User-centered
requirements definition activities

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Summary

Figure 0. The process of user-centered activities.

This report describes user-centered activities in requirements definition. User-centered approach to product development focuses specifically on the user and customer point of view and making systems usable. The aim of this report is to provide information about what kind of user-centered activities exist and why and when to practice these activities.

The figure shows an example of user-centered requirements definition activities and their relationships. The first step of getting user view is to identify who the users are or are likely to be. User descriptions make users alive and categorize different users and their characteristics. User studies are the way of gathering user information and needs by direct contacts to users.

The results of the user studies are then analyzed and presented in order to work toward the first prototype. First the present contexts and processes of users are described in task scenarios. Then these present processes are analyzed in order to show how the processes are performed in the new product. The task scenarios are used to create use scenarios to describe how the users, tasks, and environment will look in the new design and how the present problems of users are solved in it. If several users perform tasks together, workflows can be drawn to illustrate how the users collaborate using the new product.
The challenge is to define a coherent use structure for the product, so that it supports users and fits with their expectations. A use structure is a kind of ground plan of the user interface; it describes what kind of “places” there are and how a user can move across the interface. In order to do that the use structure of use scenarios is analyzed, the sequence of tasks may be described in use sequence diagrams and the hierarchy of tasks, subtasks and the sequences may be described in use hierarchy diagrams. The use scenarios and the diagrams are used to design and describe the overall use structure of product.

Usability goals are set to keep in mind the user and usability issues. The goals need to be achieved to ensure that users find the product useful and usable.

Use scenarios and storyboards can be used to validate the general idea of the product and its functions in general level with users. Prototypes can be used to test the look and feel of the product and functionality in more detail.
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1. Introduction

This report describes user-centered activities in requirements definition. User-centered approach to product development focuses specifically on the user and customer point of view and making systems usable. The aim of this report is to provide information about what kind of user-centered activities exist and why and when to practice these activities. The more specific instructions for the implementation of the activities will be described in an other report.

Table 1 gives a general overview of the user-centered activities and their objectives in product development lifecycle.

<table>
<thead>
<tr>
<th>Objectives:</th>
<th>Activities:</th>
<th>Estimated effort:</th>
</tr>
</thead>
<tbody>
<tr>
<td>User needs gathering -&gt;</td>
<td>User identification</td>
<td>Low</td>
</tr>
<tr>
<td>User study</td>
<td>User description</td>
<td>Low/Medium</td>
</tr>
<tr>
<td>User needs analysis -&gt;</td>
<td>User studies</td>
<td>Medium/High</td>
</tr>
<tr>
<td>and product definition</td>
<td>Task scenario developing</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td>Use scenario developing</td>
<td>Medium</td>
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<td></td>
<td>Use sequence developing</td>
<td>Low</td>
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<td></td>
<td>Use hierarchy developing</td>
<td>Low</td>
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<tr>
<td></td>
<td>Analyzing use structure</td>
<td>Medium</td>
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<td></td>
<td>Workflow developing</td>
<td>Low</td>
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<td></td>
<td>Usability goal setting</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>Rapid prototyping</td>
<td>Medium</td>
</tr>
<tr>
<td>Validation and testing -&gt;</td>
<td>Interviews</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td>Usability assessment</td>
<td>Low/Medium</td>
</tr>
<tr>
<td>Development -&gt;</td>
<td>Prototyping</td>
<td>High</td>
</tr>
<tr>
<td></td>
<td>Usability assessment</td>
<td>Low/Medium</td>
</tr>
<tr>
<td>Follow up -&gt;</td>
<td>User feedback gathering</td>
<td>Medium</td>
</tr>
</tbody>
</table>

**Table 1.** A classification of user-centered activities according to their objectives in product development cycle.

The relationships of the user-centered requirements activities are described in Figure 1. The first step is to identify who the users are or are likely to be. User studies are ways of gathering data from real users. The rest of the activities aim at describing and analyzing the results of user studies in order to define user requirements and the first prototype of the system.
In chapter 2, the principles of user-centered approach are described. The rest of the chapters are organized according to Table 1 and they describe the user-centered activities mentioned in it. This report focuses on requirements definition and thus the activities used in actual development are not described.
2. Principles of user-centered approach

The user-centered approach can be characterized by the following principles:

1. the active involvement of users and a clear understanding of user and task requirements;

2. the iteration of design solutions and feedback from users;

3. testing of systems with real users;

4. multi-disciplinary design.

The involvement of users in the development process provides a valuable source of knowledge about the context of use, the tasks, and how users are likely to work with the future product. The interaction between the developers and the users is an important factor in the successful development of products. For example, Keil and Carmel (1995) found that more successful software development projects employed more direct links to users and customers.

In iterative design, feedback from users becomes a critical source of information. Feedback information provides an effective means of minimizing the risk that a product does not meet user requirements. In addition, there are user requirements that are not evident until the new product is implemented in an actual use situation (Karlsson, 1996). Testing of systems with real users is a way of gathering user feedback and checking the validity of user requirements and design solutions.

Multi-disciplinary design means that the roles in teams may include end-user, purchaser, application domain specialist, marketer, user interface designer, human-computer interaction specialist, trainer and support personnel.

In order to implement user-centered approach in a company, a plan should be developed to specify how the user-centered activities fit into the overall product development process. User-centered activities should not be identical in every project, but activities may be customized in a particular project.

User-centered development is placed in the context of an overall business process that must consider the market, its users, and the competition. Marketing departments often have very useful information to aid user-centered development. They may have data on size and composition of market segments and they may have excellent contacts. On the other hand, user-centered activities focus on more specific information of user behavior in order to help product development.
3. User needs gathering

The idea of user-centered approach is to gather real user needs using direct contacts to users. What users say they need may not be the best solution to their problems, and that is why the user-centered activities focus on user behavior.

3.1 User identification

The first step of getting user view to product development is to identify who the users are or are likely to be and which kinds of groups they form.

Benefits

After you have defined users and user groups you can focus your product for them and pay attention to their special characteristics and needs. User identification is also necessary in order to study real users and gather user feedback. The result of the user identification may be a list of user groups including estimates of their percentage in the total user population.

Implementation

First, you may be developing a product for an organization and then, you may get information of the users from that organization. If not, market research may have data on market segments and they may have information about users as a group. You can find out the users of older versions of the product or the users of competitive product, but then you may also have to consider whom you wish to be users in future.

When you are planning user studies, you have to carefully plan who are the users you are contacting. The users chosen should be representative of all users in order to understand the essential group of users. It is useful to select typical users from the main user groups.

Ulrich and Eppinger (1995) find useful to contact a group of users called lead users. Lead users are very experienced and active users. Lead users may reveal more needs, because they have had to struggle with the inadequacies of existing products. However, not all users are equally motivated and they will use the product less frequently than lead users. Thus it is most useful to contact both kinds of users; lead users to find advanced needs and usual users to find out the problems they struggle with.

3.2 User description

User description is a way of making users alive and categorizing different users, their tasks, roles, characteristics, physical and social environments.
Benefits

User description is done in order to understand users, their characteristics and environments. As the users, their essential tasks, roles, characteristics and environments are described, these aspects are easier to consider in design work. Descriptions are more specific, alive and real, when they are based on user studies.

Implementation

There are many different ways of describing users. It is possible to make a simple list of users and describe their essential characteristics. A characteristic matrix lists users or user groups and their main characteristics like age, experience of computers, profession, and subject matter expertise (see Table 2). This kind of characteristics matrix can be done for groups of users or individual users who represent a significant and potentially important group of users and who has been visited.

An user/task matrix gives information about what kind of tasks would each user group do with the intended product (see Table 3.).

User profiles are descriptions of typical users. They can be done by lists, in narrative form or in poster illustrations. User environments can be listed or described in environment profiles. It is also possible to visualize users by drawings or real photos.
3.3 User studies

User study is a way of gathering user information and needs by direct contacts to users. There are many different approaches and methods to study users.

Benefits

User studies provide direct links to users and customers. User study methods support communication between users and designers and help to gather useful information. Interacting with users is essential in gathering right user requirements early enough and designing good products. By including user studies in the predesign stages of the life cycle, you get real data behind your ideas and you have an opportunity to create inexpensive design models and test them with users before you have spent much time implementing the design into the technical environment.

Implementation

See Appendix 1 for instructions how to plan a user study.

The main approaches to user studies are:
• Contextual design (Holtzblatt & Beyer, 1998)
• Ethnography
• Task analysis
• Participatory design

The most useful strategy is to choose an approach according to product type and use different user study methods in a flexible way. Contextual design is focused on studying people in their work. The user study method is called contextual inquiry. Users are watched and talked with, usually one at a time, about their work as they work in their own environment. The idea is to study the work processes, describe and redesign them by changing role structures, supporting tasks, automating and eliminating unnecessary steps. The approach includes a general philosophy of visiting users, which is useful in all kind of user studies.

Ethnography is an approach that is used by sociologists and anthropologists. It is the description of human activities and culture and the focus is the social aspects of human co-operation. That is why it is most influencing in computer-supported co-operative work. The usual method is observing. Viller and Sommerville (1999) have developed ethnographically informed method for requirements engineering.

Task analysis is a wide range of methods to analyze the goals and tasks of users. Task analysis is most useful when it is based on real observations of users. The identified goals, task sequences and hierarchies are used in design by recognizing the familiar paths for users and the problems they have.
Participatory design is an approach of Scandinavian origin. Designers and workers have collaborated on understanding users and their tasks and on planning and designing new business practices and interfaces. Users participate by analyzing organizational requirements and planning appropriate social and technical structures to support both individual and organizational needs.

The different user study approaches apply several user study methods. The main user study methods are:

- **Interviewing**
  Interviews are very efficient ways of gathering requirements, but you may lose detailed and nonverbal information. That is why, it may be useful to combine interviews with other methods like think-aloud method or observing. Semi-structured interviewing can be used to get a general overview of usage and users. The interviews are carried out in the natural settings of potential users using their own task-related language. The idea is to gain deeper understanding and help users to remember details by seeing and maybe trying the tools and artifacts being discussed. The users are encouraged to show artifacts and give demonstrations. Possible interview topics are:
  - Background information
  - User's goals and preferences
  - User's tasks and tools
  - User's skills and experiences
  - The context of using a tool
  - The pros and cons of the current tools
  - The specific problems and requirements of the user

- **Observing**
  Observing is a very important method to gather nonverbal information about users, tasks and users’ physical, social, and cultural environments affecting them. Users are not able to express verbally routinized actions, their detailed behavior and they have restrictions in their memory. Observation can uncover this kind of important information, but it can be time-consuming. It is also important to have a clear focus and objective for the observation or vast amount of useless information may be gathered.

- **Contextual inquiry**
  Contextual inquiry is a method of Contextual Design (Holtzblatt & Beyer, 1998). In contextual inquiry interviewing and observing is combined; users are watched, listen to, and talked with at the same time as they work in their own environment. Contextual inquiry also includes a philosophy, how to make site visits. The principles of contextual inquiry are context, partnership, interpretation, and focus. Context means that users are visited in their own environment and the conversation is made concrete by focusing on the ongoing events. The goal of partnership is to treat the user as a partner and users are seen as the best experts of their work. The interpretation principle implies that you should share your emerging understanding with the user to make sure you are interpreting your observations correctly. Focus defines the point of view and objective an interviewer takes while studying work.
• **Interactive feature conceptualization**
Interactive feature conceptualization provides an overall picture of the user and her/his context and is a method to validate interview results. During the interview, tools, processes, places, persons, etc., that the user mentions are recorded on sticky notes. At the end of the interview, all sticky notes are placed on a large sheet of paper. The user is asked to rearrange the items into categories that make sense to them in their context. Alternatively, the interviewer places sticky notes containing places on a sheet of paper and asks the user to place other notes according to them. As the notes are grouped, the interviewer tries to understand the overall picture. For instance, to capture communication patterns between people, she/he can ask clarifying questions about communication and draw arrows representing connections between people or flows of information.

• **Artifact walk-throughs**
In addition to interviewing and observation, it is possible to ask for examples of various artifacts that are mentioned. Artifacts can be forms and reports that are used during a process, examples of output of tasks or hand-written manuals or notes. The artifacts can help to understand, how tasks are done, what is difficult for users to do or remember, and what kind of information flows there are from user to user.

• **Think-aloud method**
The aim of the think-aloud method is to find out nonverbal information like how users use their present tools and what beliefs, theories, skills, etc. delineate the use. In a modified version of the method, users can be asked to show how they use a tool by thinking aloud or users are asked to tell how he/she uses a tool by thinking aloud during imagined use. The user has the tool in hand, imagines his/her typical use situations, and tells/shows how he/she would use the tool in the situation. The interviewer asks clarifying questions when needed.

• **Simulations, role-playing**
If it is not possible to disturb users in real situations or it is unlikely to observe a particular task that occurs infrequently, you can create a situation in which you can observe and talk during the task. Data gathered by role-playing or simulations is not as credible as data taken under actual conditions, but it may be the only substitute available. The other solution may be video observing. Videotapes can be rewind and you can discuss about the events with users afterwards.

Again, it is efficient to use a combination of methods. Different methods gather different kinds of information. The efficient using of these methods requires specific skills and training.
4. User needs analysis and product definition

The results of the user needs gathering need to be described and analyzed so that they can be communicated forward and product definition can be based on them. There are many approaches to do this, scenario-based design and rapid prototyping may be the best known. Scenario based design can proceed from task scenarios to use scenarios.

4.1. Task scenario developing

Task scenario is a short description of how users handled a particular task, including details of steps, actions, and objects.

Table 4. An example of a task scenario for developing a remote control.

<table>
<thead>
<tr>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Task scenario is one way of describing the present processes, environments and characteristics of users in a vivid way. Task scenarios are used to develop use scenarios, which describes the intended product from the user point of view. Use cases may be the next step from use scenarios.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Task scenarios are written based on user studies. Table 4 is an example of a task scenario, which could be a result of a user study, when a remote control was developed for television.</td>
</tr>
</tbody>
</table>

4.2 Use scenario developing

Use scenario is a short description of the users, tasks, and environment, as they will look in the new design. Use scenario may include the same tasks and users as a task scenario, but it is a description of how the user’s goals will be achieved with a new product. Use scenarios can be illustrated in visual form by storyboards. A storyboard combines text and graphics, moving the design process along into rough sketch of what the interface might look like.
Table 5. An example of a use scenario for developing a remote control.

<table>
<thead>
<tr>
<th>Benefits</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Matti Meikäläinen, a teacher, thinks that he had a really hard workday and he wants to relax and watch TV. He presses the on/off-button of the TV and sits down on his soft sofa. Unfortunately, he is not interested in that soap opera and he has to change channels in order to see is there anything interesting. He grasps at the remote control from the nearest table and starts to change channels.</td>
<td></td>
</tr>
</tbody>
</table>

**Benefits**

Use scenarios describe the use of a product from a user point of view in a form that users can understand and evaluate. Use scenarios can describe the whole functionality from the user point of view. Use scenarios can point out some potential problems in design, as in creating them you have to consider real users, their tasks and environments. Use scenarios are cheap to produce and they can be used to validate user requirements with users. Use scenarios can be used later to test that the product can really do the tasks in a way it was intended. They offer realistic tasks and settings to the usability tests.

**Implementation**

Table 5 provides an example of a use scenario. This use scenario could be written based on the task scenario for developing a remote control (Table 4). The task scenario identified the problem of changing channels without standing up and walking. The use scenario intends to solve that problem by a new product.

4.3 Use sequence developing

A use sequence describes the sequence of tasks, as the users will perform them with the new design. The sequence of steps taken in use scenario can be described by a use sequence. The steps should clearly indicate what actions the user will perform, what decisions the user must make, and what actions the system will perform for the user.

Table 6. An example of a use sequence for an online catalog system (Hackos & Redish, 1998).

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>The user arrives at the catalog shopping home page, sees a description of the catalog shopping system, and views the initial graphic of the shopping area.</td>
</tr>
<tr>
<td>2.</td>
<td>The user decides to browse through the catalogs and clicks the GO to Catalogs button.</td>
</tr>
<tr>
<td>3.</td>
<td>A graphic display of all the catalogs appears.</td>
</tr>
<tr>
<td>4.</td>
<td>The user clicks on a catalog and the catalog home page appears with a graphic and a table of contents of what is in the catalog.</td>
</tr>
<tr>
<td>5.</td>
<td>So on..</td>
</tr>
</tbody>
</table>
Benefits

Use sequences enable the design team to examine the details of the user performance, to maintain consistency among tasks, and to relate future performance with the users’ current ways of performing the tasks. Use sequences can be used to create a task-oriented manual.

Implementation

Use sequences are written based on use scenarios. Table 6 is an example of a use sequence.

4.4. Use hierarchy developing

Use hierarchies show use sequences in a hierarchical order to show their interrelationships in the new product.

Figure 2. An example of a use hierarchy for a PDA (personal digital assistant) application.

Benefits

Use hierarchies illustrate the interrelationships among tasks and the hierarchical order of tasks and their subtasks, as they will be in the new product. A use hierarchy can help you to analyze user goals and the necessary collection of functions from the user point of view. The hierarchies may influence menu and icon design as well as how the tasks are accessed and when sequences are appropriate.
Implementation

Use hierarchies are based on task hierarchies that describe the results of the task analysis. The goals, present tasks and subtasks of users are identified and described. Then the task hierarchies are translated to use hierarchies to show how the tasks are completed with the new product and what kind of new subtasks are introduced. Even if the product is something totally new, the goals of the users are probably the same and a user expects a similar kind of task structure. An example of use hierarchies is shown in Figure 2.

4.5 Analyzing use structure

Use structure imply the overall movement through the system. A use structure diagram show how the users will take many paths through the new system.

![Edit slide notes](#)

**Purpose:** View and change the notes associated with a slide

**Functions**
- View content of slide
- View slide notes
- Change relative position of slide view and notes
- Edit content of notes

**Links:**
- Edit slide
- Edit slide show

**Objects**
- Slide
- Slide notes

**Issues**
- Can’t edit slide content from here

![Edit slide](#)

**Purpose:** Create, view, and change the content of an individual slide

**Functions**
- View slide content
- Edit text
- Add shape to slide
- Add text box to slide
- Save slide show

**Links:**
- Edit slide show
- Edit slide notes

**Objects**
- Slide contents

**Figure 3.** An example 1 of use structure diagram.
Figure 4. An example of use structure diagram.

Benefits

When the number of scenarios and use sequences increase, use structure diagram can be used to summarize and show how the users will take many paths through the new interface. This use structure is the first step in defining product structure and user interface. The challenge is to define a coherent use structure for the product, so that it supports the users and fits with their expectations.

Implementation

The use structure of the product consists of the places in the product where a user can perform a task, the functions that support user tasks in each place, and the links that allow the user to move from one place to another. The use structure diagram is built from use scenarios, storyboards (chapter 4.2), use sequences (4.3) and/or use hierarchies (chapter 4.4) by collecting the different stories of use into one structure supporting them all. Every use scenario has consequences for places, functions and links. After all use scenarios have went through, it is checked that the use structure is coherent and rational. Figures 3 and 4 give examples of use structure diagrams (Beyer & Holtzblatt, 1998; Hackos & Redish, 1998).

4.6 Workflow developing

Workflows describe worktask flow between users or how many users interact with the new product.
Figure 5. A workflow diagram of the medical records application (Hackos & Redish, 1998).

Benefits

The workflow diagram helps to understand how a particular work process is accomplished when several users are involved in and it gives an opportunity to find areas in which the workflow and a division of labor must be significantly modified.

Implementation

Based on user studies a workflow diagram is drawn to illustrate how several users collaborate and perform tasks together. The workflow is analyzed to find redundancies and unnecessary steps and to see how the new product could solve the identified problems. Then the redesigned workflows are describe in diagrams. An example of a workflow diagram is shown in Figure 5.

4.7. Usability goal setting

Usability goals are set to keep in mind the user and usability issues. The goals need to be achieved to ensure that users find the product useful and usable.

Table 7. Examples of usability goals and measurable objectives.

<table>
<thead>
<tr>
<th>Goal</th>
<th>Measurable objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>Users will be pleased with using the product.</td>
<td>80% of users will rate the software at the highest level of satisfaction.</td>
</tr>
<tr>
<td>Users will be able to find the information they need.</td>
<td>100% of users will be able to find the information within three minutes.</td>
</tr>
</tbody>
</table>

Benefits

Written usability goals ensures that you have considered the goals of the product from the user and usability point of view and they help the development team to notice these goals. Measurable goals also provide a way to know if a product achieve an acceptable level of usability.
Implementation

After you have done user studies, the qualitative usability goals are easy to derive from values the users bring to the task. You may also need to think about different components of usability and consider which of them are essential for this product. The traditional components are learnability, efficiency, memorability, low error rate and user satisfaction (Nielsen, 1993). It is not always possible to achieve optimal level for all usability attributes simultaneously. That is why it is important to decide which ones of them are the most essential from the point of users and from the point of the product.

After you have formed qualitative usability goals you can think about measurable objectives if possible (see Table 7). Try to think, what the general usability goals mean on a task level to make the general goals more concrete. You can use older versions of the product or competing products as a baseline, when you are considering the level of the measurable objectives.

4.8. Rapid prototyping

Rapid prototyping includes developing and evaluating simple and usually throw-it-away prototypes. Prototypes are used to collect information about both requirements and the adequacy of possible designs. The prototype may be focused on an important aspect of the product. The emphasis is evaluating the prototype and the underlying assumptions and gathering user feedback from it.

Benefits

The idea of rapid prototyping recognizes that requirements are likely to be inaccurate when first specified and it resolves uncertainty about how well a design suits users’ needs. As the prototype is produced quickly and cheaply, the found problems are cheaper to correct than from the final product.

Implementation

After the present user goals, processes, and contexts are understood and the technical possibilities realized, it is possible to start to redesign the user processes and define the product. Rapid prototypes can be created quickly by animators, screen painters and report generators. First, you have to recognize a type of prototype you are producing. A horizontal prototype shows the user interface but has no functionality behind the buttons. A vertical prototype contains all of the high level and low level functionality for a restricted part of a system. Wizard of Oz prototype involves developer who performs the functionality of the product. The chapter of validation and testing describes how user feedback can be gathered from prototypes.
5. Validation and testing

User studies help to focus the requirements near the goal, but the results of the user studies need interpretation and adapting. Thus it is important to validate the final requirements with users. The requirements can be validated using use scenarios (chapter 4.2), storyboards (chapter 4.2) or prototypes (chapter 4.8). Scenarios and storyboards can be used to test the general idea of the product and its functions in general level. Prototypes can be used to test the look and feel of the product and some functions in more detail.

5.1. Interviews

Validation can be done by interviewing users or “walking through” the prototype with them. Use scenarios, storyboards are shown to users or the prototype is walked through step by step with a use scenario.

Benefits

Interviews and walk throughs validate the requirements on high level, so that the requirement should be right. It is important for the designer to be looking not for validation, but the ways in which the requirements fails. The purpose of the validation may be to anticipate customer satisfaction and provide feedback on the high-level design. In addition, rough usability problems about the conceptual model of the product, use sequences and general function logic can be found.

Implementation

Use scenarios or storyboards may be shown to a set of representative users and their opinions are asked. Users may have difficulties to express opinions of the use scenarios, it is important to ask them, if they would use or buy that product and why so.

Prototypes may be walked through step by step with use scenarios. It is impossible to predict how the product will affect the user and his/her task processes. A solution is that users image to use a prototype to reach their real goals. If a user misunderstands something, it is important to find out how the user interpret that feature in order to find another approach to it.

It may also be useful to compare the functionality and features with older versions or competitor product. Mockups or prototypes of the high-level design of both products are shown to users, and they rate their satisfaction and intent to purchase or use both products. Validation can be based on tasks or scenarios, and then the products can be compared by task or function level.

Other team members (technical communicators, trainers, usability specialists, and business analysts) should also walk through the prototype or scenarios.
5.2. Usability assessment

Usability assessment is gathering data about the usability of the prototype. Usability assessment may include usability tests with real users, observing and heuristic evaluation. Heuristic evaluation means that the designers and usability specialists assess usability by using heuristic roles.

**Benefits**

To know how well the emerging design is going to work for users, you must have users to try it out. Usability assessment is for finding usability problems of more detailed functionality. Users do not find usability problems by seeing a prototype, but they need to use the prototype. Usability testing of earlier or competitive product can help the design team to understand user requirements by showing how an already existing product is being used in the field.

Heuristic evaluation is cheap and quick way to find some problems before the prototype is usability tested, but as it can be seen from Table 8 usability tests can uncover more severe problems.

**Table 8.** Usability tests tend to uncover sever problems compared to heuristic evaluation (Desurvire, 1994).

<table>
<thead>
<tr>
<th>Method</th>
<th>Minor confusion</th>
<th>Error</th>
<th>Task failure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Usability test</td>
<td>5</td>
<td>3</td>
<td>17</td>
</tr>
<tr>
<td>Expert evaluation</td>
<td>80%</td>
<td>67%</td>
<td>29%</td>
</tr>
<tr>
<td>Software engineers evaluation</td>
<td>40%</td>
<td>0%</td>
<td>12%</td>
</tr>
<tr>
<td>User evaluation</td>
<td>20%</td>
<td>0%</td>
<td>6%</td>
</tr>
</tbody>
</table>

**Implementation**

In a usability test representative users attempt to do realistic tasks with a prototype while someone watches and takes notes. The tasks are prepared in advance. The user is asked to do the tasks independently one at a time while talking aloud what she or he is trying to do. The test situation is usually video taped and the errors and comments that the user made during the test are analyzed from the videotape.
6. Follow up

Follow up is done after the product is released. The idea is to gather user feedback from real user situations.

6.1. User feedback

User feedback is actively gathered, when users are explored to see what is their attitude towards the product and how they use it.

Benefits

User feedback is gathered in order to help to understand the user requirements of the next version and to provide designers feedback from their job. Usability tests are one way to get initial feedback from users and these tests are useful to disclose what kind of usability problems people have when they face the system for the first time. However, in usability tests users have little control over tasks and only a limited number of functions can be tested. After the product is released, a developer has the possibility to get a realistic view about the practical utility and usability that the product really offers to a user. Usually users are not using products as developers designed it to be used and the real usability problems arise in longer period of time. After you have seen the real problems and usage ways the users have it is much easier to develop a better product for the users.

Implementation

An effective way of gathering user feedback is combine observing or interviewing and the talk-aloud method. A user is observed in his/her real context using the product or if this is not possible, he/she is asked to tell about his/her goals and way of usage. When the user mentions a usage way, he/she is asked to show how he/she does it with the product. It is useful to keep the interview grounded in real events. If the user mentions a problem, she/he is asked to give a description how it happened last time.
7. Glossary

**Context of use** (käyttöyhteys tai -ympäristö) – Users, tasks, equipment (hardware, software and materials), and the physical and social environments in which a product is used.

**Prototype** – (prototyyppi) Representation of all or part of a product or system that, although limited in some way, can be used for evaluation.

**Rapid prototyping** – (nopea prototypisointi) A form of simple, rapidly produced prototyping in which the prototype usually thrown away. The prototype is used to collect information about both requirements and the adequacy of possible designs.

**Task scenario** – (tehtäväskenaario) Narrative descriptions of a task, ranging from stories of incidents to elaborate descriptions of how users handled a particular incident, including details of steps, actions, and objects.

**Usability** – (käytettävyys) extent to which a product can be used by specified users to achieve specified goals with effectiveness (utility), efficiency and satisfaction in a specified context of use.

**Use structure diagram** – (käyttörakennekaavio) Drawings of the use structure of the product, it may consist of the places in the product where a user can perform a task, the functions that support user tasks in each place, and the links that allow the user to move from one place to another.

**Use hierarchy** – (käyttöhierarkia) Tasks and subtasks arranged in a hierarchical arrangement to show their interrelationships in the new product.

**Use scenario** – (käyttöskenaario) Brief narrative descriptions of the users, tasks, and environments, as they will look in the new design.

**Use sequence**– (käyttösekvenssi) A description of the sequence of tasks, as the users will perform them with the new product.

**Workflow diagram** – (työvuokaavio) A description of the major tasks performed by groups of users.

**User** – (käyttäjä) An individual interacting with the product.

**User group** – (käyttäjäryhmä) A group of users, which share a common characteristic, for example doctors or nurses.

**User interface** – (käyttölöittymä) The surface aspects of a computer system, such as its input and output devices, the information presented to or elicited from the user, feedback...
presented to the user, the system’s behavior, its documentation and associated training programs, and the user’s actions with respect to these aspects.
8. References


APPENDIX 1, Planning a user study

In planning for a user study, you have to think about and make decisions on
- Issues and objectives of the use study
- Data collection methods
- Data analysis and reporting
- Who are the participating users and how to find them
- Locations where to go
- User study team
- Recording of the user visits
- Materials prepared for user visits
- Schedule

Issues and objectives of the user study

The first step is to decide what do you want to learn through user visits. Consider if there are special questions you are trying to answer, for example, issues that people in your company have raised. Through user study you can challenge or verify the general assumptions made about users underlying a product.

The assumptions that may affect user requirements are:
who are the users
users’ characteristics and cultural differences
users’ knowledge, vocabulary, expectations, and skills
the goals and preferences of users
users’ tasks
users’ motivation
users’ existing tools
user’s environments and conditions
the present processes: problems, pros and cons of the tools and processes

It is a good idea to involve all the stakeholders in your decisions. Stakeholders are all the people affected or who may need to pay attention to the results. Write down the main objective and the issues of the user study.

Data collection methods

The selection of data collection methods depends on the objectives of the user study, the information that is searched for, and the available resources. Usually, it is efficient to use a combination of methods in order to gather different kinds of information. Often, it is useful to take a broader view of your users than your application area would suggest. For example, it may be good to understand the whole field of work or a whole day of the user in order to get ideas how to support a certain task. See chapter 3.3 for an information of the main methods.
**Data analysis and reporting**

It is important to plan data analysis methods and reporting beforehand, so that you will have the necessary materials and resources after the data collection. It is useless to do many interviews, if you do not have time to analyze the results. The results need to be not only analyzed, but also communicated to others.

There are many ways of describing the results of the user study. Photographs or video or audio clips can be used to illustrate significant observations. The results can be described simply by lists of issues identified and insights about them that may affect design decisions. The lists can be organized according to the issues of the user study, for example user description, the goals of the users, the needs of the users.

The other way of organizing data is constructing affinity diagrams together with the user study team. In this approach, each interviewer records individual pieces of data to a self-sticking note. Then the interviewers as a group put their respective notes up on a wall one at a time, clustering related notes together. Then the team labels the clusters and groups them into higher-level categories.

Developing task and use scenarios is a way of describing and analyzing results (see chapters 4.1 and 4.2). The scenarios are useful, if application specific tasks and task sequences are possible to identify. By using scenarios you can analyze use hierarchies (see chapter 4.4) and the whole use structure of the product (see chapter 4.5).

The results can imply better user descriptions (chapter 3.2). If the product is for many users who are working together describing and redesigning the workflows is important (see 4.6).

**Who are the participating users and how to find them**

The most important thing is that the users chosen are real users and they are representative of all users. It is impossible to get all users, but you may get a typical user from the main user groups. You need to decide on the number of users and the type of users. Start small, you can learn a great deal from a relatively small number of participants. Five to ten well-chosen participants may be enough, especially if you are iterating the studies. After the first user visits, you may refine old issues and discover new questions.

Ulrich and Eppinger (1995) find useful to contact a group of users called lead users. Lead users are very experienced and active users. Lead users may reveal more needs, because they have had to struggle with the inadequacies of existing products. However, not all users are equally motivated and they will use the product less frequently than lead users. Thus, it is most useful to contact both kinds of users; lead users to find advanced needs and usual users to find out the problems they struggle with.
The marketing or sales department may be the best place to get lists of users. Customer registration database, your website, and user clubs are other possible user sources. Make sure you find users and not merely buyers and consider both present and future users or even now lost users.

**Locations where to go**

If possible visit users in their own locations and environments. Consider the variety of user locations and try to visit different ones. You are probably not going to get the resources to do an international study right away, but start with what you can do and try to consider cultural differences. Consider also the time of the user visit. During peak hours you can get many observations, but interviewing may be impossible.

**User study team**

The team for a user visit can not be more than two persons, one to interact with the user and the other to record what has happened. Decide the roles of the user study team beforehand. User visits can be done with only one person, but then video- or audiorecording is necessary. Of course many persons can be involved in user visits in multiple teams. This way the right people can see what users are really doing. Ideally, one of the two-person team has experience doing user studies. Choose a style of your clothes so that you fit in with your users’ environment.

**Recording of the user visits**

Recording of the visits is useful. Videotape or audiotape allows you to go back and review what happened, if you did not capture something in your notes. If you are using recording, be sure that users know that you plan to do it before you go and confirm that they will give you permission. Some users find recording disturbing and you have to give up recording with them. Video recording is often more disturbing than audiorecording, but you can concentrate on recording surroundings not users. Prepare a permission form to be signed.

**Materials prepared for user visits**

Prepare a data collection form for each user visit. Forms should include identification information of the user visit: date, place, user visit team members and user’s background information. Then forms can include interview questions or issues to be observed

• Schedule