions. It is problematic to look at their own work from the outside. This is clearly where methodological support is needed to help the user viewing their work with new eyes. This is also where skilled designers could help supporting new views on the system.

Future Research Directions

This study shows that we need to focus more on the integration of user centered design methods into the organization's methodological frameworks. Studies of different ways of incorporating organizational factors, competence development and work activity development into the user centered design life cycle would be important future work.

REFERENCES

1. International Organisation for Standardisation (1998) *ISO 9241. Ergonomic Requirements for Office Work with Visual Display Terminals (VDTs) Part 11: Guidance on Usability*. International Standard
2. Dray, S.M., & Siegel, D.A. (1998) User-Centered Design and the "Vision Thing". *Interactions* Vol. 5, No. 2, pp. 16-20.

3. Leavitt, H.J. (1958) *Managerial Psychology*. University of Chicago Press, Ltd. London.
4. International Organisation for Standardisation (1998) *ISO/DIS 13407 Human Centred Design Process for Interactive Systems*. Draft International Standard.
5. Maguire, M., (1997) *Requirements Engineering and Specification in Telematics. RESPECT User Requirements Framework Handbook, Version 2.2*, HUSAT Research Institute. Loughborough, U.K.
6. Daly-Jones, O., Bevan, N. & Thomas, C. (1997) *Handbook of User Centred Design*. INUSE Telematics Application Project IE 2016
7. Carlshamre, P., Löwgren, J., & Rantzer, M. (1994). Usability Meets the Real World: A Case Study of Usability-Oriented Method Development in Industrial Software Production. In G. Bradley and H. Hendrick (eds.) *Proceedings of the 4th International Symposium on Human Factors in Organization Design and Management*.
8. Poulson, D., Ashby, M. & Richardson, S. (eds.) (1996) *USERfit – A practical handbook on user-centred design for Assistive Technology*. Technical report from the TIDE 1062 USER project. ECSC-EC-EAEC, Brussels-Luxembourg.
9. Booch, G., Jacobsson, I., & Rumbaugh, J., (1997) *Version 1.0 of the Unified Modeling Language*, (on-line). Available: <http://www.rational.com/uml/references/docset.html>
10. Lif, M. (1997) User interface modelling for design of administrative information systems. In *Proceedings of the 7th International Conference on Human-Computer Interaction, HCI International '97*, pp. 383-386. San Francisco, U.S.A.:Elsevier.
11. Gulliksen, J., Lif, M., Lind, M., Nygren, E., & Sandblad, B. (1997) Analysis of Information Utilisation (AIU), *International Journal of Human-Computer Interaction* 9(3), pp. 255-282.
12. Gulliksen, J., & Sandblad, B. (1995). Domain specific design of user interfaces. *International Journal of Human-Computer Interaction* 7(1), pp. 135-151.
13. Olson, J., & Olson, G. (1997) Research on Computer Supported Cooperative work. In M. Helander, T.K. Landauer, & P. Prabhu (eds.) *Handbook of Human-Computer Interaction*. Amsterdam: Elsevier Science B.V. pp. 1433-1456.
14. Gould, J.D. & Lewis, C. (1985) Designing for Usability: Key principles and what designers think. *Communications of the ACM* 28(3), pp. 300-311.
15. Grudin, J. & Poltrock, S. (1998) CSCW, Groupware and workflow: Experiences, state of the art, and future trends. Tutorial at the ACM SIGCHI Conference on Human Factors in Computing Systems, CHI '98.

APPENDIX 1

User centered system design - interview guide

Following is an excerpt of the questions that were asked during the interviews:

- What persons work in a project (roles, competencies, power relations, communication)?
- Project supervision (roles, competencies, power relations, communication)?
- How was the user centered activities performed?
- What are the prerequisites to the analysis of the work activity, task and problems are made?
- What was your demands on the user representatives?
- How were the user representatives selected?
- What is the initial methodological support? General methods; standards, evaluation methods?
- Do you know how the users regard their role in the development project?
- What problems did you experience?
- Did any extraordinary results or events occur?
- In what way did the management participate/support the project?

These questions were complemented with several questions regarding the nature of their work activity, the organization of the development work, etc.