HaptiMap

D1.2 user study guidelines

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HaptiMap

User Study Guidelines

SEVENTH FRAMEWORK PROGRAMME

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SEVENTH FRAMEWORK PROGRAMME, THEME 3
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Abstract
This deliverable contains guidelines for the user-centred work in HaptiMap.

Keyword list
User studies, design, user-centred design

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"Would you tell me, please, which way I ought to go from here?"
"That depends a good deal on where you want to get to," said the Cat.
"I don't much care where ----" said Alice.
"Then it doesn't matter which way you go," said the Cat.
"----- so long as I get somewhere," Alice added as an explanation.
"Oh, you're sure to do that," said the Cat, "if you only walk long enough."

Alice's Adventures in Wonderland, Lewis Carroll

Introduction

In the HaptiMap project we use and advocate an iterative and user-centred design methodology where end users are involved all through the work process and where designs and prototypes are tested iteratively. We have compiled these guidelines in order to provide a common basis for this work and to help partners in the project carry out user studies in a uniform way. But we also hope that this document can be valuable and useful for designers, developers and researchers outside HaptiMap.

The guidelines contain the following sections:

Users and design: Here we discuss the design process and the role of users in it. We also introduce some basic concepts.

Ethics: This section describes key points to consider when working with users. We also provide readymade templates to be used in the HaptiMap user studies in Appendix B.

Putting things together: This section explains how you can use and mix different forms, tools and methods to create unique and well-fitted methods for your own study.

Techniques: Here you will find a compilation of user study techniques and design tools that have or will be used in the HaptiMap project.

Examples: This section provides step-by-step instructions for two different kinds of user studies. These can be used as is or be modified to fit a particular context or kind of user study.

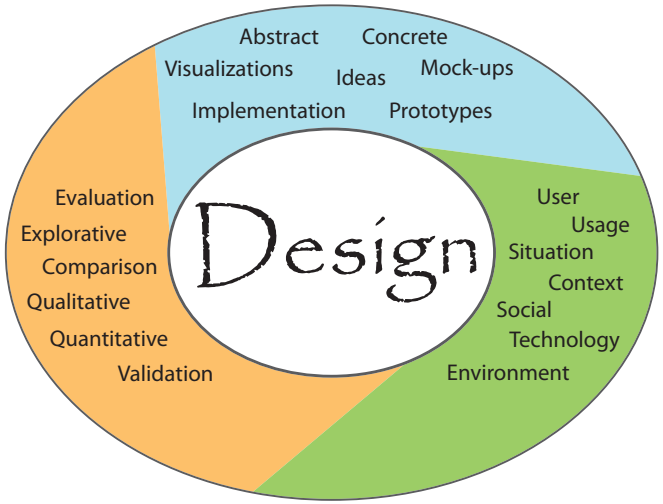
These guidelines are written for designers and developers who want to make better designs by involving users in their work, as well as for researchers who want to gain a better understanding of interactions, users or designs.

The sections you choose to read depend on who you are and what you want to do, but everyone should read the section on ethics before planning any user activities.

Thinking about users and design

The way you think about design is important. If you believe that design is about exploring a space of possible solutions, that design is about usability as well as aesthetics and that you need to meet real users and real situations, this will have a major impact on the way you work.

A typical feature of any design process is that much information about "the problem" (the user, the usage, the context, etc.) is missing at the start of the process. And since user, usage and context will change as artefacts change and new artefacts are introduced, the designer aims at a moving target.



"There is no direct path between the designer's intention and the outcome. As you work a problem, you are continually in the process of developing a path into it, forming new appreciations and understandings as you make new moves." (Schön, Bennett, Winograd, 1996)

In a sense this can be termed "doing for the sake of knowing". The designer is progressively moving along, making judgements about different responses from the medium – and sometimes discovering completely unexpected things.

Design in action

Schön talks about *reflection in action* as well as *reflection on action* and uses the term "backtalk" for surprising discoveries – the medium talks back at you telling you things you did not know.

If the final product is to be usable, then the user and the usage have to be part of the processes of reflection and action. After all, the person who decides if an artefact will be used is the user. If a device provides inappropriate services it will certainly not be much used, and if the services are the right ones but the system is hard to use, people tend to try to find other ways of accomplishing their tasks.

Thus, the needs and wishes of the user need to be considered right from the start of any design process. The cost of implementing any changes becomes larger the closer you approach the finished product. Because of this you need to find the problems as early as possible.

You need to get to know the user, but it is generally not enough to just to ask them what they want. Confronted with the question "What do you want?" most people will answer "What can I get?" Some of the information you need may be found in reports etc., but you should always complement such knowledge by firsthand experience of users and environments.

A mobile phone user

In addition you need to consider the context in which the product will be used. A mobile situation is quite different from one where the user(s) are

able to sit down and concentrate – in a mobile setting people have less attention to spare. If we take a cyclist as an example, it is obvious that the kind of interaction and information this person is able to handle is quite different from what he or she will find acceptable while using a desktop environment.

Something that is almost equally important to consider is that the social situation can play a major role when it comes to why artefacts are used (or not). As an example we may take the case when the management decides to introduce new technology which is more or less forced on the employees. In this case it is very unlikely your product will be popular, even if the design is quite good.

So, it is important to investigate all aspects of the design problem early on – to be prepared, and to be able to change your approach if necessary.

The combination of technology, users and context can be thought of as a design space that needs to be explored. To do this, idea generation is crucial. And it is not enough with only one idea – a skill that every good designer must have is to be able to generate lots of ideas. But it is not enough with ideas – you also need to be able to visualize (articulate) them so that others can understand your intent and evaluate what you have done. The feedback you get from evaluation is not just a way of getting rid of poor solutions, but also an important means of generating new ideas.

To summarize, we can say that there are three basic components in any design process:

Idea generation. Ideas should be generated, selected and visualized (articulated).

Know the user, usage and context. You should try to discover user needs, how the user performs the same set of tasks today, how the user will use the proposed artefact, and how this fits into the context.

Evaluate. Ideas, concepts, models, prototypes need to be evaluated.

These activities are not strictly separable. To be able to visualize or articulate you need to know the user and the usage. And information about the user and the usage may result from the evaluation of visualized ideas or concepts.

If you (as we do) believe that design is about aesthetics and usability, that it is about exploring a space of possible solutions, and that one needs to involve real users and situations in the process, then we hope you will find useful and practical information in the following sections of this document.

Further reading

Schön, D., Bennett, L., Winograd T., (1996) Reflective Conversation with Materials, Bringing Design to Software, ACM Press, 1996, pp. 171 – 174.

Gedenryd, H. (1998) How designers work – making sense of authentic cognitive activities, PhD thesis, Cognitive Science, Lund University.

Ethics

Any designer, developer or researcher who engages people as sources of information or evaluators of products needs to think about ethics. If you are a researcher, there are formal regulations on ethics which you have to follow, but ethics is something very practical and useful that should concern everyone. Ethics deals with treating the people involved with respect, and it is a good way of making sure they will be happy to be contacted again.

A good ethic code is achieved by:

- Treating participants with respect
- Making information and activities accessible
- Ensuring a basic level of success
- Pilot testing activities
- Informed consent

Treating participants with respect
Always do your best to ensure that the outcome of the activity is such that the users' participation is justified (and is perceived as such by the participants). There is a tradeoff between possible gain and possible unpleasant experiences, and everyone needs to know enough beforehand to judge if they can agree to participate. It is also important that there is no pressure on the persons to participate – not participating or declining to participate in parts of the activity should never produce negative effects.

You should be aware that you are using their valuable time, and ensure that the activity is carried out efficiently (although not rushed).

Give the participants some kind of feedback concerning their participation, especially if they have taken part in activities that ask them to produce material (such as in workshops or triggered by cultural probes).

Be sure to inform the participants in testing activities that you are not testing them; you are testing designs, ideas or technology.

Avoid publishing or distributing information that allows easy identification of the persons involved (like photos) unless this is explicitly agreed upon by the participant.

Making information and activities accessible
You need to make sure that a variety of participants are able to contribute. Information, tasks and locations should be accessible for everyone involved.

This includes making printouts of information material or informed consent forms in Braille print if needed, assuring that menus (if coffee, snacks or lunch is provided for participants) have appropriate food alternatives, choosing a meeting room that is wheelchair accessible, just to mention a few examples. A sample checklist for planning user activities is provided in Appendix A.

Also make sure that the activities are possible to carry out by the participants that are invited.

Ensuring a basic level of success
Even if you inform participants in testing activities that you are not testing them, complete failure is not a good experience. Therefore, the activities should be designed to result in some basic level of success. If you are carrying out a usability test for example, you will need to design some tasks that you are sure the user will be able to carry out without much difficulty. This is not to say that you should rig the whole test beforehand – failure is of course allowed if you are trying to find out how things work. But there should be some initial exercise that everyone has a fair chance of completing.

Pilot testing activities
A pilot test is one that is carried out before the actual testing session with invited participants. Ideally, pilot testing should be done in stages, an iterative design of the testing situation.

A participant for a pilot test could be a person that is involved in the project, but not in the particular design of the product or test, or a colleague that has little or no knowledge of the project. The results from a pilot test are not to be reported in the same way as the actual test results. The aim of the pilot test is also to redesign the test if necessary, so pilot tests are rarely carried out exactly the same way as the actual tests.

Informed consent
Informed consent is a procedure which deals with how information is given and processed – and ensures a basic level of decency. In this procedure you provide information about what will happen – and allow everyone to make an informed decision if they want to participate or not.

Informed consent

Informed consent is a procedure which should be followed to make sure participants have the information they need to decide if they want to participate. The main points of this procedure are:

Information sent out in advance
An information kit about the particular project is sent out together with an invitation letter which explains the particular details for the activity in question. The invitation letter should also contain contact details for the persons responsible to allow potential participants to pose questions or ask for further information.

Information repeated just before the start of the test
Before the test, the main points in the invitation letter and the information kit are presented verbally and the person is given the opportunity to pose questions.

Informed consent form
The informed consent form must be signed in advance by the participants and contains the following points:

- I am willing to participate in the specified test.
- I have been informed in advance.
- I have been informed about how the test will be performed.
- I have been informed about any recordings that will take place and how these are handled afterwards.
- I know who to contact in case of questions.
- I am aware that I can – at any time – discontinue my participation without indicating any reasons.
- I am aware that I will only be refunded for my travel costs (no other payment will be received).
- I permit the recording of data on video/audio tape.

It should be possible to completely reject video/audio recording, to allow it to be used in a restricted way and to allow it to be shown/published to a wider audience (with the added choice of their identity hidden by means of image manipulation, like black rectangles, for example).

Confidential handling of personal data
Personal information like name and date of birth should not be available to persons outside the project, and should be handled in a secure manner. Test results and test data should not contain name or date of birth data, only a code for the participant(s) and if necessary the age in years (not date of birth). Personal information that is made public should be anonymous. When ethical permits are required for the work, such permits should be obtained.

A sample informed consent form can be found in Appendix B.

Practical user study checklist

Basic principles

User studies cover a wide range of activities designed to obtain information on the interactions between users and specific products. User test involves watching and listening carefully to users as they interact with a product or system. Some principles should be followed when planning a user study:

- Set an objective
- Decide on the methods
- Design the tasks
- Determine the setting
- Decide what to record
- Determine the roles
- Determine which users to involve
- Prepare

Set an objective: you should always specify what is (as well as what isn't) being tested and what it is you are trying to find out. Are you doing exploratory testing, assessment, validation or comparison?

Decide on the methods: consider carefully which methods and techniques you should use in order get the information you are after.

Design the tasks: try to make use of realistic tasks. Task descriptions should be written in a way that is easy to understand, without giving away the kind of information that will influence your results. It can often be a good idea to have users testing in pairs or groups, since people talk more working together (discussing the task, features of the product, explaining how things work, etc.).

Determine the setting: the ideal setting for user studies is the kind of context in which the system is expected to be used. Lab studies can also be used, but you should carefully consider if and how these are to be done in order to get valid results.

Decide what to record: decide on which data you are recording.

Determine the roles: decide what kind of persons are needed to run the test (test leader, observer, etc.).

Determine which users to involve: it is important to involve the kind of persons that can be expected to use your future product.

Prepare: you need to prepare the test environment. For a lab test you need to setup all that is needed, and for a test in real environments you need to get permits, check out risks, etc. You also need to prepare the things that are to be tested and make sure everything works.

Before the test you should *always* do a pilot test to make sure everything works as intended. You also need to send out the informed consent materials. To make sure you remember all the different things that needs to be done before and during your test, we suggest you put together a specific checklist for your test. A sample checklist regarding things to consider when inviting a group of end user participants can be found in Appendix A.

Further reading

Rubin, J. (1994) Handbook of Usability Testing, John Wiley & Sons, Inc.

Choosing and combining techniques

In the following sections, we present a comprehensive collection of user study techniques and design tools for use in the HaptiMap project. Each technique is presented on a single sheet of paper, to make it easy to bring along separately.

Each of the methods and tools is presented with up to eight headings:

- Background
- Description
- Examples
- How-to
- Tips
- Inclusion
- Expected outcome
- Further reading

We have included a separate heading for inclusion issues, since this is something we think should be considered explicitly, not only in HaptiMap, but in any user centred design process.

Combining techniques

User studies form an essential part of user-centred design methodology. The kind of techniques you use depend on your unique design situation as well as on where you are in the design process. The aim with this part is to:

- Describe how you can select and combine different techniques.
- Guide you in choosing the users for your study.
- Offer tips on design.

All the techniques we have described can be used at different stages in the design process and for various purposes. Therefore, our most important guideline is that you develop your own user-centred design practice by trying and experimenting with different techniques.

Planning and organizing user and design studies

No single technique will fit all needs and situations. Because of this you will need to find a suitable set of techniques that fit well together. To facilitate this selection we suggest that you develop a user-centred design framework, which helps you decide which techniques to use at different stages of your design process.

For example, a framework that includes both down-to-earth grounding and blue-sky design concurrently has been demonstrated to be very useful in the design of new communication media. In such a case it might make sense to combine observations with prototype development and then perform some field studies using these prototypes.

ACTIVITY	FUNCTION
Observations	Base our innovations in a real context, bridge between cultures.
Prototypes	Understand the user's experience.
Field studies	Assess the design in a real context.

A framework for early design activities can involve questionnaires, focus groups, diary studies, scenarios, workshops and bodystorming.

ACTIVITY	FUNCTION
Questionnaires	Mapping users' needs and habits.
Focus groups	A discussion and demonstration of artefacts.
Diary study	Further mapping of users' needs and habits.
Scenarios	Develop scenarios to be used in design workshop.
Workshop	Lets the user express their design ideas.
Bodystorming	Demonstrate design workshops artefacts in the field.

When combining different techniques into a framework the first thing to consider is what kind of input you need – you have to to decide what it is that you are trying to achieve. After this you should start looking at which techniques that can be expected to help you obtain your goal.

A basic factor to consider is if you are in the beginning of a project exploring ideas, or if you are in the later phases evaluating your design(s). Idea generation and evaluation is interlinked (new ideas almost always result from evaluation) but there are still some techniques more geared towards idea generation, while others are more aimed at evaluation.

Overview table of user study techniques

	Technique	Ideas generation or evaluation	Degree of user interaction	Realistic context	Length of the activity	Degree of technology development needed
1	Principles	Both	Low	N/A	N/A	Low
2	Checklists	Both	Low	N/A	N/A	Low
3	Personas	Ideas	Low	No	N/A	Low
4	Scenarios	Ideas	Low	Yes	N/A	Low
5	Functional analysis	Ideas	Low	No	Short	Low
6	Empathic modelling	Ideas	Low	Yes	Short/ Long	Low
7	Cognitive walkthrough	Evaluation	Low/ Medium	No**	Short	High
8	Wikis, blogs, and discussion forums	Ideas	Medium	No	N/A	High
9	Questionnaires	Both	Medium	No	Short	Low/High
10	Cultural probes	Ideas	Medium	Yes	Long	Low
11	Diary studies	Ideas	Medium	Yes	Long	Low
12	Heuristic evaluation	Evaluation	Low/High*	No	Short	High
13	Lo-fi prototyping	Ideas	Low/high*	No	Short	Low
14	Brainstorming	Ideas	Low/high*	Yes**	Short	Low
15	Bodystorming	Ideas	Low/high*	Yes**	Short	Low
16	Interviews	Both	High	No**	Short	Low/High
17	Field observations and field studies	Both	High	Yes	Long	Low/High
18	Focus groups	Ideas	High	No**	Short	Low
19	Workshops	Ideas	High	No	Short	Low
20	Informal usability testing	Both	High	No**	Short	High
21	Controlled usability tests in the lab	Evaluation	High	No	Short	High
22	Mobile usability tests in the field	Evaluation	High	Yes	Short	High
23	Longitudinal studies	Evaluation	High	Yes**	Long	High

* Depends on if end users are involved

** Depends on where the activity takes place

In addition you need to consider the degree of user involvement, as well as if you should do this in a lab or in a realistic context. It is also important to think about the length of the activity – it can be very valuable to include some more long-term studies. A practical factor influencing your choice is the degree of technology development needed. To perform a formal usability evaluation you need some concrete technology to test.

To help with the planning of your user and design studies see the overview table in the previous page which specifies how different user study techniques can be classified according to the dimensions:

- Idea generation or evaluation: Ideas / Evaluation
- Degree of directness of the interaction between end users and designers: Low / Medium / High
- Realistic context: No / Yes
- Length of the activity: Short / Medium / Long
- Degree of technology development needed: Low / Medium / High

End users representatives

When you are developing a system that is going to be used in a professional context (like a system for cashiers in a shop for example) the end users are rather well specified. Consumer products are different – it can be very hard to predict who exactly the end user will be. Studies of current consumer habits as well as marketing research can provide some insights – but if you target unknown areas it will be hard to know for sure. Thus you need to involve a range of different users in your design and development process. Basic factors to consider are age and gender, but also factors such as education as well as social and cultural background can be expected to play a role.

If you are also attempting to increase the accessibility and usability of your product, you need to involve also users that can be expected to have problems with traditional designs. Although all persons are unique, at the same time it is helpful to consider the four big groups:

- Visual impairments
- Hearing impairments
- Physical impairments
- Cognitive and language impairments

You need to remember that multiple impairments also occur. More details can be found in the overview at http://trace.wisc.edu/docs/population/populat.htm.

You should keep in mind, however, that written overviews tend to be simplified, while real persons and situations are complex. This is why you need to involve real persons and situations in your design and development process.

To get hold of end users it is usually a good idea to contact an end-user organization. People in the organization can be of help themselves – but you can also ask them to send out requests for study participation to their members. In addition you can advertise in newspapers – and of course make use of informal social networks (mailing lists, web forums, etc., can also be useful). To improve your understanding of a specific group of problems it is also a good idea to talk to professionals who deal with persons from the selected group.

In the HaptiMap project our goal is to increase the number of persons who are able to use main stream map services by making this type of application easier to use also for persons with visual impairments. Thus our user group contains both sighted persons and persons with visual impairments (including elderly persons). Although our main focus is on the problems related to visual impairments, since our user group includes elderly persons we will consider also issues related to limited dexterity, hearing problems and cognitive overload. Problems related to cognitive impairments or dementia are outside the scope of the project.

Thus our user studies should include:

- Sighted persons
- Elderly persons
- Persons with a range of vision problems

In addition we will consider age, gender and also involve persons from different countries. One overall factor that will be considered in addition to the above is the degree of familiarity with technology. This can seriously impact all user activity results, and care will be taken to include also persons with little or no technology experience.

Number of users to involve

For explorative activities there is really no lower limit on how many users to involve. An informal study with only one person may provide a lot of valuable information. As is observed already in Nielsen (1993) major usability problems can be identified also with quite a small group of users – a group size of 3-5 is suggested as an optimal size which allows you to do many tests. Bigger tests take longer time, and will limit the amount of user feedback you get. We recommend you use a range of different techniques to get a better understanding of the actual design space.

For group activities a group size of 3-8 persons is recommended, although depending on the situation larger group sizes may work. The larger the group the more important it is to have a moderator to help the group keep on track.

For more formal methods the user selection is part of the study design. In order to control for different variables you need to make certain selections, and there is often an assumption that you select users randomly within some specified group (or alternatively that you include the whole group in your study). See further: Greene, D'Oliveira (2006).

It is important to note is that even well-represented user groups could fail in generating interesting results. We recommend that you as a complement also choose critical cases and users. The idea behind a critical case is that if it works in the critical case, it can be expected to work for a wide range of users and situations.

In addition, you also need to make sure you consider the different contexts in which your product is going to be used. In the HaptiMap project we are targeting two main use cases:

- Urban situations, for example travelling, visiting a new place as well as more exploratory activities such as shopping or looking at tourist sights.
- Leisure time outdoor situations, such as planning and hiking in a national park, going on a bicycle ride, etc.

When evaluating the final HaptiMap prototype, we will perform tests at a minimum of 3 test sites (each site in a different country). Both hiking and urban situations will be tested with sighted, elderly and visually impaired users. At least 90 users should complete this final evaluation.

Further reading

Nielsen, J. (1993) Usability Engineering, Academic Press.

Greene, J., D'Oliveira, M. (2006) Learning to use statistical tests in psychology, Open University Press.

Gulliksen, J., Göransson, B., Boivie, I., Blomkvist, S., Person, J., Cajander, Ä. (2003) Key Principles for User-Centred Systems Design. Behaviour & Information Technology, 1362-3001, Volume 22, Issue 6, pp. 397 – 409.

Gomoll K. & Nicol A. (1990) Discussion of guidelines for user observation. User Observation: Guidelines for Apple Developers. January, 1990.

1. Principles

Background
Principles such as “universal design”, “design for all” or “inclusive design” are helpful all through the design process. These types of principles provide a framework for thinking, and can serve both as inspiration in the creative process and kind of a high level checklist to remind you of things to consider.

Description
Universal design states seven principles which should be considered (Center for Universal Design):

1. Equitable Use: The design is useful and marketable to people with diverse abilities.
2. Flexibility in Use: The design accommodates a wide range of individual preferences and abilities.
3. Simple and Intuitive Use: Use of the design is easy to understand, regardless of the user’s experience, knowledge, language skills, or current concentration level.
4. Perceptible Information: The design communicates necessary information effectively to the user, regardless of ambient conditions or the user’s sensory abilities.
5. Tolerance for Error: The design minimizes hazards and the adverse consequences of accidental or unintended actions.
6. Low Physical Effort: The design can be used efficiently and comfortably and with a minimum of fatigue.
7. Size and Space for Approach and Use: Appropriate size and space is provided for approach, reach, manipulation, and use regardless of user’s body size, posture, or mobility.

“Design for All is design for human diversity, social inclusion and equality. This holistic and innovative approach constitutes a creative and ethical challenge for all planners, designers, entrepreneurs, administrators and political leaders.” (EIDD-Design for All Europe, 2004).

Inclusive design, finally, is defined by British Standard 7000-6:2005 as “The design of mainstream products and/or services that are accessible to, and usable by, as many people as reasonably possible ... without the need for special adaptation or specialised design.” As can be seen from the definitions, all these three principles are comparable and are often used interchangeably.

Example
Talking books are a good example of design for all. They are accessible even if you have vision problems – or if you want to access a good book while driving, washing up, jogging, etc.

How-to
These types of principles are useful to consider at all stages in the design process. They can be used in the early stages to remind you of the extent of your design space. They can also be used when designing tests and evaluations.

As we argued in the section “Thinking about Users and Design” a necessary step in any design process aiming at solutions based on these principles is to involve real users and tasks in the process.

Tips
Although it is easy to say words like “universal design”, “design for all” and “inclusive design” it is not always all that easy to achieve. In practice there will always be some persons who need special solutions – but one should aim at making sure this group is as small as possible. When thinking about solutions – think also about who will find this difficult – and if it is possible to do things slightly differently in a way that makes things easier for these persons.

In this context it can be useful to analyze whether your solutions should fully imitate previous designs, have the same purpose but a different form or be completely different and only retain its fundamental feature, its very core (http://www.certec.lth.se/doc/certecscore/e_methodology.html).

Inclusion
These principles imply you should design for a wide range of users. Thus you need to include a range of different users in your thinking and in your design process.

Expected outcome
Considering principles like “universal design”, “design for all” and “inclusive design” as a basis for your design gives you an overall framework for both thinking and doing.

Further reading
http://www.designforalleurope.org/Home/

http://ec.europa.eu/information_society/activities/einclusion/policy/accessibility/dfa/index_en.htm

2. Checklists

Background
Checklists are (just as principles) tools both for ideas and for evaluation, but checklists are more concrete than principles. Looking at a checklist early can save you much trouble – and may also generate new ideas. And they are a valuable tool for quick evaluation to get rid of obvious mistakes. They can also be used more formally for evaluation – see the section on heuristic evaluation.

Description
In a checklist you find points important for good and working designs. They usually summarize a lot of practical experience and can contain valuable tips or suggestions. However, finding detailed guidelines that perfectly fit your evolving system in a design process is impossible. Either the guidelines are very general or they are very specific, targeted at a standard technology, like the WCAG 2.0, which is a set of detailed guidelines on how to design web pages, including how you should structure your HTML and XML code. Therefore, when working with future technology, you might be best off using the general guidelines.

Example
The following table shows an abstract of experience guidelines for map design and could be helpful when developing maps.

The characteristics are ordered as:

++ very important (must have)
+ important (should have)
0 unimportant (can have)

Characteristics	**++**	**+**	**0**	**Necessary / wanted**
Analog			x	
Digital	x			
Vector			x	
Raster	x			
Coloured	x			
Detail-generalized				highly generalized
Accuracy		x		
On board	x			
Off board			x	data connection
Download	x			
Thematic / kind of maps				Event map
Actuality	x			
POI	x			
Routing able	x			
Legend			x	
Scale				1:250 – 1:10000
Scalable	x			
Which coordinates?				UTM
Chart datum				WGS 84
Datum axis			x	
Solution				300 dpi / 30 cm
Format				CityGML
Object structure			x	
Attribute structure			x	
Interface			x	
Lumps and nodes			x	
Audio, video	x			
Tactile	x			Shaking, vibrating
2 D or 3 D				2 D
Overview			x	

How-to
To use checklists you need to find and identify which ones fit your problem domain and your technical solution. For the HaptiMap project we propose that you use at least:

- One general usability checklist
- One accessibility checklist
- One targeted checklist for the kind of technology you are working on

Tips
Since writing checklists and guidelines is an ongoing process, we suggest it is well worth the effort to look for more targeted guidelines which fit the particular area you are working on.

Inclusion
Make sure you use not only general guidelines, but also such guidelines which are aimed at helping developers producing more accessible designs.

Expected outcome

Making use of checklists can help you avoid making known mistakes. They can also support the creative process in that they remind you of the extent of the design space. Some guidelines also provide design suggestions.

Further reading

Nielsen, J. (2002) Ten Usability Heuristics. http://www.useit.com/papers/heuristic/heuristic_list.html

Tognazzini, B. (2003) First Principles of Interaction Design. http://www.asktog.com/basics/firstPrinciples.html

ISO/IEC Guide 71, http://www.iso.org/iso/catalogue_detail.htm?csnumber=33987

ISO TR22411, http://www.iso.org/iso/catalogue_detail.htm?csnumber=40933

INSPIRE, http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2007:108:0001:0014:EN:PDF

3. Personas

Background

In user-centred design, the usability practitioner typically needs to precisely define the characteristics of future users, so that the product being designed matches these characteristics. Questionnaires, user interviews and field studies are appropriate methods for doing this. However, their results are often too abstract and difficult to communicate in a synthetic and engaging manner to the other members of the design team. In order to facilitate collaboration in multidisciplinary teams, personas may be used, because they are concrete and easily accessible for everyone.

Description

Personas are concrete fictitious descriptions of potential users. They are based on real people's characteristics, which are derived either from marketing studies or from observations and interviews in real situations. When doing this, it is important to cover the largest possible number of different categories of people and situations, in order to result in representative personas for the desired user group.

Personas can be captured in 1 to 2 pages textual descriptions, in storyboards, in posters or may be represented by characters acting in short movies or plays. The content of a persona includes real users' behaviour patterns, goals, skills, attitudes, and environment, with a few fictional personal details to make the persona a realistic character. For each product, more than one persona is usually created.

Using personas has the following advantages:

- they are useful in considering the goals, desires, and limitations of future users in order to guide decisions about such product features as scope, means of interaction and visual design;
- they are useful when users are not available or are too numerous to interview all of them;
- they hide the identity of the original informants, thus allowing an ethically feasible ideation based on them.

However, personas should be used keeping in mind their limitations:

- they may be too synthetic;
- they usually provide limited information about user tasks;
- they are difficult to use when designing innovative technologies for which the future users and their characteristics are barely known.

Example

In the HaptiMap project, personas were created by meeting persons with visual impairments and elderly persons and interviewing them abut their preferences regarding maps and navigation information when visiting a national park (see figure).

Esko, 52
Engineer and Trekking guide

I am a master of science in technology. I grew up at the countryside. There we didn't go for hikes, it was part of the daily life. Besides hiking, I like to spend time at the summer cottage and take care of my wood lot. I organize and lead hikes and orienteering courses, too.

I even met my wife on a hike. I used to spend all my holidays hiking, but these days the kids are keeping me home more. I hike with my children in areas close to home. I dream about longer hikes with my children when they get older.
I want my hikes to be spontaneous with a structured frame.

I have learned with the kids that you don't have to travel far to get deep experiences. It may be the ants around your feet that provide the highlight of the day.

I want to use as big a map as possible. During a hike, when it is possible, I let my family know my location and that I am all right. After a hike, I check the route from a map.

A summary of a persona used in a HaptiMap workshop. See also Appendix D.

How-to

When designing personas, the following six steps should be followed:

1. Find real users or information on them available in company records.
2. Visit them and do interviews and observations.
3. Analyze and organize data and derive behaviour patterns, attitudes and wishes, which are common for relatively large number of users.
4. Construct personas. Include descriptions or photos of the persona's body, attitudes, character, background and emotions. This description should be closely related to your design goals.
5. Define situations in which your personas will act.
6. Validate personas and situations with the users and your design team.

Tips

Avoid creating stereotypes or superhumans. Avoid creating flat characters with only one distinctive trait. Also, user characteristics, needs and wishes may change over time. Try to reflect these changes in your personas, if the changes are important for the design of your product.

Inclusion

Personas may be easily used in inclusive design because they present synthetic characteristics and do not stigmatize individual limitations. However, they should be carefully designed in order to avoid reinforcing stereotypes of disability and people with disabilities. Thus, a large range of user characteristics, attitudes and interests should be included rather than focusing strongly on the user's limitations induced by a disability.

Expected outcome

The outcome should be several descriptions of user profiles, which can be directly used early in design or when evaluating existing products.

Further reading

Cooper, A. (1999) The Inmates are Running the Asylum. SAMS, ISBN 0-672-31649-8.

Pruitt, J. & Tamara, A. (2006) The Persona Lifecycle: Keeping People in Mind Throughout Product Design. Morgan Kaufmann, ISBN 0-12-566251-3.

Warfel, T. (2007) Data Driven Design Research: Personas. Presentation at UPA 2007, available at: http://toddwarfel.com/archives/presenting-on-data-driven-design-research-personas-for-connecticut-upa/

4. Scenarios

Background

Scenarios are stories which show the future. A scenario moves from the past to the future showing how things work and how people's behaviour and preferences change. Scenarios help us to look at the technology in a context, and the invention of specific characters for the scenarios keep us connected to a range of users and preferences.

Description

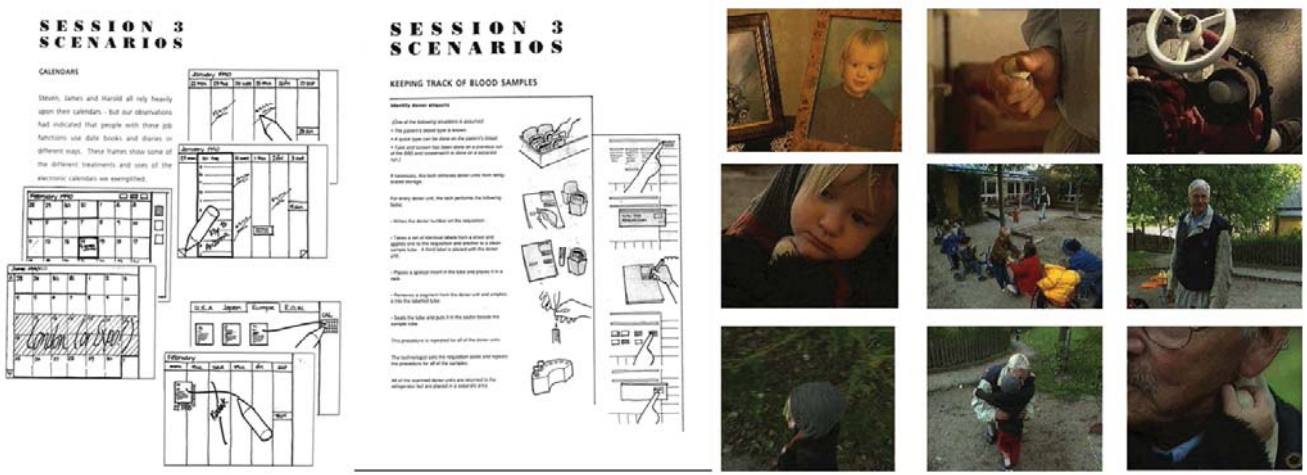
Scenarios are fictional stories with characters, events, products and environments. They can be created as written stories, storyboards, acted out plays, or full scale movies. Scenarios are useful both in discussions with users as well as within the design team since:

- Storytelling is an engaging way of focusing on user needs and system issues.
- A scenario makes us think about many levels of interaction at once.
- Scenarios include information about the environment, person, and details of screen and input devices as well as other objects and activities happening.
- They reflect the complexity of the real-world interactions with things.

How-to

To write a small scenario you can follow these steps:

1. Write a three-step scenario for one of your main persona, where you explain:
    a. The situation that motivates the need for a particular function
    b. How they access that function
    c. The satisfaction they have from using that specific function
2. Sketch a short three-panel storyboard illustrating one of your scenarios. Remember to elaborate on specific interaction styles involving sound, gestures, or touch.



Snapshots (left), storyboards (middle) and movies (right) are three different kinds of scenarios.

Tips

In order to build the scenarios on real needs and situations you need observations of "real people" that represent different categories of families, different ages, social situations and types of living. It is useful to observe and identify key themes, actions or ways of handling items that are very similar, and to collect quotes. Remember to explore the design space – there is always more than one solution!

Inclusion

Remember to create scenarios that involve persons with different abilities. Not only will this help in making your designs better for these persons, but it can also help you to find solutions that are good for everyone. Also, when using the scenarios to get user feedback – make sure the scenarios are presented in such a way that everyone in the session can take part. Think about expressing your scenarios using several media like images or sounds. You should also consider if there is a need for sign language or simplified language.

Expected outcome

Scenarios allow easy investigation of a wide range of future designs. With scenarios you can work with ideas and concepts within the design team and they also allow you to gather valuable user feedback. Working with scenarios should result in

an improved understanding and design concepts which can serve as a basis for the continued work.

Further reading

Carroll, J. M. (2000) Making use: scenario-based design of human-computer interactions, Cambridge, Massachussets, MIT Press.

Tollmar K., Junestrand S. and Torgny O. (2000) Virtually Living Together – Using Multiple-Method Design in the Search for Telematic Emotional Communication. In conference proceedings of DIS'2000, ACM Press.

Ylirisku, S. & Buur, J. (2007) Designing with Video: Focusing the User-Centred Design Process, Springer.

5. Functional analysis

Background
Functional analysis can be seen as a subpart of requirements analysis in the design process. You look at the intended user group and intended purpose of use of the planned device / software. Then you compile this information and start to design the user interface accordingly. By facilitation of this design method you have the additional advantage of finding new solutions to perform intended tasks.

Description
Functional analysis is performed by a group of people who normally have a stake in the development and design of a new product / service. In preparation for this meeting, all participants (3 – 8 people) have to be informed about the following:

- characteristics of the product / service
- intended user group
- intended purpose
- circumstances for product / service facilitation

In the meeting itself these stakeholders discuss the functionality of the product / service in question along a given set of items. Decisions will be noted and afterwards grouped and categorized.
This final summary will support designers in their decision with regard to how the user interface is constructed and where items will be placed. Furthermore, this summary can be used in order to develop usability tests.

Example
The result of a functional analysis for a coffee cup would look like this:

- allow lifting
- fit hand
- allow gripping
- insulate
- be pleasant
- etc.

By expressing functions like this you may realize that the ear-shaped handle on the cup is not necessary. A rubber ring around the cup may work just as well. Describing function instead of solution helps the designer to generate new ideas for solutions. The functions described should be classified as main functions, necessary functions, desired functions and unnecessary functions.

The functions are then grouped in areas such as:

- User functions
- Security
- Implementation
- Marketing

How-to
A functional analysis can be performed in the following manner

1. select participants for the functional analysis meeting
2. include stakeholders (i.e. product manager, designer, user representatives, etc.)
3. provide the agenda (see above) and ask participants to prepare notes according to the agenda items. In the meeting discuss the following items:
    a. product
    b. users
    c. tasks
    d. environment
4. summarize and categorize collected data

Expected outcome
The results of a functional analysis will help developers to design the product / service considering all factors that might influence the user when facilitating it. This enables objective decisions to be taken about the need for design changes to enhance usability, and about trade-offs which may be appropriate between usability and other requirements (i.e. safety, etc.).

This summary can also be used to create use cases, which in term can be applied in usability tests.

Further reading
Baxter, M. (1995) Product Design: Practical methods for the systematic development of new products, CRC Press.

6. Empathic modelling

Background
As a designer you make extensive use of your own experience. Although it is impossible to become another person, it can be very valuable to try to put oneself in the position of a user. This is also true when it comes to users with impairments – as long as one keeps in mind that the experiences of a person with simulated restrictions can be very different from those of someone who has the same restrictions as a part of his or her life.

Still, it can be a valuable experience to try to navigate a wheelchair, to try to use a mouth stick, to navigate wearing a blindfold or to use different devices while wearing earplugs. We follow the UserFIT manual and call this technique "empathic modelling".

Glasses that simulate tunnel vision

Description
The aim of empathic modelling is to give the designer or developer a direct experience of what it is like to have an impairment. You may wear suits or other devices that hinder movement; you may use a wheelchair and you can wear special glasses or earplugs.

Example
There are specially made glasses that simulate different visual impairments. It is instructive to wear these while on a hike.

How-to
The basic idea in empathic modelling is that you find some artificial way of creating an impairment. For visual problems you can try a blindfold or different types of glasses. There are glasses available commercially, and it may be worthwhile to make this investment. Alternatively, an easy way of creating blurred vision is to smear some old glasses with Vaseline. Or you can rub them with sandpaper (this has the added advantage of simulating a need of more light which is common for older persons).

Hearing impairments can be simulated by wax/earplugs or headphones that filter sound in different ways. You can also play some disturbing noise to simulate problems like tinnitus.

Severe mobility problems are quite easy – you just need to get hold of a wheelchair. Remember though to restrict your movements appropriately – if you are using an electric wheelchair you probably have quite limited arm movements (if any). Less severe problems can to some extent be simulated by wearing thick gloves or by restricting joint movement by bandages, taping stiff objects on the joints, etc. You may also wear weights to make movements more tiring. Lack of motor control can to some extent be simulated by using technology in an environment where there is a lot of movement and vibrations.

Cognitive problems are harder. Arne Svensk suggests that one should try to address this more by modifying technology or situations in such a way that normally simple tasks become much more difficult. One example of how to do this could be to give somebody a watch that shows time as a sequence of zeros and ones and then ask them to make it to an important meeting at some specified time. You may also to some extent limit you cognitive ability by having some cognitively demanding task to do at the same time as you perform a test.

Your empathic modelling will be temporary and not take into account the experience of always living with an impairment.

Tips
One big difference between your experience and that of a person actually living with an impairment is that your experience will be temporary. It is also easy to avoid doing things you think are too hard – after all you can always remove your impairing gear and do these tasks afterwards. Try to counteract these tendencies – make the experience long enough, avoid the temptation of removing your gear when the going gets tough and don't put off selected tasks just because you think they will be difficult or uncomfortable.

A general rule is also not to be alone while doing this type of exercise. There is always the possibility of accidents, and there should be someone around to make sure the exercise is safe.

Inclusion
Empathic modelling is generally a way of allowing someone without a specific impairment to experience firsthand some of the problems this impairment may generate. If you include designers with impairments of their own, you need to make sure tasks and materials are accessible for them.

Expected outcome
Empathic modelling can give you a better understanding of the kind of problems people with different impairments encounter. You can expect to gain thought provoking experiences and an understanding that is hard to get in other ways. At the same time you should be careful to complement it with contacts with persons who actually live with these problems. Living with an impairment is not the same as trying some restricting gear for a few hours, and you need to make an effort to understand which parts of your experience are valid and what it is that you are missing.

Further reading
Poulson, D., Ashby, M., Richardson, S. (editors) (1996) UserFIT – A practical handbook on user-centered design for Assistive Technology, ESCC-EC-EAEC, Brussels-Luxembourg.

Svensk, A. (1997) Empathic Modelling (The Sober Version) The 4th European Conference for the Advancement of Assistive Technology (AAATE'97) Thessaloniki, Greece.
(http://www.certec.lth.se/doc/empathicmodelling/)

7. Cognitive walkthrough

Background
People tend to prefer learning to handle their technical artefacts while they are using them rather than reading manuals. The cognitive walkthrough is a usability inspection method that takes into account the first-time user and what kind of usability problems he or she might encounter while step-by-step learning the system as he or she is using it. In its original state, it involves no end users, but is a structured way to find crucial usability problems at a low cost.

Description
The cognitive walkthrough focuses on the learning aspects of a user interface and it is typically performed by a designer or other person involved in the project and is task oriented. This means that the designer(s) of a system create a set of use cases or tasks that they expect a future user to encounter. Then, the designer(s) will "walk through" the tasks, asking themselves the following four questions for each step:

- Will the user know how to solve the (sub)task in this step?
- Will the user notice the interface element to use?
- Will the user understand the information on the interface element to use?
- Will the user receive appropriate feedback after the action?

A cognitive walkthrough can also be used in the design phase, by performing a walkthrough of a mock-up or paper prototype.

When doing a cognitive walkthrough of a mobile system you also need to consider the context and the location, and perform the cognitive walkthrough in a realistic environment.

Example
One way of using a cognitive walkthrough in the HaptiMap project would be to make a first evaluation of how standard aids, such as screen readers for mobile devices, work together with navigation systems in general and the HaptiMap toolkit in particular. The important difference between the traditional cognitive walkthrough would be that this is something a designer might not be able to do him or herself, because of lack of knowledge and experience with the aids. Thus, this activity could be carried out in collaboration between designers and expert users of aids.

How-to
Preparations:

- Define who the users are, what background and capabilities they have.
- Specify a limited number (3-5) of realistic high-level benchmarking tasks that are possible to perform with your system.
- Specify 2-3 different locations and contexts where you will perform your cognitive walkthrough.
- Plan your means of documenting the cognitive walkthrough. In a mobile setting traditional note taking might not be feasible.

Perform your cognitive walkthrough with your chosen form of documentation. Analyse your data.

Tips
Recording with a mobile phone and thinking aloud during your cognitive walkthrough could be one possible way to do documentation in a mobile setting.

Also a "second hand" cognitive walkthrough experience, where the designers analyse a video recorded, situated walkthrough of a system, performed by a (novice) user could yield valuable input for a systematic evaluation. This is described in more detail in Gabrielli et al. (2005).

Inclusion
Since this method typically involves the designer and not the user, there are no inclusion issues in the particular activity when carried out the traditional way with a designer. However, to ensure a barrier free design, this method could be combined with empathic modelling if needed, see next section.

When users are involved, as in the video walkthrough approach or the evaluation set-up described in the Examples sections, inclusion issues need to be considered in the test design. Proper precautions should be taken regarding the choice of test location so that it is safe and possible to access for the intended user.

This method is one way to minimize usability issues before doing tests with actual users, but not a way to entirely avoid end user testing.

Expected outcome
This method should provide you with a list of usability issues that need to be considered in your design or redesign phase.

Further reading
Wharton, C., Rieman, J., Lewis, C., Polson, P. (1994) The Cognitive Walkthrough Method – A Practitioners Guide in Usability Inspection Methods, Eds. Nielsen, J. & Mack R. John Wiley & Sons, New York, USA.

Gabrielli, S., Mirabella, V., Kimani, S., Catarci, T. (2005) Supporting Cognitive Walkthrough with Video Data: A Mobile Learning Evaluation Study in Proceedings of the 7th international conference on Human computer interaction with mobile devices & services (MobileHCI 2005), Salzburg, Austria.

8. Wikis, blogs, and discussion forums

Background

The general idea of wikis, blogs and discussion forums is that anyone having an Internet connection can contribute by posting or editing information, which has already been posted. In this sense, these technologies gather user opinions, experiences and practices of users from all over the world. For this reason, wikis, blogs and discussion forums may be a bountiful source for user requirements or user experience with a particular product or service.

Description

Wikis are often used to create collaborative websites, to power community websites, and for note taking. In business, they are used to provide intranet and knowledge management systems. Blogs are usually used to express personal opinions on activities, situations, services and products. Discussion forums are used to exchange information and views on a particular topic. Many wiki communities or discussion forums have limited access or require membership. Others, on the contrary, are "open to everyone".

All these technologies relying on remote user participation, user expression and collaborative generation of ideas can be used as a complementary technique for eliciting requirements. The idea behind this is that, with the growth of the global IT marketplace, customers and developers are often geographically distributed, and in-person requirements meetings are not feasible on a regular basis. Also, the growth in size and complexity of software systems and the associated increase in the number of stakeholders, introduces significant problems in managing and coordinating the human-intensive requirements elicitation process, especially in large or multinational projects.

In this sense, wikis, blogs and discussion forums are particularly useful:

- when observation is difficult or expensive (e.g. when designing for international users or when designing home technologies, in-car equipment, social networks and mobile devices);
- when input from a large number of users is necessary;
- when these tools are inherent parts of users' activities (e.g. if analysing the design of open source software).

However, wikis, blogs and discussion forums should be used having in mind the following limitations:

- they may express the point of view of a small number of people controlling the interaction (e.g. webmasters, moderators, etc.);
- they provide indirect insight into the users' experience;
- they are focused on opinions, attitudes and views and may provide limited information about user characteristics, tasks and environment.

Example

Example of a discussion forum: www.gname.org .

How-to

When analyzing wikis, blogs and discussion forums, the following should be done:

1. Decide on a topic which is relevant for design and which can be analysed in available discussion forums, blogs and wikis.
2. Read a portion of the exchanged opinions in order to get an idea of their content and organization.
3. Decide on your unit of analysis (e.g. a message, a discussion).
4. Decide on the number of exchanges you will analyse.
5. Construct a coding scheme.
6. Analyze the portion of the discussion, which you have chosen and synthesize results.
7. Validate, if possible, these results with the users participating in the forum or creating the blogs and the wikis.

Tips

Subscribe to the forum if required. Post messages on the forums or blogs in order to get in contact with the participants and to ask for your contribution.

Inclusion

Specialized discussion forums of technologies for people with disabilities may be very useful to get acquainted with a community and to get feedback on existing products from "real" users. These forums may also be useful to gather and promote ideas about inclusive design and design for all.

Expected outcome

The outcome should be a synthetic description of the major topics discussed, the roles of the participants and the prevailing opinions.

Further reading

Barcellini, F., Détienne, F., Burkhardt, J.-M., & Sack, W. (2008) A socio-cognitive analysis of online design discussions in an Open Source Software community. Interacting with Computers 20(1), 141-165.

9. Questionnaires

Background

Questionnaires are used in both experimental and exploratory user studies. The underlying principles and the results obtained from questionnaires are similar to those obtained from directive interviews. Questionnaires can complement ethnographic work, field observations and field studies, which provide relatively objective data on users' activity.

Description

To develop a questionnaire, which means getting the choice of questions, their format, ordering, etc., right, is often very time consuming but also very important. After you send off the questionnaire forms there is no way back. The questionnaire should be based on the objectives and the hypothesis of the research. The subsequent administration of the questionnaire is, in principle, easier and quite rapid. Furthermore, questionnaires may be administered to a potentially large number of respondents, which makes them a relatively inexpensive way to gather information from a large number of users. Nowadays, there are also great benefits with using online questionnaire.

Example

An example of a questionnaire used in the HaptiMap project is the Santa Barbara Sense Of Direction scale. This questionnaire asks about spatial and navigational abilities, preferences, and experiences. Another example is the background questionnaire that can be found in Appendix C.

How-to

When developing a questionnaire, keep the following points in mind:

- Provide a clear statement of purpose & guarantee participants anonymity;
- Decide on whether phrases will all be positive, all negative or mixed;
- Pilot test questions – are they clear, is there sufficient space for responses;
- Decide how data will be analysed & consult a statistician if necessary;
- Offer a short version for those who do not have time to complete a long questionnaire.

Questionnaire format can include:

- "yes", "no" checkboxes;
- checkboxes that offer many options;
- Likert rating scales; 3, 5, 7 & 9 point scales are common;
- semantic scales;
- open-ended responses.

Questionnaire data analysis & presentation:

- present results clearly – tables may help;
- simple statistics can say a lot (e.g. mean, median, mode, standard deviation);
- percentages are useful but give population size;
- bar graphs show categorical data well;
- more advanced statistics can be used if needed.

Tips

Follow-up with emails, phone calls or letters for example. You could also provide an incentive to attemt to raise the response rate (40% response rate is high, 20% is often acceptable).

Use online questionnaires:

- responses are usually received quickly;
- data can be collected in database for analysis
- time required for data analysis is reduced;
- errors can be corrected easily;
- disadvantage – sampling problematic if population size unknown;
- disadvantage – preventing individuals from responding more than once;
- disadvantage – Individuals have also been known to change questions in email questionnaires.

Inclusion

Traditional forms of questionnaires could be difficult to use for certain groups of users. Hence we recommend online questionnaires but you need to check that the online tools you are using also match inclusive design criteria (that they are possible to access with screenreaders for example).

Expected outcome

A well-designed questionnaire that is used effectively can gather information on different aspects of system design such as:

- the user activity which should be supported by the future technology at a high-level;
- user demographics and identification;
- user performance with the technology;
- user satisfaction, attitudes, values and the holistic user experience.

The scope of a questionnaire is quite flexible. Questionnaires can be used as a standalone usability activity or as a supplement to other user ac-

tivities like for instance field testing (Courage and Baxter, 2005). However, questionnaires rely on self reporting. For this reason, they are not an objective source of data and may sometimes express a phenomenon known as “social desirability” (the tendency to answer based on how people think questions should be answered, rather than expressing their own opinion).

Further reading

Courage, C. & Baxter, K. (2005) Understanding your users: a practical guide to user requirements. Elsevier & Morgan Kaufmann Publishers.

Visser, P.S., Krosnick, J.A., & Lavrakas, P.J. (2000) Survey research. In H.T. Reis & C.M. Judd: Handbook of research methods in social and personality psychology. Cambridge University Press.

Santa Barbara Sense Of Direction Scale
http://www.psych.ucsb.edu/~hegarty/instruments/sbsod.pdf

10. Cultural probes

Background

The method called “Cultural Probes” was originally invented at the Royal College of Art in the UK by Gaver et al. (1999). The word “probe” refers to an automated recording instrument sent out to space to capture signals and samples where people cannot reach. A cultural probe is a package sent to the users’ reality. The original use of the probes was artistic inspiration, but during the last decade the method has grown into a widely utilized asset for practical design purposes as well.

Description

Cultural probes function as an effective means of explorative discovery into the cultural meanings and dreams of people. Mattelmäki (2006) outlines four aspects of how probes foster designing: 1) information, 2) inspiration, 3) participation, and 4) dialogue. While the first three refer to the content, the fourth aspect refers to the power of cultural probes to foster social collaboration.

The form of a cultural probe is open. A probe may include a diary, a voice recorder, or a disposable camera, and usually it contains tasks and questions related to the study theme. It may contain some design material as well, such as clay, or provocative material. Also digital and interactive probes are an option to consider.

Example

In the HaptiMap project, a hiker study was carried out in two user groups: middle-aged and visually impaired hikers. Both of the cultural probes included a diary with questions and tasks with maps.

Examples of cultural probes: A task in a probe package for visually impaired hikers (left) and the entire probe package for middle-aged hikers (right).

In the probe for the visually impaired persons the map tasks as well as an additional physical mock-upping task were created of tangible design material. The probe for the middle-aged hikers additionally included a pictorial task, i.e. taking and using personally meaningful photos, which is a commonly utilized task in probes.

How-to

The following steps are usually included in a probes study:

- Focusing, i.e. choosing the participants and outlining relevant themes
- Creating the probe package
- Contacting the participants
- Delivering the probe package
- Waiting for the probes to return
- Interviewing the participants about the materials resulting from the probes
- Interpreting the meaning of the results for the current project

In order to ensure that a cultural probe study will provide the design team with valuable materials, it is important to pay extra attention both to steps one and two, and steps six and seven. The tasks, questions, and materials will guide what kinds of issues the participants will be focusing on. An interview and interpretation are necessary in order to translate the fragmented pieces into meaningful structures for design.

Tips

Limit the number of participants, between 4 and 8. Usually a very limited number of participants can be included in a probe study due to the excessive diversity of the material.

Be open-minded. The tasks and materials should provide insights and issues that you could not discover with other means. Let the participants have the chance to lead the study where they find it relevant.

Be concise and engaging. The tasks should be brief and engaging so that the participants are willing to invest their time in it.

Complement with other methods. Probes should not be the one and only method in a project to involve users, as they will provide a very personal and biased version of the reality. Probes should be complemented by interviews or observations, for instance.

Inclusion

Consider who the participants are. For example, visually impaired people have different capabilities and preferences than young sighted engineers. All the tasks should be accessible and relevant for the group of people involved.

Expected outcome

This method generates diverse material about people's lives, experiences, and dreams. The value of the method derives first of all from its personal relevance and vividness. The results contain thoughts and feelings, sketched ideas, stories of experiences, and usually pictures. The material is a valuable and concrete asset for designers, and can be utilized as an effective basis of presentation of the findings to various stakeholders in a design process.

Further reading

Gaver, B., Dunne, T. and Pacenti, E. (1999) Design: Cultural probes. Interactions, Vol. 6, Issue 1, Jan./Feb. 1999. ACM Press, pp. 21–29.

Mattelmäki, T. (2006) Design Probes. University of Art and Design Helsinki, Doctoral Thesis, Publication series A 69. Helsinki, Finland.

11. Diary studies

Background

Diaries emerged into the tool palette of user-centred designers at the outset of the extensive interest in cultural probes (see the Cultural Probes section). Diaries have been employed within ethnography a lot, but such studies have usually featured the ethnographers themselves, who have been the authors of the diaries. In a design-related diary studies, the potential users are the authors.

Description

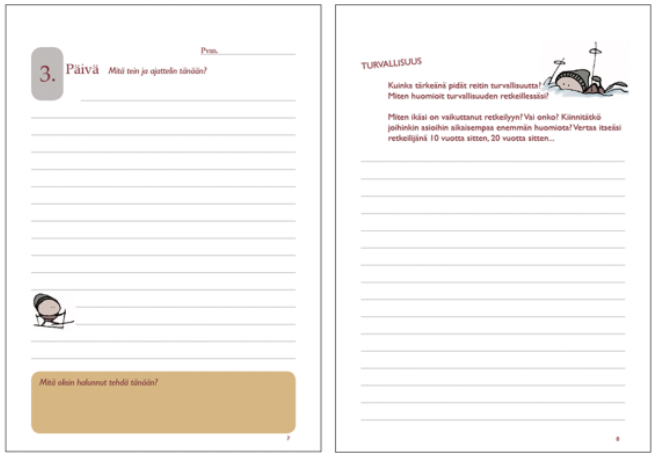
In a diary study participants are asked to keep a daily record of their activities and thoughts. The written format may enable participants to express such issues about their lives that might be omitted when asked directly in speech. The diary also gives people more time to think about what they feel is important and relate it to the project team.

As a diary study explicitly encourages people to look at and think about their lives, it renders them sensitive to the issues – in their own context – that may be of relevance for a design project. In fact, diaries are a good means for preparing users for project-related interviews.

Example

Diaries were part of a cultural probes study that was conducted in the HaptiMap project. A diary was designed for the two user groups individually: one for the middle-aged and another for the visually impaired hikers. The diaries were accompanied by a motivation and instruction sheet.

The diary contained for each day a question that was related to the theme of the project, for example: "What's fun in the forest?" In the beginning of the diary, the questions were related to the background information about the participant, and toward the end of the diary, the questions explored more detailed issues on hiking. Each day the participant was also instructed to write about "What did you think and do today?"



An example of a diary for middle-aged hikers. On the left page there is a common question about the day, and on the right there is a theme related question.

How-to

The following steps can be included in a diary study:

1. Focusing, i.e. initial immersion into the themes of a project
2. Creating the diary, i.e. forming concrete questions on the themes
3. Contacting the users
4. Delivering the diary
5. Waiting for the diary to return
6. Interviewing the participants about the diary
7. Interpreting the meaning of the results for the current project

Emphasis should be put on steps one and two in order to make the diary study relevant for a design project. These include making decisions about who will be invited to participate in the study. The questions in the diary need to be tailored to provoke responses that serve the project.

Steps six and seven are also very important for the effectiveness of the diary study. Without these steps the results risk being non-relevant and of little value for the project. The participants' own explanation about their diaries will add a lot of lively details to the facts in the diary. Some people talk much more eagerly than write, yet brief notes in a diary may function as important mnemonic cues.

Tips

Make it personal. A diary should attract stories about one's personal life. Choose the materials and create the style so that it will invite personal responses. Also formulate the possible questions in a language that is meaningful to the participants. Consider also the chance that the participants will carry the diary in public.

Be open-ended. The questions should leave room for imagination and storytelling. These may open up new discoveries.

Include questions and tasks. Questions may help the users to get their writing to flow. Questions and tasks also direct the reflections of the participants towards themes that are relevant for a project. Tasks might encourage participants to think of what might be desirable.

Complement. Probes should not be the one and only method in a project to involve users, as they will provide a very personal and biased version of reality. Probes should be complemented by interviews and observations. In an interview it is possible to use the diary entries as cues about topics to explore.

Inclusion

Diary studies that require writing should involve people, who are capable of expressing their thoughts in writing. As diary studies require a level of sustained attention, it also should not be utilized with participants, who cannot be expected to focus on a prolonged task.

For people with visual impairments the diary could be implemented on a computer. In this case it must be ensured that the participants have proper equipment for this and are willing to make entries into their diary in such a way. A voice recorder might also be an option for this user group.

Expected outcome

This method generates open-ended material about people's lives, experiences, and dreams usually in textual format. The value of the method stems from the capacity to develop a chronological and personal view into one's life. When diaries are complemented with interviews, and possibly with observations, a project team may develop a rich picture, or "empathic view" (Koskinen et al., 2003), of a potential user. The significant issues may be transformed into new presentations, such as Personas (see the Persona section), in order to communicate the discoveries within a design organization.

Further reading

Koskinen, I., Battarbee, K. and Mattelmäki, T. (2003) Emphatic Design. User Experience in Product Design. IT Press/Edita, Helsinki.

12. Heuristic evaluation

Background
Heuristic evaluation is a very informal usability testing method for user interfaces. It was developed by Jakob Nielsen, assisted by Rolf Molich, in 1990 based on his long-term experience in teaching and consulting about usability engineering. The method is mostly based on but not limited to commonly accepted heuristics. In 1994 Nielsen published a set of heuristics which are still used today.

It is a fast and easy method to test user interfaces in order to recognize failures with respect to intended purposes and can be performed by the designer or developer him / herself thus sparing the effort to go through the process of user involved testing.

Description
The designer or developer compiles a set of heuristics appropriate for the task ahead. One can either take them from Nielsen or if a style guide for the user interface in question exists, one can create his / her own heuristics from this guide. Then these heuristics will be grouped in categories and prioritized according to their influence on user performance and acceptance, i.e.:

- The user cannot carry out the intended purpose of the application.
- The user can, with some major effort, carry out the intended purpose of the application.
- Nice to have (cosmetic changes, which can be made if time and budget allow for it).

Then the designer or developer goes through the interface according to these heuristics and checks if they are true or false. This can be done multiple times in the development phase.

Example
Here are some heuristics from Nielsen (1994) in order to demonstrate how they look like for testing user interfaces:

1. *Visibility of system status*
   The system should constantly provide feedback to the user about what is happening.
2. *Match between system and real world*
   Present information logically structured and avoid terminology unfamiliar to the users.
3. *User control and freedom*
   Always provide a simple way to cancel an operation and support un-do and re-do functionality.
4. *Consistency and standards*
   Follow the look and feel of the target platform.
5. *Error prevention*
   If errors are not caught by the system, present the user an error message describing the problem in clear language and ask for confirmation before executing a critical operation.
6. *Recognition rather than recall*
   Reduce the cognitive load by making actions, options and objects always visible.
7. *Flexibility and efficiency of use*
   Avail users to custom configure frequent operations.
8. *Aesthetic and minimalist design*
   Present only necessary information.
9. *Help and documentation*
   Provide an online help which is easy to search, focused on the user and list concrete steps to solve a problem.

How-to
The following list provides an outline for performing a heuristic evaluation:

- Create common use cases
- Create a set of heuristics
- Categorize and prioritize the heuristics
- Apply the heuristics along the use case
- If need be incorporate the results in a redesign of the UI and re-evaluate it

Expected outcome
This method will already in the design and development phase identify potential problems associated with the design of user interfaces, thus giving the designers and developers the chance to reduce the effort in bug fixing after user tests or the release of the application.

Further Reading
Nielsen, J., and Molich, R. (1990) Heuristic evaluation of user interfaces, Proc. ACM CHI'90 Conf. (Seattle, WA, 1-5 April), 249-256.

Nielsen, J. (1994) Usability Engineering. San Diego: Academic Press. pp. 115–148.

Gerhardt-Powals, J. (1996) Cognitive Engineering Principles for Enhancing Human-Computer Perfor-

mance. “International Journal of Human-Computer Interaction”, 8(2), 189-21.

13. Lo-fi prototyping

Background
A lo-fi prototype has been defined as an artefact that has been created independently from the likely form of a finished product. According to Rettig (1994), it is estimated that a designer working with lo-fi prototypes will spend approximately 95% of his or her time thinking about the design and only 5% thinking about the tools used for implementing the prototype. This ratio is roughly reversed when testing computer-based prototypes.

Description
The main advantage of a lo-fi prototype is that it is quick and easy to make modifications to the system. As a result, it can be tested much sooner in the design process, meaning focus can be on design rather than implementation issues. In addition, lo-fi prototyping makes it possible to prototype and assess features that may not be currently implementable with current technology. In some cases, it may be appropriate to involve the user in the lo-fi prototype creation process, a method referred to formally as participatory design.

Once a lo-fi prototype has been developed, evaluation techniques such as the Wizard of Oz can be used to mimic the intended functionality of the system.

Example 1: Paper prototyping
Paper prototyping involves the use of paper, post-it notes and index cards to build up a paper representation of a system. One example implementation of paper prototyping that has successfully enabled discussion of concepts and creation of metaphors was the "cardboard computer" (Ehn and Kyng, 1991),

Example 2: Haptic lo-fi prototyping
Haptic lo-fi prototyping involves the use of materials with a variety of tactile feedback. People generally find it difficult to verbalize or explain tactile feeling easily – lo-fi haptic prototypes provide a good method to convey this type of information.

Lo-fi prototypes crafted during the HaptiMap user workshop in Belfast in February 2009

How-to
A general approach to building a low-fi prototype is as follows:

- Gather the materials required. It is important that a good range of materials is provided.
- Specify the core functionality of the application to be developed.
- Build the low-fi prototype.
- Test with users and refine iteratively.

Kuber et al. (2007) outline a more specific scenario-based design methodology that employs lo-fi prototypes.

Tips
Guidelines for developing haptic prototypes have been developed by Kuber et al. (2007). The scenario is an important factor in the development of a lo-fi prototype.

Inclusion
Ensure that there is a wide range of materials. Provide assistance to participants who may have a disadvantage in the performing of some tasks (in assembling the lo-fi prototype) through sensory impairment or manual dexterity. Don't worry too much about the quality of the finished prototype – what is important is that the prototype reflects the interaction available in the final product.

Expected outcome
Firstly, a prototype that mirrors the envisaged system will be developed. This prototype can then be used in early-stage evaluations of a system.

Further reading

Rettig, M. (1994) Prototyping for Tiny Fingers, Communications of the ACM, April 1994, Volume 37, Number 4, pp. 21-27.

Rudd, J., Stern, K., Isensee, S. (1996) Low vs. high-fidelity prototyping debate. Interactions, January: pp. 76-85.

Kuber, R., Yu, W. & McAllister, G. (2007) Towards Developing Assistive Haptic Feedback for Visually Impaired Internet Users. In proceedings of CHI'07, San Jose, USA, 1525-1534.

Ehn, P., Kyng, M. (1991) Cardboard Computers: Mocking-it-up or Hands-on the Future. In J. Greenbaum & M. Kyng (Eds.). Design at Work: Cooperative Design of Computer Systems, Lawrence Erlbaum, Hillsdale, New Jersey, pp. 169-195.

14. Brainstorming

Background

Brainstorming was first introduced as "organized ideation" in an adverising company, where it was utilized already in the 1930s (Osborn, 1963). The word "brainstorm" has since then become almost a synonym for any ideation session.

Description

The basic idea of brainstorming is to generate as many ideas or solutions to a problem as possible in an intensive group session. The ideas are articulated by a means proper for the setting, such as by writing on sticker-notes, by drawing, by mocking up, or by acting out (see the Bodystorming section).

Example

In a HaptiMap workshop we used brainstorming to generate user requirements. The ideation of the requirements was grounded in a prior exploration of concrete situations through video scenarios and imagined-but-cued situations, such as "think about the use of the navigational appliance in the locker room of a swimming hall". The requirements were collaboratively grouped into affinity diagrams.

How-to

- Set the context, i.e. clarify the purpose and framing for the session
- Generate options
- Focus on the next steps, i.e. discuss or group the ideas.

At a HaptiMap workshop user-requirements were brainstormed and grouped into an affinity diagram.

Tips

Focus on quantity. The more ideas generated the bigger the chance there is to find something radically new.

Postpone criticism. It is important to allow exploration also of ideas that do not make sense at first. These may later prove to be the most valuable ones.

Encourage building on each other's ideas. This makes participants more eager to listen to each other and fosters the discovery of novel thinking paths.

Stimulate. Sometimes it is helpful to utilize visual, tangile, and other kinds of materials to stimulate new ideas. Another way is to utilize enhancers, such as asking questions. For example, a technique called "SCAMPER" lists the following questions (Isaksen et al., 1998): "Substitute? Combine? Adapt? Modify? Put to other uses? Eliminate? Reverse?"

In order to discover the most potential ideas a vote may be taken during the brainstorming session. The participants may vote for their personal favourite idea with the most business potential, or the easiest idea to realize, for example.

Inclusion

In some cases it may be helpful to involve potential users as participants. Then it becomes essentially important to plan the format such that supports contribution of the participants regardless of their possible disabilities such as deafness.

Expected outcome

Brainstorming results in a number of potentially new ideas. In some cases, when the team has had time to discuss more on the relevance of the ideas, brainstorming may lead into concrete articulations of ideas, which may help the team to advance towards the goals of a project.

Further reading

Isaksen, S., Dorval, B. and Treffinger, D. (1998) Toolbox for Creative Problem Solving: Basic Tools and Resources, Creative Problem Solving Group, Buffalo, USA.

Osborn, A. F. (1963) Applied imagination: Principles and procedures of creative problem solving. Third revised edition. Charles Scribner's Sons, New York, NY, USA.

15. Bodystorming

Background
Brainstorming is often done in a meeting room. For designs not targeted to sitting users (like mobile devices and applications) the actual situation and the physical experience also plays a role. Since our cognition is anchored in the real world, new and better ideas may result if the brainstorming is done more in context and includes the appropriate physical experiences. Because this type of brainstorming explicitly involves the body (and movements of the body) it is also called bodystorming.

Description
On the overall level bodystorming and brainstorming follow the same rules. What is important in a bodystorm is that you involve the body explicitly – by using physical materials like sponges, stones, pipe cleaners, etc., one can explore ideas physically. You can sit down during some parts of the exercise, but if you are working with the design of mobile or wearable technology you should also move about while trying to come up with ideas.

Example
In HaptiMap we organized a haptic lo-fi (bodystorming) workshop at NordiCHI 2008 (Magnusson, Brewster, 2008). The idea presented in the pictures below show a design to test haptic feedback for a NFC (Near Field Communication) setup for mobile payment.

How-to
In addition to the guidelines for a brainstorm, you need also to consider these points:

- Put effort into how you can move/include the body during the session;
- Think about which locations to involve;
- Use as many materials as possible;
- Put effort into making good scenarios;
- Build up a wide collection of materials.
- Use wizard of oz to prototype advanced functionality;
- Finally – have fun!

A lo-fi prototype of a NFC setup is used during a bodystorm session

Adapted from (Magnusson and Brewster, 2008) and (Oulasvirta, Kurvinen et al., 2003).

Tips
It can also be a good exercise to try to map the functions you are working on to different material properties. As an example you can take a sponge, and try to map the functionality of a music player to the different actions available with the sponge. Squeezing could be the next song, throwing could be sending a song to someone else, etc.

Bodystorming can be an activity carried out within the design team, but it can also be a way of involving users in the early design process. Typically a bodystorm involving users needs to be more structured – users are not designers, and you need to provide suitable materials, scenarios and instructions to help them get started. A moderator is often needed to guide and support during a bodystorm, and you may also need a group leader to structure the exercise – the group leader can decide when to move to a new location or when to move on to the next design problem (Oulasvirta, Kurvinen et al., 2003).

Inclusion
When including end users in the exercise it is important to make sure the different parts of the exercise are accessible. Since a bodystorm involves moving about you should also make sure it is reasonably safe.

Expected outcome
A bodystorm should be expected to generate many

useful ideas in the early stages of the design process. If end users are involved in the activity it can also be used as a means of getting user feedback.

Further reading

Oulasvirta, A., Kurvinen, E., Kankainen, T. (2003) Understanding contexts by being there: case studies in bodystorming. Personal Ubiquitous Comput., 7(2), 125-134.

Magnusson, C., Brewster, S. (2008) Proceedings of the workshop: Guidelines for Haptic Lo-Fi prototyping, http://www.english.certec.lth.se/haptics/Proceedings_lo_fi_workshop.pdf

16. Interviews

Background
Interviews are the most traditional technique for trawling for requirements. Even if the general procedure for doing interviews is rather straightforward – you ask the stakeholders what they want and they tell you their requirements – there are many techniques that are useful to learn to carry out the interviews in a professional, efficient and in this context scientific way.

Description
The process of asking things can be more or less controlled or "directed" by the interviewer. Consequently, interviews may be totally open (without a pre-established interview guide), semi-directive (with a roughly pre-established interview guide), or directive (with a strict interview guide).

Example
Interviews could be used in almost all instances of a design process. But a typical example is in the early phases where requirements are gathered from a broad and less controlled group of participants to get a general overview of a problem. This is often very useful as a guide before the designer's own ideas solidify and influence the design process.

How-to
Even if you are planning for an unstructured interview make a detailed plan of how you will collect and analyse the discussion and answers: take notes, record audio, or even do a video recording.

There are basically two types of questions:

- "closed questions" have a predetermined answer format (e.g., "yes" or "no");
- "open questions" do not have a predetermined format.

Closed questions are quicker and easier to analyse.

Things to avoid when preparing interview questions:

- Long questions
- Compound sentences – split into two
- Jargon & language that the interviewee may not understand
- Leading questions that make assumptions (e.g., why do you like …?)
- Unconscious biases (e.g., gender stereotypes)

Using probes and prompts:

- Probes are devices for getting more information (e.g., "would you like to add anything?")
- Prompts are devices to help interviewee (e.g. help with remembering a name)
- Remember that probing and prompting should not create bias.
- Too much can encourage participants to try to guess the answer.

Tips
In the very beginning of the design process, open interviews are usually used. There is no set of pre-established questions and no time limit for the discussion, and both the interviewer and the interviewee control the discussion. These open interviews help the designer, the researcher or the practitioner to get acquainted with the studied domain and to prepare more controlled (i.e. semi-directive) interviews.

It can often be useful to make use of a combination of *why* and *how* questions. Why leads people to explain underlying thoughts and concepts, while asking how gives you concrete information on how things are done.

Unstructured contextual interview

The semi-directive interviews are largely used in exploratory HCI research such as requirements elicitation because they combine a relatively open-ended format with certain guidance by the interviewer.

Directive interviews aim at comparing various users by asking each one the same questions. For this reason they are applied in experimental studies rather than in exploratory research such as user requirements elicitation.

Inclusion

Although interviews may be a useful technique in many situations, it is difficult to apply this technique when designing technologies which stakeholders barely know because:

- it might be hard for people who have never thought seriously about a system to identify what functionality they would like (Jönsson, Magnusson et al., 1995);
- different stakeholders are likely to specify different functions;
- since users are not designers, the way they specify functionality may not be suitable for use as a design representation (Van Schaik, 1999).

Expected outcome

Interviews could generate huge amounts of information; hence it is important that you plan how to collect and analyse the outcomes of your interviews. Combining audio recording with note taking on paper is a simple but effective way of storing the information. Using some kind of software for interview transcriptions could also be timesaving and meet scientific demands.

Further reading

Briggs, C.L. (1986) Learning how to ask: A sociolinguistic appraisal of the role of the interview in social science research. Cambridge: Cambridge University Press. 155 p.

Robertson, S. (2001) Requirements trawling : techniques for discovering requirements. International Journal of Human-Computer Studies, 55, pp. 405-421.

Jönsson, B., Magnusson, C., Eftring, H. (1995) Capturing better data, UserTalk, Issue 6, pp 4-5 (http://www.certec.lth.se/doc/capturingbetter/).

Van Schaik, P. (1999) Involving users in the specification of functionality using scenarios and model-based evaluation. Behaviour & Information Technology, 18, 455-466.

17. Field observations and field studies

Background

The general idea behind field studies and especially behind field observations is that you get an idea of what users do when you observe them and talk to them in a real setting (i.e. in the context and environment in which they usually live and work).

Description

Field studies usually consist of collecting data in the field by observations, interviews and apprenticeship (in the case of an apprenticeship, the apprentice observes what the master does, asks questions and then tries to learn the work by doing some of it).

During field studies, the user's environment may be her office, home, mall, etc., depending on the tasks to be supported by the future technology. Field studies can last for a couple of hours to several days or weeks depending on the resources and the goals of the study. The main advantage of this method is the direct observation or, in the case of apprenticeship, the experience of user's difficulties in a given task, the task flow and challenges.

Field studies are particularly useful in the early design stages, because at this point, uncertainty regarding user requirements is likely to be high. Thus, an explorative and contextual approach is essential. On the basis of the diagnosis done in the field studies, key aspects of remaining uncertainty may emerge and be further tested in more controlled studies either in the laboratory or in the field.

However, in field studies, the amount of raw data collected can be overwhelming. The time necessary for data analysis can be important and impacting the design can be difficult if requirements analysis, in general, and field-oriented methods, in particular, are not an accepted part of the development process. In this sense, a promising approach, especially with new technologies for which user requirements are constantly evolving, is "quick and dirty ethnography" (Hughes et al., 1995). This approach encompasses short focused studies to gain a rapid understanding of the work setting. The main advantages compared to "traditional" field studies are that such short focused interventions are less time consuming and can be reiterated to capture the evolution of user requirements.

A field study in a shopping mall in Lund

Example

In the HaptiMap project, we conducted field studies in shopping malls to investigate how people want navigation information in an unstructured task focused on exploration.

How-to

When doing field studies, the following should be taken into account:

1. Organize a preliminary visit of the field in order to get a general idea about the context, the environment, the users, their tasks and relations.
2. Decide on what part of the users' tasks/activities you will observe/talk about.
3. Make a preliminary list of observable behaviours or questions to ask.
4. Test this list in a first observation/interview. Record if necessary.
5. Refine your list.
6. Do systematic field observations/systematic interviews.
7. Do not try to get the maximum number of details. You will be rapidly overwhelmed with information.
8. Stop the field studies when you consider you have enough information for designing the system.
9. Analyze and synthesize results.
10. Validate, if possible, these results with the users participating in the field studies as well as with other stakeholders involved in the project.

Tips

Be sure to have regular access to the field. Try not to disturb users in their daily activity. Try to keep your opinions to yourself.

Inclusion
Field studies may be very useful for getting insights into the requirements of people with special needs, because they give insight into the difficulties and strategies these people use in their daily life.

Expected outcome
The outcome should be a synthetic description of the major findings from the field study (e.g. user difficulties, strategies, limitations, user environment, etc.).

Further reading
Hughes, J. O., Brien, J., Rodden, T., Rouncefed, M. & Sommerville, I. (1995) Presenting ethnography in the requirements process. In Proceedings of Requirements Engineering, pp. 27-34, IEEE Computer Soc. Press, York, UK.

18. Focus groups

Background
A focus group can be said to be a group interview or discussion. The participants are expected to be end users, and in addition there is at least one researcher who acts as a moderator (to keep the discussion on track) and introduces different topics. It is a good idea to have one person from the research team who is responsible for the documentation and taking of notes.

Focus groups can provide valuable input early in the design process but one needs to consider the fact that the discussion often takes place out of context, since it is common to have the focus group in a meeting room somewhere. The group discussion is usually unstructured, which can potentially be problematic since important topics may be missed depending on the flow of the discussion. Also if someone in the group has strong opinions or is very dominant this can influence the other participants.

Description
A focus group usually follows the same rules as open or semi-directive interviews. You need to plan in advance which topics you want the group to discuss and if you should have some sample technology or models to help the users understand your intentions.

You should also plan how the discussions are to be recorded and if notes are to be taken, make sure there is one person available for doing this (it is in general not suitable to combine the roles of a moderator / interviewer and note taker).

Example
Although focus groups activities usually take place in meeting rooms it is also possible to do them during a walk. In the HaptiMap project we did a combined meeting room and walking tour focus group at the early stages which proved very productive. In the room, general issues relating to mobile technology and maps were discussed (a selection of mobiles were available for demonstration). This was followed by a walking tour where two different GPS devices were tested and discussed. Thus it was possible to address general questions and discussions as well as more situated topics which came up in the mobile context (during the walk).

A focus group "in the wild"

How-to
You need to decide who to have in your focus group. You also need to think through which topics should be discussed – and if necessary gather models, demos or other devices. You should follow the informed consent procedure, and send information and materials in advance to the participants.

At the activity you need:

- Informed consent forms (signed before the activity starts)
- A moderator / discussion leader
- Recording facilities and/or someone who takes notes
- Suitable technology and models

Tips
When dealing with mobile devices it can be very fruitful to have some of the discussion in a mobile context.

Since it can be hard for persons with limited experience of the technology in question to realize the implications it may have or to specify demands, it is a good idea to provide some technology samples or at least some models or mock-ups that illustrate some of the possibilities.

Inclusion
It is important to involve persons from a wide range of users in the discussions. It can be problematic to mix people with very different requirements, and can actually be more productive to have several focus groups targeted at different user groups. As always you need to make sure materials and information are accessible.

Expected outcome
A focus group should be expected to generate a lot of useful information and ideas. It is suited for use at the early stages of design, but can (and should) be used during the whole process.

Further reading

Morgan, D., L. (1997) Focus groups as qualitative research, Sage Publications (CA).

19. Workshops

Background
Design workshops can be used to increase the awareness and facilitate communication between professionals and users, but also as a way to enable designers to participate in activities that are different than ordinary design activities, tailored to encouraging the designers to "think out of the box".

Design workshops have become broadly popularized as a method through the development of participatory design, and more recently through interaction design with influences from art and design practices. However, the design workshop has a long history and has been used in other disciplines for a long time. Examples of this are citizen involvement in politics, focus groups in business and habitants in architecture and city planning.

Description
Workshops are hands-on sessions where small groups of professionals and/or non-professionals work creatively together. The key is the group work, allowing for an interaction between group members that can trigger ideas based on other people's ideas.

At a workshop one can examine concepts, technologies and practical examples. This can be achieved through a set of tutorial activities, or hands-on sessions that give the participants a chance to work with the new concepts or technologies. Normally a workshop consists of a few different activities ranging from discussion and idea generation to practical doing and implementing of simple prototypes.

Example
The HaptiMap workshop in Soest was a one-day end user workshop with many different activities:

- Presentation of navigation devices and ad-hoc outdoor technology test
- Discussions
- General questionnaire
- Break out session (lo-fi design workshop in groups)
- Presentation of lo-fi designs
- Introduction to travel diary

How-to
In order to plan a design workshop think about pre-workshop arrangements, workshop agenda and post-workshop activities.

Ensure you have enough time for your workshop. Conducting a workshop with end users (whom you have never met before) and designers in the design team can require different preparations. For an extensive checklist for preparing an end user workshop, see Appendix A. Plan for breaks during the workshop, and if it is a longer workshop, serve refreshments. The breaks are also valuable time, since discussions tend to continue but in a more informal way. This way you can learn other things from your participants.

Depending on the activities in your workshop, read the appropriate introductions in this report (Lo-fi prototyping, Interviews, Questionnaires, Focus groups just to mention the most common activities).

Three groups at a HaptiMap workshop discussing scenarios before a design exercise

Put together your workshop agenda. Take special considerations about the order of activities. Plan a presentation phase after the creative part of the workshop, where participants show their ideas to the workshop leaders and other groups.

Plan your documentation of the workshop. You will potentially have a lot of rich information available, if you are able to do a detailed documentation. Audio and video recordings, photos of people, photos of lo-fi designs and notes taken by participants and workshop leaders are all potential information sources.

After the workshop make a compilation of the material.

Tips

It might be well invested time to do an ad hoc testing activity of current technology before the design activity if you are conducting a design workshop on new technology that few users are familiar with (like mobile navigation systems).

Spend some time to introduce the design activity if you are conducting one. Not all workshop participants feel comfortable making lo-fi prototypes with hobby material.

If you are having several groups for a workshop, make sure you assign one moderator to each group, who is involved in the project and is able to help the participants when needed.

Inclusion

Several design workshops methods were originally developed to support discussion among citizen groups with limited resources for decision making in public planning. This approach seems also to work well when discussing accessibility issues. Use a variety of workshop material – be it material for designing, note taking or other documentation, to ensure that participants with some kind of impairment are able to take full part in the workshop and able to access the results generated.

Expected outcome

Design workshops often generate novel ideas and invoke creativity. Store images, video and scan notes taken during the workshop. Analyse and summarise the outcome from the workshop. Highlight, for example:

- unique and innovative group design proposals
- unique and innovative quotes from workshops

Further reading

Greenbaum J. and Kyng M. (1991) Situated Design. In J. Greenbaum & M. Kyng (Eds.): Design at Work: Cooperative Design of Computer Systems, Lawrence Erlbaum, Hillsdale, New Jersey, pp. 1-24.

Kelley T. (2001) The Art of Innovation. A Currency Book Published by Doubleday.

20. Informal usability testing

Background
Although much testing is (and should be) formally planned, there is also the possibility of doing informal tests. These can be done while doing demos at conferences or fairs, or at any other occasion when you meet end users. Whilst the results are not as reliable as other more formal tests, they do provide the possibility of gaining early feedback and refining a design and can be incorporated as part of a user centred design process.

Description
An informal test can take place anyplace and anytime. Since it is informal it is usually less planned, but some planning and preparation may be needed in order to have something to test.

Informal tests can be a valuable source of information – particularly for idea generation or as a way of obtaining initial feedback before a real test.

Example
When doing a demo at a conference you can observe how people use your design to gather ideas and opinions.

How-to
The informal nature of this type of test makes it hard to put down any particular rules, but some suggestions may still be useful:

1. You often get more out of an informal test if you plan in advance.
    a. What is it that you want to know?
    b. What do you need to prepare? What materials do you need?
    c. What can go wrong? Always try to have some backup solution for technology failures.
2. As for every other type of test, it is a good idea to do a pilot.

An open house day where users are allowed to test differnt forms of assistive technology

Tips
When interacting with the users it is important to show how valuable you think it is that someone tries out your stuff. Encourage comments and be open also to criticism. Try to avoid being defensive about what you have done – criticizing/antagonising a potential source of useful information is not a good idea.

Inclusion
Remember to design a flexible setup that can be used by persons with different abilities. Have a layout that works if a person can't see or hear very well. For mobile demos you also need to consider wheelchair users and avoid stairs or rough/sandy ground. You should also consider if there is a need for sign language or simplified presentation.

Expected outcome
Informal tests can be expected to give you a better understanding of how people react to your design. You are likely to get input that helps you in the creative process – both with idea generation and with evaluation. You also need to do more formal tests – but informal tests are a valuable complement, which allow you to easily get feedback from a large number of users.

Further reading
Preece, J., Rogers, Y., Sharp, H. (2002) Interaction design – beyond human-computer interaction, John Wiley & Sons, Inc.

21. Controlled usability tests in the lab

Background

Often a designer may have developed multiple versions of an interface or system that he or she may wish to compare in a focused way. These systems may have been developed from focus group studies or lo-fi prototyping, and the researcher wishes to determine the usefulness of the design in a more quantitative way. He or she may wish to consider how particular tasks affect user performance. Lab based usability studies allow us to focus on how user performance is affected by particular changes in the tasks that users perform, and to quantify that difference.

Description

Lab based studies involve the user carrying out a set of constrained tasks with one or more variations of a system in a controlled environment. In all cases there will be at least two systems or task variations that will be compared (the independent variable [IV], which the experimenter controls), against each other on a number of metrics (such as time taken, accuracy, etc.) called the dependent variable (DV).

Each combination of IVs is called a condition. The key element of these studies is that there should be no other differences between the conditions than the differences of the IVs. This means that the experimenter must control all other factors including lighting, instructions given to participants, ambient noise and temperature. To assist with this, these studies are usually carried out in a dedicated usability laboratory. The measures of the DV are then compared using a statistical analysis (such as a student t-test or other appropriate statistical analysis) to validate the hypotheses derived from the research question. Controlled studies are useful as:

- They allow study of particular aspects of a user interaction in a way that cannot be done with less formal studies
- They are fairly cheap to perform, and can be useful as a pilot test of more long term studies, or more expensive off-site evaluation
- They provide a concrete analysis of the performance of a system or technique .

A haptic usability test in a laboratory

They are not suitable if:

- An understanding of how a system fits into everyday life is desired
- If the system required the interaction of external facilities (e.g. GPS navigation)
- The designer is trying to decide amongst a very large number of design decisions or the design space has not been constrained. In such cases low-fi prototyping and brainstorming may be more appropriate.

How-to

A controlled study will usually involve the following steps:

1. Construct a research question that you wish to answer;
2. From that, derive a set of testable hypotheses;
3. From these determine the Independent Variable(s) and Dependent Variables;
4. Develop a set of representative tasks that a user will perform;
5. Create the training materials, and the procedure the participant will perform;
6. Ensure that, as much as is possible, any confounding variables are accounted for;
7. This can be done by counterbalancing (vary the order participants carry out conditions);
8. Carry out two or three pilot tests to confirm if the experiment can be completed;
9. Run the experiment and analyse the results.

Tips

Quantitative studies will tell you if a system is better than another system, but the results may not tell you why. It is always useful to add a short discussion and questions session to the end of the study to gauge participant's subjective views.

Inclusion
As with all experiments, the study should be designed according to the subset of users that the experimenter is interested in. Materials can be read out or printed on special materials if required. A pilot study is useful in determining how an experiment should be adapted.

Expected outcome
The controlled study will usually produce a quantity of objectively measured data, such as task times, number of correct answers or in some cases eye-tracking data. These data can be analysed to answer the hypotheses and the initial research questions.

Further reading
Miller S. (1984) Experimental Design & Statistics, 2nd Ed, Routledge.

Rubin, J. (1994) Handbook of Usability Testing, John Wiley & Sons.

Greene, J., D'Oliveira M. (2006) Learning to Use Statistical Tests in Psychology, 3rd Ed. Open University Press, McGraw-Hill publications.

22. Mobile usability tests in the field

Background

Whilst lab based usability studies can be used to quantify the particular differences between two or more systems, they, by nature, assume a user would carry out tasks in an office or at a desk. The growth of mobile computing, and the development of interfaces that assume that the user would not be sitting at a desk carrying out a task mean that it is necessary to carry out quantitative studies in a realistic situation that a user may find his or herself in.

Description

These type of studies are very similar to the In-Lab usability tests. The experimenter is again comparing one or more types of interface, or different types of tasks, in a quantitative way. However in this situation, the experiment is taking place outside of the traditional usability laboratory. This means that the experimenter has much less control over extraneous environmental variables (such as lighting, temperature, etc.). This means that there is more possibility that those variables will adversely affect the results obtained. For example, if the user is carrying out a navigation task on two different systems in a public pedestrian shopping area, performance may be affected by the system, but also by how busy the shopping area is when the study is carried out. This is something the experimenter has limited control over. It may mean that some trials need to be discarded. There are several different situations that can be used for such testing, and it depends on the actual system under consideration which is best. Many studies have looked at navigation systems in walking and GPS navigation using parks or other quiet but public areas. Other studies have considered how particular use environments such as on the subway or a bus affect performance when interacting with mobile devices. In all cases the experimenter needs to consider how the real world will affect performance and ensure that extreme cases of confusion do not occur.

Such studies are particularly useful as:

- They allow systems to be quantitatively validated in real world usage scenarios;
- They can reveal aspects of usability that would not be found in a controlled lab study.

A group of users trying out GPS devices

However, they have issues as:

- They allow for less control over other factors that may influence the experiment;
- They require more resources to run and can take longer due to the need to avoid certain times of day.

Example

In the HaptiMap project, we have conducted ad-hoc usability tests in the field to trigger discussions and creating a common ground between users and designers.

How-to

Carrying out such a study is the same as for a lab based quantitative study but with the following other issues.

- Ensure that appropriate permissions have been obtained for the test site that will be used;
- Visit the test site at various times to identify any significant variations that may affect user performance;
- Safety of participants must be of the highest priority. Ensure that consideration is given to personal safety and be prepared to physically stop a participant if required. Additionally avoid areas which present significant physical danger. The roads of a park may be just as good as a busy road.

Tips

Ensure you have telephone numbers for participants. Trials may need to be postponed or changed at short notice. It can also be useful to measure

environmental factors to consider against the data collected. Ambient noise or movement data can be recorded and analysed if necessary.

Inclusion

The environment chosen will largely affect the inclusiveness of the experiment. Kerbs or steps will affect those with limited mobility and unfamiliarity for visually impaired users. In such cases increased safety, perhaps another person whose sole responsibility is to ensure the participant does not put his or herself in danger, should be used.

Expected outcome

The controlled study will usually produce a quantity of objectively measured data, such as task times, number of correct answers. These data can be analysed to answer the hypotheses and the initial research questions.

Further reading:

Hoggan, E., Crossan, A., Brewster, S.A., Kaaresoja, T. (2009) Audio or Tactile Feedback: Which Modality When? In Proceedings of ACM CHI2009 (Boston, USA). ACM Press Addison Wesley.

23. Longitudinal studies

Background
A typical usability study only provides a snapshot in time of the usability of a system, and thus may only provide insight into a system's learnability (Menoza and Novick, 2008). Conducting a longitudinal study works around this issue by also considering the role of time and experience in the usability of a system. A longitudinal study may be conducted over the duration of anywhere from a few days to several decades.

Description
A longitudinal study has been defined by Menard (1991) as a study in which:

- "data are collected for each item or variable for two or more distinct time periods";
- "the subjects or cases analyzed are the same or at least comparable from one period to the next";
- "the analysis involves some comparison of data between or among periods".

A longitudinal study may be conducted by either running repeated measurements in a lab setting or in a field setting. One way of gathering information from participants is to conduct a diary study, or through regular contact with participants.

Example 1: Diary study
A diary study is a longitudinal study where participants are asked to keep a diary of their usage patterns and interactions with a system over a period of time. For example, one of the first longitudinal studies in HCI was a diary study by Rieman (1993) in which the researchers wanted to gain insight into how people learnt the functionality of their computer system over a period of time.

Example 2: Field study
A longitudinal field study is one where repeated visits are made to the context in which the system is used. For example, Peters and Allouch (2005) studied 25 users of a new communication device over three months by employing a longitudinal field study.

Example 3: Lab study
A lab study is one where participants are invited to a session in a controlled environment on a regular basis. Many researchers classify longitudinal studies as a form of meta-method – in this way, a longitudinal lab study might have significant similarities to the traditional lab-based usability study.

How-to
A longitudinal study may be similar in design to a controlled usability test. However fewer test participants may be required. If running a longitudinal study, the procedure is:

- Derive a research question.
- Develop a hypothesis.

Collect data on at least two occasions. The form of this data will be dependent on the nature of the research question being asked, and may be derived from field observations, interviews, etc.

Analyse results.

Tips
Ensure that variables are kept consistent across the duration of the study; otherwise all that will be tested is the learnability of the system.

A snapshot does not give the whole picture...

Inclusion
Provide an accessible means for participants to record their data. For example, if running a diary study, provide a recording device for the participant. It is also important to be aware of the impact that a longitudinal study may have on a person's lifestyle – for example, participants may have difficult travelling circumstances.

Expected outcome

By conducting a longitudinal study, it is possible to monitor the effect of time on a user's interaction with a system. This means that a more accurate analysis of the usability of a system can be done.

Further reading

Dumas, J. (2002) User-based evaluation, in J. Jacko & A. Sears (Eds.) The Human-Computer Interaction Handbook, Mahwah, NJ: Lawrence Erlbaum, Assoc., p. 1112.

Menard, S. (1991) Longitudinal Research, Newbury Park: Sage Publications.

Mendoza, V., Novick, D. G. (2005) Usability over time. In ACM 23rd International Conference on Computer Documentation, ACM Press, pp. 151-158.

Peters, O., ben Allouch, S. (2005) Always connected: a longitudinal field study of mobile communication. Telemat. Inf. 22, 3 (Aug. 2005), pp. 239-256.

Rieman, J. (1993) The diary study: a workplace-oriented research tool to guide laboratory efforts. In Proceedings of the INTERACT '93 and CHI '93 Conference on Human Factors in Computing Systems (Amsterdam, The Netherlands, April 24 - 29, 1993).

Example: early design – design workshops

A typical user-centred activity in the early phase of a design process is a design workshop. Here will we describe an actual design workshop that took place in November and December 2008 in the HaptiMap project. The aim was to investigate user requirements related to maps and location based services for both elderly and visually impaired users.

This explorative study had three parts:

1. A discussion/focus group meeting where the groups also tested different navigational systems informally in a scenario walk.
2. A diary study performed over a week where the participant recorded his or her experiences of everyday routines when travelling.
3. A design workshop in which each group envisioned new kinds of interaction with mobile navigation systems by building and demonstrating low-fi prototypes and demonstrated these in a simulation walk.

The study in this example combined the following elements:

Ethics: At the very first session we asked the participants to read and sign the informed consent. This information was already emailed to all of them together with a note that they were covered by insurance during the workshop activities.

Questionnaire: At the first session we asked the participants to fill out a questionnaire. The questionnaire followed to a large degree the template provided in Appendix C. For our visually impaired participants we provided assistance to complete the form.

Focus group discussion: Based on the questions in the questionnaire we had an open discussion where all kinds of questions and issues where debriefed.

Contextual focus group/test: To get a more concrete vision we then asked the participants to use a few different commercial navigation systems. We had planned a short outdoor route, and we also video recorded the walk. To demonstrate current technology, we made use of an *iPAQ* with a *TomTom* navigation system and a *Garmin GPS* during the outdoor session. This was supposed to support the imagination and the feeling of using a device in a real situation and trigger discussion between users and researchers.

Diary study: We had prepared a paper version as well as a non-graphical electronic version for the visually impaired participants. This way they could fill in the diaries using their own computer at home.

User workshop: In this session the participants were asked to design lo-fi versions of potential services. These were demonstrated using bodystorming-like methods.

The study involved a group of eight persons: five elderly people between 67-78 (2 male / 3 female) and a group of three relatively young visually impaired university students (1 male / 2 female).

Even if the outcomes from the design workshops varied, both our user groups had many requirements in common. This indicates that the study was useful for delivering rich results. We found the combined study design to be very fruitful, and we feel this type of more longitudinal user and design study is well-suited for early design stages of mobile devices in general.

Users at a lo-fi design workshop

Example: late design – prototype evaluation

In this example we describe a field experiment designed to evaluate one of the prototypes developed in the HaptiMap project. The prototype, called *Tactile Wayfinder*, was intended as an alternative to traditional navigation systems for pedestrians, such as *TomTom*. It uses tactile feedback instead of visual maps and turning directions to guide a user along a predefined route.

By building a prototype of the *Tactile Wayfinder* we were able to investigate if our tactile feedback can outperform the traditional audio-visual navigation systems. Specifically, we wanted to investigate whether it supports a better spatial understanding, free attention, and ultimately allows better navigation performance. We therefore conducted a field experiment where we compared the *Tactile Wayfinder* to a *TomTom* device.

The experiment took place on three consecutive Saturdays in the city centre of a mid-sized and busy German city. The task participants had to perform was to walk two routes using each of the navigation devices. The routes were chosen to be complicated and to run across places that were typically very crowded. We assessed familiarity with the evaluation environment and sense of orientation through self-reports prior to the study.

The study was divided into the following parts:

1. For each session the experiments and the participants met near the starting point of the first route at a well known place. Before starting the actual evaluation, the participants had to fill out a questionnaire containing demographic questions and the questions from the *Santa Barbara Sense Of Direction* (SBSOD) scale. The experimenters then explained the tactile navigation system to the users and if necessary demonstrated the use of *TomTom*. The participants were able to test both devices before the measurements started.
2. In alternating order, one of the navigation systems was then made ready for the first route. Right before starting, the participants also learned that they had to complete spatial knowledge tests afterwards so they were to pay attention to the route they took. As the participants followed the navigation instructions, two experimenters followed at short distances and took notes on a protocol according to the dependent variables.
3. When the participants arrived at the end of the first route they were asked to perform the two spatial knowledge tests (photo direction recall and drawing the walked route) and complete the *NasaTLX* test.
4. Then, the navigation system was changed and the participants walked the second route. Arriving at the second route's destination, the participants again performed the spatial knowledge tests and the *Nasa TLX*.

Fourteen participants took part in the experiment. These were mainly young university students. In this case we wanted participants that were rather familiar with mobile technology to make the results more comparable, we chose a homogenous group. If such tests turn out well recommendations can be made to extend the user representative group after the initial investigations.

The basic idea of experiments is to reveal cause and effect relations by altering a single aspect in the study and to look for systematic changes in the results. In this case we altered the navigation aid used. Differences in the results can then be attributed to differences in the design of those devices. Hence, the experiment used a repeated measures design, which meant that every participant used both navigation aids successively. The *Tactile Wayfinder* served as the experimental condition while *TomTom* served as the baseline to compare against. To avoid sequence effects the navigation aids were used in alternating order (i.e. we randomly assigned which navigation aid was used first). If the participants got better or worse in time due to training or fatigue, we would measure these changes equally for both navigation aids.

We measured spatial knowledge, level of attention, and navigation performance. Spatial knowledge was measured by two tests:

1. Participants were presented photos of crossings along the route and they had to recall how they proceeded there.
2. Participants had to draw the route they had just walked from memory onto a sheet of paper that only showed the boundaries of the city centre as reference.

The level of attention was measured:

- by self-report through a *Nasa TLX* and
- by counting how often participants were close to colliding with another person or object because they focused their attention on the device instead of their surroundings.

The navigation performance was measured by:

- recording the time it took the participants to complete the route,
- how often they felt disoriented, and
- how often they made navigation mistakes by deviating from the intended route.

The scores that are measured are referred to as dependent variables. Choosing the right dependent variables is crucial for the validity of the study. For example, in this case we used completion time as an indicator for navigation performance. However, one can argue that walking slowly but effectively is also "good" navigation performance, but will most likely result into longer completion times.

The results of the spatial knowledge tests did not show any significant differences between the *Tactile Wayfinder* and *TomTom*. However, there were strong correlations between a good sense of direction and high scores in the spatial knowledge tests. Regarding workload and attention, we observed significantly fewer near collisions with the *Tactile Wayfinder* than with *TomTom*. Navigation performance was, however, worse with the *Tactile Wayfinder*, as the participants made significantly more navigation errors.

Accurately reporting the procedure is important for other researchers to be able to replicate the study. It also needs to be clear in what situations things were measured, as, for example, it would surely have made a difference if we issued the *NasaTLX* for both devices after the overall study was completed.

Links

NasaTLX scale
http://humansystems.arc.nasa.gov/groups/TLX/

SBSOD scale
http://www.psych.ucsb.edu/~hegarty/instruments/sbsod.pdf

Appendix A: User activity preparation checklist

This checklist can be used for different user activities. It was originally made for user workshops, but you can pick out the parts that fit your activity.

User selection

First one has to decide which users to aim for:

Blind people (blind)

- Guide dog / white can required for navigation
- Depend on Braille / synthetic speech in order to get information

Visually impaired people (vip)

- Can navigate without special orientation aids
- Can read printed material by facilitation of glasses and / or magnifying aids

Elderly people (elderly)

- People over the age of 60

One has to decide beforehand which of the user (sub)groups to invite with regard to the intended workshop.

Number of Users

In cases where all user subgroups will be present in the workshop, one has to take care that the respective subgroups are uniformly distributed. A number of participants less than or equal to twenty is a reasonable group size for the discussions and activities that take place with the entire group present. In cases where the workshop only aims at the blind, up to seven participants are manageable. Staff needs to be available for guiding blind participants. For both remaining user subgroups, up to sixteen participants is a feasible size. Even though members of these groups can get by, they might require support in order to complete certain tasks. You need also to consider the group sizes for break-out activities. A size of 3-5 end users participants is good if the group also will be accompanied by a moderator and perhaps an additional person from the staff.

Publication of announcement

Invitations should be sent out between two and three weeks before the workshop. Depending on the selected user group there are several means of contacting them:

Blind participants

Contact the respective disability organizations (preferably their local chapters) or, if available, special education or training facilities for the blind. One could also broadcast this information on the local radio station(s). Provide accessible electronic or printed grade one Braille invitations to distribute amongst possible participants.

Visually impaired participants

Contact the respective disability organizations (see above). In most cases they also have members with other visual impairments than blindness, such as low vision. You could also prepare an article for the local newspaper(s) requesting readers to inform possible participants. Prepare electronic and printed (if possible large print) material for distribution amongst interested parties.

Elderly participants

Contact residential homes, churches and / or publish an article in the local newspaper(s) / radio station(s).

All published materials have to contain the name of the person responsible for the organization of the workshop and means of contact:

- phone / mobile
- e-mail
- postal address
- standard office hours

Contacting participants

When the list of participants is finalized, personally contact them all – best by phone – and consider the following issues.

General questions

- Means of transportation. Be prepared to give
- driving and parking information
  - » closest bus stop, respective bus lines and walking directions to the location of the workshop
  - » which entrance to take and whom to contact how / where
- Special food arrangements in order to arrange for appropriate snacks and meals
  - » diet food
  - » vegetarian
  - » vegan
  - » gluten free
  - » nut free
  - » lactose free
- Material provision. Inquire about the best format of provided materials
  - » regular print out
  - » large print
  - » Braille (Grade I only is enough)
  - » accessible electronic documents

- Level of functional limitations. Ask all participants about their level and kind of functional limitations:
  - » vision
  - » hearing
  - » mobility
- in order to prepare appropriate
  - » barrier-free access to the conference room and cafeteria
  - » selection of conference room and, if need be, accessible restroom(s)
  - » seating arrangement

Blind / vip specific issues

- Means of transportation
  - » be prepared to help with bus / train connections
  - » offer pick up from and delivery to the nearest bus stop
  - » offer a shuttle service from and to the train station
  - » if need be provide detailed (vip / blind appropriate) walking instructions from the nearest bus stop
- Guide dogs
  - » inquire if blind people will be accompanied by their guide dog and ask if food / water bowls can / have to be provided

Provision of printed material

If participants request hand outs in a particular format (Braille, large print / electronic version) make sure that these documents are ready in time. If one cannot print Braille / large print in-house, one has to find a printing house / institute which is able to do this. Ask beforehand how long it takes to print and ship the material and in which format they prefer the input. If participants prefer an electronic version make sure that the files are provided in an accessible format (doc, pdf, html, txt).

Hand outs

Prepare a brief for all participants containing the following documents:

- short flyer about the company / organization holding the workshop;
- agenda;
- printed slides of the HaptiMap project presentation;
- 2 x written consent forms: one signed form for the workshop organizer to keep in house (this has to be a regular printed version) and one for the participant to take home in a format according to the participant's preferences (in Braille for example);
- 2 x questionnaires based on the basic HaptiMap questionnaire with additions and changes according to the workshop goals: one regular printed version to be filled out by participant or workshop assistant and one according to participants preferences;
- printed slides of the short introduction to the design workshop;
- short description of activities in the workshop
- other material related to the workshop, diaries or other cultural probes material, for example;
- menu (if applicable);

Further workshop goal-related documents can be added by the organizers if necessary. If not otherwise noted, all documents have to be provided in a format requested by the participant.

Things to organize

The following devices and materials have to be organized before a user activity with a larger group of users.

- (digital) video cameras (for recording the workshop in general and the break-out sessions specifically)
- sample navigation devices to show to users
- material for break-out session like a design workshop for example (consider that each group has to be equipped sufficiently)
- note taking material, A1 / A2 flip chart sheets or similar
- Sufficient number of pens and highlighters (for the flip charts)
- water / food bowls for guide dogs (if requested)
- meeting room
  - » with beamer
  - » with silver screen for presentations
  - » make sure that the windows have shutters in order to provide suitable lighting for vip
  - » meeting room has to be accessible (no stairs)
  - » large enough to hold all participants, assistants, guide dogs and companions of blind / visually impaired participants
  - » power outlets if blind / vip participants would like to bring notebooks / electronic

note takers
  - » an accessible restroom close by
- additional meeting rooms for the break-out sessions (if possible close by)
- one complete hand out brief for each participant with material in requested format (label each brief with the participant's name)
- name tags for each participant (arrange seating order so that sighted participants / assistants are uniformly distributed amongst the blind / vip in order to assist them)
- moderators and assistants to lead break-out sessions (at least one per break-out group)
- food
  - » always offer something to drink (coffee, tea, water, juice, etc.)
  - » snacks for morning and afternoon coffee breaks
  - » special food if requested
  - » if any participants are alleric to nuts, avoid food with nuts in general
- detailed travel descriptions
  - » nearest bus stop and lines that stop there
  - » how to get from the bus stop
  - » how to get to the building entrance (detailed with landmarks)
  - » train connections
  - » driving and parking information

Model agenda

This is a suggested agenda for a one day workshop which can be changed according to your needs.

- greeting by the head of division / institute
- presentations
  - » agenda / structure of the day
  - » presentation of the HaptiMap Project
- reading and explanation of the written consent form (WCF)
- signing of the WCF (assist the blind / vip participants)
- organizing of the groups
- short coffee break
- presentation of navigation devices and short outdoor exercise
  - » introduce participants to different navigational aids
  - » prepare basis for discussion
- fill out general questionnaire (suggestion: do it in the groups with assistants reading the questions aloud and filling in the answers for blind / vip participants)
- lunch break
- organize departure: organize shuttle service; if necessary support further time planning
- introduction to design workshop
- break out session (design workshop in groups)
- coffee break
- another opportunity to demonstrate and explain navigational aids and special devices
- presentations of group results
  - » remember to give positive feedback
- introduction to travel diary
- closing of the day
  - » ask everybody for a short statement about the day
  - » thank everybody for participating
  - » briefly mention what you will do next with the resluts from the activities

Appendix B: Informed consent form

Consent to participate in user activities in the HaptiMap Project

1. I am willing to participate in an interview/test in the EU HaptiMap Project.
2. I have been informed of the Project's goals and aim by personnel from <partner>, which is the responsible Project partner in <country>. I feel that I have been adequately informed.
3. I have been informed:
    a. that I am participating in a project called HaptiMap, which has as its goal to make mobile navigation services and products accessible for a larger target group, primarily people with reduced vision;
    b. of the purpose of my participation;
    c. that the interview/test will be documented in writing and will be audio and video recorded;
    d. that I am in no way obligated to answer the questions that are asked;
    e. that my personal data are protected by the <Federal Data Protection Act> which means that my identity will not be disclosed to the public and that no conclusion can be drawn as to my identity from published data. Data provided by me will only be used in the HaptiMap Project and for scientific purposes. Data concerning my identity will be deleted after termination of the HaptiMap Project or stored in an anonymous way.
    f. that I at any time and without explanation can discontinue an activity.
4. I can contact <name of responsible person>, whose address is supplied, if I have any questions about the Project or my participation.
5. I have been informed that I will not receive any payment for my participation with the exception of reimbursement for travel.
6. I have been informed that <partner> has taken out special insurance for my participation that covers trips to and from <partner> as well as the time spent there.

Place, date

Name

Signature

Appendix C: HaptiMap common background questionnaire

Participant Identifier:
Experiment:
Experimenter:
Date:

Please complete the questions below as fully and accurately as possible.

A. Basic Information

1. Gender: Male Female

2. Age:

3. Occupation (current/past):

4. Highest completed education:

B. Hearing, Vision and Motor ability

5. Please rate your visual ability (with the best possible correction for your glasses):
- Full vision
- Minor vision problems
- Moderate vision problems
- Severe vision problems, with some residual vision
- Blind

6. Are you colour blind: Yes No

7. If you have vision problems, please provide some details:

8. Please rate your hearing:
- Full hearing
- Minor hearing problems
- Moderate hearing problems
- Severe hearing problems, with some residual hearing
- Deaf

9. If you have hearing problems, please provide some details:

10. Do you have practical musical experience (playing instruments, singing in a choir, etc.):
Yes No

11. Please rate your motor abilities:
- Fully mobile
- Minor motor problems
- Moderate motor problems
- Severe motor problems

12. If you have motor problems, please provide some details:

13. Dominant hand: Left Right

C. Experience of Mobile Devices

1. Do you own a mobile phone? Yes No

2. If yes, how long have you owned a mobile phone?

- Less than 6 months
- 6 months to 1 year
- 1 to 2 years
- More than 2 years

3. What is the model and brand of your mobile telephone:

In a typical week, how often do you use you mobile phone to:

	0	1-3	4-6	7-10	+10
4. Make phone calls					
5. Send SMS					
6. Send MMS					
7. Use calendar					
8. Take pictures					
9. Record video					
10. Listen to music					
11. Use the alarm					
12. Web browsing					
13. Other					

14. If you use other services, please provide more details on the services you use:

D. Everyday navigation

How often times do you travel using the following modes of transport:

	Less than once a year	Once or twice a year	3-5 times a year	Bi-monthly	Monthly	Weekly	Daily
1. Car							
2. Bus							
3. Train							
4. Metro							
5. Bike							
6. Taxi							
7. Walking							
8. Other							

9. Please provide some details on your other means of transportation:

In a typical week, how many times do you travel for the following reason:

	Never	1	2	3	4	5	6	Every day
10. Work								
11. Leisure								
12. Shopping								
13. Other								

14. Please provide some details on your other reasons for travel:

How often do you bring the following material on your travels:

	Almost always	Often	Sometimes	Occasionally	Never
15. Mobile phone					
16. Map (paper)					
17. GPS					
18. Compass					
19. Another person					
20. Timetable					
21. Other					

22. If other, please specify what :

23. How often do you travel new (unknown) routes?

Less than once a year	Once or twice a year	3-5 times a year	Bi-monthly	Monthly	Weekly	Daily

24. How often do you need to plan your journey in advance?

Less than once a year	Once or twice a year	3-5 times a year	Bi-monthly	Monthly	Weekly	Daily

25. Please provide some details on your normal planning tools/strategy:

26. How would you rate your sense of direction (please circle the numbers):

Very Poor 1 2 3 4 5 6 7 Very good

E. Online Map Services on desktop computer

1. In an average week, how often do you access online map services:

0 1-3 4-6 7-10 more than 10

2. If you use online map services, please tell us which :

3. Please also tell us how and why you use online maps:

F. Mobile Map Services

In a typical week, how often do you use:

1. Mobile maps:
0 1-3 4-6 7-10 more than 10

2. GPS (handheld) :
0 1-3 4-6 7-10 more than 10

3. GPSs (in your car) :
0 1-3 4-6 7-10 more than 10

4. If you use mobile map services, please tell us which:

5. If you use a GPS, please tell us which:

6. Please also tell us how and why you use mobile maps and/or GPS:

Personas

for the HaptiMap Workshop
23. - 24.4.2009

Anna
23 years

Elmo
76 years

Esko
52 years

Irma
57 years

Antti
38 years

Kaisa
43 years

Tuomo
43 years

BACKGROUND I am a master of science in technology. I grew up at the countryside. There we didn't go for hikes, it was part of the daily life. Besides hiking, I like to spend time at the summer cottage and take care of my wood lot. I organize and lead hikes and orienteering courses, too. I even met my wife on a hike.

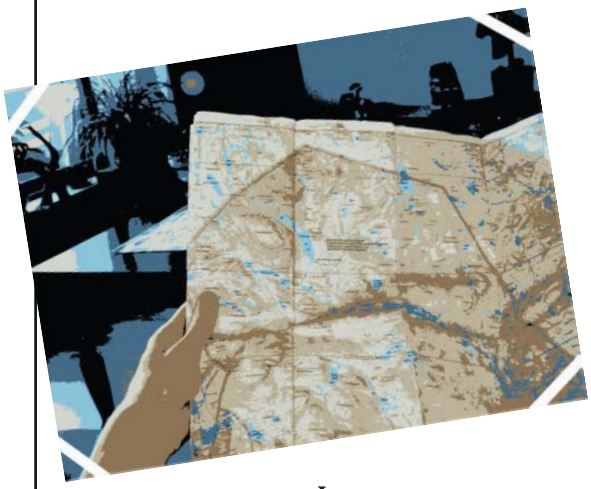
Go far, see near!

STYLE I want the hikes to be spontaneous with a structured frame. For hikes that I is organize I want the daily structure to be very precise. I used to spend all my holidays hiking, but these days the kids are keeping me home more.

Esko, 52

Esko, 52 years old, an engineer and a trekking guide.

When hiking, people are real. There you can truly be yourself.



I want to see the whole route at once. That's why I'm not fond of the car navigators.

TECHNOLOGY AND GEAR I have collected my gear by time. I find information of the hiking area from the internet, library and people I know. When planning a hike, I want to use as big a map as possible. I also collect interesting articles to a notebook so I can read them during quiet evenings at hikes. During a hike, when it is possible, I let my family know my location and that I am all right. After a hike, I check the route from a map.

ACCESSIBILITY ISSUES I don't have accessibility problems alone, but when I travel with a group as a group leader, I must consider the others and their wishes.

I hike with my children in areas close to home. I dream about longer hikes with my children when they get older.

I have learned with the kids that you don't have to travel far to get deep experiences. It may be the ants around your feet that provide the highlight of the day.

The most important things in choosing a hiking route are:

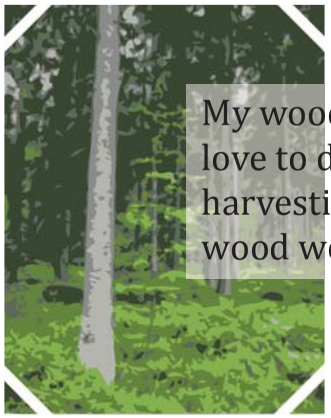
1. Possible attractions
2. Convenience of paths
3. Potential camping sites
4. Availability of drinking water

Difficult areas are avoided with good planning.

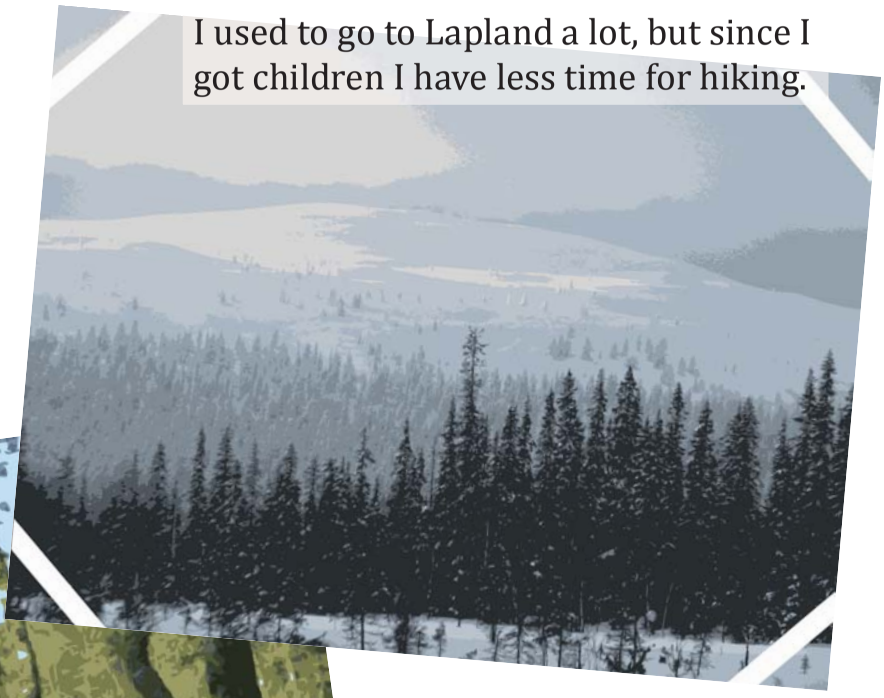
The most challenging part of hiking is to get all the participants to the starting point. They may come across the country. You need to find out how (e.g. by train, bus, car pool, etc.) people should travel to the starting place.

If changes are made to the route plans while hiking, the decisions are made as a group.

IMPORTANT PLACES AND TRACES

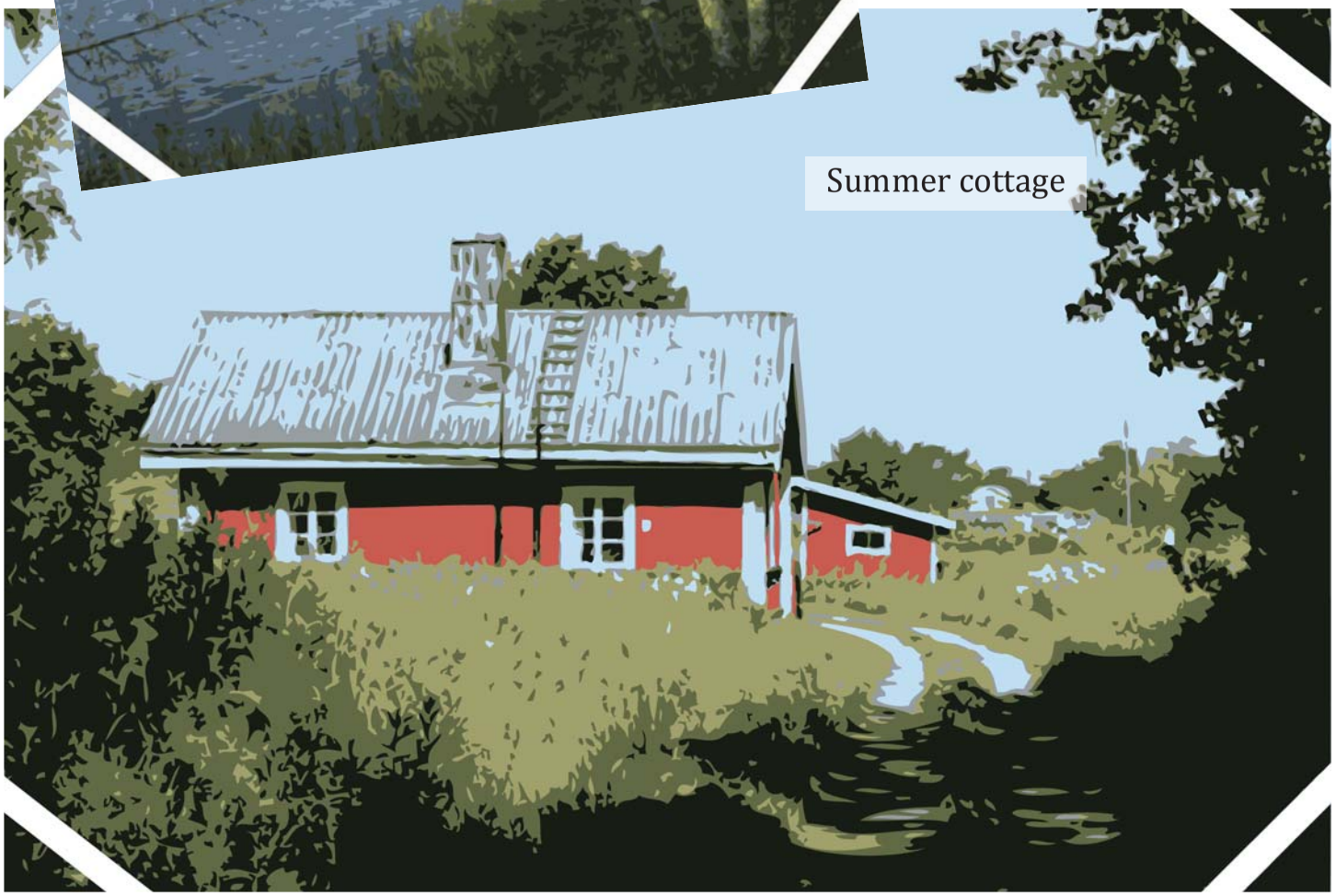


My wood lot, where I love to do traditional harvesting and wood work



I used to go to Lapland a lot, but since I got children I have less time for hiking.

Hiking destinations in Southern Finland are also very good options. Especially canoeing is one of my favourite things to do in the south.



Summer cottage

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ICT – Information and Communication Technologies

FP7 – ICT – 224675, HaptiMap, Haptic, Audio and Visual Interfaces for Maps and Location Based Services
Large-scale integrating project, Challenge 7 – Independent living and inclusion