

Discoverijssel
Interface and Interaction Design

Group 1
Michel Jansen
Anne-Katrin Krolovitsch
Marcel Melching
Mariëlle Winarto

January 13, 2010

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Chapter 1

Introduction

This report documents the design process of Discoverijssel: a mobile, location-aware system developed for Landschap Overijssel as part of the course Interface & Interaction Design.

1.1 Project goal

The goal of the design project described in the following chapters, has been defined by the course instructors in cooperation with Landschap Overijssel as follows:

Design a mobile, networked system that allows people with and without visual disabilities to share their stories, experiences, observations and questions of the landscape around them with others, while they are moving through the environment. (van der Geest & van Velsen, 2009)

1.2 Landschap Overijssel

The Dutch non-profit, governmental organisation Landschap Overijssel (literally: Landscape of Overijssel), acts as the client of the system designed in this project.

Landschap Overijssel “preserves and develops nature reserves and other areas of cultural and historical value in [the province of] Overijssel.” (van der Geest & van Velsen, 2009). Because one of their core activities is raising awareness, educating and communicating the value of the landscape of Overijssel to the general public, they are interested in new ways of doing so and thus in this project.

Although it was generally not possible to involve Landschap Overijssel in the design process, ask detailed questions or get feedback on design decisions,

they have been considered as the primary stakeholder throughout the project, and all decisions were taken with their best interest in mind.

1.3 Approach

In the project several stages could be identified: task analysis, gathering and defining requirements, design and evaluation (Stone, Jarrett, Woodroffe, & Minocha, 2005). Before defining the requirements, a brainstorm and user study were held to get insight on both the task domain and the desired characteristics of a mobile application for this domain. Both functional and non-functional requirements were listed and were assigned priorities. In the design stage, conceptual models were defined before moving on to more specific screen and interface design. The initial design was evaluated heuristically, and based on this heuristic evaluation some adaptations were made to the design. The resulting prototype was further evaluated in a small-scale ($n = 5$) user evaluation. Finally, the strengths and weaknesses of the designed prototype were discussed and recommendations were given based on these findings.

1.4 Discoverijssel

The result of the design process that this document reports on, is an application called Discoverijssel. This application consists of three major parts: a context- and location aware mobile application that can be taken along on trips, a web application that can be accessed from the comfort of one's home and a web service that forms the backend to both these applications. This relation is clarified in Figure 1.1.

Although the two client applications, the mobile application and the web application, are essentially equal players in the Discoverijssel ecosystem, their intended purpose is very different. As will become apparent in the task analysis in Chapter 2, the activities people might undertake while they are on a trip can be set apart from the activities before and after they leave. When at home, a full-scale computer, with a decent keyboard and a large screen always beats a small touchscreen phone, so the form of a web application will be most suitable for preparing a trip, looking up information in advance or afterwards, reading about other people's experiences, looking up events in the area etcetera. The power of a mobile application is that it can be there when it all happens: right in the user's pocket. That's why this report focuses on the design of this mobile application, which should *help people discover interesting things while visiting natural areas of Landschap Overijssel and share them with others*.

Because in the beginning, the project carried the working title of 'OnSpot', it will sometimes be referred to as 'OnSpot', sometimes as 'Discoverijssel'. This refers both to the concept as a whole, the service including the applications that surround it, as the specific application where needed.



Figure 1.1: The three components of Discoverijssel: a web service, a mobile application and a web application.

Chapter 2

Task analysis

Any design begins with an understanding of what it is that the resulting product should support. The first phase of the design process, was brainstorming about the potential directions to take, who the users might be and what they might get from a hypothetical system. As we narrowed down to a more concrete vision of the system, more information was gathered about the nature of the tasks typical users perform now and might do later and what the role of the system should be in supporting those. In line with the iterative nature of the design process, this section has been updated with more detailed information as it became available.

2.1 Brainstorms

Three brainstorm sessions were conducted for identifying circumstances of the system and its users. First, a brainstorm meeting was held where different ‘main’-activities of the system were discussed. This discussion showed there are seven possible ‘main’-activities, namely guiding, navigation, planning, sharing, finding, retrieving/recognition of (information) and experience/explore.

Another session was held where the different features the system could contain were dealt with. In total, 29 features were found, ranging from GPS location to Categorising information.

Last but not least, a brainstorm session was needed to talk about all characteristics of users, using the system. 14 characteristics were devised. Also, four limits were noted, namely age limits (10 or older), being not illiterate, having a cellphone and being less or more mobile.

These brainstorms were used to get a unified idea about what the system should be able to do more specifically, this way it also became clearer which the target group of this project would be. The result of all brainstorm sessions can be found in Appendix B of this document.

2.2 Persona

To make it easier to identify with the users of the OnSpot system, four personas were developed. Personas can aid a development team to understand and focus on a set of target users, and can serve as a tool for communication (Pruitt & Grudin, 2003). Although often personas are created based on available data about the intended user population, here the initial personas were created after the brainstorm but before the user study. At this stage in the process, one of their main functions was to make assumptions about the target audience explicit, which was amongst others of use in defining the topics that needed to be investigated during the user study.

These personas are based on the outcome of the brainstorming session where the target group for this system was established. They were reviewed after the user study. The personas can be found in Appendix C of this document.

The personas consist of:

- Alice, a 16 year old ‘gadget girl’, that loves computers, from London, England. She is in Enschede for a school assignment;
- Gerard, a retired man who has lived his whole life in Overijssel, and goes often into nature;
- Maria, a 45 year old mother, living with her children and husband in the little town of Losser, Overijssel;
- Peter, a 30 year old musician from Utrecht. Peter is blind but loves to go into nature and ‘experience’.

2.3 User goals

The goal is to let the user explore and experience the environment of ‘Landschap Overijssel’ with the help of the future application. This shall be achieved with the following:

- Share media (pictures, stories etc.)
- Satisfy curiosity
 - Retrieve *information*¹ about the surroundings (pull)
 - Receive *information* about the surroundings (pushed)
- Interact with the environment (through games, questions etc.)

¹The term *information*, as meant here, is defined in a very broad sense and includes not only facts, but also pictures, stories, music, poems etc.

2.4 Usage scenario

Using the persona, some typical scenarios were explored of how users might use a system like the one being designed in a realistic situation. Such scenarios can be very useful during the development process, because they are both concrete and flexible and can be created and revised quickly and easily (Rosson & Carroll, 2002). The scenarios can be found in the Appendix ‘Scenarios’ at the end of this document. To summarise, the system might be used as follows:

A user is visiting one of the popular destination in the natural landscape of Overijssel that he or she is not entirely familiar with. The main reason for doing so may be to enjoy the natural scenery, to get some exercise or simply to relax. There are many peculiarities about the surroundings, but the user is not aware of all of these and would easily walk past without noticing them. Fortunately, the system subtly notifies him or her at appropriate times of interesting things to see, hear or read about the environment. If the user visits a sight or point of interest, he or she can also choose to actively search for more information and maybe even entertainment ‘on demand’. This information can come from official sources, but also from other users. Any user can contribute factual information about, or more creative material such as pictures, stories, experiences etc. about specific areas or points of interest. These are instantly available to other users.

2.5 Hierarchical task analysis

The structure of the task ‘visiting nature’ can be described in a hierarchical task analysis diagram with several levels of subtasks. Because the task description ‘visiting nature’ refers to a broad, general task and different users will have their own different ways of full-filling this task, the hierarchical task analysis does not go into much detail.

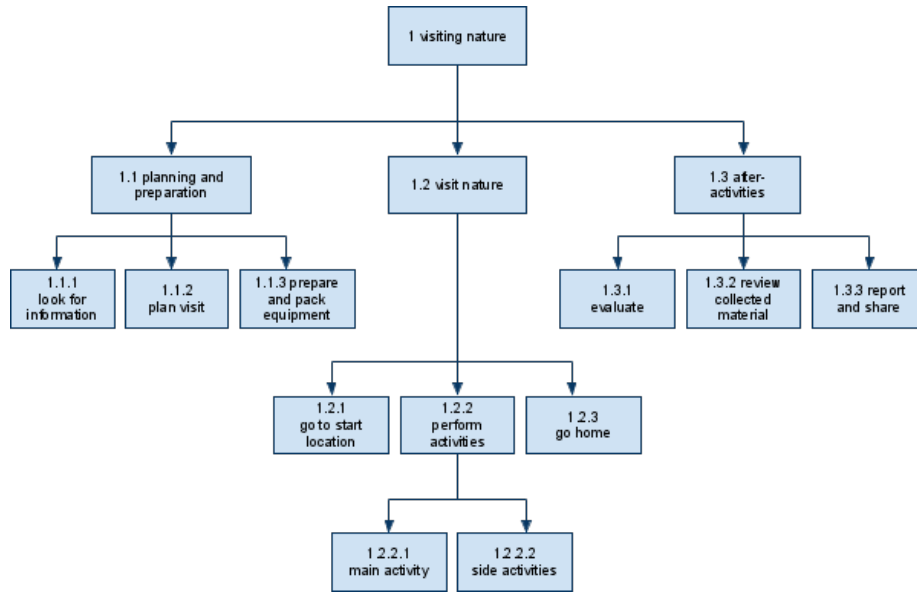


Figure 2.1: Hierarchical Task diagram

2.6 Essential Use Cases

Essential use cases describe interaction between users and the system at a high level of abstraction (Stone et al., 2005). They put focus on what the user would like to do with the system; they do not contain any assumptions about the graphical user interface of the future application. The following use cases refer to “1.2 visit nature” in Figure 2.1. The parts “1.1 planning and preparation” and “1.3 after-activities” will not be covered by the application, therefore they do not relate to any use cases.

Search for content item

User Intention	System Responsibility
Enter a query to search for a picture or a video clip	Display all search results
Choose a specific item	Display the chosen item

Share content

User Intention	System Responsibility
Share a content item (e.g. picture)	Give option to make it public or private
Choose privacy settings	Display image on the map according to privacy settings

Search for a group

User Intention	System Responsibility
Enter query to search for a group	Display result for the query
Choose a group	Display the chosen group

Join a group

User Intention	System Responsibility
Choose a group	Display the chosen group
Join the group	Show that the user is now a member of this group

Select a lens

User Intention	System Responsibility
Enter query to search for a lens	Display search result for that query
Select a lens to view it more detailed	Display chosen lens
Add lens to your collection	Show clearly that the lens has been added to the personal lens collection

Receive notifications

User Intention	System Responsibility
User wants to be notified about certain point-of interest	Emits a signal near a point-of-interest to notify the user
Reads the notification and decide if to save it or if to dismiss it	Acts according to user's choice

Choose a route

User Intention	System Responsibility
	Display routes for the current area
Select a route to be followed	Displays only the selected route

General Search

User Intention	System Responsibility
look for information about a particular area	Display search result (e.g. background information about the area, practical information (location, how to get there...) scheduled activities, etc.)
Prepares for the trip	

Chapter 3

User requirements study

To find out more information about potential users, their needs and requirements for the system, a short preliminary study was conducted. The following research questions were taken into account:

1. What are the demographics of potential and existing visitors of Landschap Overijssel and how do they compare to the persona that were defined?
2. What is the target audience of the proposed system?
3. What reasons do people have for visiting natural areas in the landscape of Overijssel and what activities do they conduct?
4. What information needs do people have?
5. What kinds of information, if any, do people share and how do they do it?

3.1 Methodology

To find the answers to the research questions, a series of semi-structured interviews (see Appendix E) was conducted among varying types of participants, including current visitors of natural areas and potential users of the system. The interviews were conducted individually by the different group members, each of which chose a different location for finding participants. Some of the group members went themselves into a nature area and interviewed people who just arrived there or were about to go back home. Other group members interviewed friends and family. In addition to the user interviews with normal-sighted users, information was gathered from two people with a visual disability: one person was interviewed in person and the other completed a short questionnaire by email. Additionally, existing sharing behaviour was observed in three locations: Geocaching community website geocaching.nl and photo sharing websites Flickr and Panoramio.

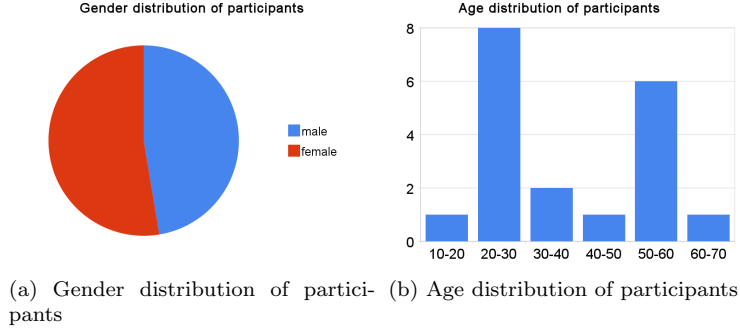


Figure 3.1: Participant demographics

3.2 Interview results

A total of 16 interviews were conducted among 21 participants: 19 participants with no apparent visual disabilities ¹ and 2 participants with visual disabilities. The interview results from the visually disabled are described later in Section 3.2.1, the results described here apply to the participants who were not selected based on their eye-sight.

In the normally sighted group nine were male and ten were female. Most of them were in the age groups 20-30 and 50-60, as is apparent from Figure 3.1b.

Participants were asked what their reasons are for visiting natural areas and how often they do so. The most often mentioned motivations were relaxation or leisure and exercise or sports / fitness. Other reasons participants mentioned were taking part in a guided excursion, walking the dog, getting some fresh air but also for Geocaching, social activities and photography.

There was a lot of variation in the frequencies at which participants visited natural areas. Only fourteen participants answered this question, and their responses have been coded into categories of decreasing frequency, as is shown in Figure 3.2. This graph also shows a cumulative plot of the data, which represents the amount of participants that indicated they visited *at least* this often. In other words, about half of the participants visited natural areas at least once every two weeks.

The majority of participants likes to vary their destinations, rather than revisit the same place every time (16 of 19). Of the three participants that indicated they revisit the same place every time, two of them frequently walked their dog there together, and one went to the same place for running.

Most of the participants were walking or hiking when they were interviewed, with some of them indicating that they sometimes went cycling as well. Because many of the interviews were conducted on a walking trail, no conclusions can be made from these results.

¹For the purpose of this study, wearing glasses or contact lenses was not regarded as a visual disability.

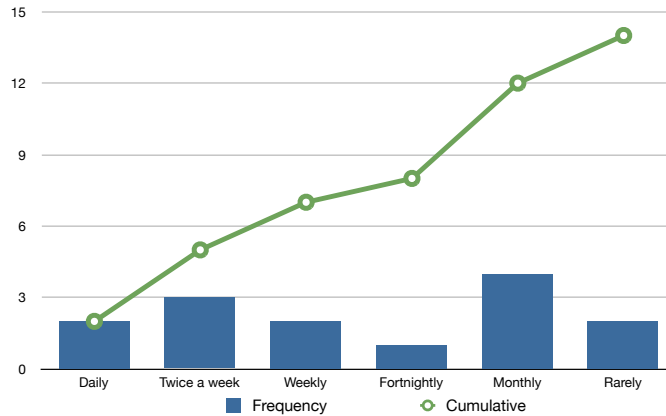


Figure 3.2: Frequency of activities

Only a few participants took any information with them on their activities. Some of them had maps or routes on them, especially when biking. One participant was on a Geocaching trip and had thus preprogrammed his GPS device in advance with the target coordinates from a Geocaching community website, where he had also read information and comments from other people. Another participant indicated that he took his iPhone with him and occasionally used it to look up information about the weather.

To the question “How do you receive information of things that interest you when you are in the nature?”, most participants answered that they read the information signs about natural and cultural objects, as well as signs with route and walking trail information. The coloured signs that indicate the walking trails are also frequently used. Only one group of three people visited an information centre during or prior to their trip. In fact, none of the visitors that were interviewed on their trip had done any planning in advance. Some interviewees did say that if they planned a trip they would get information about the area, places to eat and drink something, points for hiking trip, places to park the car, special locations, how to get to the destination, distance from home to the area, how much it would cost and ask if other people are interested in joining them.

Hardly any participants indicated they missed any information during their activities in natural areas. During one interview session, the two participants mentioned that sometimes route signs are missing from the trails. If they could get more information, however, one participant would be curious about what restaurants are closest nearby. Another participant indicated that it would be useful to know how far she had walked and how long it would take to get back. On the other hand, many participants answered that they would not like to receive more information or at least had no need for it.

Of the nineteen people interviewed, only six had a PDA or smart-phone with them. The most often mentioned reasons for not owning a smart phone was that they had no need for it or it was too expensive. In response to the suggestion

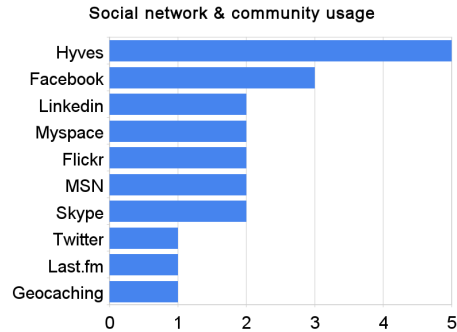


Figure 3.3: Social network and community usage.

that it could be possible to borrow or rent a device that could support them in their activities, some participants who did not own a smart-phone themselves, said they would be open to borrowing one if it was available. Participants who did have a smart-phone said they used it to look up information and take pictures, but not for sharing since it is “too time-consuming”.

Not everyone was active on social networking sites, but the people that were, often indicated using multiple networks at once. One group of interviewees had their own forum for sharing information with family. A list of the social networking sites and applications used is given in Figure 3.3. Some participants stated that they do not have accounts on such sites since they either do not have a computer but also because they do not trust social networking sites because of privacy reasons.

One of the last questions that was asked, was about what kind of information participants would like to receive or what they would like to use the future application for. The answers which were received included information about history of an area and the future plans for it, information about animals and plants special to an area, the location of nearby restaurants, different ways to reach destination, different costs (especially larger amounts), different settlements, more choices (“a trip can be made in different ways”).

The ideas on what features the future application could have the following was put forward, a possibility for image recognition (augmented reality), a replacement for a PC for doing Geocaching, a way to report waste (garbage) to protect nature, and finally a dream one of the participants had was about an applications that you could “ask any question and get an immediate reply (what is this bird? who is this person? can I rely on this brand? is this a reasonable price? where should I invest my money?), this should be easy to use, maybe with brain signals or speech. For sharing: immediately share thoughts and experience, something like a weblog that anyone can search. Different media: pictures, voice, not only text.”.

3.2.1 Interview results visually impaired

Two people from the target group of visually impaired users were interviewed separately, one in person and one by email. Here, the results are presented together from the two interviews, to allow for easier reading and facilitate comparison.

Participants description In addition to the interviews with the normal-sighted users, one interview was held in person with a 39-year old woman with unknown occupation. She described her visual disability as ‘functionally blind’: she could only distinguish light and dark. She has lost her vision 10 years ago, and had been able to see until then. She reads braille, uses speech software and uses a guide dog in daily life.

The second participant in the user study who has a visual disability was a 61-year old man, who works as a university professor. He suffers from the condition ‘retinitis pigmentosa’, which causes a limited field-of-view (of about 10 degrees) and night-blindness. Due to this condition, he has trouble avoiding obstacles and other people. In busy areas he uses a cane, so that other people can recognise him as having a visual disability.

Visiting nature and preparation The woman regularly visits nature (mainly forest and heath) for walking, cycling, and making trips by car (in that case someone else drives). If there is a visitor’s centre, she occasionally visits it and sometimes finds it useful. Before she goes on a nature trip, she tries to find out whether there are existing hiking routes in the area, or create her own route. She also likes to know if she can combine the nature trip with something else, such as events near-by, cultural locations and other things such as a swimming pool.

The man sometimes visits nature, a couple of times a year, at irregular intervals. As main reasons for going into nature, he named relaxation, physical exercise, and enjoying the beauty of nature. Usually he walks, sometimes he visits nature by bike, but he likes the former best. In general, he prefers visiting new places to revisiting familiar destinations.

To prepare his visits he uses books with route descriptions, and maps. In case of hiking, it is important to find out how to get to the location by public transport. During his visit, he takes maps and route descriptions with him to refer to on site. He sometimes visits a visitor centre if there is one, for the purpose of getting information about nature, the surrounding area, cultural history and information on public transport (in case of hiking).

Implications of the disability on the experience of visiting nature Because she cannot see, in order to experience nature the woman pays attention to odours and sounds (birds, plants and trees). Except for those sounds and odours, it does not make much of a difference to her whether she walks through a village or through a forest. She ‘feels’ it when there is a tree in front of her, although it could just as well be a wall. Her guide dog loves to run, but it is

not always easy to know if her dog is allowed to run loose and if it is safe to do so with regards to traffic.

Due to his disability, the man needs to be careful with unexpected obstacles while walking, such as hanging branches of trees etc. because he risks bumping into them when they are outside his field of view. He cannot walk or cycle in low-light conditions (dawn/dusk, or at night).

Information access Usually she does not have access to information in nature, unless she has company from someone who reads the information signs to her. If there are other people with her, they sometimes let her feel things along the route (although she is not always interested in feeling). A pleasant exception is at a special path from Boswachterij Appelscha (2 km in length). There they have information signs in both braille and large letters, regularly spaced along the route.

There supposedly are other paths like this in The Netherlands, although she does not know exactly where. They also have audio information (spontaneously mentions here that it would be possible to do something like this with a PDA). In The Hague there supposedly is an audio-based city tour with headphones. If you walk past a historic building, you will hear information about that place. She would be interested in trying something like this.

The man indicates that he uses information signs in nature. He also takes a booklet with him and often gets information from his wife who knows a lot about nature. In response to the question what kind of information he would like to have, he responds that he would be interested in getting more background information on flora and fauna or natural phenomena that can be seen or experienced at the location.

Technology use At the interview, the woman gave a demonstration of the speech interface to her telephone (a Nokia N82, with speech software installed). The program lists all items in the menu sequentially. It has settings for speed (slow, normal and fast) and volume. She always uses the fast speech setting (normal setting feels to slow – since she already knows the menus). Speech is a very effective interface, she also reads braille but the problem with that is the amount of space it takes. A problem she has experienced with PDAs is that the touch screens are very hard or impossible to use so she prefers devices with physical buttons. Her Internet usage mainly consists of MSN, email and ‘just Internet’; although she has an account on Hyves, she does not actively use it.

The man has no social networking accounts. Occasionally uses his phone (a Nokia 6300) to look up information, and sometimes uses it to send a photo. He finds the possibility to get information more important than to share information with others.

He would be interested in using a device for determining location (finding out where he is) and getting ‘links’ to the things that interest him. He would not be hindered by a sound-based application.

3.3 Observation results geocaching.nl

Geocaching.nl is a Dutch community website that aims to promote and support Geocaching.

One of the features on geocaching.nl is a country map with two zoom levels, on which the locations of the caches are shown. Each location is represented as a dot; the colour of the dot signals the cache type. There is a standard notation (with symbols) for practical information such as length, difficulty and terrain. Often, some background information on the area is given. On the Dutch website, most information is available in Dutch, although sometimes there is a translation in other languages as well (English, German).

People can give their reactions on the cache page. Elements that occur frequently in these reactions are: weather info ('it was a cold day today'), comments on completion ('we found the cache'), company (friends, dogs, other teams), changes to the contents of the cache ('IN: coin; OUT: tb'), warnings (mosquitoes, mud, staying on the tracks), photos (of the environment and animal sightings).

Users have their own profile. They often use nicknames. Next to the user name, the number of found caches is listed.

Topics discussed on the Geocaching forum include discussions about hardware and software, practical tips, a thread on 'what animal is this?' with photos, and discussions regarding the Geocaching community and cache maintenance.

3.4 Observation results Flickr

Flickr is currently the biggest photo sharing community on the web. It allows users to upload their pictures privately or publicly and view, rate, comment and tag those of others. If a public picture is geotagged, e.g. it contains the coordinates where it was taken in its EXIF-metadata tag, or its location is manually set by the user, the picture appears on the public map, as can be seen in Figure 3.5.

In total, there were slightly less than 55,000 pictures geotagged as being taken in Overijssel on Flickr at the time of observation. It should be noted that this number refers to all of the pictures taken, many of which have nothing to do with the landscape or nature of Overijssel.

Both the photographer and other users can add tags to photos. There seems to be a big variance in the amount of tags added to photos, but most of the photos of natural scenes mentioned things like the location where the photo was taken (even when the photo was also geotagged) and what was shown in the photo.

Users can also add general comments, shown below the photo, and notes, shown as rectangles on the picture. In a sample of the more recent pictures, some pictures had many comments, while others had none. An interesting thing to note, is that Flickr does not have a rating system, although users can "favourite" a picture. It does allow users to create "pools" of other people's photos, which

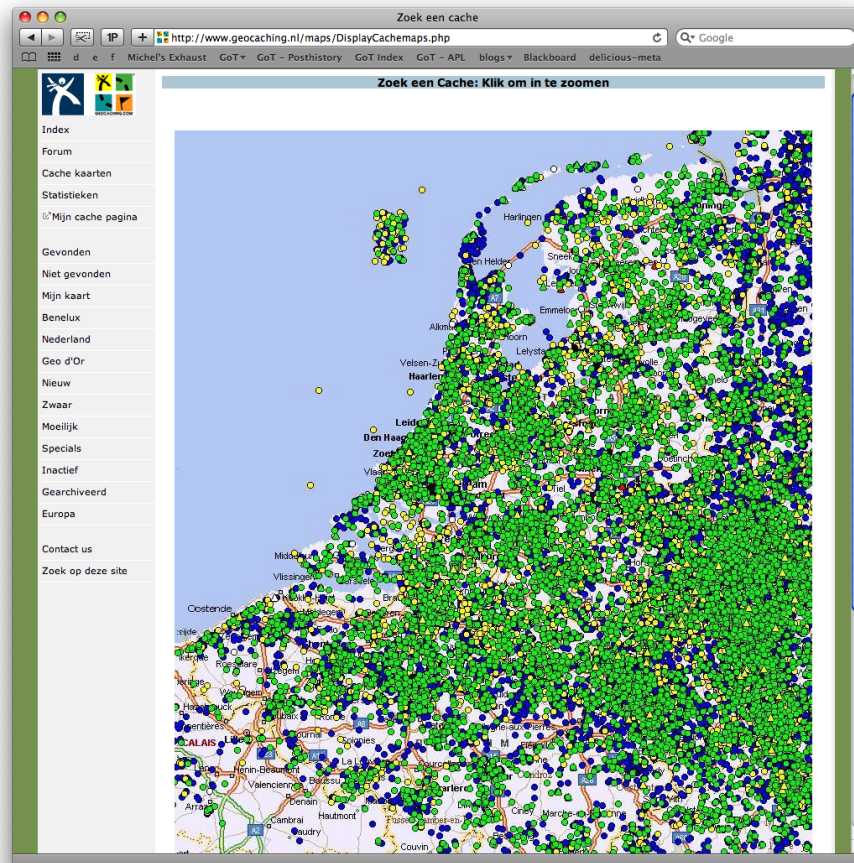


Figure 3.4: Geocaching.nl map

has lead to users creating “award pools” and then nominating pictures for those awards.

3.5 Observation results Panoramio

Like Flickr, Panoramio is a photo sharing website. However, it is aimed solely at sharing geotagged photos. It was recently acquired by Google and integrated with their Google Maps application, which makes it very suitable for exploring pictures taken at a certain location.

Google Maps does not allow one to easily see how many pictures there are around a given location, but judging from looking at different natural areas in Overijssel, users are using Panoramio for sharing pictures about those sites.

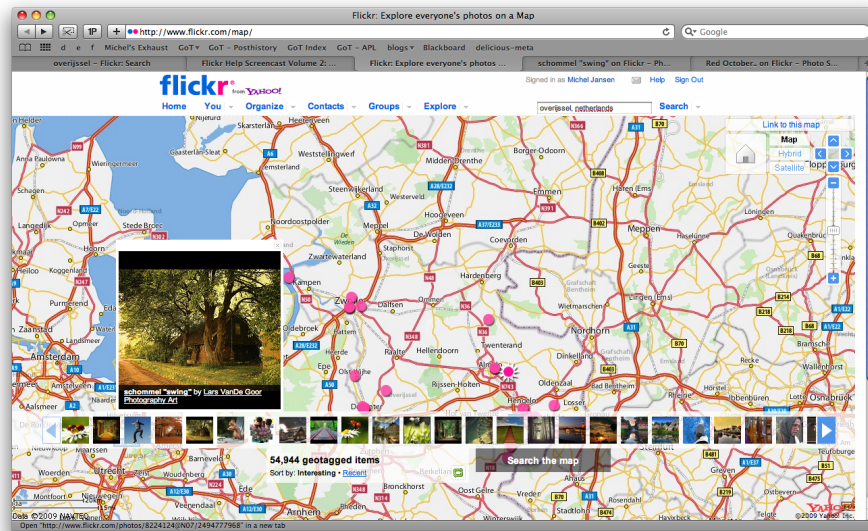


Figure 3.5: Flickr map

There are significantly less pictures on Panoramio than there are on Flickr, but the focus does seem to be more towards nature and landscape photography.

Panoramio also allows users to tag and comment pictures, as can be seen in Figure 3.7. The features are simpler than those of Flickr, but they are used in a similar way.

3.6 Discussion and conclusions

Looking at the combined results from interviews and the observations of existing sharing behaviour on three different websites, a number of things can be noted.

First of all, some things can be said about the group of users that already visits natural areas and their current motivations and activities. Most people seem to enjoy natural areas either on foot or by bicycle. Many people who were walking, running or hiking were observed to go by car from their homes to a natural area and then continue on foot. It should be noted that none of the participants were cycling at the time they were interviewed, so information or needs of that group of users might be missing. People seem to often conduct their activities in the company of others. Only a few participants were out on their own and the rest of them were with a partner or family. They most often mentioned relaxation (or leisure) and exercise (or sports/fitness) as their motives for visiting natural areas, but less often mentioned reasons might be important as well. Some of the activities witnessed, such as taking guided excursions, practicing Geocaching and doing volunteer work hint towards those

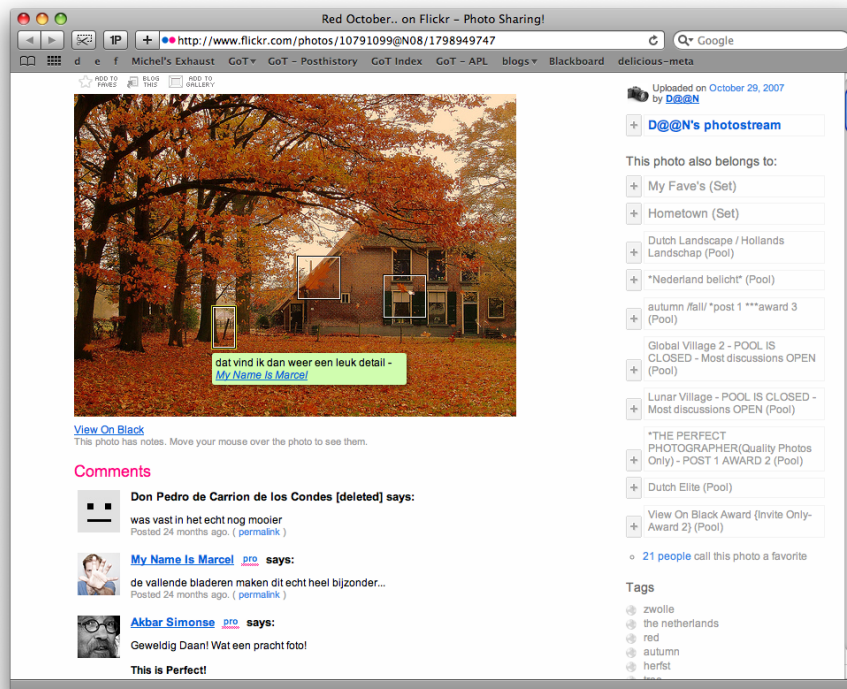


Figure 3.6: Details of a single photo, with its comments, notes, tags etc. on Flickr

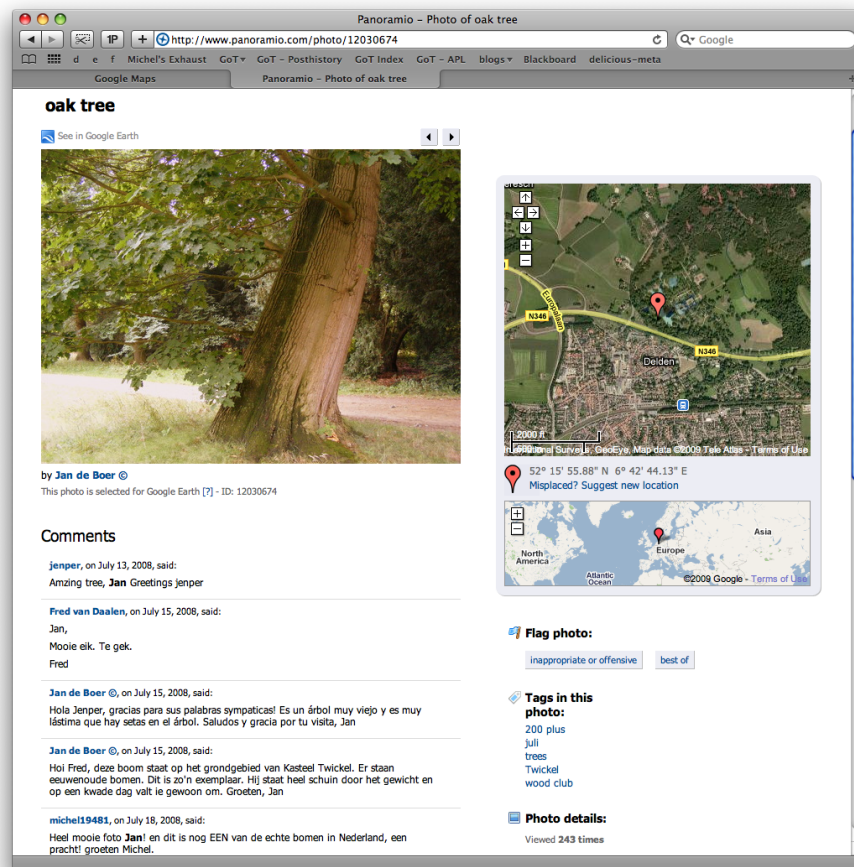


Figure 3.7: Details of a single photo, with its comments, tags etc. on Panoramio

motivations, for instance curiosity, entertainment etc.

Secondly, the results give insight to the information needs of potential users and the way they deal with information at present. There were some exceptions, such as the participant that was Geocaching, but most people visited the natural areas of Landschap Overijssel on a very ad-hoc basis; they did not plan ahead or look up information to take with them. They usually get their information from signs on the spot. Information about routes and the history or background of certain places are considered most useful. Practical information about the weather, restaurants in the neighbourhood etc. was usually not present, but was mentioned as being desirable. It should be noted, however, that a significant number of participants remarked that they were either perfectly content with the information they can presently get, or simply wished to be left alone. This is in line with the often mentioned motivations of relaxing and getting exercise. People “escaping into nature” can thus be expected to have a negative attitude towards a technological solution such as the one under development. The fact that many of the people interviewed had left their phone at home and most of them did not own a smart phone illustrates this.

There was a large difference between the interviewed visually impaired users in the nature of their impairment. Their impairments influenced their experiences of visiting nature and their ability to find information while in nature. Both of the interviewed users would in principle be interested in using an application for navigation and finding interesting information. When designing for this target group, we have to keep in mind that it is not a homogeneous group, and different people may have different user needs, possibly related to different impairments.

Finally, information was gathered about social network usage and sharing behaviour. Among the interview participants, social network usage was not very pervasive. Of the relevant social networks, Hyves and Facebook were most often used, mostly by younger people. The networks that were observed during this part of the research, Flickr, geocaching.nl and Panoramio were not often enough mentioned to provide any first hand information. From looking at those websites, it can be concluded that there are people who share pictures and factual information, as well as their comments and opinions with other people part of the same community. They also contribute to the archival and maintenance of data by tagging or modifying it.

Chapter 4

Requirements

With the knowledge gathered from the task analysis of Chapter 2 and the user requirement study described in Chapter sec:user-requirements-study, the full set of requirements for the system can be defined. This chapter starts with design decisions based on the results from the previous chapters and ends with the functional, non-functional and system requirements as they were compiled.

4.1 Design decisions

Based on the task analysis (Section 2.5), the results of the user requirements study (Section 3) and the various brainstorm and discussions, a number of decisions were taken with regard to the direction and nature of the design. While most of them have already been included in the requirements, these design decisions are summarised in this section.

Primary focus on discovery, exploration and experience during visit

Because the user requirements study showed that most people visit natural areas on a very ad-hoc basis, without planning ahead or looking up information in advance, it was decided that the focus of the project should be on the experience *during the visit* to a natural area, which is point 1.2 of the Hierarchical Task Analysis (Section 2.5), and not so much on any activities beforehand or afterwards. In other words, the device supports discovery of new things in the environment.

The brainstorm sessions on potential user activities, yielded a number of technology-supportable candidates, which are summarised in Figure B.3. Looking at the results of the user requirements study, there seems to be little demand for a device that assists in navigation, planning or information retrieval. The most promising focus seems to be that of exploring, discovering or experiencing the environment. This is in line with the project goal as defined by the client in Section 1.1. A strong desire to share information was not found among current visitors of Landschap Overijssel, but this functionality will still be included since

it is important to the client and is believed to be easy to combine with the rest of the envisioned functionality.

In summary, the system should *help people discover interesting things while visiting natural areas of Landschap Overijssel and share them with others.*

The system takes initiative Considering the device’s primary goal of supporting discovery of new things in the environment, it cannot be expected of the user to continuously monitor or poll a device. Respecting the user’s peace while enjoying the landscape, the system should remain in the background until it is needed, but this also means it should take initiative when there is something interesting that justifies the user’s attention.

Focus on what is around current location Given the focus of the system on the ‘here and now’, it is the information that is closest to the user’s current location that is most important. When a user is visiting a certain natural area, it is more likely that he will be interested in information about that particular area than any other place. Such functionality would be useful for planning or navigation, but as mentioned earlier, these activities are considered outside the scope of this system.

Following from this decision, the system will show what Points Of Interest (POI) are nearby on a map, in a list or some other sort of visual or audio representation.

Unobtrusive sharing functionality As mentioned earlier, it could not be concluded from the user requirements interviews that current visitors of Landschap Overijssel are generally interested in sharing information with others. It is still interesting to include this possibility, but it should not interfere with the system’s primary functionality of exploring the landscape. The ‘social’ aspect of the application is regarded as a bonus for users that find such functionality desirable, but is not mandatory for the proper functioning of the system.

Related to this decision, and requirement 2.1 stating the system should already come with a good deal of information ‘prepackaged’, it was decided that all the content in the system will be regarded as user generated content. There will simply be a user called “Landschap Overijssel” that shares the information that is already available at the information centres, the hiking trails around etc. Users will be able to rate, comment, categorise and tag that content just as they would with content from any other user.

Tagging For the content in the system to be findable without knowing the name, tagging should be enabled. Tagging makes users create keywords about the content, so the content can be found using these keywords in a search function. Making tag suggestions will make the user tag more and better (Ames & Naamen, 2007).

Web Application It is thought that the mobile application will be accompanied by a web application. Through this website, the users will be able to plan their trips in detail and search for information. The website will be connected to the mobile application, so the plans made prior to the trip (e.g. walking trails) will be visible on the mobile application. Similarly, when the users return from the trip they will be able to see and edit their gathered material on this website. Having an extra website which deals with the planning part of an outing, allows for the possibility to design the mobile application solely for the “here-and-now” experience.

The design of this web application will however not be included in this project. The only reason for this decision is the time constraint put on the project.

Application name change Since, as previously stated, the primary goal of this system is to discover things in the area Overijssel, it has been decided to change the name of the application from “OnSpot” to “Discoverijssel”. It was found that this name fits the system better, since it stimulates the potential user to ponder about this name and purpose and become curious about the system.

User generated Content The decision has been taken that one of the features of the application shall be the ability to produce content and make it public to other users(if desired). This feature is thought to stimulate users to generate content about the area they visited, for other users to see and enjoy. According to Bruns (Bruns, 2007) “producers engage not in a traditional form of content production, but are instead in produsage - the collaborative and continuous building and extending of existing content in pursuit of further improvement”.

Power users To introduce some extra advantages for advanced users, e.g. user who own a smartphone, it has been decided that power user functionality should be part of the system. One of the functionality intended for advanced users is the implementation of the lens metaphor. Applying this lens, the user will be able to add new sets of information onto his or her map view which will increase the experience with the system.

Social networking Social networking has undeniably become part of our lives therefore it was thought that giving the opportunity for exchanging experiences would make the application more attractive to the potential future users. Even though the application will not support instant messaging, the users will be able to join groups and add friends with whom they will be able to share content and give recommendations about locations. “Social interaction environments play an important role in the interaction and task experiences in these opportunities by coupling critical social relations with communication and information technologies” (Girgensohn & Lee, 2002).

Privacy and Trust Several decisions have been taken to assure that users will be able to trust the system. First of all it has been decided that the user should be allowed to decide the privacy settings for the self generated content. This means that every time the user takes the decision to add content to the map view (e.g. pictures), the user will be asked to decide if this specific content shall be displayed to everyones map, only the maps of friends or if the content shall be kept private on the user's own map. This is confirmed by Nippert-Eng who writes that "in order to afford privacy to individuals who share a world view rooted in the model of controlled accessibility, an object, environment, service, system or feature should provide users with the ability to selectively and easily make some things available to some people at some times but not to other people at other times"(Nippert-Eng, 2007).

Another major decision is that the application can be used with and without a created account. This means that when a user creates an account he or she will be able to have a profile page, and among other features will be able to add groups and add friends. It is thought that being able to set privacy settings in your profile will increase the trust users will have into the system. Using the system without creating an account, means that the user will remain anonymous. He or she will not have a profile page and other users will not be able to add this user. There might be users who take comfort in the knowledge that everything will stay anonymous.

Target Group After careful consideration it has been decided that the target group for this application will be between the age 10 and older. It is recognised that this is a fairly wide target group, however, technology is advancing fast and it is very likely that even teenagers will possess a smartphone in the near future. Also, the possibility that older people (55 and older) will more frequently use a smartphone. Therefore, it was decided to not set an exact age range for the target group and be quite open towards all ages.

4.2 Requirements

The following section outlines all Functional and Non-Functional requirements, which were found during brainstorming sessions and the user study, and requirements which were given by the client of this project.

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4.2.1 Functional requirements

Enriching the experience of visiting nature.

The aim of the system is to make a visit to nature more enjoyable and enrich the experience by means of pointing users of the system to things that are of interest to them.

Requirement 1.1

The system should give notifications about relevant (recommended) points-of-interests

Rationale	The system takes initiative to point the user to relevant points-of-interest so the user does not have to continuously poll or pay attention to the device and can just put it in his/her pocket.
Originator	Brainstorm
Fit criterion	The device emits a signal near a certain point-of-interest
Priority	Medium

Requirement 1.2

The system should show possible points-of-interest as icons on a map

Rationale	Conventional way of showing where to find something interesting will be easy to use for first-time users.
Originator	Brainstorm
Fit criterion	
Priority	High

Requirement 1.3

The system should show the user's geographical location

Rationale	User can find out where he is.
Originator	Brainstorm, User study
Fit criterion	The systems shows the location of the user as a dot on the map
Priority	High

Requirement 1.4

The system should allow users to switch between map views (radar view, north up, fish eye view, list view)

Rationale Multiple views allow for flexible use of the system with different tasks.

Originator Brainstorm

Priority Medium

Requirement 1.5

The system should be able to give recommendations to the user

Rationale Will present those items to the user that are most interesting. Enhances user experience.

Originator Brainstorm

Fit criterion Some point-of-interests are marked as recommendations

Priority Low

Information**Requirement 2.1**

The system should contain some basic information package about Overijssel (starter package, user doesn't need to plan a trip)

Rationale When acquiring the system, the user should be able to have access to content about Overijssel from Land-schap Overijssel

Originator Brainstorm

Fit criterion Historical, demographical and at least 15 points-of-interest about Overijssel are in the package

Priority Medium

Requirement 2.2

The system should be able to give practical information about the area (restaurants etc.)

Rationale This is what users search for when planning

Originator User study

Fit criterion Points-of-interest of these locations are shown on the map

Priority Medium

Requirement 2.3

The system should allow the user to view an agenda of upcoming events

Rationale	Users can schedule their trip when there is an interesting event (or plan a return visit at a time when there is an event).
Originator	Brainstorm, User study
Fit criterion	The upcoming events for the next week are shown on the map.
Priority	Low

Requirement 2.4

The system should show the nearest bus stops

Rationale	Users will be able to go home after their visit.
Originator	Brainstorm
Fit criterion	Near bus stops are shown as a point-of-interest on the map
Priority	Medium

Requirement 2.5

The system should show timetables

Rationale	Users will be able to go home after their visit.
Originator	Brainstorm
Fit criterion	Information about the timetables is included with the information of the point-of-interest of the bus stops
Priority	Low

Requirement 2.6

The system should contain information about walking trails and cycling routes that already exist in the area (indicated with signs, ANWB routes, etc.)

Rationale	Users want to walk without looking for signs (especially without the fear for having missed a sign along the route)
Originator	User study
Fit criterion	All the signed routes on Landschap Overijssel are in the system
Priority	Medium

Saving content.

Requirement 3.1

The system should be able to remember hiked or biked trails

Rationale If users want to review where they have been, or share that information with others, there has to be some kind of recording functionality for routes.

Originator Brainstorm

Fit criterion The systems saves the location every 10 meters

Priority High

Requirement 3.2

The system should allow the user to save the current location (point-of-interest)

Rationale Allows them to find a specific location again on a return visit or share it with others.

Originator Brainstorm

Fit criterion The user can retrieve the saved content again

Priority High

Requirement 3.3

The system should allow users to save arbitrary locations (point-of-interests)

Rationale Allows them to find a specific location again on a return visit or share it with others.

Originator Brainstorm

Fit criterion The user can retrieve the saved content again

Priority Medium

Requirement 3.4

The system should enable the user to save trails, pictures, short videos, audio, text, location bookmarks (point of interest)

Rationale Content that is collected can be retrieved later.

Originator Client, Brainstorm and User study.

Fit criterion The user can retrieve the saved content again

Notes Added to account for the case that a user wants to save content without sharing.

Priority High

Requirement 3.5

The system should let the user record/create content without leaving the application.

Rationale	The user does not have to leave the application to take for example a picture.
Originator	Brainstorm
Fit criterion	The user can take a picture from within the application
Priority	High

Sharing content.

Requirement 4.1

The system should enable the user to share trails, pictures, short videos, audio, text, location bookmarks (point of interest)

Rationale	Content that is collected by someone can be interesting to someone else.
Originator	Client, Brainstorm and User study.
Fit criterion	Another user can retrieve the shared content
Priority	High

Requirement 4.2

The system should allow users to view content that other users have shared

Rationale	Content that is collected by someone can be interesting to someone else
Originator	Client
Fit criterion	The user can view content that was shared by others
Priority	High

Requirement 4.3

The system should allow users to respond to other people's content

Rationale	Will socially reward users for sharing interesting content
Originator	Brainstorm
Fit criterion	Users can add a comment to content
Priority	Medium

Requirement 4.4**The system should allow users to give a rating to content**

Rationale Will socially reward users for sharing interesting content
Originator Brainstorm
Fit criterion Users can add a number between 1 and 10
Priority High

Requirement 4.5**The system should allow users to tag content**

Rationale Tagging makes content easier to find.
Originator Brainstorm
Fit criterion Users can add a word to content
Priority High

Requirement 4.6**The system should allow users to categorise content**

Rationale Categorisation makes content easier to find.
Originator Brainstorm
Fit criterion Content belongs to at least one category
Priority High

Requirement 4.7a**The system should allow users to specify default user access settings**

Rationale This is for protecting privacy, it allows for control over who has access to what.
Originator Brainstorm
Fit criterion When certain users are restricted to viewing certain content items
Priority High
History Dismissed

Requirement 4.7b**The system should allow users to specify user access for specific content items**

Originator Brainstorm
Priority High

Social aspects

Requirement 5.1a

The system should allow users to create their profile

Rationale Sense of ownership and users can identify themselves to other users.

Originator Brainstorm, Client

Fit criterion Users can enter or delete their personal information and add a picture

Priority Medium

Requirement 5.1b

The system should allow users to update their profile

Priority Medium

Requirement 5.1c

The system should allow users to delete their profile

Priority Medium

Requirement 5.2

The system should allow users to view other users profiles.

Rationale Users can be curious about other people.

Originator Brainstorm, Client

Fit criterion A user can access another users profile page, without the rights to edit or delete

Priority Medium

Requirement 5.3a

The system should allow users to create groups

Rationale Groups allow users to find others with similar interest and choose to share content with group members. Also, with this feature the application will support the geocaching society.

Originator Brainstorm, Client

Fit criterion Users can form and join, leave, update and delete groups

Priority Medium

Requirement 5.3b

The system should allow users to join groups

Priority Medium

Requirement 5.3c

The system should allow users to leave groups

Priority Medium

Requirement 5.3d

The system should allow users to delete groups

Priority Medium

Requirement 5.3e

The system should allow users to update group information

Priority Medium

Requirement 5.4

The system should allow users to control who can join a group.

Rationale This is to protect the group.

Originator Brainstorm

Fit criterion Only Administrators of the group can accept users' join requests.

Priority Medium

Requirement 5.5

The system should allow group owners to delegate administrative tasks.

Rationale This is to ensure that the group still exists when the creator of the group deletes his account.

Originator Brainstorm

Fit criterion When more than one user has administrative rights.

Priority Medium

Requirement 5.6

The system should allow users to specify relationships (Friends) between them and others.

Rationale If two people know each other they can create a relationship.

Originator Brainstorm

Fit criterion When the users are in each other's friends list.

Priority Medium

Requirement 5.7**The system should display a user's friends list.****Rationale** A user should be able to easily see who he/she is friends with.**Originator** Brainstorm**Fit criterion** When the user can see his/her friends in a list**Priority** Medium**4.2.2 Non-functional requirements****Look and feel requirements**

Appearance requirements The section contains requirements relating to the spirit of the product. It includes any particular demands for the product, such as corporate branding, colours to be used, and so on. This section captures the requirements for the appearance.

Requirement 6.1**The product shall include the logo of Landschap Overijssel****Rationale** The product's development was initiated by Landschap Overijssel and the product will function in nature areas owned by Landschap Overijssel.**Originator** Client**Fit criterion** The logo of Landschap Overijssel is visible in the application.**Priority** Low**Requirement 6.2****The product shall fit with corporate branding standards of Landschap Overijssel****Rationale** The product's development was initiated by Landschap Overijssel and the product will function in nature areas owned by Landschap Overijssel.**Originator** Client**Fit criterion** The product's appearance will be associated more with Landschap Overijssel than with its main competitors: In a user test, the majority will recognise the corporate branding in a multiple (4) choice question**Priority** Low

Style requirements Requirements that specify the mood, style, or feeling of the product, which influences the way a potential customer will see the product.

Also, the stakeholders' intentions for the amount of interaction the user is to have with the product.

Requirement 7.1

The product shall be associated with current technology (not old-fashioned, but not complex and inaccessible)

Rationale Old-fashioned products are not attractive to use.

Originator Brainstorm

Fit criterion Findings from user evaluation: average score on the HQ-S dimension (hedonic qualities-stimulation) of the AttrakDiff questionnaire is at least 1 (Hassenzahl, Burmester, & Koller, 2003)

Priority Low

Requirement 7.2

The product shall be associated with leisure (not with work)

Rationale Targeted use of the product is during leisure.

Originator Brainstorm

Fit criterion Findings from user evaluation: at least 70% of users associates product with leisure instead of work

Priority Low

Requirement 7.3

The system should provide a good user experience

Rationale User experience plays a large role in technology adoption and user satisfaction.

Originator Client

Fit criterion Findings from user evaluation: average score on SUS of at least 65 (Brooke, 1996)

Priority High

Usability and Humanity Requirements

This section is concerned with requirements that make the product usable and ergonomically acceptable to its hands-on users.

Ease of Use Requirements This section describes the client's aspirations for how easy it is for the intended users of the product to operate it. The product's usability is derived from the abilities of the expected users of the product and the complexity of its functionality.

Requirement 8.1

The system can be used in an ad-hoc manner, without planning in advance

Rationale	Users visit ad-hoc
Originator	User study
Fit criterion	The user can see near points-of-interest when he starts the application without further user input
Priority	Medium

Requirement 8.2

The product shall help the user to avoid making mistakes (such as inadvertently deleting information)

Rationale	Making a lot of mistakes will ruin the user experience.
Originator	brainstorm
Fit criterion	System displays confirmation dialogue when deleting content
Priority	Medium

Requirement 8.3

Sharing function should not be time consuming

Rationale	‘Too time consuming’ was mentioned as a reason for not using sharing functionality.
Originator	Brainstorm, user study
Fit criterion	Sharing content can be done in five steps
Priority	Medium

Requirement 8.4

The system can be used passively (it takes initiative)

Rationale	Put into the pocket let it do the work
Originator	Brainstorm
Fit criterion	Fulfilled when requirement 1.1 is fulfilled
Priority	Medium

Requirement 8.5**The system can be used without having to create an account first**

Rationale	People can try the application without committing themselves and can immediately start using the application.
Originator	Brainstorm
Fit criterion	After installation, the application starts in the ‘Discover screen’
Priority	Medium
Notes	Related to requirement 29.4.

Personalisation and Internationalisation Requirements This section describes the way in which the product can be altered or configured to take into account the user’s personal preferences or choice of language.

Requirement 9.1**The system should allow users to choose what kind of information they want to see (lens metaphor)**

Rationale	Showing all available information at the same time would be cluttered and confusing — what’s relevant is up to the user to decide.
Originator	Brainstorm
Fit criterion	Selecting a different lens shows different information on the map
Priority	High

Requirement 9.2**The look and feel of the system should be able to be personalised**

Rationale	Since different users have different needs
Originator	Brainstorm, Client
Fit criterion	You can select a colour scheme. There are at least 2 different schemes available.
Priority	Medium

Requirement 9.3**The system should allow the user to view, set and change preferences**

Rationale	Different users have different preferences.
Originator	Client
Fit criterion	The preferences can be changed by the user
Priority	High

Requirement 9.4**The product shall use the Dutch language**

Rationale	Many visitors of Landschap Overijssel speak Dutch
Originator	User study, Client
Fit criterion	The product contains Dutch text
Priority	Medium
Notes	For this course the design will be in English

Requirement 9.5**The product shall use Dutch conventions for date notation, decimal symbols and currency**

Rationale	The product will be used in The Netherlands.
Originator	User study, Client
Fit criterion	Date notation is dd-mm-yyyy or another commonly used notation, commas as decimal separators and Euro as currency.
Priority	Medium

Requirement 9.6**The product shall be usable in an English and German version, targeted at non-local visitors**

Rationale	Not all users of the product will be fluent in Dutch.
Originator	User study
Fit criterion	The product can be set to the English or German language
Priority	Low
Notes	For this course the design will be in English

Learning Requirements This section describes the way in which the product can be altered or configured to take into account the user's personal preferences or choice of language.

Requirement 10.1**The product shall be able to be used by members of the public who will receive no training before using it**

Rationale	Users from the general public will use the product voluntarily and for fun.
Originator	Brainstorm
Fit criterion	Findings from user evaluation: 70% of people sampled from general public will be able to complete 70% of the tasks in a user test
Priority	Medium

Requirement 10.2

The product shall enable frequent (expert) users to benefit from their experience with the product

Rationale	Increased efficiency for expert users.
Originator	Brainstorm
Fit criterion	Predicted completion times for the same tasks for experienced users will be shorter than completion times from user study. This can be done with CogTool (John & Suzuki, 2009)
Priority	Low

Understandability and Politeness Requirements This section is concerned with discovering requirements related to concepts and metaphors that are familiar to the intended end users.

Requirement 11.1

The product shall use symbols and words that are understandable by users with little domain knowledge

Rationale	Some users have little knowledge about nature.
Originator	User study
Fit criterion	User evaluation with people with little domain knowledge.
Priority	Medium

Accessibility Requirements The requirements for how easy it should be for people with common disabilities to access the product. These disabilities might be related to physical disability or visual, hearing, cognitive, or other abilities.

Requirement 12.1

The computer-accessible website shall adhere to the Webrichtlijnen

Rationale	Mandatory for governmental organisations.
Originator	Client
Fit criterion	Webrichtlijnen checklist
Priority	High

Requirement 12.2**The product shall be usable by users with a visual disability****Rationale** Target group for Landschap Overijssel.**Originator** Client**Fit criterion** The product can be used without depending on visual information: a blind-folded volunteer is able to complete the majority of tasks in the user study.**Priority** Medium**Requirement 12.3****The product shall be usable by users with an auditory disability****Rationale** Target group for Landschap Overijssel.**Originator** Client**Fit criterion** The product does not rely on and can be used without sound.**Priority** Medium**Requirement 12.4****The product shall be usable by colourblind users****Rationale** Different needs than people with very little or no vision.**Originator** Brainstorm**Fit criterion** Test some screenshots with colour-blind simulator (Vischeck) for Deuteranopia**Priority** Medium**Requirement 12.5****The product shall be usable by users with limited motor skills (dexterity)****Rationale** Small screen devices may be difficult for users with limited hand-function (including age-related decline).**Originator** brainstorm**Fit criterion** During the evaluation of the prototypes it is confirmed that the size of all buttons are optimal for all users.**Priority** Low**Performance Requirements****Speed and Latency Requirements** Specifies the amount of time available to complete specified tasks. These requirements often refer to response times.

They can also refer to the product's ability to operate at a speed suitable for the intended environment.

Requirement 13.1

The product shall update location information fast enough to be useful while cycling

Rationale	Receiving information about a point one has already passed might cause frustration.
Originator	Brainstorm
Fit criterion	Navigation information is given at least 50 m in advance at a speed of 20 km/h.
Priority	Medium

Requirement 13.2

The product shall update location information fast enough to be useful when walking

Rationale	Receiving information about a point one has already passed might cause frustration.
Originator	Brainstorm
Fit criterion	Navigation information is given at least 5 m in advance at a speed of 5 km/h.
Priority	Medium

Requirement 13.3

The product shall give an intermediate partial response in those cases where it would take a long time to wait for the full response

Rationale	Long waits can cause users to think that the product stopped functioning.
Originator	brainstorm
Fit criterion	Product shows a response or status information within 2 seconds after user input. (Example: show <alt>-tag while image loads or indication of 'loading').
Priority	Medium

Requirement 13.4

Notifications should be given at an appropriate time and location taking into account properties of the point-of-interest, preferences of the user, etc.

Rationale	For a good user experience, notifications should be neither too early nor too late.
Originator	Brainstorm
Fit criterion	Notifications should be given 10 to 20 meters before the point-of-interest
Priority	Medium

Safety-Critical Requirements Quantification of the perceived risk of damage to people, property, and environment.

Requirement 14.1

The product shall by default use an audio volume that is considered safe for use in traffic and with regards to hearing loss

Rationale	Loud volume in earplugs can cause hearing problems.
Originator	brainstorm
Fit criterion	Volume no more than 80 dB(Nederlandse Vereniging voor Slechthorenden, 2009)
Priority	Medium

Precision or Accuracy Requirements Quantification of the desired accuracy of the results produced by the product.

Requirement 15.1

The product shall be precise enough to be useful while cycling

Rationale	Receiving information about a point one has already passed might cause frustration.
Originator	Brainstorm
Fit criterion	Current position on map should be no more than 15m off
Priority	Medium
Notes	Equivalent of 13.1

Requirement 15.2

The product shall be precise enough to be useful when walking

Rationale	Receiving information about a point one has already passed might cause frustration.
Originator	Brainstorm
Fit criterion	Current position on map should be no more than 15m off
Priority	Medium
Notes	Equivalent of 13.2

Reliability and Availability Requirements This section quantifies the necessary reliability of the product. The reliability is usually expressed as the allowable time between failures, or the total allowable failure rate.

No specific requirements were identified for Reliability and Availability.

Robustness or Fault-Tolerance Requirements Robustness specifies the ability of the product to continue to function under abnormal circumstances.

Requirement 16.1

The product will continue to function (with limited functionality) when there is no GPS signal available

Rationale	Sometimes the product will not be able to get GPS information.
Originator	brainstorm
Fit criterion	The product does not stop functioning completely when it does not receive a GPS signal.
Priority	Medium

Requirement 16.2

The product will continue to function (with limited functionality) when there is no internet connection available

Rationale	Sometimes the product will not be able to get an internet connection.
Originator	brainstorm
Fit criterion	The product does not stop functioning completely without internet access.
Priority	Medium

Capacity Requirements This section specifies the volumes that the product must be able to deal with and the amount of data stored by the product.

Requirement 17.1

When the system load is within predictable and expected limits, the product will be available for use most of the time

Rationale	Uptime is not critical, but too much downtime will cost users.
Originator	brainstorm
Fit criterion	Product capacity is expected to be sufficient for busy days such as Easter and Pentecost with beautiful weather.
Priority	Medium

Scalability or Extensibility Requirements This specifies the expected increases in size that the product must be able to handle. As a business grows (or is expected to grow), our software products must increase their capacities to cope with the new volumes.

Requirement 18.1

The product can be extended for use in other areas

Rationale	Users might wish to use the product in areas not owned by Landschap Overijssel as well. Landschap Overijssel may acquire new landscape areas.
Originator	brainstorm
Fit criterion	New areas can be added to the system.
Priority	Low

Requirement 18.2

Information can be added to the product at a later stage

Rationale	Adding additional information after the product is released enables to benefit from feedback and experience.
Originator	brainstorm
Fit criterion	Information can be added to the product without having to take the system offline.
Priority	Medium

Requirement 18.3**A developers API should be available for external developers**

Rationale	External developers can extend the current functionality of the product
Originator	Brainstorm
Fit criterion	After this course project, access can be given to developers who are interested in further developing the application.
Priority	Low

Requirement 18.4**The product shall be able to show content from other providers, such as Flickr and Panoramio**

Rationale	Adding additional information after the product is released enables to benefit from feedback and experience.
Originator	Brainstorm
Fit criterion	The user will be able to see content that has been shared by users of other providers.
Priority	Medium

Requirement 18.5**The product shall be able to share content generated in the application with other content providers.**

Rationale	Being able to share your content with users, being registered in other content providers will enhance the experience of the application.
Originator	Brainstorm
Fit criterion	When user has succeeded in sharing content with other content providers such as flickr or Panoramio
Priority	Medium

Longevity Requirements This specifies the expected lifetime of the product.

Requirement 19.1

The product shall require only minor updates during the first years of use

Rationale A major upgrade soon after release would cost too much resources (both time and money).

Originator brainstorm

Fit criterion Known major issues and bugs are solved before the official release.

Priority Low

Operational and Environmental Requirements

Expected Physical Environment This section specifies the physical environment in which the product will operate.

Requirement 21.1

The product shall be usable during a cycling tour

Rationale Cycling is a popular way to enjoy nature.

Originator User study

Fit criterion The major part of functionality of the application can be used while biking.

Priority Medium

Notes Relative to 13.1 and equiv.

Requirement 21.2

The product shall be usable while hiking

Rationale Hiking is a popular way to enjoy nature.

Originator User study

Fit criterion All features of the application can be used while hiking.

Priority Medium

Notes Relative to 13.2 and equiv.

Requirement 21.3

The product shall be usable in dim light

Rationale Lighting conditions in a forest, cloudy weather conditions, use at dawn/dust/night.

Originator Brainstorm

Fit criterion Product use does not depend on bright light.

Priority Medium

Requirement 21.4

The product shall be usable in bright sunlight

Rationale	Product will be used outside, sun may shine.
Originator	Brainstorm
Fit criterion	Product use works independent of sunlight.
Priority	Medium

Requirement 21.5

At default settings, the product shall not be louder than the volume of people having a conversation during the activity

Rationale	Loud volume may disturb nature (animals) and other visitors.
Originator	Brainstorm
Fit criterion	When the application gets started, the volume is not louder than 80dB.
Priority	Medium

Intended use Where the section above related to the physical environment in which the product will be used, this section considers the expected and intended task environment and use context.

Requirement 22.1

The system can be used for geocaching

Rationale	Target group for system since geocachers are already used to taking GPS-enabled devices into nature.
Originator	Brainstorm, User study
Fit criterion	The users can view their GPS coordinates
Priority	Low

Requirement 22.2

The system should be able to let the user follow walking trails and cycling routes that already exist in the area (indicated with signs, ANWB routes, etc.)

Rationale	Users want to walk without looking for signs (especially without the fear for having missed a sign along the route)
Originator	User study
Fit criterion	Existing trails are included in the map
Priority	Medium

Requirement 22.3

The system should support the discovery of new things in nature

Rationale Attractive for users who want to discover

Originator User study

Fit criterion The response from the prototype evaluation indicates that users can learn from the application.

Priority High

Requirements for Interfacing with Adjacent Systems This section describes the requirements to interface with partner applications and/or devices that the product needs to successfully operate.

Requirement 23.1

A web interface to the product shall work on the browsers that are most popular among the intended audience.

Rationale Web interface will be used from home computers with different browsers.

Originator Brainstorm

Fit criterion Web interface works in Internet Explorer, Firefox and Safari.

Priority Medium

Productisation Requirements Any requirements that are necessary to make the product into a distributable or sellable item. It is also appropriate to describe here the operations needed to install a software product successfully.

No specific requirements were identified for Productisation.

Release Requirements Specification of the intended release cycle for the product and the form that the release shall take.

Requirement 25.1

The product prototype shall be delivered according to the course schedule for I&ID

Rationale Design project is part of the I&ID course.

Originator Project briefing

Fit criterion Deliverables finished according to course schedule.

Priority High

Maintainability and Support Requirements

Maintenance Requirements A quantification of the time necessary to make specified changes to the product.

Requirement 26.1

The product must be able to be maintained by its end users or by developers who are not the original developers

Rationale	After development, the original developers may not remain available. If maintenance is done by the users, it saves costs.
Originator	Brainstorm, Client
Fit criterion	Little need for professional maintenance expected, documented software design.
Priority	Low

Supportability Requirements This specifies the level of support that the product requires. Support is often provided via a help desk. If people will provide support for the product, that service is considered part of the product.

Requirement 27.1

The product will facilitate users to support each other

Rationale	If users can help each other, many issues can be solved without professional support.
Originator	Brainstorm
Fit criterion	Users can ask each other for help about the product and can share tips and advice.
Priority	Low

Adaptability Requirements Description of other platforms or environments to which the product must be ported.

Requirement 28.1

The product will have to function on future versions of mobile devices when the devices it was originally designed to become obsolete.

Rationale	There will be newer devices in the future.
Originator	Brainstorm
Fit criterion	Little dependence on the specific technical features of the current devices.
Priority	Low

Security Requirements

Access Requirements Specification of who has authorised access to the product (both functionality and data), under what circumstances that access is granted, and to which parts of the product access is allowed.

Requirement 29.1

Only developers with authorised access will be able to make changes to the core functions of the product

Rationale Protect against hackers and abuse.

Originator Brainstorm

Priority Low

Requirement 29.2

Only users with special permissions can view and edit other user's protected data

Rationale Protect user data (privacy), but allow for dealing with abuse and spam.

Originator Brainstorm

Fit criterion Normal users cannot change each other's data. Users with special permissions can delete spam and illegal content.

Priority Low

Requirement 29.4

Most functions of the application can be used anonymously, without needing to create a user profile

Rationale Users will not have to share any information about themselves if they do not want to.

Originator Brainstorm

Fit criterion Users can view content without a user profile; only for sharing their own content, joining groups and connecting to friends a profile is needed.

Priority Medium

Notes Related to requirement 8.5.

Integrity Requirements Specification of the required integrity of databases and other files, and of the product itself.

Requirement 29.3

The product shall protect itself from intentional abuse

Rationale Abuse (such as spam and vandalism) can occur in applications with user-generated content.

Originator Back-up mechanism to restore legitimate data, mechanism to deal with unwanted behaviour.

Priority Low

Privacy Requirements Specification of what the product has to do to ensure the privacy of individuals about whom it stores information. The product must also ensure that all laws related to privacy of an individual's data are observed.

Requirement 30.1

The system should allow users to choose what to share and what not to share (privacy).

Rationale Users may not feel comfortable with sharing all content with everybody.

Originator Brainstorm

Fit criterion User has an option to choose privacy settings.

Priority High

Requirement 30.2

The product shall make its users aware of its information practices before collecting data from them

Rationale Mandatory by law.

Originator College Bescherming Persoonsgegevens.

Fit criterion Product asks for user's permission before storing data.

Priority Low

Requirement 30.3

The product shall notify users of changes to its information policy.

Rationale This is for security reasons.

Originator Brainstorm

Fit criterion Product asks for renewed permission in case of changes in information policy.

Priority Low

Requirement 30.4

The product shall protect private information in accordance with the relevant privacy laws and the organisation's information policy.

Rationale This is to give the user the opportunity to protect content that is intended to be private.

Originator Brainstorm

Fit criterion Private information contained in the product is not available to other (commercial) parties without the user's permission.

Priority Low

Audit Requirements Specification of what the product has to do (usually retain records) to permit the required audit checks.

No specific requirements were identified for Audit checks.

Immunity Requirements The requirements for what the product has to do to protect itself from infection by unauthorised or undesirable software programs, such as viruses, worms, and Trojan horses, among others.

Requirement 32.1

The product shall have an adequate level of protection against infection by unauthorised or undesirable software programs, such as viruses, worms, and Trojan horses, among others.

Rationale Product uptime is not critical, but viruses etc. can cause serious problems.

Originator Brainstorm

Fit criterion When the application is protected against undesired software programs.

Priority Low

Cultural and Political Requirements

Cultural Requirements This section contains requirements that are specific to the sociological factors that affect the acceptability of the product. If you are developing a product for foreign markets, then these requirements are particularly relevant.

Requirement 33.1

The product shall not be offensive to religious or ethnic groups

Rationale Possible users could be offended, bad publicity for Landschap Overijssel.

Originator Brainstorm

Fit criterion Code of conduct / user rules specify that offensive content is not permitted.

Priority Low

Political Requirements This section contains requirements that are specific to the political factors that affect the acceptability of the product.

Requirement 34.1**The system should use Web 2.0**

Rationale Other Web 2.0 applications seem to be successful.
Originator Client
Fit criterion The user is able to share content.
Priority Medium
Notes Listed here because Web 2.0 is a too vague concept to be listed as a technical system requirement.

Legal Requirements

A statement specifying the legal requirements for this system.

Requirement 35.1**The product shall not knowingly violate any patents**

Rationale Legal requirement.
Originator Brainstorm
Fit criterion This has been checked by a lawyer.
Priority Low

Requirement 35.2**The product shall abide by Dutch law**

Rationale Product will be deployed in The Netherlands.
Originator Brainstorm
Fit criterion This has been checked by a (dutch) lawyer.
Priority Low

Requirement 35.3**The product shall be in accordance with privacy laws and regulations.**

Rationale Product will store user information.
Originator Brainstorm
Fit criterion This has been checked by a lawyer.
Priority Low

Requirement 35.4**The product shall be in accordance with copyright laws**

Rationale Product will contain user-generated copyrighted content.
Originator Brainstorm
Fit criterion This has been checked by a lawyer.
Priority Low

4.2.3 System requirements

A number of requirements regarding the implementation of the system were specified by the client. According to the project briefing, the system should run on a mobile device, and also have an alternative, computer-accessible website. Furthermore, the client specified that the system should use internet, GPS and ‘bocodes’. Other requirements to the system and its platform follow from user requirements implying certain system capabilities.

Requirement 36.1

The system should have an internet connection

Rationale	Reduces the memory requirements for the application on the device itself because content can be stored on a server.
Originator	Client
Fit criterion	All content from the application is stored on a server.
Priority	Low

Requirement 36.2

The system should have GPS

Rationale	For location-awareness.
Originator	Client
Fit criterion	The user is able to see at any time where he is and where he can go.
Priority	High

Requirement 36.3

The system should run on a wearable device

Rationale	Small, mobile device with enough computational power to run the application.
Originator	Client
Fit criterion	Application can be run on an Iphone.
Priority	High

Requirement 36.4

The system should make use of “Bocodes”

Rationale	It is a new type of barcodes technology and will most likely be used extensively in the future since it can contain a lot of information.
Originator	Client
Priority	Low
Notes	System/device req. / Motivate client req.
History	Dismissed

Requirement 36.5

The system should have an alternative computer-accessible application or website

Rationale	A computer with a larger screen size than a mobile device and input devices (keyboard, mouse, etc.) is more suitable for certain tasks than the mobile device.
Originator	Brainstorm, User study
Fit criterion	The user can log in on the website and can work with the content generated on the mobile application.
Priority	Medium

Mobile device requirements Requirements related to the mobile platform.

Requirement 37.1

The device has a touch screen

Rationale	Touch screen devices generally have a bigger screen and have shown to be very suitable for displaying and interacting with maps. Also, they are most likely to become the most purchased type of mobile phone in the future.
Originator	Client
Fit criterion	All tasks can be achieved by touching the display
Priority	High

Requirement 37.2

The device has an orientation sensor (compass)

Rationale	For an envisioned ‘augmented reality’ view, the system needs to be able to determine its orientation.
Fit criterion	The device knows how it is being held and which way it is pointing
Priority	Medium

Requirement 37.3

The device has a (photo and video-) camera

Rationale	This follows from requirement 4.1. If the user is to share pictures and video, the device should allow them to capture those.
Priority	Medium

Requirement 37.4**The device has a microphone**

Rationale This follows from requirement 4.1. If the user is to share audio, the device should be able to record it.

Priority Medium

Requirement 37.5**The device has a speaker**

Rationale This follows from requirement 1.1. The system should be able to produce an audible signal.

Priority Medium

Requirement 37.6**The device has a vibration motor**

Rationale This follows from requirements 1.1 and 12.3. The system should be able to produce a haptic signal.

Priority Medium

Web service requirements Because system should also be accessible from a computer at home or elsewhere, where the limitations of a mobile device do not hold, a separate web service is also part of the design. These requirements specify what is needed to be able to provide such a service.

Requirement 38.1**The service runs on a publicly accessible web server****Rationale**

Those requirements that were contained in earlier versions of the specification but were deleted at a later stage, are listed in appendix G.

Chapter 5

Platform

Up until now, the device that the mobile application will run on has been kept undefined. Although there are many options, the design process benefits from choosing a single platform to place the initial focus on. We chose to start designing for the iPhone. In this chapter, the motivations for that choice are outlined and the consequences explored.

5.1 Mobile platform choice

Having defined the system requirements in Section 4.2.3, it became apparent that most of them are already satisfied by many current device platforms. To summarise, the device:

- should have an Internet connection (Requirement 36.1)
- should have GPS (Requirement 36.2)
- should have a touch screen (Requirement 37.1)
- should have an orientation sensor (compass) (Requirement 37.2)
- should have a (photo and video-) camera (Requirement 37.3)
- should have a microphone (Requirement 37.4)
- should have a speaker (Requirement 37.5)
- should have a vibration motor (Requirement 37.6)

According to a report by Gartner, published by ZDNet UK (Meyer, 2009), the top three of mobile platforms worldwide is made up by Symbian, followed at a distance by the Blackberry and the iPhone (Figure 5.1). Because the Blackberry platform is aimed primarily at business users, which is in conflict with Requirement 7.2, and because it is not very ubiquitous among Dutch users, as apparent from recent usage statistics (Figure 5.2) (StatCounter, 2010), it was

considered to be less suitable. Android, being a relatively new but promising platform, was included instead.

Comparing three top-end devices of each of the three platforms in Table 5.1 – the Nokia N97 running Symbian (Nokia, 2009), the HTC Hero running Android (HTC Corporation, 2010) and the Apple iPhone 3GS (Apple inc., 2010b) – shows they all satisfy the system requirements. This means any of them could potentially serve as a platform for the mobile application. Because every platform comes with its own set of conventions (and subsequently user expectations) and we therefore do not believe in a “one size fits all” solution, we have decided to focus on the platform that is the most popular in the Netherlands, which is the Apple iPhone. This does not mean the resulting design can only work on an iPhone, but design decisions have been based on what’s conventional for that specific platform and should the application be ported to a different platform, any differences in conventions and user expectations should be taken into account.

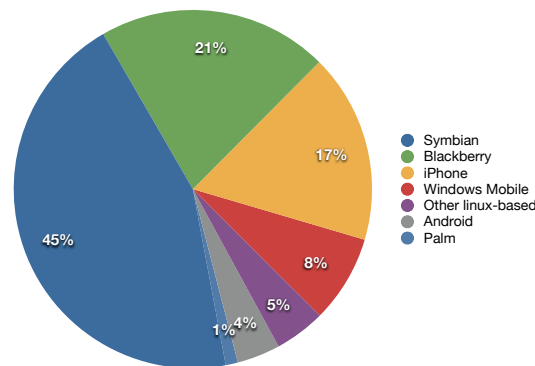


Figure 5.1: Mobile platforms and their market shares in Q3 of 2009. Source: Gartner figures published by ZDNet UK.

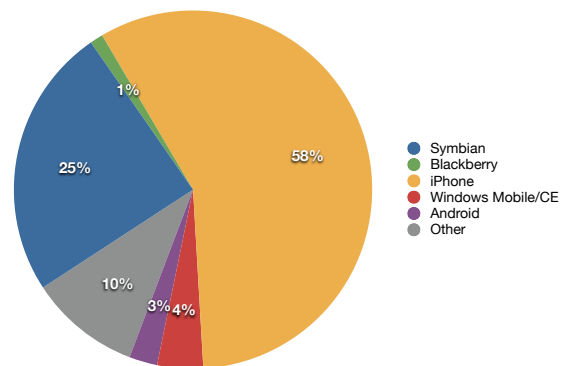


Figure 5.2: Mobile platforms most used to browse Dutch websites between December 2009 and January 2010. Source: StatCounter.

Table 5.1: Platform capabilities



Nokia N97



iPhone 3GS



HTC Hero

Platform	Symbian	iPhone	Android
Internet connection	GSM/EDGE & UMTS/HSDPA	GSM/EDGE & UMTS/HSDPA	GSM/EDGE & UMTS/HSDPA
GPS	Assisted GPS	Assisted GPS	Internal GPS antenna
Touch screen	3.5" 640x360 Touch Screen	3.5" 420x320 Multi-Touch Screen	3.2" 480x320 Touch Screen
Orientation sensor	Compass	Compass	Compass
Camera	5MP with auto-focus and flash; 640x480/30fps video	3MP autofocus; 640x480/30fps video	5MP autofocus; video recording
Microphone	✓	✓	✓
Speaker	✓	✓	✓
Vibration motor	✓	✓	✓



5.2 Apple iPhone

Choosing for the Apple iPhone as the primary platform for the mobile application, has a number of consequences, which will be outlined here.

5.2.1 The user interface

First of all, the iPhone has a very distinct user interface that is pervasive throughout almost all of the applications it runs. This not only includes the typical user interface components and widgets, such as buttons and titlebars, but also interaction styles like ‘elastic scrolling’, multi-touch zoom gestures and so on. Apple has defined a clear set of Human Interface Guidelines (Apple inc., 2009b) and expects applications to adhere to those.

5.2.2 Accessibility

The iPhone contains some features to make the device more accessible to people with hearing or visual impairments (Apple inc., 2010a).

For people with decreased hearing, headphones can be used and the device’s output can be switched to mono. For people with poor eyesight, the contrast and zoom level of the display can be increased.

With the introduction of the latest model, the iPhone 3GS, Apple added a screen-reader called ‘VoiceOver’ to the device. Although not ideal, this feature makes applications accessible to the blind, without requiring specialised accessible versions to be developed.

VoiceOver works by reading aloud items under a user's finger or a mental cursor and through some specific gestures and interaction methods that are beyond the scope of this document¹. What's important to the designer is that VoiceOver relies heavily on all components being properly labeled and put in a logical order for sequential processing or scanning.

Since we did not have access to an iPhone of the latest model, it was not possible to test the VoiceOver feature. Instead, the documentation provided by means of the Accessibility Programming Guide for iPhone OS (Apple inc., 2009a), was used as a guideline.

¹See <http://www.apple.com/accessibility/iphone/vision.html> and <http://www.apple.com/iphone/iphone-3gs/accessibility.html#video> for more information.

Chapter 6

Design

Although this whole report is about the design process, from task analysis to requirements, this chapter focuses on the actual implementation of that design by means of more tangible elements: the design of the underlying conceptual model, the interface and the interaction.

6.1 Conceptual model design

In this section the concept of Discoverijssel is shown, describing functionality and interaction between entities. This is done by modelling an Entity Relationship Diagram, showing the flow of data through the system by drawing Data-flow diagrams and presenting the interaction in Transition schemes.

6.1.1 Entity Relationship Diagram

Because a traditional Entity Relationship Diagram (ERD) proved not to be powerful enough to capture the complexity of all the entities related to content, an *enhanced* Entity Relationship Diagram was used to model the entities and relationships of the system. The enhanced ER model consists of a normal ER model with the addition of hierarchical relationships (Sumathi & Esakkirajan, 2007). See Figure 6.1.

6.1.2 Data-flow Diagrams

Data-flow diagrams are constructed to show the data flow crossing the system boundary. Furthermore, they are intended to make consistency checking easier. To be able to check that all functional requirements have been considered in the Data-flow diagrams, this subsection presents a table stating which requirement is modelled in which Data-flow diagram.

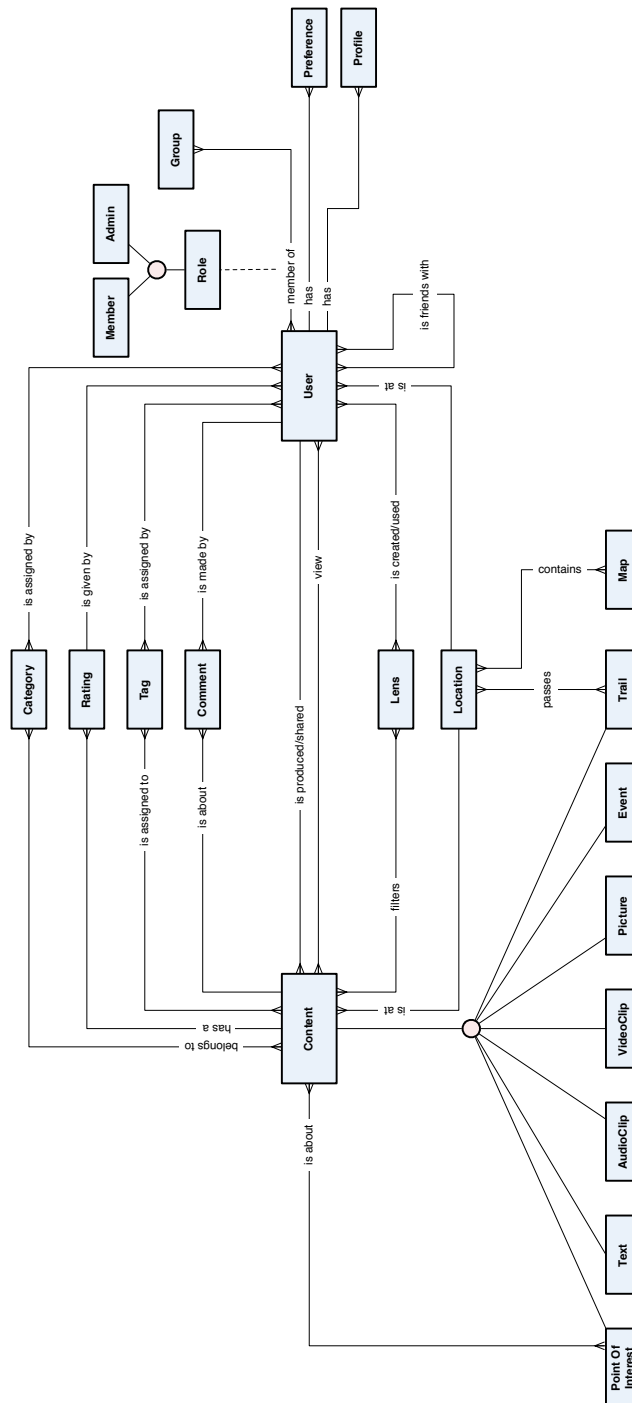


Figure 6.1: Entity Relationship Diagram

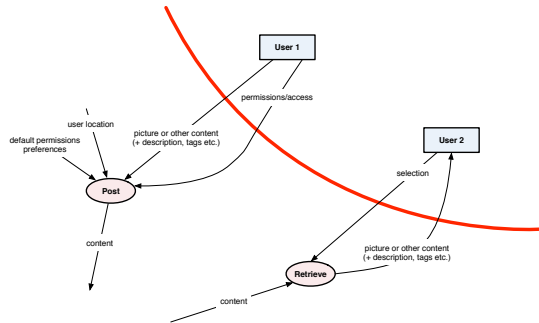


Figure 6.2: Data flow for 'sharing'

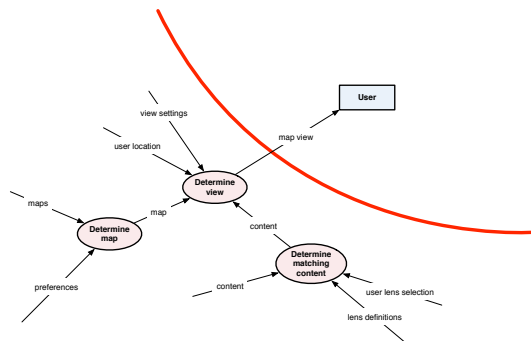


Figure 6.3: Data flow for 'view map'

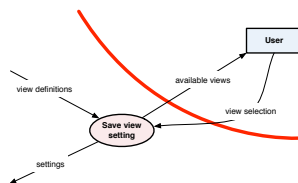


Figure 6.4: Data flow for 'select view'

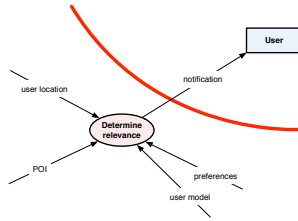


Figure 6.5: Data flow for 'notification of POI'

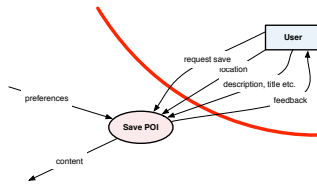


Figure 6.6: Data flow for 'tag content'

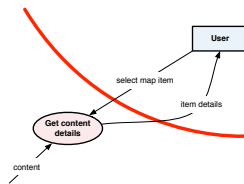


Figure 6.7: Data flow for 'content details'

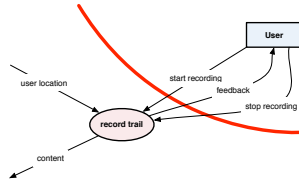


Figure 6.8: Data flow for ‘record trail’

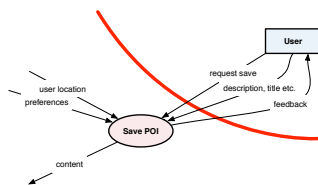


Figure 6.9: Data flow for ‘save arbitrary location’

Table 6.1: Requirements related to Data-flow diagrams

Requirements	Corresponding Data-Flow Diagram
1.1	Notification of points-of-interest
1.2	View map
1.3	View map
1.4	Select view
1.5	Notification of points-of-interest
2.1	-
2.2	View map
2.3	View map
2.4	View map
2.5	Content details
2.6	View map
3.1	Record trail
3.2	Save current location*
3.3	Save arbitrary location
3.4	Sharing
3.5	-
4.1	Sharing
4.2	Sharing
4.3	Tag content
4.4	Tag content
4.5	Tag content
4.6	Tag content
4.7a	Share content
4.7b	Share content
5.1a	Create profile*
5.1b	Update profile*
5.1c	-
5.2	View user profile*
5.3a	Create group*
5.3b	Join group*
5.3c	Leave group*
5.3d	Delete group*
5.3e	Update group *
5.4	Join group*
5.5	Appoint Admin*
5.6	Become friends*
5.7	-

*These Data-flow diagrams are not included

6.1.3 Transaction schemes

The following transaction schemes represent a way of presenting the interactions between Discoverijssel and the user(s). They show the data that is exchanged during the different transaction. They are connected to the Data-flow diagrams presented above.

Name	Share content
Agents	User 1, system
Data	Content, user location, picture, tags, description
Initiative	User
Constraints	
Prompt	Name, tag, category, ...

Name	View picture
Agents	User 2, system
Data	Content, picture, tag, description, ...
Initiative	User
Constraints	Picture orientation
Prompt	Selection of picture

Name	View map with selected points-of-interest
Agents	User, system
Data	Lens selection, map, lens definition, content, view settings, user preferences, user location
Initiative	System
Constraints	All data in one screen
Prompt	-

Name	Select a view
Agents	User, system
Data	Available views, selected view, view definitions
Initiative	User
Constraints	-
Prompt	-

Name	Receiving notification
Agents	User, system
Data	User location, Point-of-interest, preferences, notification details
Initiative	System
Constraints	-
Prompt	Notification to the user

Name	Tag content
Agents	User, system
Data	Content, location, tag details
Initiative	User
Constraints	-
Prompt	-

Name	Record trail
Agents	User, system
Data	User location
Initiative	User
Constraints	GPS needs to work
Prompt	Show that it is recording

Name	Get content details
Agents	User, system
Data	detailed content item
Initiative	User
Constraints	-
Prompt	Details of the content item

Name	Save arbitrary location
Agents	User, system
Data	User location, location description
Initiative	User
Constraints	-
Prompt	-

6.1.4 Categorisation of items

In order to find a sensible categorisation method for the different points-of-interest included in the application, a card sorting study was carried out. This consisted of a preliminary open card sort to determine a suitable set of items and a second open card sort with a smaller item set albeit with more participants. Preparations were made for a third card sort, a closed sort, to validate the results.

Preliminary card sort

In a brainstorm, the project group came up with a number of items (possible points-of-interest), loosely based on information from Landschap Overijssel and information gathered in earlier phases of the project. 73 of the items from the brainstorm were included in a preliminary card sort (see Appendix H for the full list) with the online card sorting application Websort (Lime & Chile Productions, n.d.).

The card sorting method can be described as an ‘open card sort’, i.e. without predefined categories. Participants were free to choose any grouping method and any number of categories.

This sort was completed by all 4 group members and 2 participants from outside the group. The shortest completion time for the sort was 12 minutes, which was considered too long for a study with volunteers. Additionally, some people expressed that grouping all items on a single screen resulted in a cluttered view. Therefore, it was decided to run a second card sort with fewer items and participants from outside the project group.

Second card sort

From the results from the preliminary card sort, it was possible to group the items into 10 categories: one category with only one item (‘animal cage’), the others with multiple items. These results were used to identify a set of items for the second card sort, making sure the smaller set contained items from each of the 9 larger categories and leaving out ambiguous items. Instructions were the same as for the first card sort.

After announcements online, 10 voluntary participants completed the second card sort. Due to limitations of the software, the number of participants for a single study was limited at 10. It has been suggested that 15 may be a good target number of participants for card sorting studies, a number based on data from a large card sort with 168 participants (Tullis & Wood, 2004). In this regard, the sample size is on the small side, so results should be interpreted with caution. Nevertheless, the results from the same study results indicate that the card sorting results for a sample size of 10 correlated with the full sample results with a correlation over .8.

Participants used between 3 and 9 categories (with an average of 5.6). The chosen category names are listed in table 6.2.

The tree diagram for this second card sort can be seen in Figure 6.10. This tree diagram was drawn based on a hierarchical cluster analysis of the results, using a distance matrix (i.e. items that are often placed in the same category together can be regarded close to each other, while items that never occur in a category together are considered to have a large distance).

Another graphical representation of the same data (Figure 6.11) was made with the technique multi-dimensional scaling. The items are represented as labeled dots on a two-dimensional surface, where the distance between dots approximates the distance between items in the data set. Note that there is a very dense cluster of items in the left part of the image: river, forest, heath, hill, bird’s nest, trees, mushroom, flowers, and butterflies.

Conclusions

To arrive at a category scheme for the application, in addition to the automatic clustering methods described above, a ‘common sense’ approach to grouping items was also taken. Using the raw results from the second card sort in a

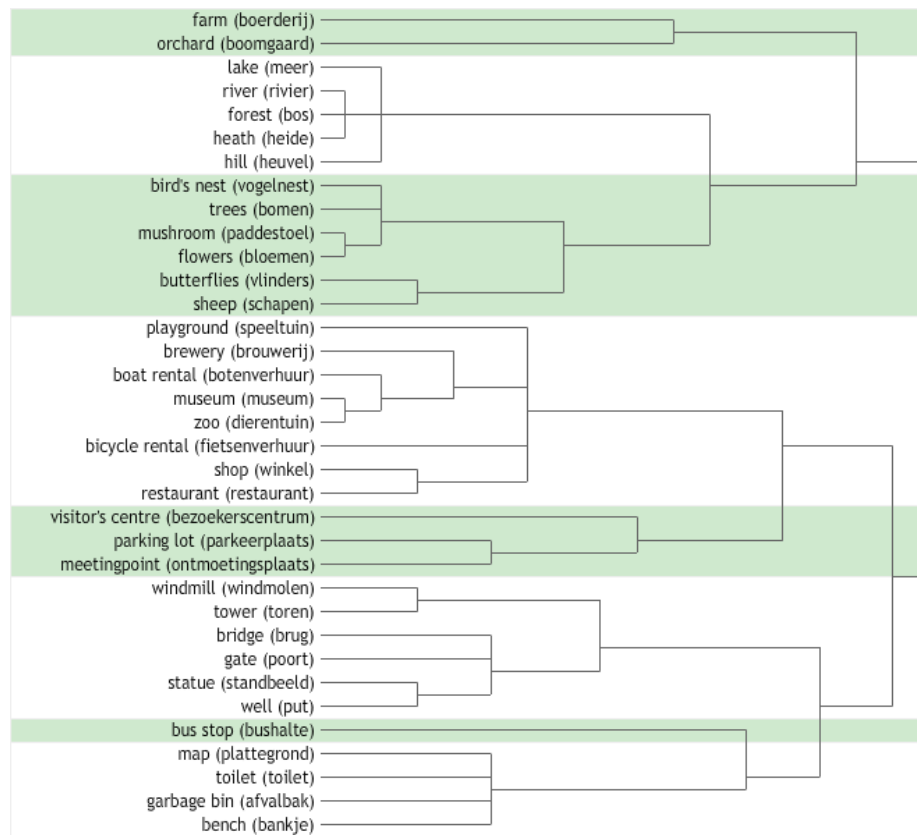


Figure 6.10: Tree diagram of the raw results for the card sort with 35 items, here divided into 8 categories.

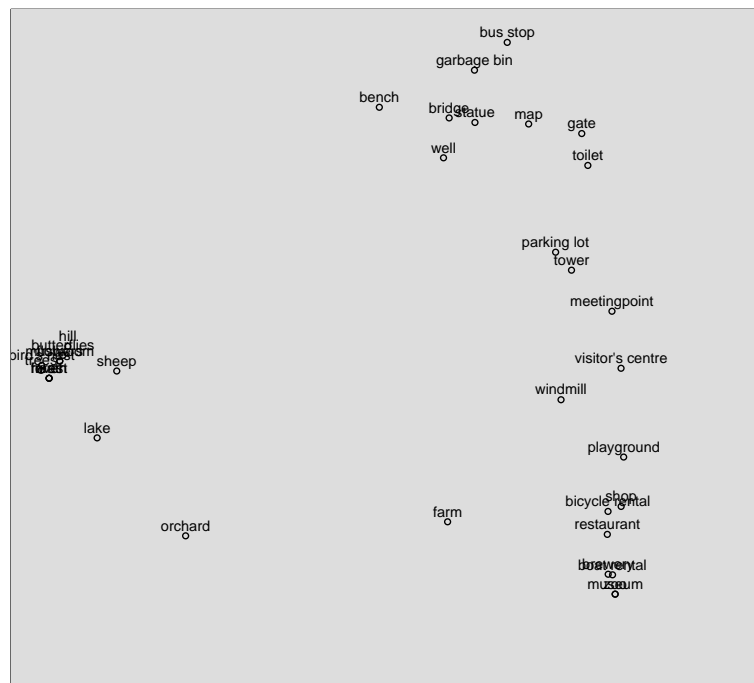


Figure 6.11: Graphical representation of card sort results with multi-dimensional scaling.

Table 6.2: Category names chosen by the participants in the card sort. Spelling and typing mistakes were not corrected, for the Dutch answers translations are added between brackets.

ID	category names
1	P + R [Parking and Recreating], Attracties [Attractions], Natuur [Nature], Bezoekersinformatie [Visitor's information]
2	natuur [nature], uitjes [trips], stedelijk [urban], platteland [countryside]
3	nature [nature], winkels en attracties [shops and attractions], aanwezig bij attracties/parken/musea [present near attractions/parks/museums], gebouwd door mensen [built by people], boerderij [farm], versieringen [decoration]
4	flora, fauna, human artefacts, type of landscape, describing items, human buildings
5	Natuur [Nature], Gebieden [Areas], Handige plaatsen [Useful places], Landschappsonderdelen [Parts of the landscape], Toerisme [Tourism], Gebruiksvoorwerpen [Utensils], Voorwerpen [Objects]
6	Infrastructuur [Infrastructure], Natuur [Nature], Omgeving [Environment]
7	Things a visitor needs, Things to go to / to do, things on map only, The map
8	animals, flora, utilities, man-made landscape elements, structures, public places, natural landscape elements, service providers
9	Tourimse/vermaak/vrije tijd [Tourism/amusement/leisure], Elementen natuur groot [Nature elements large], Objecten in openbare ruimte [Objects in public space], 'Productieve/nuttige gebouwen' ['Productive/useful buildings'], Elementen natuur klein [Nature elements small]
10	Rental Places, Animals, Forest, Landscape, Visitor's Centre, Meeting Point, Things you see in a City, Tourist Places, City Structures

matrix form, similarities were coloured in by hand, resulting in the grouping shown in Figure 6.12. Based on the findings from the card sort a category scheme was proposed, containing the following categories:

landscape Type of landscape (example: forest, heath),

flora Content about plants, flowers, etc.,

fauna Content about animals living in the landscape,

leisure Content about opportunities for activities

sights Landmarks, viewpoints, places of touristic interest.

countryside Content about farms, livestock, etc.

shopping Content about shops, etc.

eating/drinking Content about restaurants, snackbars, etc.

getting around Information that is useful for getting around.

utilities Practical information.

information/signage Information signs and maps.

A third card sorting study was prepared to evaluate this category scheme, but could not be performed due to time constraints. In this study, the participants would participate in a closed card sort, i.e. with predefined categories, and they would be asked to sort the full 73-item set. One of the advantages of the closed card sorting method over open card sorting is that the nature of the sort allows for further statistical analyses, such as calculation of inter-rater agreement. It would be advisable to conduct such a card sort before fixing the category scheme.

6.2 Interface Design

Although there was not enough time to design all the screens in the system, the most important ones are described in this section. The matrix in Figure 6.13, which shows which screens or components are responsible for which functional requirements, was used as a guideline.

6.2.1 Discover screen

The ‘Discover’ screen could be seen as the main screen of the mobile application. It is the screen that shows the user what is around and allows further exploration. Also, much of the system’s functionality, including sharing content and pulling in content shared by others, is accessed from this screen.

Because the Discover screen is one of the four main entry-points described in Section 6.2.8, an application-level tab-bar is visible at the bottom of the screen. As can be seen in Figure 6.14, the Discover screen is accessed through the first tab in the tab-bar at the bottom of the screen, indicating its importance.

At the top of the screen, below the iPhone’s own ‘status bar’, a ‘navigation bar’ is shown. On the far left of this bar, there is a ‘lens selection’ button and on the far right, a button meaning ‘add content to the map’. A button with a plus icon is by convention used to add something, and was taken from the standard library of icons. The original ‘lens selection button’ (still visible in Figure 6.16a) was retrofitted from Safari, the iPhone’s web browser, where it switches to an overview of what webpages are currently open. During heuristic evaluation, it became apparent that this icon might be mistaken for ‘resize’, so it was changed into three stacked rectangles to more closely represent the lenses screen.

Although both these icons can, in the framework of McDougall and Curry (McDougall & Curry, 2004), be classified as both abstract and simple, the semantic distances to their relative functions are small. Both the plus icon and the lenses icon build upon conventions and although their function may be hard to predict the first time, they are very likely to be recognised later. In the case of the plus icon, this is due to the semantic relation between the plus icon and the function of ‘adding something to the map’; in the case of the lenses icon, it is due to the visual similarity between the icon and the screen that follows and the icon, and the resemblance to the icon with similar functionality in Safari.

Finally, in the centre of the navigation bar, a segmented button can be used to switch between view types within the Discover screen. Because users have different preferences as to how they like to access the information this screen provides, and these preferences are likely to change depending on the user’s current goals, they can switch between three kinds of views on the same data:

- The *map view* (Figure 6.14a) shows the user’s surroundings as icons on a topographic map.
- The *list view* (Figure 6.14b) shows the same information in a list, ordered on distance to the current location.

[illegible]

Figure 6.13: Screen-requirements matrix



Figure 6.14: The ‘Discover’ screen

- The *3D view* uses the device’s camera to provide the user with a ‘live view’ of the surroundings, which is overlaid with information. This is a type of view often seen in ‘Augmented Reality’ applications, such as Layar, which is shown in Figure 6.15. Because time constraints demanded a focus on things that could be tested in a laboratory setting, the 3D view was omitted.

Map view The map view, shown in Figure 6.14a, summarises the user’s position and surroundings as icons overlaid on a map. Originally, a satellite image like in Figure 6.16a was used as the base for this view, because a good schematic map seemed unavailable. However, during heuristic evaluation, this was considered to make the screen cluttered and hard to use. Fortunately a better image turned out to be available for this particular location, but it should be noted that the availability of good quality maps is important for the usability of the map view.

Analogous to the iPhone’s built in maps application, the user’s current location is shown as a blue marble dot on the map, surrounded by a circle that shows the GPS accuracy. If the user moves, the dot moves too.

Points of interest, or POIs, are shown as coloured push pins sticking out of the map. Because the standard iPhone push pin icon, shown on the right in Figure 6.17c, does not allow much space for icons describing the type or category it represents without requiring an action on the user’s part, an alternative design



Figure 6.15: Layar, an Augmented reality application

was made.

Upon touching a pushpin or icon, a popup label like in Figure 6.17a appears above the icon and the screen pans towards that location to create space if needed. Touching the blue ‘detail disclosure button’ (Apple inc., 2009b) – or any part of the popup label for that matter – opens a details screen, described in Section 6.2.5. Touching somewhere else on the map hides the popup label.

All interaction methods have been kept as close to the way iPhone maps usually work. This means the same multitouch gestures are used for panning and zooming. One exception is that there was no space for a ‘recenter on current location’ button. Instead, an arrow pointing towards the position of the blue marble appears if the user pans it outside of view, which upon touching, triggers the same functionality.

To provide more details about the scale and accuracy of the view, as well as the exact coordinates, a status bar is shown at the top of the map. Although this screen uses a lot of colour, it is mostly used for clarifying things. Testing it with colourblindness simulator ‘Sim Daltonism’ (Fortin, 2010) showed that the screen is still almost fully usable, albeit without the added value that the colours provide. The only items that makes use of colour as the sole information carrier are the trails: they are given the colour they have in the environment.

List view As an alternative to the map view, the information around one’s current location can also be viewed as a list like in Figure 6.14b. This shows the different items in a long list, sorted on their distance.

The advantage of this, is that it’s easier compare the relative distances of things, for instance to find the nearest bus stop, one just scrolls down to the first one. The list view is also able to show more detail, at the cost of showing less items at once. The most important job of the list view, however, is providing a particularly accessible ‘view’ for blind users. With each item labeled in a way that VoiceOver can pronounce, the screen is particularly suitable for users



Figure 6.16: Old and alternative designs



Figure 6.17: Discover screen details

relying on a screen reader. The larger surface area of each item also makes this view easier to use for users with limited dexterity.

Analogous to touching a push pin in the map view, touching anywhere on a list item takes the user to that item's details. Scrolling the list is done with the iPhone's standard 'elastic scrolling' gestures, including the shortcut to jump to the top of any list.

During heuristic evaluation, it was decided that the category icons of each list item should be augmented with the same colours it has in the map view, but due to time limitations this was not yet implemented in the mockup shown in Figure 6.14b. Although colourblind users will not benefit from this, it makes the different categories easier to recognise for other users.

Notifications As described in Requirement 1.1, the system gives notifications when the user passes something of interest. Originally, this was implemented using a default iPhone notifications dialog, as shown in Figure 6.16c. However, during heuristic evaluation, it was found that such a notification would be hard to ignore: it demands a response. To improve user experience, the dialog was replaced by a more subtle notification cue: depending on the current or last used view, the user is notified by a highlighted item. For the map view, this means a popup label (Figure 6.17a) appears, in the list view this translates to a highlighted list-item.

Notifications are accompanied by a vibration and/or sound, which is configurable in the application's preferences by the user. Notifications can be implicitly ignored or explicitly turned off for some or all types of content. This is up to the user.

6.2.2 Visible Lenses

After the user clicks the lenses button in the top-left corner of the Discover screen, the 'Visible Lenses' screen pops over, hiding the tab bar and any view that was open. The screen can be used to manage what is shown on the map or in the list. Each layer of content is represented by a so called 'lens', referring to the metaphorical transparent panes of glass panes with content on them.

The top of the screen shows a navigation bar showing the screen title and two buttons: 'cancel' and 'done'. Both take the user back to the screen that was open before the 'lenses' button was pressed, with 'cancel' discarding any changes that might have been made and 'done' accepting them.

In the middle, the screen shows the composition of the current map view as a stack, with the map at the bottom, and the active (or *visible*) lenses on top. The factory defaults of the application are that only lenses with official content provided and/or selected by Landschap Overijssel are active, which should be sufficient for most users. Users that are more demanding can use this screen to add or remove lenses and thus change what they can see and access from the Discover screen.

The bottom of the screen shows a shelf containing icons that represent lenses. The shelf has three controls: left, right and up. To understand what these



Figure 6.18: Visible Lenses

controls do, it is first necessary to explain the three states of the lens model. There might potentially be a large number of lenses, of which only few are likely to be relevant to a particular user. On the other hand, it should be easy to activate and deactivate lenses without having to dig through a huge collection of lenses every time. Therefore, there exists a hierarchy of lens ‘sets’, of which the shelf is the middle. A schematic view of this hierarchy is given in Figure 6.19.

Touching the left and right controls scrolls thus scrolls the shelf left and right, revealing all the lenses that are currently ‘on shelf’. When it reaches the end, the shelf wraps around. The up control extends the shelf upward, revealing its contents as shown in Figure 6.18b.

By default, the lenses are ordered to when they were installed, but they can be reorganised by dragging them around. Pressing the button ‘Lens Store’, takes the user to the lens store, which is discussed in Section 6.2.3.

There are two ways to activate lenses that are on the shelf. The preferred way, is to drag the lens icon from the shelf to the stack of visible lenses. The icon disappears from the shelf, transitions into a perspective representation and slides into the stack while the user drags it around. Because it was expected that novice users might not understand this interaction method, a second way to activate lenses was also included. If a user touches a lens icon, a popup like the one in Figure 6.18c appears, showing a preview of the lens and a button to add it to the stack of visible lenses. Removing a lens from the visible lenses, or deactivating it, is the reverse of adding it.

Although this screen is able to summarise a lot of information into a compact view, it is not be very accessible to users with visual disabilities. An alternative list-view, like in the Discover screen, was not designed, but could be trivially realised as a screen showing all the lenses that are ‘on the shelf’ with checkboxes in front of them indicating whether or not they are active.

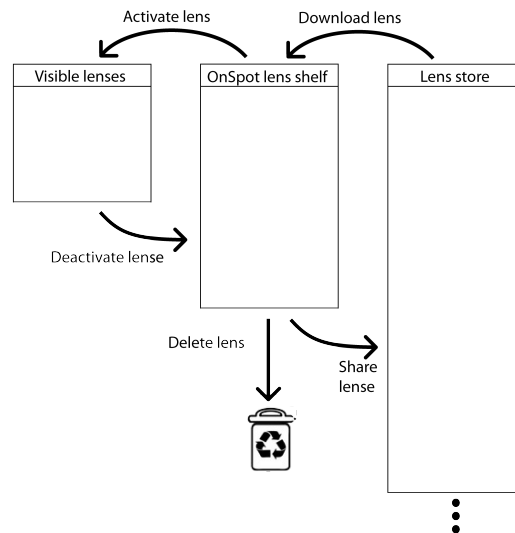


Figure 6.19: Hierarchy of lenses

6.2.3 Lens store

The lens store is used for downloading lenses from the collection of all available lenses to a user's lens shelf, as is symbolised by the right half of Figure 6.19. It is accessed from the 'Visible Lenses' screen and therefore does not show the tab-bar at the bottom of the screen. It lies deep within the navigation hierarchy, because it is not frequently needed.

The lens store is designed analogous to the iPhone's own App store, so the screen design will not be discussed in detail here. What's important is that once the user downloads a lens, he is returned to the 'Visible Lenses' screen, described in Section 6.2.2. with a dialog like the one in Figure 6.18c shown for the newly downloaded lens.

6.2.4 Adding content (creating and sharing)

Pressing the '+'-button in the Discover-screen, pops up the 'action sheet' in Figure 6.17b, where the user can choose what type of content to add to the map.

With the 'Camera' option, a video can be recorded or a picture taken. The Point of Interest option allows the user to define a new point on the map where a push pin is shown. The 'Sound' option opens a sound recorder and the 'Trail' option starts recording the user's movement. This last option will require that the device can be operated while the trail is recording in the background. To still be able to return to this background process, a red bar will appear above the the screen similar to how the iPhone's 'Voice Memos' (shown in Figure 6.21

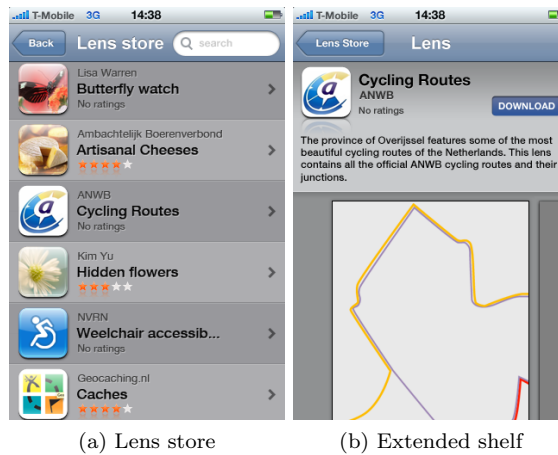


Figure 6.20: Lens store

works when it is running in the background. Touching the red bar returns to a screen where recording can be stopped. The remainder of the sharing workflow is similar for all content types and can be seen in detail in Figure 6.28.

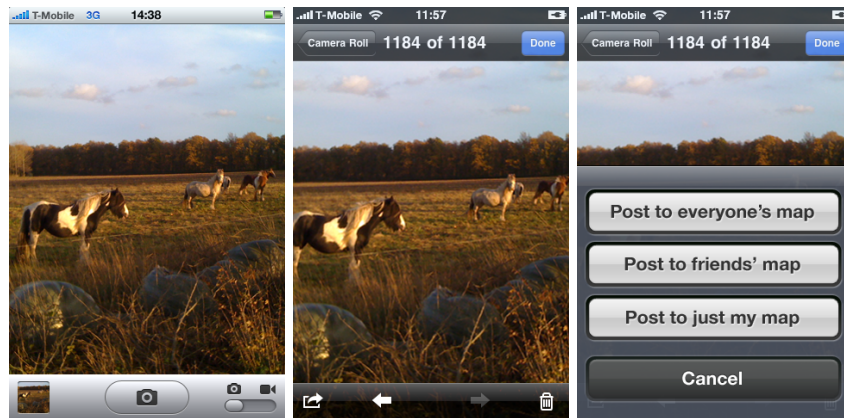
Because it was expected that pictures will be the most important things that can be shared, this is the content type that was explored in full. After selecting 'Camera' from the list of options, a (live) camera viewfinder as in Figure 6.22a appears. This behaves exactly the same as the standard iPhone camera application: After the user presses the camera button in the centre of the bottom of the screen, a shutter sound animation is played with the sound of a picture being taken. Then an animation is shown of the picture as it was just taken moving to the lower left corner of the screen where it remains visible as the viewfinder takes back the screen to show the view through the camera's lens.

This means the user can continue taking pictures until he/she is happy with the result, without being delayed by dialog screens in between. Once a satisfactory picture has been taken, the user can touch the thumbnail in the lower left corner to enlarge it, leading to the screen shown in Figure 6.22b. This again is a default screen for viewing camera pictures on the iPhone, so it has the same controls for watching older/newer pictures and deleting them. The icon in the lower left corner, of a square with an arrow pointing out, is used in various places in the iPhone user interface where it starts an action for the current item (Apple inc., 2009b), for example send a picture by email or post it to the user's photo gallery. Here it pops up the action sheet shown in Figure 6.22c, which allows the user to share it.

Doing so leads the user to the final step in the sharing process: adding optional metadata to the image. This screen is similar to the 'edit content details' screen, which is further described in Section 6.2.5. Once the user clicks



Figure 6.21: Red bar indicates recording



(a) Camera screen

(b) View photo

(c) Choose privacy settings

Figure 6.22: Sharing a picture

the ‘submit’ in that screen, the picture starts uploading in the background and the user is returned to the Discover screen.

The accessibility of the camera screen was not tested, but it not expected to be used by the visually impaired and it was not considered worth breaking with conventions and user expectations.

6.2.5 Content detail screen

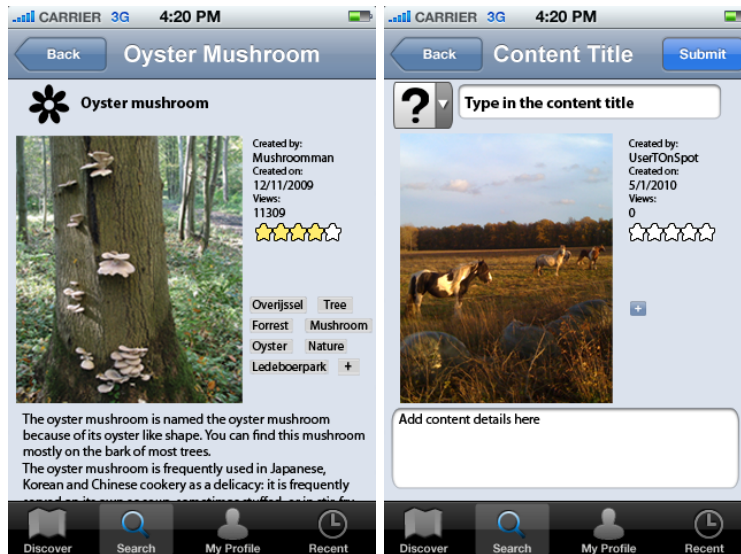
First (Pre heuristic) The first version of the content detail screen, was placed on the map as a pop up. The major part of the screen was taken by the actual content (in this example, a picture). In the upper left corner, a pushpin was place, with the colour of the layer the content belongs to. The pushpin was a placeholder for a possible category for the content.

The titlebar contained besides this category placeholder, also the name of the content and the name of the creator. Next to the picture are four buttons. The first one links to the profile page of the creator. The other three buttons are grouped together. The first of these buttons links to a rating page for the content. The second one refers to a tagging screen and the third one is for changing the category the item belongs to.

In the bottom are navigation breadcrumbs. With these, you can navigate through the content, with use of the categorisation of all content.



(a) Pre heuristic content detail screen (b) Second content detail screen



(c) Final content detail screen (d) Edit content detail screen

Figure 6.23: Content detail screens

Second (mid) The second version of the content detail screen was fully revised. This screen is a screen on it self, and not, as the previous version, a pop up over the map screen. Also, the breadcrumbs disappeared, and the titlebar was replaced by a conventional iPhone titlebar. This also contains the navigation button to go one step back.

The content itself is reduced in size, so some description text fits underneath. Also, the page is scrollable, so more text can still be added. The title of the content is placed above this text, with the icon of the category next to it. Details about the creator, date created and total amount of views are place on the right. This green balloon is clickable, and links to the user profile of the creator. Above this balloon are three buttons. The tag and rating button remained the same, only with some cosmetic make-over. The category button was replaced by a comment button, so users can comment to the content. The category can only be changed in the detail-edit screen, by the creator him or herself.

Final screen The final version of the content detail screen, is quite the same as the second screen. The most striking difference is the lack of buttons on the right side. The green balloon was replaced by normal text. The rate and comment button disappeared. The rating can be done by simply clicking one of the stars. Comments are placed at the bottom of the screen, with a balloon where you can input your own comment. The button for tagging is still there, only in another form. The most used tags for this content are displayed, with on the end a bigger clickable plus, with what you can go to the add tag screen. This tag screen (which is not in this report) contains an input text field, in which you can type your tag. This screen also contains tag suggestions. These suggestions can be location-based and user-based (of the current user) tags. This motivates the user to tag, according to the (Ames & Naamen, 2007).

Besides these button-changes, the title of the content moved to the top, still with the category item next to it. The title is also displayed in the titlebar, so you still see the title when scrolled down. In this screen, also different content types can be shown. For example, when a bus stop is selected, the details can contain a timetable and the directions of the bus.

Blind users would ‘see’ this page as mainly a description of the content. The screen reader can also read the comments, so people know what other users think of it.

Edit content detail screen When adding new content, the content detail forms have to be completed. This form looks the same as the normal detail screen, with the only difference that the text is replaced by input text fields. Also, the icon for the content category is replace by a drop down list with a big question mark selected. This drop down list contains all category icons.

Also, a begin can be made with tagging this content, by pressing the plus sign. Comments can’t be made at this stage, for commenting on your own content is not conventional. A not yet added feature in this screen is manually reposition the location of the content. This way, the application can also be

used for Geocaching.

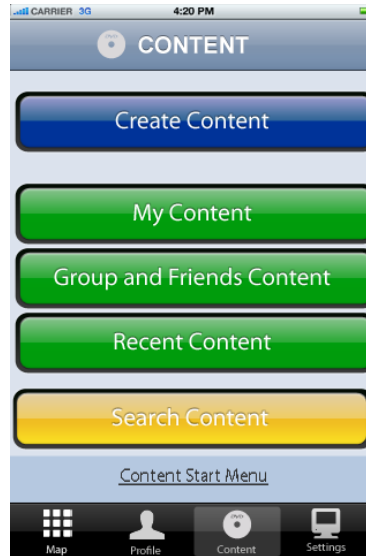


Figure 6.24: Content menu

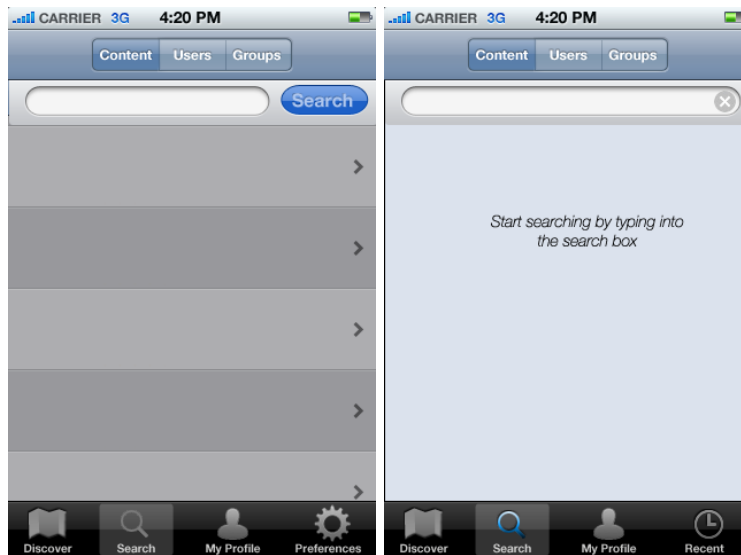
6.2.6 Content Menu

In the heuristic evaluation, also a Content screen was evaluated. This screen was the top screen of the ‘Content’. button, in the tab bar at the bottom of the screen. As in the first content detail screen, above the bottom tab bar, a breadcrumb is visible.

With the content menu, you can create new content (e.g. take a picture), view ‘my content’, view the content of groups you belong to or content of friends and content you recently watched. You can also search for content with the ‘search content button’. In the later versions of the screens, this screen no longer exists for a change in menu-structure.

6.2.7 Search Screen

First After the content menu (see above) was deleted from the menu, a search screen was added. In the title bar of this search screen, the tabs Content, Users and Groups can be selected. This way you can search in these different categories. Below this screen is the search bar. When a keyword (like the title of the content, or a tag) is filled in, you press the Search button to search all content (or users or groups). In the grey bars below the search bar the results appear when search is pressed.



(a) First search screen

(b) Final search screen



(c) Search results screen

Figure 6.25: Search and results screen

Final The final search screen has only some small changes. The most striking changes is the missing of the grey bars. This is because they have a click able affordance, however, without a search keyword, they aren't click able. The empty screen now contains a hint, so users know what to do.

Another difference is the lack of a search button. This is because the search bar makes use of live search results. When you are typing the search results get updated directly. With the cross on the right of the search bar, the input can be deleted.

Search results The final search results screen does not differ from the empty search screen, besides the grey bars with search results. These bars show first the icon of the content. Next to this, they show the title and a small description. On the right is an arrow, which makes clear the bar is clickable.

Because these search results are displayed in a clear list, it is very well usable for a screen reader. Blind users can thus use this feature properly.

6.2.8 Organisation and flow of screens

To determine how the different screens of the system relate, a brainstorming session was held to determine which screens, sub-screens or views relate to which and how they should be organised. Post-it notes were made for all the screens in the system, which were then clustered into the affinity diagram shown in Figure 6.26. This affinity diagram formed the basis for further organisation of the application's main screens.

Because the standard iPhone tab-bar component generally has about four tabs, it was necessary to reduce the amount of top-level or main screens to four. This resulted in the organisation shown in Figure 6.27, where 'Discover', 'Search', 'My Profile' and 'Recent' are the main entry-points. Figure 6.28 shows the implemented screens in a similar format.

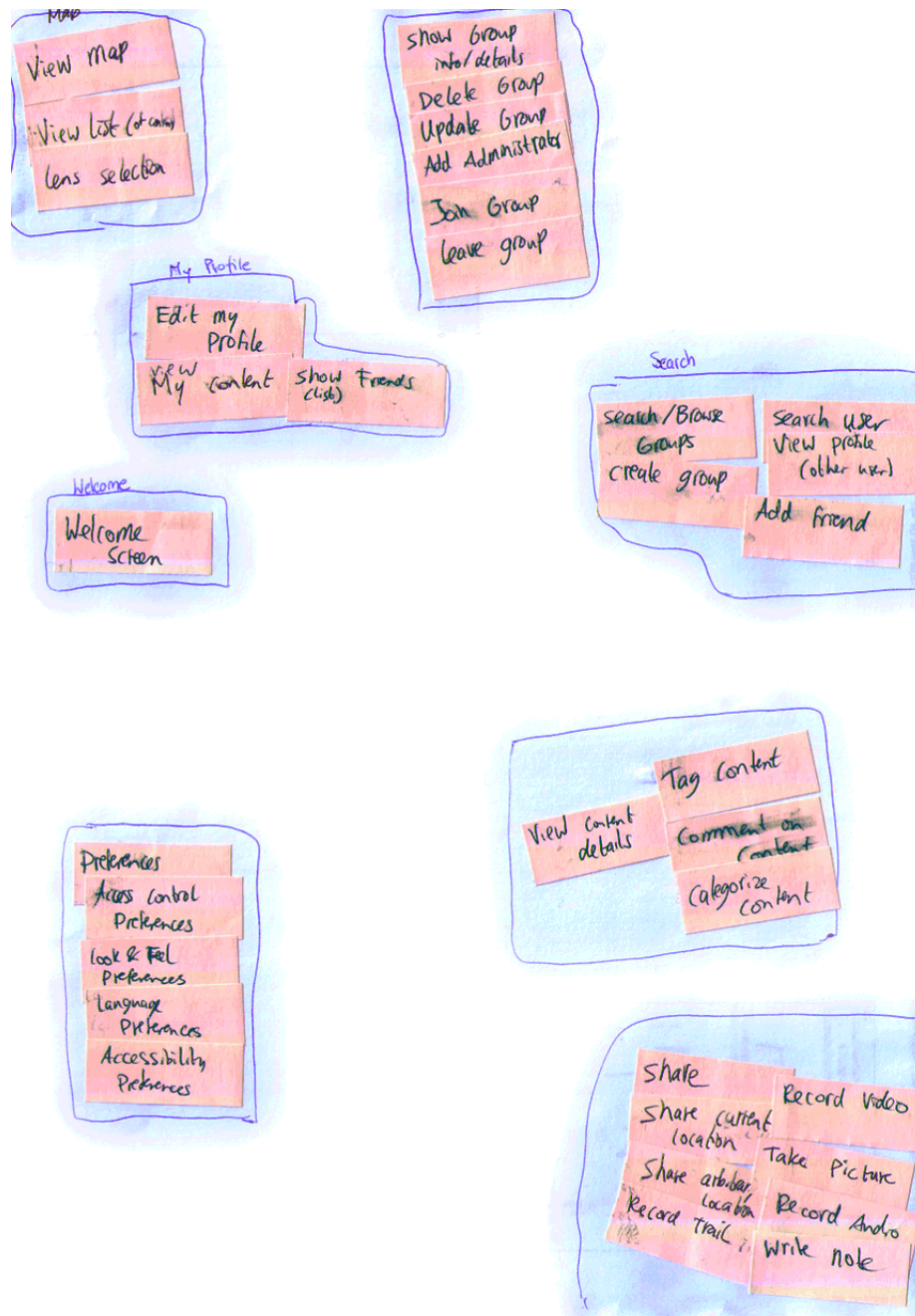


Figure 6.26: Affinity diagram resulting from screen-clustering brainstorm session

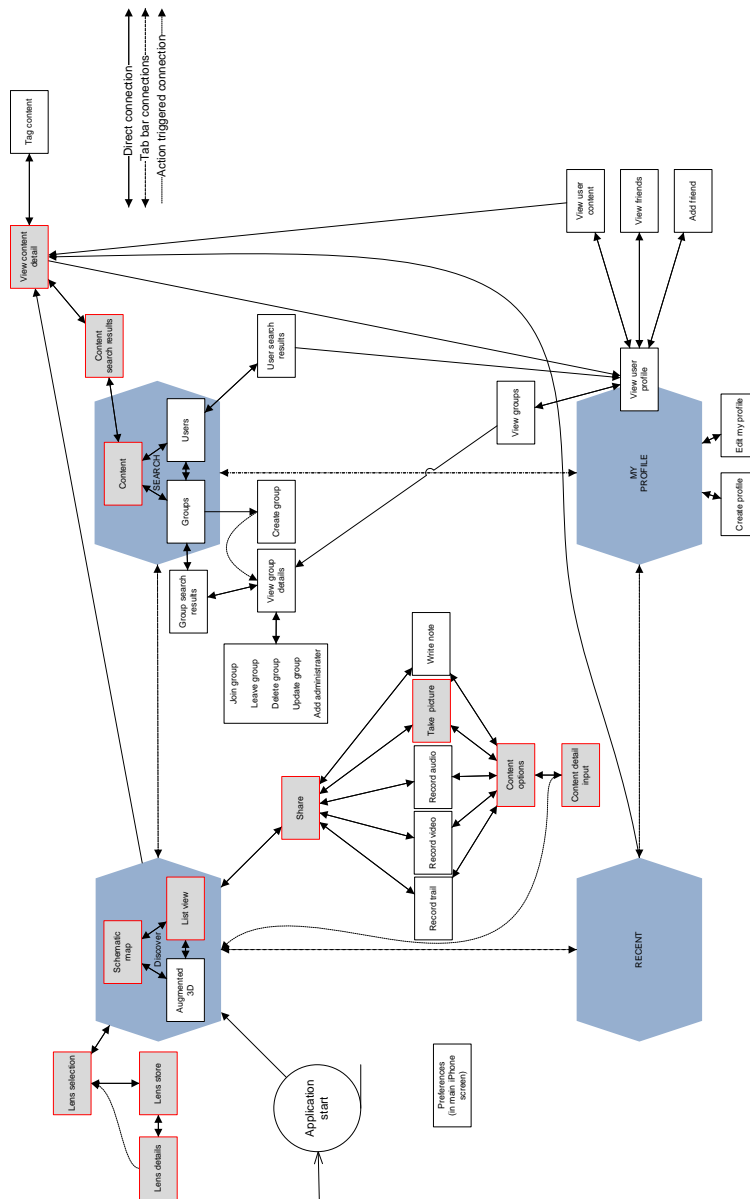


Figure 6.27: Screen flow diagram of Discoverijssel application

Chapter 7

Evaluation

To determine weaknesses and strengths and check assumptions made during the development, the designed prototype was evaluated in two separate evaluations. First, it a heuristic evaluation was carried out, in which several screen designs were checked with a list of heuristics with the primary goals of identifying issues, i.e. possible usability problems, and formulating specific questions to be addressed in the second evaluation, a formative user evaluation. For the formative evaluation, five volunteer participants were shown a video prototype, asked to complete a number of tasks with a paper prototype while they were observed and a video recording was made and interviewed about their thoughts and attitude about the product.

7.1 Heuristic evaluation

Heuristic evaluations are often done by external experts. Evaluation by the design team can cause them to oversee issues, because they already have knowledge about what the application is supposed to do and about the rationales for the design decisions that were made. On the other hand, having knowledge about the project background can also be an advantage since it enables the evaluators to consider the designs within the envisaged context, both application context and expected use environment. The latter is especially important in evaluation of mobile devices, which cannot be de-contextualised as easily as more traditional applications, and often have shorter task durations. In an evaluation of a Route Planner, the expert evaluators expressed having difficulties with the evaluation due to the absence of a palpable use context. (Vetere, Howard, Pedell, & Balbo, 2003)

The main goal of a heuristic evaluation is to name potential problems with the application, using a set of heuristics. Heuristic evaluation is an analytical, not an experimental method, and it is worth noting that the issues found do not need to correspond to *actual* problems, as (Gray & Salzman, 1998) points out. Both false positives and false negatives occur frequently. Therefore, results

from a heuristic evaluation need to be interpreted carefully. They can be used as input for (another iteration of) the design process, or to identify important questions that can be answered by other methods.

Still early in the development phase, small number of finished screen designs (non-functional prototypes), shown in Figure 7.1. For best results from a heuristic evaluation by external experts more completeness would be desirable and possibly locating the evaluation in a real-life, natural environment. However, there are strong reasons for starting evaluations as early as possible in the process: then, changes can still be made. Chosen: thorough self-evaluation of the design by the members project team, complemented by a small-scale evaluation by external experts.

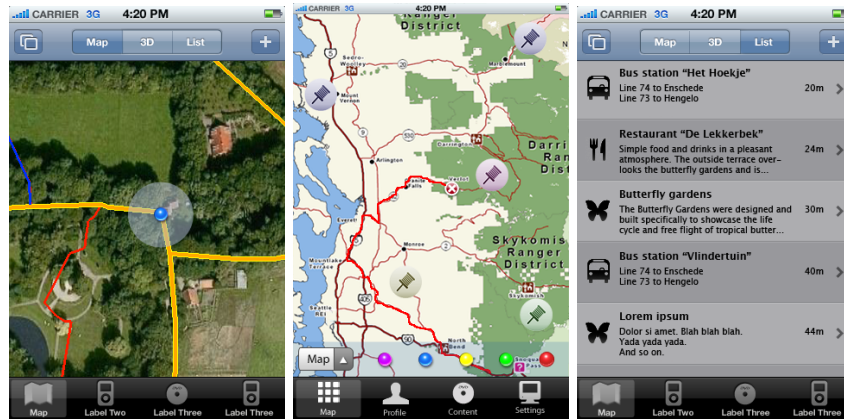
7.1.1 Method

Heuristics: Nielsen (as formulated in the Xerox checklist category headings); list from Interactive Heuristic Evaluation Toolkit (Barber, Accessed December 2009); from ‘Seven things all iPhone apps need’ (McGookin, Brewster, & Jiang, 2008).

Participants: project group. Started with a single screen, worked through the list of heuristics, noting remarks and potential problems. Created a list of ‘issues’ and estimated a severity rating and a cost rating (or ‘ease of fixing’). Chose a small number of issues for more in-depth exploration, including considerations on ways to address the issue.

The heuristics associated with the issues in the table in the results section (column H#) are coded according to the following scheme, which combines the heuristics from the Interactive Heuristic Evaluation Toolkit (Barber, Accessed December 2009) with the Xerox heuristics (D. Pierotti, Accessed December 2009):

1. Visibility of system status
2. Match between system and real world
3. User control and freedom
4. Consistency and standards
5. Error prevention
6. Recognition rather than recall
7. Flexibility and efficiency of use
8. Aesthetic and minimalist design
9. Help users recover from errors
10. Help and documentation
11. Navigational feedback
12. Use of modes
13. Structure of information
14. Enjoyment / Pleasurable and respectful interaction
15. Physical constraints
16. Extraordinary users
17. Skills
18. Privacy



(a) Map screen - map view (b) Map screen - alternative (c) Map screen - list view



(d) Map screen - notification (e) Lens selection (f) Lens store



(g) Content - menu (h) Content - details

Figure 7.1: The screens evaluated during heuristic evaluation phase

Table 7.1: Severity ratings: 1 to 5 stars

Rating	Definition
★	Violates a heuristic, but doesn't seem to be a problem.
★★	Superficial: Problem occurs extremely infrequent or is easily to overcome by user.
★★★	Minor: Occurs more often than superficial or is more difficult to overcome by user.
★★★★	Major: Occurs frequently or users are unaware or may not know how to fix this problem.
★★★★★	Catastrophic: Use of product is in danger, problem cannot be overcome by users.

Table 7.2: Cost ratings: 1 to 5 stars

Rating	Definition
★	Very easy to fix. Can be done by one team member.
★★	Easy to fix. Involves only specific elements of interface and solution is clear.
★★★	Requires more effort to fix. Requires multiple team members and more interface elements have to be fixed or altered
★★★★	Difficult to fix. Requires multiple team members and multiple aspects of interface. Problem is interwoven in application, solution is not clear.
★★★★★	Impossible to fix. Possible fix would disturb rest of system or other guidelines too much.

These severity and cost ratings were adapted from (Tennant, Anastasia, & D'Amato, 2005).

7.1.2 Results

65 issues, divided across 7 categories. Severity ratings between 1 and 5 with a mean of 2.2 and cost ratings between 1 and 5 with a mean of 2.3.

Application-wide issues					
	Issue	H#	Severity	Cost	
1	Lots of different functionality combined in a single application that is only loosely related (e.g. befriending people).	I.1	★★★★	★★★★	1
2	Touch screen cannot be used with gloves	15	★★★	★★★★★	2
3	No tactile feedback	16	★★	★★★★	
4	Registration is required to be able to use sharing functionality	7	★★	★★★★	
5	Small screen	16	★★★	★★★★★	3
6	Emergency exit of exiting and restarting application will not work if system saves its state	9	★★	★★★★	4
7	No on-line help available	10	★	★★★★	5
8	Social functionality features may distract users from core functionality and make the application seem more complex and harder to master.	8	★★	★★★	
9	Sharing functionality features may confuse users	8	★	★★★	

¹Client requirements

²Device limitations

³Device limitations

⁴Changing this would introduce more problems than it fixes.

⁵No space available

Map screen					
	Issue	H#	Severity	Cost	
10	Unclear ‘Map’ icon in tab bar. Looks like restaurant menu	6,8	★★	★★★★	6
11	Tabs at the top and bottom are not very easily identified as such, could also be seen as buttons.	2	★	★★★★★	
12	Tabs in top bar have only labels, no icons	6	★	★★★★★	7
13	Meaning ‘lens selection’ icon is unclear	2,6	★★	★★★★	8
14	‘lens selection’ icon looks like Windows’ ‘resize’ icon	2	★★	★★★★	9
15	Buttons in top bar have no labels	6	★★	★★★★★	
16	Label ‘3D’ is ambiguous	4	★★	★★★★	10
17	Duplicate use of label ‘Map’ with different meanings	4	★★	★★★★	
18	Meaning ‘+’ icon is unclear for non-iPhone users	2,6	★★	★★★★★	11
19	Some buttons have only icons or only labels and some both	4	★	★★★★	12
20	‘Power user’ controls, such as sharing and lens-selection may confuse novice users.	7,8	★★	★★★★★	13
21	No history of visited or watched items is kept.	11	★★	★★★★★	
22	When receiving a phone call or exiting the application while recording a trail, a gap appears in the recording where accuracy is reduced.	5	★★★	★★★★★	14
23	Indicator and stop button missing when recording a trail	1,3,5	★★★★★	★★	
24	Tabs at top may be small	16	★★	★★★★★	
List view					
25	Unclear what happens if the content of the list changes, for instance because the user is moving. Clear notifications should be provided to the user.	1	★★★★★	★★	15
26	Meaning ‘>’ icon could be unclear for non-iPhone users.	2	★	★★★★★	
27	List is ordered on distance, but does not give information on direction	13	★★	★★★★	16
28	Because list is ordered on distance, it shows items the user has just passed at the top.	13,8	★	★★★★★	
29	Accuracy of displayed distances not visible	1	★★★	★★★★	17
30	Length of list is unclear	11	★★	★★★★★	
31	Listing items by distance is uncommon	13	★	★★★★★	
32	Not completely safe while cycling. Too much text.	5	★★	★★★★★	

⁶Standard iPhone components.

⁷Little space available

⁸Icon taken from “standard library”

⁹Standard iPhone solution, little space available

¹⁰Standard iPhone components. Changing would violate Apple HI guidelines.

¹¹No space available

¹²Fixing would require explicit expert mode or other elaborate solution.

¹³Architecture limitations

¹⁴Standard iPhone components.

¹⁵Standard iPhone components. Changing would violate Apple HI guidelines.

¹⁶Standard iPhone solution would be to show ‘scroll indicator’ when scrolling, but this requires a finite list.

¹⁷Assumed that distance correlates with relevance, but this is probably not true for all use cases.

33	'Swipe' interaction method depends on user experience and familiarity	6	★★	★★★★★	18
34	Cannot sort or filter on categories within this screen.	7	★★	★★★★	
35	Screen contains lots of text	8	★	★★	19
36	Walking a trail is difficult in list view	7	★★★★	★★★★	
37	Scanning requires scrolling	13	★★	★★★★★	
38	Descriptions font is small for some people	16	★★	★★★★★	
39	No colour in screen. Items only distinguishable by icon shape and text label.	16,6	★★	★★	
40	Category icons should have pronounceable alternative for visually impaired users.	16	★★★★★	★★	
Map view					
41	Zoom status not visible	1	★★★★	★★	20
42	No shortcut to return to current position after panning the map.	1,3	★★★★	★★★★	
43	Overlapping icons are difficult to select.	3	★★★★	★★★★★	
44	Coloured icons can make screen ugly	8	★★★★	★★★★	
45	Current location not clearly distinguishable from other icons on map	13	★★	★★★★	
46	Coloured trails could be wrongfully associated with coloured icons.	13	★★	★★★★★	
47	Satellite image clutters view	8	★★★★	★★★★★	
48	Current GPS coordinates and exact accuracy not shown	1	★★★★	★★	
49	Lack of high-quality content	14	★★★★★	★★★★★	
50	Category icons may not clearly communicate meaning	2	★★	★★★★	
Notification popup					
51	Action required to dismiss notification	7	★★	★★★★	
52	Notifications are intrusive and block map view	3	★★★★	★★★★	
53	No way to indicate that user wishes to ignore / is not to be bothered with similar notifications in the future	3	★★★★	★★★★	

¹⁸Standard iPhone solution

¹⁹Icons could be colour-coded

²⁰No better map available at the time.

Lens selection screen					
	Issue	H#	Severity	Cost	
54	Lens metaphor not familiar (maybe layers?)	2	★★	★★★	
55	Title 'visible lenses' is ambiguous	2	★★	★★	
56	Shelf metaphor not familiar	2	★★	★★★	
57	Novice users may not understand dragging as a shortcut	2,7	★★	★★★	
58	Order of lenses on shelf unclear	13	★★	★★★	
59	Lens screen does not follow existing iPhone conventions	4	★	★★★	
60	Blue icons used for different purpose than they were meant for (according to iPhone Human Interface Guidelines).	4	★	★★	

Alternative map screen					
	Issue	H#	Severity	Cost	
61	Lens icons at bottom of screen are not descriptive.	6	★★★★★	★★★	
62	Lens icons at bottom of screen are difficult for colour-blind users	16	★★★	★★★	
63	Unclear what would happen if an item on the map is on multiple lenses	2	★★★	★★★	
64	Map icons are different from standard Apple push pins.	4	★	★★	
65	Location icon is different from standard Apple 'marble'	4	★	★★	
66	Lens icons at bottom of screen are round, whereas lenses are square.	2,4	★	★★	
67	Lens icons at bottom of screen look much like standard Apple 'marble' used to indicate current location	4	★	★★	

7.1.3 Discussion

Issue 3: No tactile feedback

Problem For blind users it is difficult or sometimes impossible to use a device with a touch screen. The screen does not give any tactile feedback when an action is performed.

Recommendation This issue can not be fixed by a change in the application. Apple has to alter the iPhone, or a device with tactile feedback features has to be used for the application. Another solution might be using overlays to lay over the screens, which can give tactile feedback (McGookin et al., 2008).

Issue 17: Duplicate use of label 'Map' with different meanings

Problem The first tab of the tab bar at the bottom of the screen is the 'Map' tab. This tab contains three different 'Map' views, that are displayed in the top tab bar: Map, 3D and List. With this setup, there are two buttons with the same 'Map' label. This inconsistency is confusing to the user. Also,

the bottom ‘Map’ label, suggests you go to the map, although it is possible that you actually go to an augmented 3D view or a list view.

Solution The bottom tab ‘Map’ was to be replaced by ‘Discover’. The top bar labels Map, 3D and List have to be under the umbrella of this term.

Issue 27: List is ordered on distance, but does not give information on direction

Issue 28: Because list is ordered on distance, it shows items the user has just passed at the top

Problem In the list view, everything is ordered in distance, with closest items on top. When at a static location, this is appropriate. Only, this device is used when walking, and thus not only distance but also direction is important. After all the items you just passed, you have no interest in anymore. For the first meters this item will nevertheless be at the top of your list.

Recommendation In modern iPhones, there is a compass so the phone knows where you are pointing, and where you are heading. With this information it can calculate what information is most important, and can place upcoming objects higher on the list. This however will confuse the user, because there won’t seem to be a logic order when a 5 meters far object (behind you) will be lower on the list than the upcoming item in 20 meters. This can be solved by only displaying objects in front of you or placing an arrow behind each item, to where it is.

Issue 36: Walking a trail is difficult in list view

Problem One of the main purposes of the Discoverijssel system is the walking of trails. Only, when in the list view, this feature of the system cannot be used. Thus when following a trail, the map screen has to be selected to be aware of where the trail leads.

Recommendation A small status bar can be placed below all list items, with information about how far the user is from the path and where the path is leading next, again making use of the system compass of the iPhone.

Issue 41: Zoom status not visible

Problem In the map view, with the multitouch feature of the iPhone, enlarging the map by zooming with two fingers is possible. When zooming however, there is no status or zoom level information provided.

Recommendation It is easy to add a zoom scale to the menu. Also, when it clutters the screen too much, it can be made only visible when the user is making use of the zoom function or is panning.

Issue 51: Action required to dismiss notification

Problem When approaching a possibly interesting object on the map, a notification can appear. When the object turns out to be not interesting for the user, it can be conceived to be obtrusive. This feeling is strengthened by the fact this notification needs an action to dismiss it, namely press ‘dismiss’ on the pop-up screen.

Solution The notification will be set to disappear when a certain amount of time passes, or when the object is too far away.

Issue 54: Lens metaphor not familiar

Problem The lens metaphor that is used in the system, won’t be easy to understand by the user. In the real world, there is not a commonly used metaphor for this feature.

Recommendation However there is no appropriate metaphor for this feature in the real world, the virtual world already implemented this same idea. For instance, in Photoshop a similar system is used. Different layers (as they are called there) can be placed over each other. Using this naming convention wouldn’t fix the whole issue, but layers are more commonly used than lenses.

7.1.4 Colourblind Users

The application is also tested for use by colourblind users. The most important test was to see if the map screen, with all its different colours, was ‘readable’ when colourblind. Figure 7.2 shows that, however there is some loss of information, the screen is still perfectly usable.

7.2 Formative evaluation and usability study

In evaluating the strengths and weaknesses of the designed program, attention was given both to usability issues (focusing on task-based, goal-oriented design objectives of efficiency and utility) and user experience evaluation (with a wider concept of user experience in mind, with more attention for aesthetics, enjoyment and creativity), a combination which allows for a thorough exploration of the product. The purpose of this evaluation was to predict the expected performance of the actual users using the current prototype and materials, as well as detect any serious problems prior to the further development of the product.

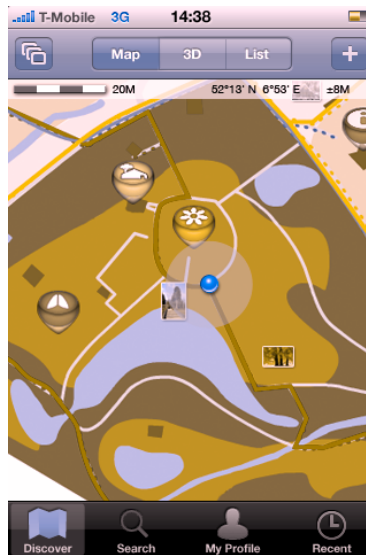


Figure 7.2: The map screen through the eyes of a colourblind user

The evaluation was focused on determining if the needs of the user are met in a easy to understand, useful, and productive manner.

Key experiential categories for another mobile device (in casu a Smartphone) have been found to be identity, sociability, security and organisation, within a super ordinate category of relevance.(Swallow, Blythe, & Wright, 2005) The same topics seem to be worth investigating for the Discoverijssel application, but they get only little attention in a usability evaluation that just focuses on finding usability issues in the interaction design. Therefore we also asked a couple of general questions about the participant's willingness to use the product and held a short open interview.

Purpose of the Usability Evaluation The usability evaluation of the Discoverijssel application aimed to evaluate the potential for errors and difficulties involved in using the application. Some of the areas that were be tested through the usability evaluation process were derived from the heuristic evaluation performed on Discoverijssel. Other concerns were identified by the project.

Concerns Some specific questions to be addressed in this usability evaluation included:

1. Will users be able to use the application without help?
2. Will users understand the application?
3. Will users be willing to share their own content in the application?

4. Will users like the idea of the application?
5. Are there tasks that users will want to perform that are not currently supported?

The question ‘Will users be able to install and launch the application?’ will be tested at a later development stage.

Usability Evaluation Goals Specific usability goals were determined from the above concerns. These goals allowed for the creation of evaluation scenarios and tasks that would let us know if our concerns are valid and what measures can help us determine if in fact the participants are having trouble completing the tasks.

- Participants will be able to begin using the application with no documentation.
- Participants will be able to find information with no expressed or visible frustration.

We also used a survey to determine subjective reactions to the product. For this purpose we have chosen to use the System Usability Scale (SUS) (Brooke, 1996), a scale that covers the three general classes of usability measure effectiveness, efficiency and satisfaction and was designed for simplicity and speed.

Attention was also be given to the following questions, although they were not be explicitly tested:

- Users feel that the pictures used on the icons are recognisable and do facilitate system use/understanding?
- Users associate the product with leisure, not with work.

In measuring the user experience, different types of metrics can be used: performance metrics, issues-based metrics, self-reported metrics and behavioural and physiological metrics (Tullis & Albert, 2008). In the setup of the user evaluation we have aimed for a mixture of these types. Performance measures included task success and errors; the System Usability Scale was a self-reported measure and behavioural metrics included observation and coding of verbal and nonverbal behaviours. Issues could be identified based on user behaviour and verbal remarks.

7.2.1 Method

The individual evaluations took place in the following order:

1. A video prototype to introduce the product to the participant and invite their remarks
2. A performance evaluation in which each participant is asked to perform a series of real-life tasks

3. A questionnaire and an interview after the performance evaluation to gather additional insights from the participants about the project

A ‘thinking aloud’ protocol was used during the interaction of the participant with the paper prototype. Participants were instructed to voice their thoughts, feelings, associations, etc. while working on the tasks.

Measures that were collected include the following, with a focus on qualitative data:

1. The percentage of participants who finished each task successfully
2. The (number of) cases in which the participants were not able to complete a task due to an error from which they could not recover
3. (The number of times) when the participant asked the expert for help for each task
4. (Number of and) types of errors, including:

Observations and comments. The evaluation monitor notes when participants have difficulty, when an unusual behaviour occurs, or when a cause of error becomes obvious.

Non-critical error. A participant makes a mistake but is able to recover during the task in the allotted time.

Critical error. A participant makes a mistake and is unable to recover and complete the task on time. The participant may or may not realise a mistake has been made.

5. (The number of) indications of frustration or joy from the participant
6. (The number of) subjective opinions of the usability and aesthetics of the product expressed by the participants

The average amount of time to complete each task was not be recorded, since the amount of time will be different from the time needed for a task in the functioning application (using a paper prototype in a lab setup differs from using a mobile functioning application in a natural environment; the thinking aloud protocol may also influence response times).

For the complete evaluation plan, see appendix I.

7.2.2 Video Prototype

Because the highly context-dependent nature of the system was difficult to demonstrate in a laboratory setting, a different prototyping technique was needed to show the typical use of the system in its natural environment. Video Prototyping is a scenario-based technique for conveying design ideas that has been

shown to be suitable for this purpose (Tognazzini, 1994; Sellen, Massimi, Lottridge, Truong, & Bittle, 2009). Because it is non-interactive, a video prototype is much easier to produce than a working mockup. It also allows the designer complete control over what functionality is demonstrated, which makes it particularly suitable to show physical (Halskov & Nielsen, 2006) and social (Tognazzini, 1994) aspects of the system and interaction.

However, there are also some pitfalls to look out for when creating a video prototype. As the creators of ‘Starfire’, one of the first video prototypes, already noted, it is tempting to be overwhelmed by the seemingly possibilities of film that “lure the prototyper away from the possible toward the land of fantasy” (Tognazzini, 1994). Also, Sellen et al. (Sellen et al., 2009) have shown that there may be a ‘medium effect’ that could result in differences among user groups, especially with older participants.

Therefore, the following design guidelines, based largely on those from ‘Starfire’ (Tognazzini, 1994), were used to create the video prototype:

- First design the interface, then make filming decisions.
- Do not introduce new interaction techniques that were not already part of the system design unless they are feasible.
- Avoid impossible hardware designs and reintroduce hardware artefacts when needed.
- Show unresolved issues and limitations of the design.

Because the video prototype was to be followed by the evaluation of the system’s usability, an additional guideline was used:

- Keep an external viewpoint. Show as little as possible of the actual touch-screen interaction to prevent affecting the usability evaluation and keep the focus on the general idea of the system.

The resulting video prototype²¹ was a three minute long film of a couple deciding to go for a walk in the park. Upon arrival, they learn about the Discoverijssel application and start using it. While walking around the park, they are pointed to things they didn’t notice at first, learn about the interesting background of notable sights and see pictures that were shared by others. The video also shows them using the system in a more active manner, as they share a picture of their own and look up how to get back to their car.

The video prototype, of which a few stills can be seen in Figure 7.3, was to communicate a few key ideas of the system:

- The system is not used for preparation of the trip, nor for navigating to the park.
- The system can be advertised on an existing information-sign and installed by scanning a digital barcode (for instance, a QR-code).

²¹See <http://www.youtube.com/watch?v=0X4AyY9wxsk>

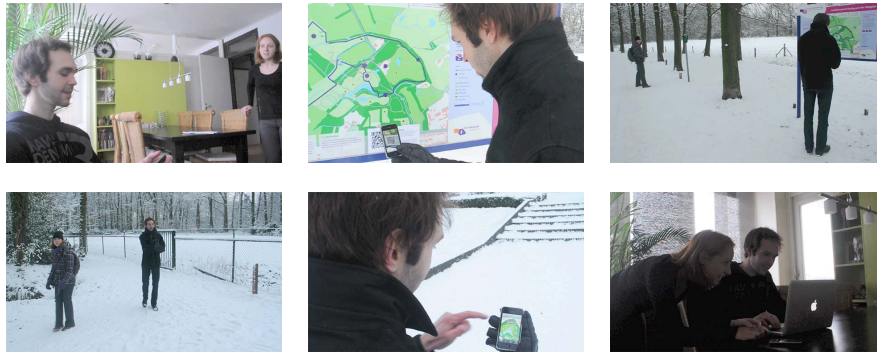


Figure 7.3: Stills from the video prototype

- The system plays only a modest role in the user's activities. John's mobile phone remains in his pocket for most of the time. He only takes it from his pocket when the application notifies him of something nearby or when he wants to look something up.
- The mobile application is backed by a website, which can be visited from a computer at home.

7.2.3 Paper prototype

For testing the way users would interact with the product while performing a number of tasks, the paper prototyping method was used. Although some studies have found validity issues with interaction data from paper prototypes (Liu & Khooshabeh, 2003), another study (Sefelin, Tscheligi, & Giller, 2003) found that paper- and computer-based prototypes led to almost the same quantity and quality of user statements.

The material used for the paper prototype consisted of a printout of an Iphone, with the screen part cut out. The 'screens' used for the tasks were those shown in Figure 6.27, with larger ('scrollable') versions for some of them. Two versions of the map were available: one with and one without pictures.

7.2.4 Task-based Approach

The main functionality of Discoverijssel was tested by giving the users a set of tasks (see Appendix I.8.6) which they were instructed to carry out one after another. The goal was to find out about the difficulties the users had with the design of the prototypes, which then would lead to their improvement.

By showing the video prototype to the participants, they were introduced to the intention of how Discoverijssel is supposed to be used. Furthermore, the tasks were designed in a way so that the participants would have to imagine a

specific scenario in order to carry out the tasks(e.g. imagine that they are in the Ledeboerpark (shown in the video prototype).

Starting with the easier task, the participants were asked to describe what they could see on the main screen, and familiarise with the application by finding other ways to display the main view. Secondly, the design of the prototypes for searching for content was tested, followed by the task to find out how more information could be displayed on the main screen (testing the lens metaphor). In the final task the participants were asked to test the feature for sharing content.

7.2.5 Lab setup

During the test, four people were present in the room besides the participant: one facilitator who explained the procedure and gave instructions, one controller/wizard who was responsible for the paper prototype reactions and two observers, one of whom also had the task of controlling the equipment.

The participant was seated in front of the laptop that was used for showing the video prototype. Next to the participant the controller was seated (Figure 7.4); the facilitator was seated on the left side of the participant, on the other side of the table as well as one of the observers. The second observer watched the test via a computer monitor showing the recordings from the two cameras.



Figure 7.4: Test set-up showing positions of participant, paper prototype and controller, laptop screen and over-the-shoulder camera

7.2.6 Participants

Five people participated in the user evaluation, four male and one female. They were aged between 19 and 30 years, with a mean age of 22.2 years. Most of the participants were students (4 out of 5), and one participant was a research assistant.

The participants' frequency of visiting nature ranged from 'almost never' to 'once a week'. Their modes of transportation while visiting were on foot (hiking or jogging) or by bike. Only one participant owned a smartphone (an android phone HTC hero), the other participants described their mobile phones as 'very simple' or 'old'. Four people indicated that they had accounts on social networking sites. The person without social networking accounts explained that he prefers to talk to people face to face.

It could be argued that the amount of participants for the user evaluation was not sufficiently big enough to draw valid conclusions from this investigation. However, Tullis&Albert argue that "In our experience, five participants per significantly different class of user is usually enough to uncover the most important usability issues. In most of the usability tests we're conducted over years, regardless of the total number of test participants, we're seen most of the significant issues after the first four or five participants. In fact, it is a rare occurrence when we see a new and significant issue during the fifth or sixth usability session. [...]" (Tullis & Albert, 2008).

A further reason for a small number of participants was the time constraint. In order to guarantee validity in the results, a single class of users had to be chosen. Since the representative of Landschap Overijssel had indicated that they see people from 18 to 30 as their main target group, this class was the most obvious to choose. The participants who volunteered for this study were all students or research assistance at the University Twente. Nielsen acknowledges, that conducting a study with a small number of participants "will not be a perfect study that will discover everything that's possible to know about the design, but we accept this trade-off in return for having more iterations in the design process and conserving resources for subsequent evaluations of these iterations" (Bevan et al., 2003).

The reasons for not testing the prototypes with visually impaired people are first of all that it was not possible to find enough people from this target group, but also the fact that there was a time constraint on this project and preparing for tests with this target group would have been too time consuming, especially since a different test setup would have been required. However, even though the iPhone guidelines are straight forward about the expected behaviour for the screen reader (Apple inc., 2010a), (Apple inc., 2009a), if the decision should be taken that these prototypes should be further developed, then it is strongly recommended to carry out a user evaluation study with visually impaired people.

7.2.7 Results and Discussion

Reactions to video prototype

Positive comments about the video prototype included comments that the product was 'funny', 'cool' or 'fancy'. However, some of the participants immediately told that they would not be interested in using the product. One of the participants started to describe what he had just seen as 'a program that tells you

about a location’, which is probably representative of what he regarded the core functionality of the product. Another one talked about how it resembled another application with ‘augmented reality’.

None of the participants owned an iPhone, which they frequently mentioned as a reason that they would not use the product. However, three people said that they would be inclined to try the product if they had a suitable phone.

Reasons the people who did not want to use the product themselves gave included that in their opinion visiting nature was a situation where they did not want to use technology and that they would like to see their environment with their own eyes, not through their phone.

According to the participants in the user study, the product would be interesting for tourists that go to a tourist location and want to know more information about it. It would not be interesting to people without smart-phones and people from older generations (parents/grandparents).

Task completion

Discover the different views When given the task of finding their current location, all participants could find the blue dot with the circle around it in the middle of the screen. Several comments about the red line were made: people thought that the line represented the path they were planning to walk (or even *had to walk*).

For getting more details about the giant sequoia, one participants did not click on the pushpin in the map screen, but instead chose to work via the list view. The other participants clicked on the pushpin and easily found the details screen.

Search content Most people were able to find the Search tab in the lower part of the screen. One person tried to find content via the list view. He apparently did not notice the interaction elements on the bottom of the screen.

Comments made by other people about the content were difficult to find for one of the participants: she did not discover scrolling, which might have to do with the fact that she did not have any previous experience with the Iphone. After the opportunity to scroll was found, it became immediately apparent what was needed for adding comments.

Discover the lens metaphor In this task, participants often considered the ‘+’-button first, some people tried it but found out that it was not what they were looking for. Then they found their way to the lens button in the top left corner. One of the participants explained his thoughts as follows:

I think I would ... so I have here the map, the 3d view and the list view and I am interested in the map so to see more information
I would ehm try the it’s not really obvious to me but I would try the plus though the plus could mean a lot
[clicks on the plus and the add content screen appears]

camera ... sound [mumbles]

[facilitator asks 'so what's this?']

I assume I would click there but I assume now that this is applic
[stops abruptly] camera?

I don't know, normally I would expect pictures, sounds and assume that these are files other users uploaded and I can have access to them also I can have access to a trail, trail information, point of interest these cute eh small ehm items that I see there on the map so probably just a list of these items ... but as here is written camera, I really wonder it either means pictures and videos or it means that I can make a picture

Ah! [exclaims] Because this guy John right took a picture of the tree and ehm I guess this goes directly in this application and I mean to the website ... so that's is my intuition ... but that would be rather active things than just ... so producing instead of consuming

When trying to activate the lens 'user pictures' in the lens screen, most people clicked on it as if it was a button. One person used a dragging movement. Two people tried to click on the small pictures in the user pictures lens and expected a zooming behaviour.

Finding the lens store was difficult for all of the participants. The label 'lens store' elicited comments such as 'oh, I have to *buy* it'. After the lens store was found, downloading the lens did not pose any further problems.

For one of the participants the second subtask for the lenses (adding the cycling tour lens, which had to be found from the lens store) was skipped, since she clearly expressed frustration and nervousness and had had difficulties with the previous subtask of activating the user pictures lens already.

Share content Sometimes people had difficulty finding the '+'-button, even though they had visited it before and had commented on it then. One participant quit the application to take a picture with the standard iphone camera application.

The sharing button turned out to be difficult to find for most participants. One person commented that it looked like an 'exit'.

Even though he had been instructed to share the taken picture with 'everyone', one participant spontaneously chose the option of sharing it with his friends.

In the details screen, the participants recognised that they could enter descriptive text and a title. The question mark icon in the top left corner was a little bit more confusing, but the purpose became clear after clicking on it. People differed in the amount of text they would enter before submitting the picture from no details at all to complete details.

Issues

While the participants worked on the tasks with the paper prototype, a number of usability issues came up. They are presented here in a similar way as the issues found in the heuristic evaluation. Although the issues originated not in a heuristic evaluation but in the user evaluation, it was possible to assign categories to them in the same manner (Table 7.7).

Table 7.7: Category codes for grouping the issues during the user evaluation.

1. Visibility of system status
2. Match between system and real world
3. User control and freedom
4. Consistency and standards
5. Error prevention
6. Recognition rather than recall
7. Flexibility and efficiency of use
8. Aesthetic and minimalist design
9. Help users recover from errors
10. Help and documentation
11. Navigational feedback
12. Use of modes
13. Structure of information
14. Enjoyment / Pleasurable and respectful interaction
15. Physical constraints
16. Extraordinary users
17. Skills
18. Privacy

As with the heuristic evaluation issues, severity ratings and cost estimations were assigned to the discovered issues. The severity ratings, listed in Table 7.8 take into account the frequency of occurrence of a problem, the proportion of users that will be affected and the estimated effect on the user experience. For the cost ratings the same scheme was used as in the heuristic evaluation, for the convenience of the reader the scheme is repeated here in Table 7.9.

Table 7.8: Severity ratings: 1 to 5 stars

Rating	Definition
★	Minor: has little influence on the overall experience.
★★	Superficial: Problem occurs extremely unfrequent, is easy to overcome by user, or affects only a small group of users.
★★★	Minor: Occurs more often than superficial or is more difficult to overcome by user, or affects a major group of users.
★★★★	Major: Occurs frequently or users are unaware or may not know how to fix this problem. Affects most users and may cause users to stop using the product.
★★★★★	Catastrophic: Use of product is in danger, problem cannot be overcome by users.

Table 7.9: Cost ratings: 1 to 5 stars

Rating	Definition
★	Very easy to fix. Can be done by one team member.
★★	Easy to fix. Involves only specific elements of interface and solution is clear.
★★★	Requires more effort to fix. Requires multiple team members and more interface elements have to be fixed or altered
★★★★	Difficult to fix. Requires multiple team members and multiple aspects of interface. Problem is interwoven in application, solution is not clear.
★★★★★	Impossible to fix. Possible fix would disturb rest of system or other guidelines too much.

Discover the different views					
	Issue	C#	Severity	Cost	
1	Red line (route) is confused by 'the route that I'm taking or have to take'	2	★	★★★★	
2	Red line is interpreted as 'route that is planned to walk'	2	★	★★★★	
3	It is not clear whether the star rating is about the object or about the article	2, 4	★	★★	
4	Circle around blue dot interpreted as field of vision.	2	★	★★★★	
5	Bars and buttons can be overseen (attention to the map only)	4, 6, 8, 11	★★★★	★★★★★	
6	Clickable pushpins in map view not recognized as such	3, 6	★★	★★★★	
7	Direction not visible	1	★★	★★	
8	Tags in content details screen unclear	6, 8	★	★★	

Map screen					
	Issue	C#	Severity	Cost	
9	Iphone scrolling behavior unknown to non-Iphone users	4, 7	★★	★★★★	
10	Pictures/thumbnails not visible in search results.	1, 7	★	★★★★	
11	Star ratings mistaken for comments	4	★	★★★★	
12	Expected search possibilities in list view	4, 7	★★	★★★★★	

Discover the lens metaphore					
	Issue	C#	Severity	Cost	
13	Lens store not found in visible lenses screen	4, 11	★★★★	★★	
14	Search does not allow for searching lenses	3, 6	★★	★★★★	
15	Red line confused with adding other routes	3, 6, 8	★	★★	
16	More content expected when zooming in	4, 6	★★	★★★★★	
17	Plus icon is tried for adding lenses	4, 8	★★★★	★★★★	
18	Lens store associated with paid content	2	★★★★	★★	
19	Lens button not obvious	6, 8	★★★★	★★★★	
20	Pictures in 'user pictures' lens are very small and hard to see	15	★★	★★★★	
21	Clicking on pictures in user pictures lens does not result in expected behavior (zooming in)	7	★★	★★★★	
22	Green button for adding a lens not recognised as giving access to content by others (only own content)	2	★★	★★★★	
23	Upward arrow for the lens store not found	8	★★★★	★★	
24	Button 'Lens store' can be overlooked	8	★★★★	★★★★	

Share content					
	Issue	C#	Severity	Cost	

25	Not clear that pictures can be taken from within the application.	2	★★★★	★★★★	
26	Share button is unclear.	4, 8	★★★	★★★	
27	Share button is confused with 'exit'	4, 8	★★★	★★★	
28	'+'-sign not associated with adding own content	4, 8	★★★	★★★	
29	It is not possible to escape from the camera screen without taking a picture and adding it to the map	5	★★★★	★★	

System Usability Scale

The scores on the System Usability Scale for the five participants were 82.5, 80, 72.5, 57.5, 72.5 (mean 73, median 72.5). According to (Tullis & Albert, 2008)[page 149], an average score under about 60 percent qualifies as ‘relatively poor’, while a score above 80 can be considered ‘pretty good’. In their comparison over 129 conditions, they found a mean SUS score of 66 percent with a median of 69 percent. Both the mean and the median of our study are above these numbers, which indicates that the prototype was received with satisfaction. However, there is still room for improvement, and caution needs to be taken because of the small sample size. Also note that there was a large difference between the participants: the highest score was 82.5, the lowest only 57.5. It may be worth mentioning that the participant who gave the lowest ratings was also the one who seemed to have most difficulties with the tasks.

7.2.8 Conclusions

Although some of the tested users indicated that they would like to use the product themselves, most of the users voiced positive comments about the prototype, and found the prototype easy to use, which is also reflected in the ratings of the SUS.

Most people were able to complete most of the tasks, mostly without hints. The task of downloading a lens from the lens store proved to be the most difficult task, so in that part of the application the interface could use some adaptations.

Familiarity with the iPhone interface seemed to make a large difference in the experienced ease of use of the prototype. The one participant who was somewhat familiar with the interface because he owns an iPod was able to complete the tasks with considerably more ease than the others. It is possible that, if in the future more people will own an iPhone and be familiar with the interface, more people will be able to benefit from their experience when using the Discoverijssel product.

Chapter 8

Conclusions and recommendations

This chapter describes to what extend the requirements are fulfilled, recommendations are given to the client, and acknowledgements are given.

8.1 Requirements Check

In the table below, the requirements from chapter 3 are checked against the Discoverijssel prototype. Many of the requirements that were stated in 4 were out of the project scope. However, most other requirements are implemented in the concept or in the prototype.

IP	Implemented in prototype
IC	Implemented in concept
OP	Implemented only partial
Un	Not tested/unknown
NI	Not yet implemented/Outside of project scope
NR	Not reached

Check of requirements			
Req.#	Requirement	Check	
1.1	The system should give notifications about relevant (recommended) points-of-interests	IC	1
1.2	The system should show possible points-of-interest as icons on a map	IP	
1.3	The system should show the user's geographical location	IP	
1.4	The system should allow users to switch between map views (radar view, north up, fish eye view, list view)	OP	
1.5	The system should be able to give recommendations to the user	NI	
2.1	The system should contain some basic information package about Overijssel (starter package, user doesn't need to plan a trip)	NI	2
2.2	The system should be able to give practical information about the area (restaurants etc.)	IP	
2.3	The system should allow the user to view an agenda of upcoming events	IC	
2.4	The system should show the nearest bus stops	IC	
2.5	The system should show timetables	IC	
2.6	The system should contain information about walking trails and cycling routes that already exist in the area indicated with signs, ANWB routes, etc.)	IC	3
3.1	The system should be able to remember hiked or biked trails	IC	4
3.2	The system should allow the user to save the current location (point-of-interest)	IC	
3.3	The system should allow users to save arbitrary locations (point-of-interests)	IC	
3.4	The system should enable the user to save trails, pictures, short videos, audio, text, location bookmarks (point of interest)	IC	
3.5	The system should let the user record/create content without leaving the application	IP	
4.1	The system should enable the user to share trails, pictures, short videos, audio, text, location bookmarks (point of interest)	IC	
4.2	The system should allow users to view content that other users have shared	IC	
4.3	The system should allow users to respond to other people's content	IP	
4.4	The system should allow users to give a rating to content	IP	
4.5	The system should allow users to tag content	IC	
4.6	The system should allow users to categorize content	IC	

¹The different views changed to be Map (schematic map), 3D (augmented reality through camera lens) and List

²This can be added as an agenda lens

³Some of this information is as default in the system. Other information can be added via lenses that have to be downloaded

⁴This is implemented as the same feature as 4.1, when shared only with yourself

4.7a	The system should allow users to specify default user access settings	NI	
4.7b	The system should allow users to specify user access for specific content items	IC	
5.1a	The system should allow users to create their profile	IC	
5.1b	The system should allow users to update their profile	IC	
5.1c	The system should allow users to delete their profile	IC	
5.2	The system should allow users to view other users profiles.	IC	
5.3a	The system should allow users to create groups	IC	
5.3b	The system should allow users to join groups	IC	
5.3c	The system should allow users to leave groups	IC	
5.3d	The system should allow users to delete groups	IC	
5.3e	The system should allow users to update group information	IC	
5.4	The system should allow users to control who can join a group.	IC	
5.5	The system should allow group owners to delegate administrative tasks	IC	
5.6	The system should allow users to specify relationships (Friends) between them and others	IC	
5.7	The system should display a user's friends list	IC	
6.1	The product shall include the logo of Landschap Overijssel	NI	
6.2	The product shall fit with corporate branding standards of Landschap	NI	
7.1	The product shall be associated with current technology (not oldfashioned, but not complex and inaccessible)	IP	
7.2	The product shall be associated with leisure (not with work)	IP	
7.3	The system should provide a good user experience	IP	5
8.1	The system can be used in an ad-hoc manner, without planning in advance	IC	
8.2	The product shall help the user to avoid making mistakes (such as inadvertently deleting information)	Un	
8.3	Sharing function should not be time consuming	IC	6
8.4	The system can be used passively (it takes initiative)	IC	
8.5	The system can be used without having to create an account first	IP	
9.1	The system should allow users to choose what kind of information they want to see (lens metaphore)	IP	
9.2	The look and feel of the system should be able to be personalised	NI	
9.3	The system should allow the user to view, set and change preferences	IC	7

⁵The SUS indicates the user experience is very good

⁶Fastest route of sharing a created picture only takes 3 steps. Uploading happens in background

⁷This feature won't be in the application, but preferences can be made in the main iPhone preferences screen

9.4	The product shall use the Dutch language	NI	8
9.5	The product shall use Dutch conventions for date notation, decimal symbols and currency	NI	
9.6	The product shall be usable in an English and German version, targeted at non-local visitors	OP	9
10.1	The product shall be able to be used by members of the public who will receive no training before using it	IP	10
10.2	The product shall enable frequent (expert) users to benefit from their experience with the product	IP	11
11.1	The product shall use symbols and words that are understandable by users with little domain knowledge	IP	
12.1	The computer-accessible website shall adhere to the Webrichtlijnen	NI	12
12.2	The product shall be usable by users with a visual disability	IC	13
12.3	The product shall be usable by users with an auditory disability	IC	14
12.4	The product shall be usable by colourblind users	IP	15
12.5	The product shall be usable by users with limited motor skills (dexterity)	IP	
13.1	The product shall update location information fast enough to be useful while cycling	Un	16
13.2	The product shall update location information fast enough to be useful when walking	Un	
13.3	The product shall give an intermediate partial response in those cases where it would take a long time to wait for the full response	NI	
13.4	Notifications should be given at an appropriate time and location taking into account properties of the point-of-interest, preferences of the user, etc.	IC	
14.1	The product shall by default use an audio volume that is considered safe for use in traffic and with regards to hearing loss	OP	17
15.1	The product shall be precise enough to be useful while cycling	Un	
15.2	The product shall be precise enough to be useful when walking	Un	

⁸For course convenience, the English language was used

⁹The prototype for the Interface & Interaction Design course was made in English

¹⁰In the heuristic evaluations, all main tasks were completed, without the participants were given any training

¹¹Some tasks do have a shortcut, so expert users are faster in using them

¹²The back-end website, that supports the mobile application, was not designed, and thus could not be tested for the Webrichtlijnen

¹³The application is designed in a way that a screenreader gives valuable information. An example is the List view of the Discover screen

¹⁴The only sound emitted by the application itself (besides sound in content), is the notification. This should also be able to set to vibrate

¹⁵The map screen stays readable for colourblind users

¹⁶Unknown however a lot of applications for the iPhone already use the GPS function when moving, so this should be possible

¹⁷In the video prototype a good sound volume is used

16.1	The product will continue to function (with limited functionality) when there is no GPS signal available	IC	18
16.2	The product will continue to function (with limited functionality) when there is no internet connection available	IC	19
17.1	When the system load is within predictable and expected limits, the product will be available for use most of the time	Un	
18.1	The product can be extended for use in other areas	IP	
18.2	Information can be added to the product at a later stage	IP	
18.3	A developers API should be available for external developers	NI	
18.4	The product shall be able to show content from other providers, such as Flickr and Panoramio	IP	
18.5	The product shall be able to share content generated in the application with other content providers	NI	
19.1	The product shall require only minor updates during the first years of use	Un	
21.1	The product shall be usable during a cycling tour	Un	
21.2	The product shall be usable while hiking	IP	
21.3	The product shall be usable in dim light	IP	20
21.4	The product shall be usable in bright sunlight	IP	21
21.5	At default settings, the product shall not be louder than the volume of people having a conversation during the activity	IC	
22.1	The system can be used for geocaching	IC	
22.2	The system should be able to let the user follow walking trails and cycling routes that already exist in the area (indicated with signs, ANWB routes, etc.)	IC	22
22.3	The system should support the discovery of new things in nature	IP	
23.1	A web interface to the product shall work on the browsers that are most popular among the intended audience	NI	
25.1	The product prototype shall be delivered according to the course schedule for I&ID	IP	
26.1	The product must be able to be maintained by its end users or by developers who are not the original developers	NI	
27.1	The product will facilitate users to support each other	NI	
28.1	The product will have to function on future versions of mobile devices when the devices it was originally designed to become obsolete	IP	23
29.1	Only developers with authorised access will be able to make changes to the core functions of the product	NI	

¹⁸Only limitation is the lack of notifications and the map won't display your current position

¹⁹Limitations are lack of search functionality and content details

²⁰Unknown however the iPhone screen is usable in dim light, so the application can be made to be usable in dim light

²¹Unknown however the iPhone screen is usable in bright sunlight, so the application can be made to be usable in bright sunlight

²²When added the specific Lens, these routes can be followed

²³When designing the application, Apple iPhone guidelines were followed, so it would be save to say this requirement is achieved

29.2	Only users with special permissions can view and edit other user's protected data	NI	
29.4	Most functions of the application can be used anonymously, without needing to create a user profile	IP	
29.3	The product shall protect itself from intentional abuse	NI	
30.1	The system should allow users to choose what to share and what not to share (privacy)	IC	
30.2	The product shall make its users aware of its information practices before collecting data from them	NI	
30.3	The product shall notify users of changes to its information policy	NI	
30.4	The product shall protect private information in accordance with the relevant privacy laws and the organisation's information policy	NI	
32.1	The product shall have an adequate level of protection against infection by unauthorised or undesirable software programs, such as viruses, worms, and Trojan horses, among others	NI	
33.1	The product shall not be offensive to religious or ethnic groups	NI	
34.1	The system should use Web 2.0	IP	
35.1	The product shall not knowingly violate any patents	Un	
35.2	The product shall abide by Dutch law	Un	
35.3	The product shall be in accordance with privacy laws and regulations	Un	
35.4	The product shall be in accordance with copyright laws	Un	
36.1	The system should have an internet connection	IC	
36.2	The system should have GPS	IC	
36.3	The system should run on a wearable device	IC	
36.4	The system should make use of "Bocodes"	NR	24
36.5	The system should have an alternative computer-accessible application or website	IC	
37.1	The device has a touch screen	IC	
37.2	The device has an orientation sensor (compass)	OP	25
38.1	The service runs on a publicly accessible web server	IC	

²⁴Instead of Bocodes, the system makes some use of QRcodes. These contain less data. Use of Bocodes should be overdone for the functions used for

²⁵The latest iPhone has a compass, earlier versions don't. Compass functionality can be used in the discover screens

8.2 Recommendations

Following from the results of the user evaluation, and information gathered earlier in the project, a number of key factors can be determined that will influence whether the product can succeed or not.

High quality content. A major factor in the attractiveness of Discoverijssel is the availability of content that is interesting to the users. Initially, seeding high quality content will be the responsibility of Landschap Overijssel. We advise to use existing sources where appropriate (such as existing cycling and hiking routes) and create new content where considered necessary. Having content available from the source ‘Landschap Overijssel’ will also influence trust.

Active maintenance. The Discoverijssel product will need active maintenance for minimising spam and other unwanted content, answering questions by users and keeping the content up to date. We recommend Landschap Overijssel to play an active role: by training volunteer administrators and appointing representatives of Landschap Overijssel who are available to handle issues with the product and who can monitor and guide the introduction process.

iPhone use. Although according to various statistics the iPhone is one of the most popular smart-phones, a large part of the target audience still has an older phone with less functionality. People who do not have access to an iPhone will not be able to use the Discoverijssel application. Having iPhones with the application installed available for rent would make Discoverijssel accessible to a much larger audience.

Tourists as intended user group. A number of people expressed that they believed the product would be interesting for tourists. Further user research with tourists can show whether this is indeed the case. If tourists are indeed identified as a target audience, this has some consequences for the product: it will be important that the product can be used in languages other than Dutch (in particular in English and German) and the product needs to be designed for use by non-returning visitors.

Technology adoption. As a product with user-generated content and a social networking component, the attractiveness and value of Discoverijssel will grow when more people are using the application and more content is available. To get a smooth introduction, it might help to first introduce the product to groups of users that are already enthusiastic about nature, especially users who are members of organised groups (clubs, etc.). In the early stages of technology adoption, social influences (subjective norm, voluntariness) can be important determinants for people’s intention to use (Venkatesh & Davis, 2000).

8.3 Conclusion

The design group started with brainstorming and interviewing potential users. Via requirements gathering and creation of a conceptual model, the group has arrived at numerous iterations of screen designs. These screen designs were evaluated heuristically and through a formative evaluation.

To conclude this project, it can be said that it is very possible that further development of this application can result in a product that is fun to use and enriches the experience of visiting the Landschap Overijssel. However, the project was limited by time constraints. With more time, a functional prototype and some more iterations could have been completed.

8.4 Acknowledgements

We'd like to thank everyone who participated in user studies, card sorts and formative evaluation, as well as the actors, Richard Loos and Hester Bruikman, who made it possible to make a nice video prototype. Also, we'd like to acknowledge Yvette Bosch and Koen Kranenberg for their involvement in the early stages of the project. Furthermore, we are indebted to the course instructors Thea van der Geest, Lex van Velzen and the various guest lecturers for their guidance during this project.

References

- Ames, M., & Naamen, M. (2007). Why we tag: motivations for annotation in mobile and online media. *CHI 2007 Proceedings of the SIGCHI conference on Human factors in computing systems*, 980.
- Apple inc. (2009a, 05). Accessibility Programming Guide for iPhone OS (Revision 1 ed.) [Computer software manual]. Available from <http://developer.apple.com/iphone/library/documentation/UserExperience/Conceptual/iPhoneAccessibility/Introduction/Introduction.html>
- Apple inc. (2009b, 11). iPhone Human Interface Guidelines (Revision 9 ed.) [Computer software manual].
- Apple inc. (2010a, January). *Apple - Accessibility - iPhone - Vision*. <http://www.apple.com/accessibility/iphone/vision.html>.
- Apple inc. (2010b, Januari). *Apple iPhone Technical Specifications*. <http://www.apple.com/iphone/specs.html>.
- Barber, C. (Accessed December 2009). *Interactive Heuristic Evaluation Toolkit*. <http://www.idbook.com/catherb/index.htm>. Available from <http://www.idbook.com/catherb/index.html>
- Bevan, N., Barnum, C., Cockton, G., Nielsen, J., Spool, J., & Wixon, D. (2003). The "magic number 5": is it enough for web testing? In *Chi '03: Chi '03 extended abstracts on human factors in computing systems* (pp. 698–699). New York, NY, USA: ACM.
- Brooke, J. (1996). SUS—A quick and dirty usability scale. In P. W. Jordan, B. Thomas, I. L. McClelland, & B. Weerdmeester (Eds.), *Usability evaluation in industry* (pp. 189–194). CRC Press.
- Bruns, A. (2007). Produsage: Towards a broader framework for user-led content creation. In *Creativity & cognition* (Vol. 6, pp. 13–15).
- Fortin, M. (2010). *Sim daltonism*. <http://michelf.com/projects/sim-daltonism/>.
- Girgensohn, A., & Lee, A. (2002). Making web sites be places for social interaction. In *Cscw '02: Proceedings of the 2002 acm conference on computer supported cooperative work* (pp. 136–145). New York, NY, USA: ACM.
- Gray, W., & Salzman, M. (1998). Damaged merchandise? A review of experiments that compare usability evaluation methods. *Human-Computer Interaction*, 13(3), 203–261.
- Halskov, K., & Nielsen, R. (2006, January). Virtual video prototyping.

- Human-Computer Interaction*, -. Available from <http://portal.acm.org/citation.cfm?id=1466587>
- Hassenzahl, M., Burmester, M., & Koller, F. (2003). AttrakDiff: Ein Fragebogen zur Messung wahrgenommener hedonischer und pragmatischer Qualität. In J. Ziegler & G. Szwillus (Eds.), *Mensch & computer 2003. interaktion in bewegung* (pp. 187–196). Stuttgart, Leipzig: B.G. Teubner.
- HTC Corporation. (2010). *Htc hero specification*. <http://www.htc.com/www/product/hero/specification.html>.
- John, B. E., & Suzuki, S. (2009). Toward cognitive modeling for predicting usability. In *Proceedings of the 13th international conference on human-computer interaction. part i* (pp. 267–276). Berlin, Heidelberg: Springer-Verlag.
- Lime & Chile Productions, L. (n.d.). *Websort*. <http://websort.net/>. (Accessed December 2009)
- Liu, L., & Khooshabeh, P. (2003). Paper or interactive?: A study of prototyping techniques for ubiquitous computing environments. In *Chi'03 extended abstracts on human factors in computing systems* (p. 1031).
- McDougall, S., & Curry, M. (2004). More than just a picture: Icon interpretation in context. *first workshop on coping with complexity*, 1–8.
- McGookin, D., Brewster, S., & Jiang, W. (2008). Investigating touchscreen accessibility for people with visual impairments. *Proceedings NordiCHI 2008*, 298.
- Meyer, D. (2009, November). *Windows mobile loses nearly a third of market share*. <http://news.zdnet.co.uk/communications/0,1000000085,39877964,00.htm>.
- Nederlandse Vereniging voor Slechthorenden. (2009, 10). *EU wil volume MP3-spelers begrenzen*. <http://www.hoorwijzer.nl/hoortests/ontwikkelingen/eu-wil-volume-mp3-spelers-begrenzen.html>.
- Nippert-Eng, C. (2007). Privacy in the United States: Some implications for design. *International Journal of Design*, 1(2), 1–10.
- Nokia. (2009, April). *Nokia n97 device details*. <http://www.forum.nokia.com/devices/N97/>.
- Pierotti, D. (Accessed December 2009). *Usability techniques: Heuristic evaluation—a system checklist*. <http://www.stcsig.org/usability/topics/articles/he-checklist.html>. Available from <http://www.stcsig.org/usability/topics/articles/he-checklist.html>
- Pierotti, D. D. (1995, April 19). Usability evaluation plan [Computer software manual]. Available from <http://www.stcsig.org/usability/resources/toolkit/ut.plan.doc>
- Pruitt, J., & Grudin, J. (2003). Personas: practice and theory. In *Dux '03: Proceedings of the 2003 conference on designing for user experiences* (pp. 1–15). New York, NY, USA: ACM.
- Robertson, J., & Robertson, S. (2009). Volere requirements specification template (14th ed.) [Computer software manual].

- Rosson, M., & Carroll, J. (2002). *Usability engineering: scenario-based development of human-computer interaction*. Morgan Kaufmann Pub.
- Sefelin, R., Tscheligi, M., & Giller, V. (2003). Paper prototyping-what is it good for?: a comparison of paper-and computer-based low-fidelity prototyping. In *Conference on human factors in computing systems* (pp. 778–779).
- Sellen, K., Massimi, M., Lottridge, D., Truong, K., & Bittle, S. (2009, April). The people-prototype problem: understanding the interaction between prototype format and user group. *CHI '09: Proceedings of the 27th international conference on Human factors in computing systems*, -. Available from <http://portal.acm.org/citation.cfm?id=1518701.1518799>
- StatCounter. (2010, January). *Statcounter global stats: Top 8 mobile oss in netherlands from dec 08 to jan 10*. <http://gs.statcounter.com/>.
- Stone, D., Jarrett, C., Woodroffe, M., & Minocha, S. (2005). *User interface design and evaluation*. Morgan Kaufmann.
- Sumathi, S., & Esakkirajan, S. (2007). *Fundamentals of relational database management systems* (Vol. volume 47). Springer. Available from <http://dx.doi.org/10.1007/978-3-540-48399-1>
- Swallow, D., Blythe, M., & Wright, P. (2005). Grounding experience: relating theory and method to evaluate the user experience of smartphones. , 98.
- Tennant, E., Anastasia, D., & D'Amato, C. (2005). itunes heuristic evaluation report. *Mailbox*, 261.
- Tognazzini, B. (1994, January). The starfire? video prototype project: a case history. *Proceedings of the SIGCHI conference on Human*, -. Available from <http://portal.acm.org/citation.cfm?id=191712>
- Tullis, T., & Albert, B. (2008). *Measuring The User Experience: collecting, analyzing, and presenting usability metrics*. Morgan Kaufmann Pub.
- Tullis, T., & Wood, L. (2004). How many users are enough for a card-sorting study. *Proceedings UPA, 2004*.
- van der Geest, T., & van Velsen, L. (2009, September). *Design project for Interface & Interaction Design*.
- Venkatesh, V., & Davis, F. (2000). A theoretical extension of the technology acceptance model: Four longitudinal field studies. *Management science*, 46(2), 186–204.
- Vetere, F., Howard, S., Pedell, S., & Balbo, S. (2003). Walking through mobile use: novel heuristics and their application. , 24–32.

Appendix A

Glossary of terms

Category Content can be classified by categories. In the system, there are eleven categories. Every piece of content, belongs to only one category.

Content Anything that users can share and view through the system. Ranging from pictures, to spoken text, to (recorded) trails.

Group An entity in the system that allows users to connect to each other. Groups can be used for access- and privacy control of shared content.

Point of Interest (POI) A meaningful, user-contributed location, corresponding to a place in the world where something of interest is present. This may be anything: a building, a tree or a meeting point and it has a position and a radius.

Preference A setting that can be adjusted by the user, for tailoring the system.

Profile Background information on a (registered) user. This can contain among other things name, nickname, birthdate, favourite activities and a profile photo

Rating A scale, depicted with stars. A rating can be used to shortly express ones opinion about something in a five-point scale.

Tag A keyword about content. It can be about the location and surroundings, about the content type, about certain features of the content or about the taggers opinion. Tagging makes content to be more easily search able.

Trail A real or virtual path through the landscape. This can either be a predefined, existing hiking or cycling trail that is marked with coloured or numbered signposts, or one that has been recorded by a user and added to the system.

Appendix B

Brainstorm results

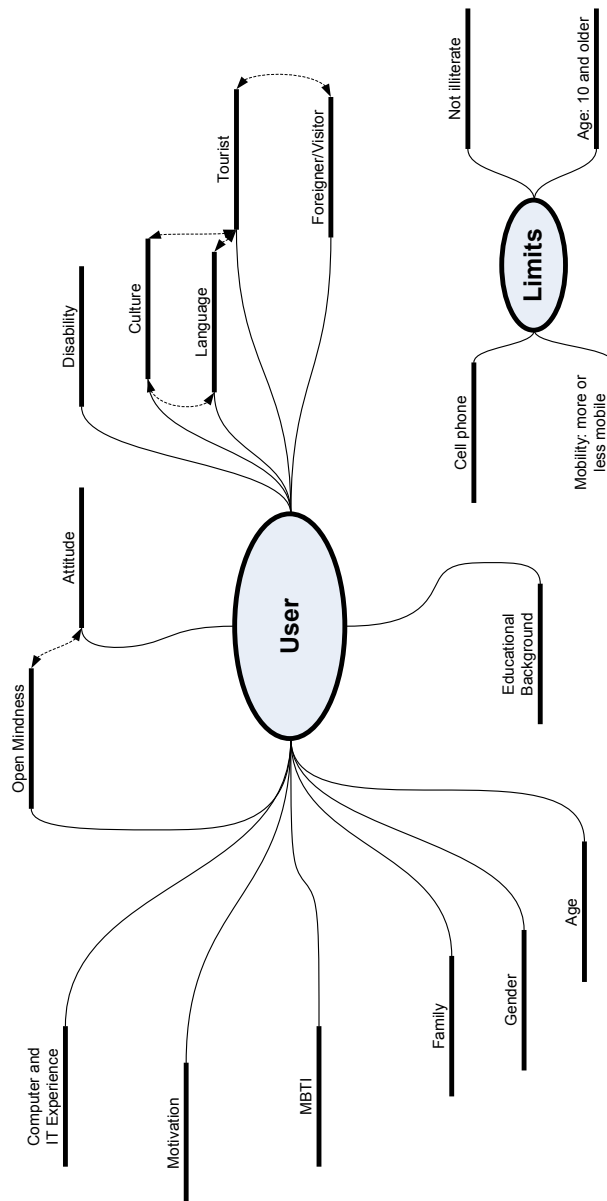


Figure B.1: User definition and limitations

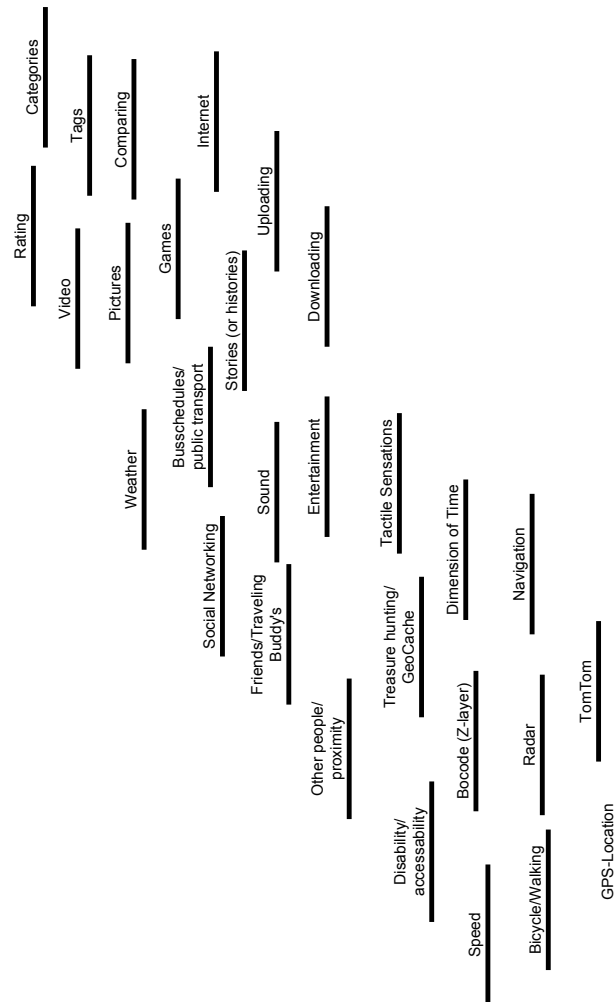


Figure B.2: System and device functionality and contexts

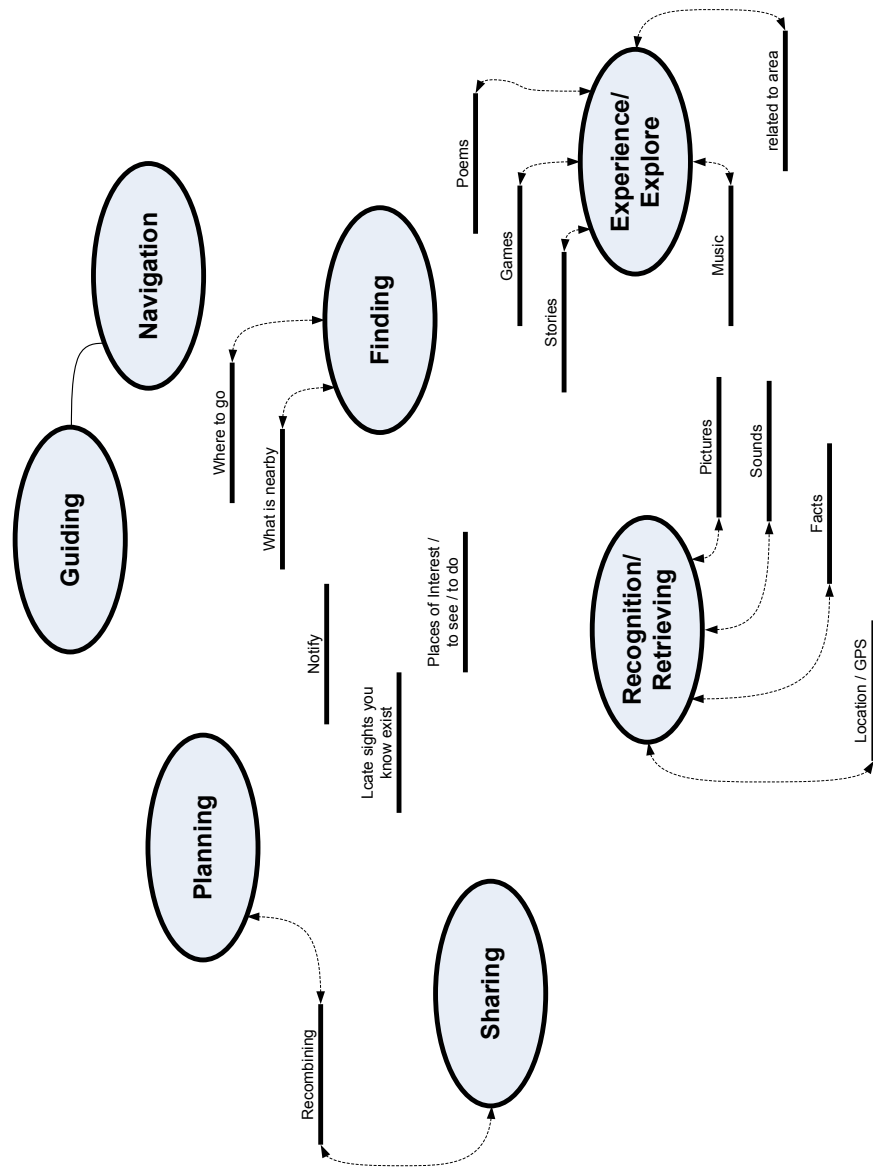
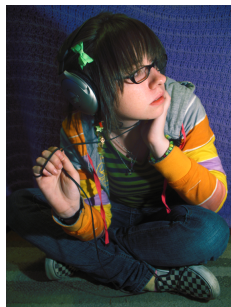


Figure B.3: User activities

Appendix C

Persona

C.1 Alice



Age	16
Nationality	English (UK)
Occupation	Student
Disabilities	None

Alice, also known as gadgetgrrl93, is a 16 year old student at Bellerbys College in Brighton, UK. She gets along with her fellow students perfectly well, but most of her friends are older and from outside the school. While most girls from her class spend most of their money on clothes and make-up, Alice rather uses it to make sure she has all the latest gadgets sooner than her friends. She can be a bit impulsive at times and although she knows her facts, a lot of the stuff she buys ends up gathering dust in an old box after barely having been used.

Ever since her parents got Alice her own computer, she's been leading a very active on-line life. People sometimes ask her how she manages to have so many identities, but she never really understood why people can make such a fuss about all that. She keeps in touch with her friends through Facebook, shares her pictures using Flickr and her drawings through Deviantart and keeps track of the gigs of her favourite bands through MySpace. What's so hard about that?

Alice likes any experience that is new and exciting for her, even if risks are involved, so she didn't hesitate at all when she was offered the opportunity to travel to the Netherlands for a school assignment. She stays in a guest house on the campus of the University of Twente with her fellow students and the

teachers, but has to complete the assignment on her own.

C.2 Gerard



Age	65
Nationality	Dutch
Occupation	Retired
Disabilities	Degraded eyesight

Gerard is 65 years old. He spent his whole life in the area of Overijssel. 40 years ago he married his wife in Enschede, and together they raised and enjoyed their four children and nine grand children. Gerard has spent his whole life in Overijssel.

He is an highly educated person, and worked in leadership his whole life. Gerard is attending computer courses, but even though his computer/IT experience is rather low, he is curious and open for new technology, but he searches for confirmation that he pushed the right button.

However, his visual impairment makes it difficult for him to read small letters. He is not blind, but he needs thick glasses to be able to see and even with the glasses he has a hard time to read small text.

Gerard is a person who doesn't make choices based on facts but the choices are well-considered. He keeps himself active and fit by taking long walks through the nature of Overijssel, often together with his wife and their dog Rufus.

C.3 Maria



Age	45
Nationality	Dutch
Occupation	Part-time sales at IKEA
Disabilities	None

Maria finished her education for becoming a secretary when she was 19 years old. This is when she started working as well, with a company that exports

cheese. During this job, she met her husband in her early twenties. When Maria was 28 her dream came true; her husband asked her to marry her, they married both at the age of 30. They could not wait to start a family; they were both ready for the next step in their life. At the age of 34 Maria got pregnant from her first child, a son and 2 years later they were blessed with a daughter.

After the birth of their son Maria quit working to be able to devote her time to raising her children and she became a housewife. When the children both went to school, she started working again (part-time) at the sales department of Ikea. She likes tools that make her life easier by saving time or effort.

Maria and her husband Marc live in a nice house with a lovely garden in the town Losser. Marc works full-time as a sales representative, the company is nearby in the city of Enschede and Mark has been working here for over the past 10 years. They really love to take the weekends for their family and Maria loves to organise trips, she will check what can be done and where. She always is really well prepared. She likes to take her time to consider the facts before making a decision. Maria also is a really cozy women, she enjoys to have a nice dinner together with a nice glass of wine.

C.4 Peter



Age	30
Nationality	Dutch
Occupation	Musician
Disabilities	Visually impaired (0% eyesight)

5 years ago, Peter married his present wife Karin. Peter met Karin during a sporting event for blind people. Karin was here with her blind brother. This is why she knows exactly how to deal with blind people. Peter was here because he would run the half marathon with his buddy.

Besides the various tools Peter also has a guide dog, this makes it possible to go out on his own.

Peter travels a lot with his orchestra. When he has the afternoon off, then he finds it wonderful to go into nature with Karin or a colleague. When he is in the nature he enjoys the different sounds of birds and other things. Sometimes he wants to know what birds he hears.

“Home sweet home”, Peter always says when he gets home in Utrecht. Recently, he bought a new stereo which sounds even better. To make a good choice he has read many forums, the opinion of others are very important to him. Because he was so satisfied with the system, he also decided to post some reviews.

Appendix D

Scenarios

D.1 Alice and her assignment

Alice is in The Netherlands as part of an international study tour organised by her school. As part of the tour, the group has to write a report about the region surrounding the University of Twente, where they are staying. Alice is responsible for the chapter on the region's landscape.

Using her laptop, Alice has already been looking for some information online. Unfortunately, none of her (online) friends has ever been to Twente, and most of the information she found was in Dutch. Wikipedia proved to be a good starting point for her search. Although the English version of the page is very limited, it at least taught her, among other things, that Twente lies in the province of Overijssel, which has a much more detailed Wikipedia page. The National Park of Weerribben-Wieden sounded especially interesting to her. Unfortunately, its website is again only available in Dutch. Frustrated by how long it takes to find even the simplest information, she eventually slams her laptop shut, thinking to herself "I'll just find it out myself". Armed with her trusty GPS-enabled smartphone, she hits the road. Using Google Maps, she quickly finds her way around the public transportation and heads to the national park.

Upon her arrival, she decides to enter the nearest visitor's centre to get some information about the park. There, she learns that she can use a system called "OnSpot" to explore the park. She can either scan a 2D barcode with her phone to launch OnSpot on her own phone, or borrow one of the phones that are provided by the visitor's centre. To cut her roaming costs, she decides to go for the last option.

Once she turns the device on, it asks her if she's a new or existing user. She's obviously new and after providing her name, email address and language, a profile is automatically created for her. On the screen, she can choose between things like "activities", and "sights". The last one gives her a map of the area, with her location on it indicated, as well as a list of everything that's nearby. She thinks the "duck cages" sound interesting. She selects that option from the

list, and sees some related pictures and information. There is also a button to show it on the map, or plan a route. Alice decides to go for the route, which brings up a map screen with a route from her current position to the cages. The map also shows other interesting points, which she can touch to get more information or add them to the route. She decides to head straight for the cages first.

Along the route, the device sometimes notifies her that something interesting is nearby. She notices that some of the pictures that pop up were taken during the winter, with everything covered in snow. “Quite a different sight”, she thinks to herself. She takes a picture of the same scene with her own phone and uploads it to her Flickr account to share it with her friends. Immediately, she notices that this picture also pops up on the device she borrowed from the information centre. “So that’s where those pictures end up,” she thinks.

Occasionally, there are also spoken stories available, but since these are mostly in Dutch, Alice doesn’t feel interested in them. Luckily, she can press a button to indicate that she wishes to no longer be notified of this type of content. This preference is remembered for her personal profile, and she is no longer bothered by spoken stories.

When she arrives at the duck cages, she reads the signpost for more information, but unfortunately it is in Dutch. She checks OnSpot for more information, and the button “more information” leads her directly to a Wikipedia page about duck cages. She explores the park some more and then returns home.

Upon getting back to the guest houses, she turns on her laptop and finds a welcome email in her inbox from OnSpot. It welcomes her to the service, and points her to her personal online profile. She clicks on the link and finds that her complete journey is available online, including all the information she needs to complete her assignment.

D.2 Gerard at the airport

Gerard and his grandchildren are on their way to visit the Twente airport to look at small planes and helicopters. For this trip they packed their OnSpot system to help them get the best experience of this adventure. Gerard will use the device as a form of teaching device for his grandchildren. Therefore he will use the tool mostly for gathering information.

At the airport they detect a really old plane and the kids would like to know more about it. Therefore, Gerard takes a picture of the plane and on the screen he is given several options on what he now can do with this picture.

The system gives the following options:

- Upload to retrieve information
- Upload to share information
- Send to a friend

Gerard chooses the option to upload the picture and retrieve information.

The displays shows a sign that tells him to wait. After a few seconds the screen displays several information about the old plane.

After having told the kids all facts and stories about the old plane he sees the notification sign on the display. He presses it.

The device notifies Gerard about a poem that someone has written about the airport, it displays the option to read or play the poem.

Since Gerard has bad vision he chooses the option to hear the audio of the poem. So he presses “play” to hear the poem.

D.3 Maria and her children enjoying a sunny Sunday

Maria, her husband and their 2 children are going out for the day. It is a nice sunny Sunday and today they will explore the area of Overijssel. Maria packed the OnSpot system to plan where they will have to go but also as a means to be entertained. Maria and her family are doing a cycling tour, their are following the route on the OnSpot system, the OnSpot system starts to make a sound; a bird is whistling.

Maria’s son checks the OnSpot system:

Welcome you are in a very special area, this is the area where you can find many fungi. Take a few minutes, who will find most of them?

The system gives the names of the parents and the children.

Maria will count how many fungi each of them counted and the father will enter the results into the system. They continue with their route.

After a few minutes the system makes a sound again; they hear a cow. A question mark appears and a multiple choice question appears for each of them. The question is related to the sound they hear. How much milk is being produced in the Province Overijssel on a yearly base?

Each of them can enter his/her own answer to this question. The device tells them which way to go to continue with their route and gives them the average results; Maria’s daughter is on the winning hand!

D.4 Peter in Deventer

Along with his orchestra, Peter arrived in Deventer. Tomorrow evening they have a show in the local theatre. Until then, he has some time on his own. Peter takes his OnSpot to look if there are any fun activities around that are appealing. Because the system is aware of Peters handicap, all non-relevant issues are left out.

Peter sorts the items, via voice-control, on “highest user-rating”, and lets the system read the first three items. He finds the stories about the IJssel appealing, so he takes his guide dog, and begins his trip. When OnSpot guided Peter to the right location, the story starts. The system tells about how dealers

came to Deventer in the 14th and 15th century to sell their goods. OnSpot involves Peter in the story by telling how life was on the market. “Potatoes! Fresh potatoes!” and the sound of the wind make Peter feel like he is really there.

On a certain moment, a sparrow hawk begins twittering. Peter recognizes the bird from his hometown Utrecht, but didn’t know this bird also lived in Deventer. Because Peter is curious where this bird lives apart from Deventer and Utrecht, he stops the story and records the sound of the bird. OnSpot recognizes the sound and tells Peter about the natural habitat, colour and origin. Now he has an answer to his question, Peter continues his story.

After an hour the story ends. The system gives Peter the opportunity to share his experience about this story with others. So he does. The system adds Peters handicap to the rating. Now other people know how to interpret the rating.

Appendix E

User Requirements Interview

Interview Structure

1. Give an introduction
This is to put the participants at ease, make them feel more comfortable with the situation.
 - (a) Introduce yourself (and that you're from the University of Twente) (if necessary)
 - (b) Talk about the purpose of the interview (A project you are working on as part of the Interface and Interaction Design course)
 - (c) Ask for the permission to conduct this interview and (if possible) record it
 - (d) Ensure that the participant remains anonymous (his/her name will not be mentioned in the report or anywhere else)
2. Conduct the Interview (see questions below)
3. Closing session
 - (a) Thank the participant for his/her time
 - (b) Re-ensure that all information will be treated anonymously
 - (c) Don't forget to write down the location and context of the interview

Interview Questions

Information about the participant

Age/Leeftijd	
Gender/Geslacht	
Profession/Beroep	

General questions

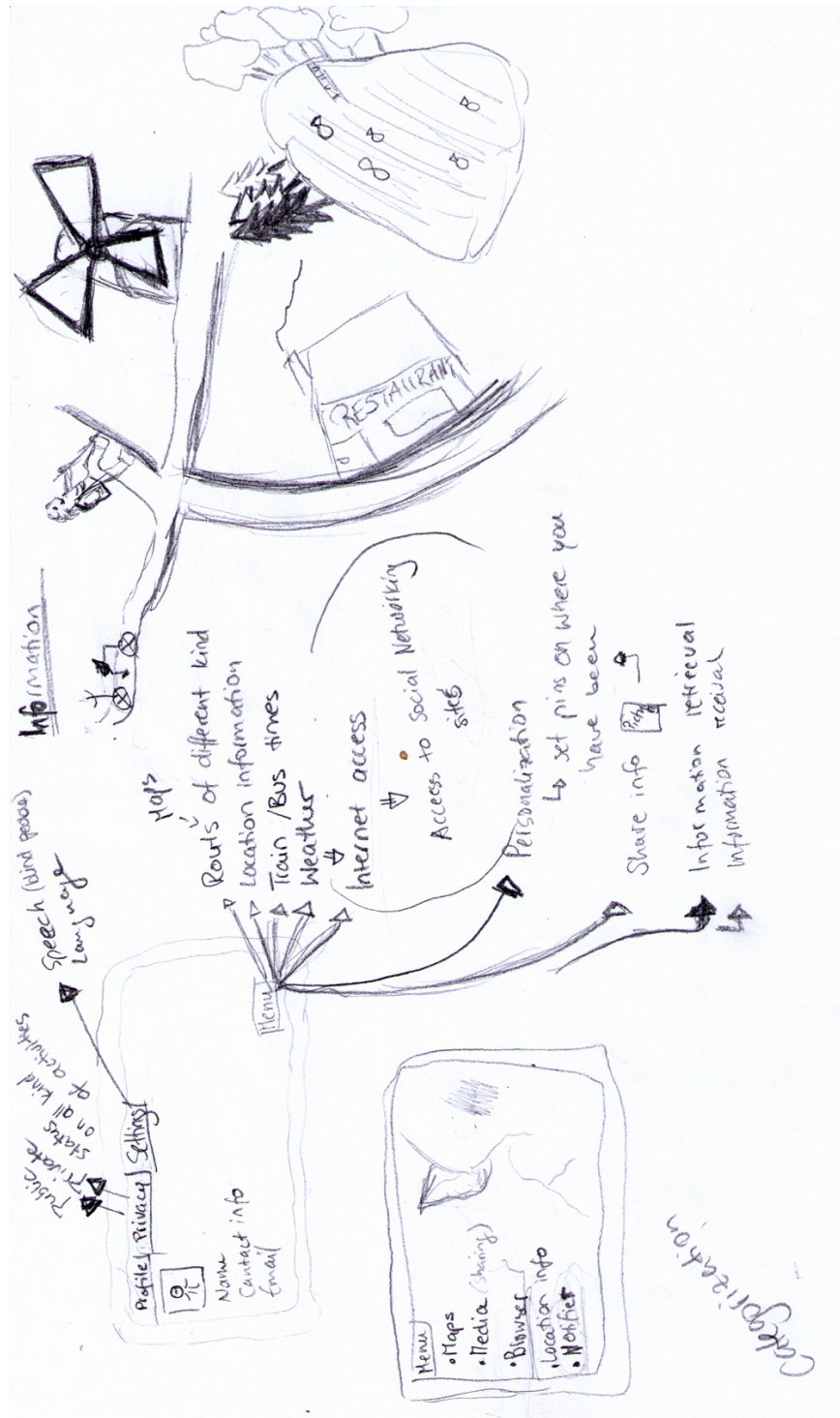
1. How often do you go out into nature?
Hoe vaak gaat u de natuur in?
2. What are the reasons for your trips into nature? (sports, geocaching, relaxation, ...)
Wat zijn de redenen voor uw bezoek aan de natuur? (sport, geocaching, ontspanning, ...)
3. Do you like to visit new places? (ask for examples)
Bezoekt u graag nieuwe bestemmingen? (vraag om voorbeelden)
4. How do you go into nature, e.g. hiking or by bike?
Hoe gaat u de natuur in, zoals bijvoorbeeld wandelend of per fiets?
5. What information do you have on you now, for use when in nature?
Welke informatie heeft u bij zich, om te gebruiken in de natuur?
6. How do you receive information of things that interest you when you are in the nature?
Hoe verkrijgt u informatie over dingen die u interesseren als u in de natuur bent?
7. What information did you retrieve from the visitors centre (only if applicable)?
Welke informatie heeft u gekregen van het bezoekerscentrum (alleen indien van toepassing)?
8. What information did you get from information signs in nature?
Welke informatie heeft u gekregen van borden in de natuur?
9. If you planned your trip, what information did you gather?
Als u uw toch gepland heeft, welke informatie heeft u opgezocht?
10. Did you miss any information while being in nature?
Heeft u enige informatie gemist terwijl u in de natuur was?
11. If you could get information while being in nature, what would it be and why?
Als u extra informatie kon krijgen terwijl u in de natuur bent, wat zou dat zijn en waarom?

“Technological solution oriented” questions

12. Do you own a (smart)phone or PDA, if so what kind?
Heeft u een (smart)phone of PDA? Wat voor type?
13. Do you have accounts on social networking sites? (eg. facebook, myspace, hyves, linkedin,...)
Heeft u accounts op social networking sites? (bijv. facebook, myspace, hyves, linkedin,...)
14. Do you use your phone for information gathering and sharing? if not, would you like to?
Gebruikt u uw telefoon om informatie op te zoeken en te delen? Als dat niet zo is, zou u dat wel willen kunnen?
15. Do you have ideas on how you would like to use your phone or another device to do information gathering/sharing?
Heeft u ideeën over hoe u uw telefoon of een ander apparaat zou willen gebruiken om informatie op te zoeken/delen?
16. Further notes/Verdere informatie

Appendix F

Early sketches





Nature



Old buildings/monuments



Ruins



Nice Viewpoint



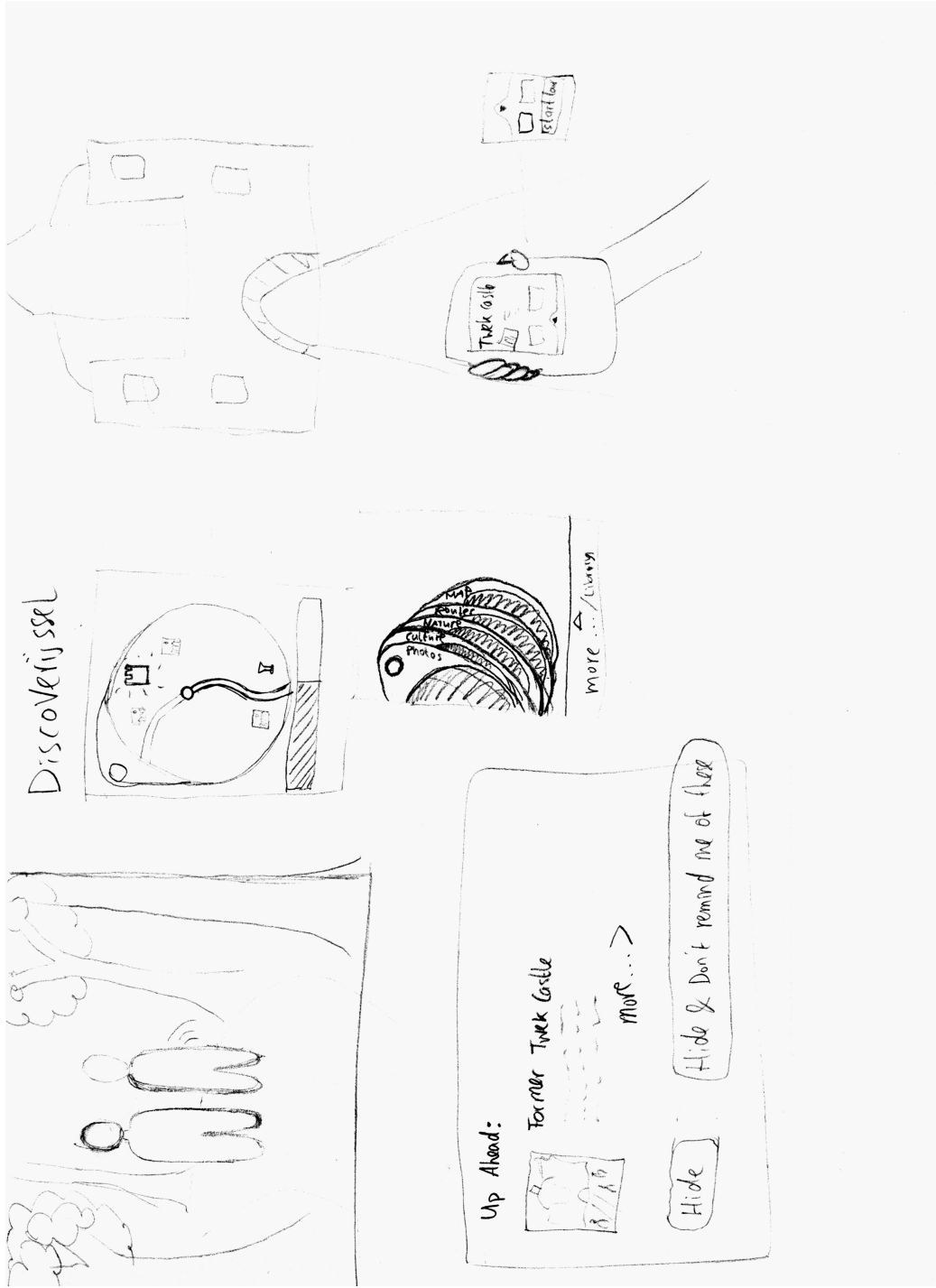
Lake

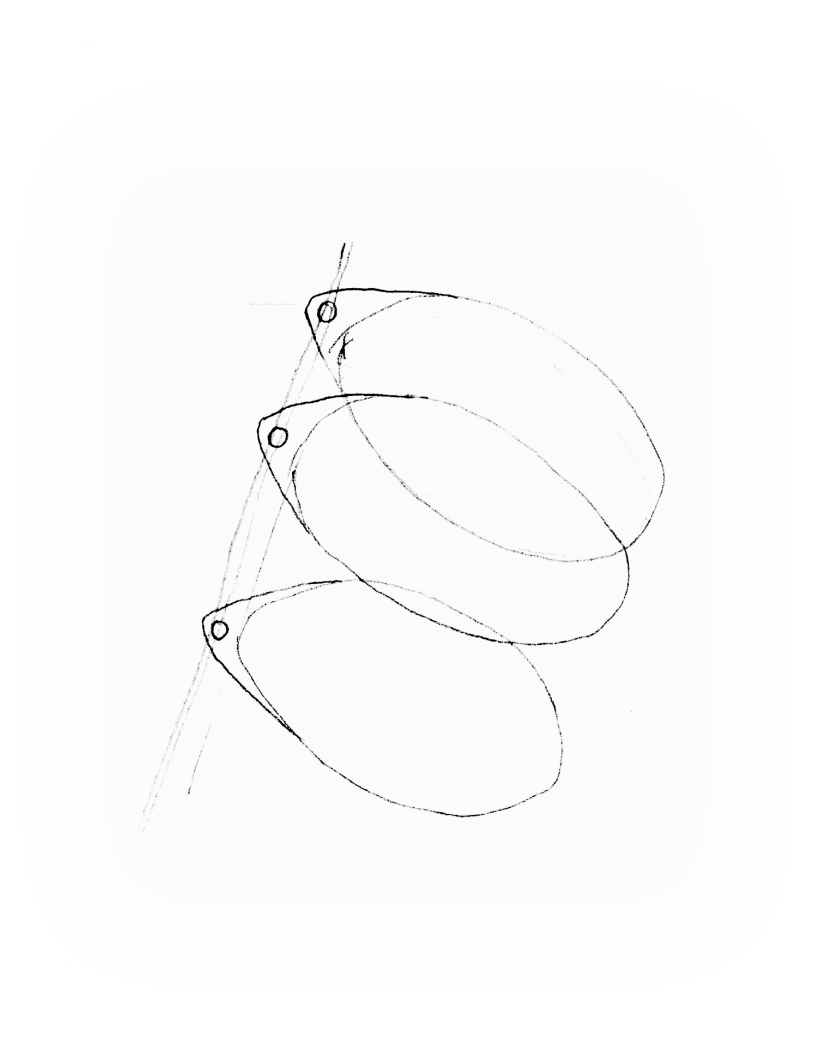


River



Pictures





Appendix G

Deleted requirements

The requirements in this section did not make it to the final version of the requirements specification. They are listed here, because they reflect the decisions we made during the process.

Requirement 3.9

the system should be able to be used without learning time

Rationale first time users should be able to use the system right away. they don't want to invest too much time in learning an application that they only use for leisure.

Originator brainstorm

Fit criterion

Priority m

Notes duplicate of 6.3

Requirement 4.2

the system should be able to let the user make new routes

Rationale alternative non-existing routes

Originator brainstorm

Fit criterion

Priority

Notes duplicate of 1.1

Requirement 5.0

the system should have a computer-accessible application or website to alter profile details

Rationale editing a user profile is a task that does not need to take place on location. working from home computer allows to use stored pictures etc.

Originator brainstorm

Fit criterion

Priority

Notes merged with 4.9

Requirement 5.1

the user should be able to get practical information about the area

Rationale during their visit to nature, users sometimes have information needs about practical issues (such as finding something to eat)

Originator user study

Fit criterion

Priority

Notes duplicate of 3.0

Requirement 5.7

the product shall allow the user to save their preferences

Rationale users will use the product more than once.

Originator client

Fit criterion the product can retrieve the user preferences when the user uses the product again.

Priority

Notes duplicate

Requirement 5.8

the product allows for personal configuration options

Rationale different users have different preferences. the product can be personalised.

Originator client

Fit criterion the product has configuration options.

Priority

Notes duplicate

Requirement 5.9

the product shall have an expert-mode aimed at experienced users

Rationale new users have different needs than users with a lot of experience with the product.

Originator

Fit criterion the product allows access to expert-level features that are not necessary for new users.

Priority

Notes duplicate

Requirement 8.7

the product shall be distributable as a single file package

Rationale easy to distribute, product package will be complete (without missing files).

Originator

Fit criterion

Priority low

Requirement 9.0

the product will not have a dedicated help desk

Rationale providing software support is not a main task of land-schap overijssel.

Originator brainstorm

Fit criterion

Priority

Appendix H

Card sort details

H.1 Instructions

[English instructions – Nederlandstalige instructies staan onder]
INTRODUCTION:

As part of the course Interface and Interaction design, we are conducting research that will help us gain a better understanding of how our product should be organized in order to make it easy to use.

INSTRUCTIONS:

On the left, you'll see a list of items. Click on the items to drag them onto the empty white area in the middle of the screen. A category will appear, and the item will be placed inside it. Repeat with the remaining items, grouping items that belong together.

What items belong together? You can choose any grouping method that makes sense to you. Then name each group with a word or words that describe the set of items it contains.

There is no right number of groups, but make sure that you think about how the items relate to each other. If you have a group with a large amount of items, you may be able to split it up.

[Nederlandstalige instructies – English instructions are above]
INLEIDING:

In het kader van het vak Interface and Interaction design, onderzoeken we wat voor indeling van ons product nodig is voor een prettig en makkelijk gebruik.

INSTRUCTIES:

Aan de linkerkant van het scherm zie je een lijst met items. Klik op een item om het naar het witte gebied in het midden van het scherm te slepen, dan wordt er een categorie aangemaakt met het item. Groepeer items die bij elkaar horen in een zelfde categorie, door ze in de betreffende categorie te slepen.

Welke items horen bij elkaar? Iedere logische indeling is toegestaan, er zijn geen goede of foute antwoorden. Hoeveel categorieën er nodig zijn, mag je ook zelf bepalen. Als er een categorie is met een groot aantal items, is het misschien mogelijk om deze te splitsen. Geef de categorieën een beschrijvende naam, en klik op 'I'm Done!' als alles is ingevuld.

H.2 Preliminary card sort

Categories resulting from preliminary card sort. Items shown in bold were included in the second card sort:

1. animal cage (dierenkooi)
2. bird watching spot (observatiepost voor vogels), **bird's nest (vogelnest)**, tree frog (boomkikker), **butterflies (vlinders)**, horse (paard), cows (koeien), **sheep (schapen)**
3. bakery (bakkerij), **shop (winkel)**, **restaurant (restaurant)**, café (café), snackbar (snackbar), ice-cream store (ijswinkel), **museum (museum)**, sport field (sportveld), **boat rental (botenverhuur)**, **zoo (dierentuin)**, petting zoo (kinderboerderij), **playground (speeltuin)**, skating rink (ijsbaan), artisan (ambachtsman), **brewery (brouwerij)**
4. accessibility (toegankelijkheid), **bus stop (bushalte)**, train station (treinstation), **parking lot (parkeerplaats)**, avenue (laan)
5. **map (plattegrond)**, sign post (wegwijzer), mailbox (brievenbus), barbecue (barbecue), **visitor's centre (bezoekerscentrum)**, **bench (bankje)**, picnic table (picknicktafel), **toilet (toilet)**, **garbage bin (afvalbak)**, **meetingpoint (ontmoetingsplaats)**, child care (kinderopvang), **bicycle rental (fietsenverhuur)**, bicycle repair (fietsreparatie)
6. potato cellar (aardappelkelder), **farm (boerderij)**, farm yard (boerenerf)
7. wild crossing (wildrooster), stairs (trap), **bridge (brug)**, tunnel (tunnel), **gate (poort)**
8. **windmill (windmolen)**, watermill (watermolen), factory (fabriek), monument (monument), **statue (standbeeld)**, castle (kasteel), ruin (ruïne), **tower (toren)**
9. canal (gracht), **river (rivier)**, **lake (meer)**, pool (poel), **well (put)**, **hill (heuvel)**
10. **forest (bos)**, flower field (bloemenveld), **heath (heide)**, **trees (bomen)**, **orchard (boomgaard)**, **mushroom (paddestoel)**, tulips (tulpen), willow (wilg), **flowers (bloemen)**, climbing tree (klimboom)

Appendix I

Usability Evaluation Plan

I.1 Introduction

This document describes the usability evaluation plan for OnSpot/Discoverijssel¹. The purpose of a usability evaluation is to predict the expected performance of the actual customer using the current product and materials, as well as detect any serious problems prior to the release of the product. This plan includes the following sections:

- Purpose of the usability evaluation
- Target audience
- Design of the usability evaluation
- Data collection methodology
- Deliverables
- Schedule
- Design Usability Goals

The evaluation will focus on determining if the needs of the user are met in a easy to understand, useful, and productive manner. Specific measurable goals for the usability evaluation are outlined in the Usability Evaluation Goals section of this document.

I.2 Purpose of the Usability Evaluation

The usability evaluation of the Discoverijssel application will evaluate the potential for errors and difficulties involved in using the application. Some of the

¹This document was based on an example plan (D. D. Pierotti, 1995) from the usability toolkit, which ‘may be used as is, or adapted for specific needs’

areas that will be tested through the usability evaluation process were derived from a heuristic evaluation performed on Discoverijssel. Other concerns were identified by the development manager and team.

I.2.1 Concerns

Some specific questions to be addressed in this usability evaluation include:

1. Will users be able to use the application without help?
2. Will users understand the application?
3. Will users be willing to share their own content in the application?
4. Will users like the idea of the application?
5. Are there tasks that users will want to perform that are not currently supported?

The question ‘Will users be able to install and launch the application?’ will be tested at a later development stage.

I.2.2 Usability Evaluation Goals

Specific usability goals were determined from the above concerns. These goals allow for the creation of evaluation scenarios and tasks that will let us know if our concerns are valid and what measures can help us determine if in fact the participants are having trouble completing the tasks.

- Participants will be able to begin using the application with no documentation.
- Participants will be able to find information with no expressed or visible frustration.

We will also use a survey to determine subjective reactions. For this we will use the System Usability Scale (SUS) (Brooke, 1996), a scale that covers the three general classes of usability measure effectiveness, efficiency and satisfaction and was designed for simplicity and speed.

Attention will also be given to the following questions, although they will not be explicitly tested:

- Users feel that the pictures used on the icons are recognizable and do facilitate system use/understanding?
- Users associate the product with leisure, not with work.

I.3 Target Audience

The selection of participants whose background and abilities are representative of the products intended end user is not possible at this stage in the product design process. We will evaluate the findings from the user study with the user background characteristics in mind.

I.4 Design of the Usability Evaluation

A single usability evaluation will be run in at least 5 individual participant sessions. Each individual session will consist of a set of tasks and an interview/questionnaire for the participants to complete.

The individual evaluations will take place in the following order:

1. A video prototype to introduce the product to the participant and invite their remarks
2. A performance evaluation in which each participant is asked to perform a series of real-life tasks
3. A questionnaire and an interview after the performance evaluation to gather additional insights from the participants about the project

I.4.1 The Evaluation Process

The usability evaluation process is as follows:

Participant greeting Each participant will be personally greeted by the evaluation monitor and made to feel comfortable and relaxed. The issue of confidentiality will be explained and the participants will be asked to sign nondisclosure statements.

Orientation The participants will receive a short, verbal scripted introduction and orientation to the evaluation. This material will explain the purpose and objective of the evaluation, and additional information about what is expected of them. They will be assured that the product is the center of the evaluation and not themselves, and that they should perform in whatever manner is typical and comfortable for them. The participants will be informed that they are being observed and asked to sign the appropriate release forms if not already completed.

Video prototype The participants will watch a short video about the product. After the video, they will be asked to tell about their first impressions and indicate whether they like the idea of the product and if they would be inclined to use it. They will also be asked some background questions about their familiarity with the task domain and with technology (mobile devices and social networks).

Performance evaluation The performance evaluation consists of a series of tasks that are evaluated separately and sequentially. The individual participants complete the tasks while observed by the usability specialists. The scenario is as follows:

After the orientation, the evaluation administrator will give the participants instructions about thinking aloud. The participant will be asked to perform a number of tasks with a paper prototype: switch views, investigate a point of interest, search for content, add a lens, retrieve a lens from the lens store and take a picture and share it.

While the participants work through the evaluation scenario, they will be encouraged to work without guidance except for the provided material and the product itself. The evaluation administrator may ask the participant to verbalize his or her thoughts if the participant becomes stuck or hopelessly confused. These occurrences will be noted by the observers, and will help to pinpoint the cause of the problem.

Participant debriefing After all tasks are complete or the time expires, each participant will be debriefed by the evaluation administrator. The debriefing will be taped and will include the following:

- Completion of a brief post evaluation questionnaire in which the participants share their opinions
- Participants overall comments about his or her experience
- Participants responses to probes from the evaluation monitor about specific errors or problems encountered during the evaluation

The debriefing session serves several functions. It allows the participants to say whatever they like, which is important if tasks are frustrating. It provides important information about each participants rationale for performing specific actions, and it allows the collection of subjective preference data about the application and its supporting documentation.

After the debriefing session, the participants will be thanked for their efforts, and released.

I.4.2 Logistics

We will ask participants to imagine they are in a nature environment during the usability evaluation. The environment will be large enough to comfortably accommodate a desk for the participant to sit at while completing the evaluation.

There will be an additional area for placement of the observers. The observers will be located in the same area as the participant but a visual barrier will be erected between the participant and the lab setup.

I.4.3 Requirements for the Evaluation

- Location: HMI lab
- Test leader (gives instructions to the participants)
- Observers (observe participant behavior and comments but do not directly interact with the participants)
- Paper prototype controller (controls the paper prototype: makes sure the prototype ‘responds’ appropriately to the participant’s actions)
- Prepared evaluation documents
- Cookies and coffee
- Space arrangements required for evaluation environment and lab setup
- Voluntary participants

I.4.4 Materials Design

The following materials will be designed and developed for use usability evaluation:

- Participant profile analysis (same questions as used in the user study)
- Task scenario package
- Observer coding sheet
- Evaluation participant debriefing materials (questionnaire)

I.5 Data Collection Methodology

Data will be collected through the use of a “thinking aloud” protocol. Measures to be collected include the following:

1. The percentage of participants who finished each task successfully
2. The (number of) cases in which the participants were not able to complete a task due to an error from which they could not recover
3. (The number of times) when the participant asked the expert for help for each task
4. (Number of and) types of errors, including:

Observations and comments. The evaluation monitor notes when participants have difficulty, when an unusual behavior occurs, or when a cause of error becomes obvious.

Non-critical error. A participant makes a mistake but is able to recover during the task in the allotted time.

Critical error. A participant makes a mistake and is unable to recover and complete the task on time. The participant may or may not realize a mistake has been made.

5. (The number of) indications of frustration or joy from the participant
6. (The number of) subjective opinions of the usability and aesthetics of the product expressed by the participants

The average amount of time to complete each task will not be recorded, since the amount of time will be different from the time needed for a task in the functioning application (using a paper prototype in a lab setup differs from using a mobile functioning application in a natural environment; the thinking aloud protocol may also influence response times).

I.6 Deliverables

At the completion of the usability evaluation, a formal analysis will be performed. A final evaluation report, which will detail the significant problems and observations detected during the usability evaluation, and recommendations to address the findings, will be delivered.

I.7 Schedule

The usability evaluation will be conducted on Wednesday 6 January. The necessary materials will be ready for review two days in advance (4 January). A pre-flight check will be held the day before the evaluation (5 January). A summary of the main findings will be prepared immediately after the evaluation and will be available on or before Friday 8 January. A full report on the user evaluation will be part of the project report, which has to be handed in on January 13.

I.8 Materials

I.8.1 Test session checklist

The test session checklist used by the facilitator of the test.

- Greet user.
- Explain the usability lab and such until the user is comfortable with the equipment.
- Proceed to the test area.

- Seat user and sit close by to explain the test session.
- Introduce others present in the room.
- Offer coffee/tea.
- Explain the overall procedure.
- Have user sign the video/audio tape and disclosure agreement.
- Explain video prototype part.
- Ask the user if they have any questions.
- Show video.
- Ask video prototype questions.
- Ask background questions.
- Explain task scenario procedure.
- Ask the user if they have any questions.
- Explain thinking aloud process and complete practice exercise until the user is comfortable.
- Ask the user if they have any questions.
- Ask the user to start with task 1.
- Invite user to briefly comment on the task or on what they did.
- After the user has finished task 1, ask if the user has any questions about the process (repeat instructions if necessary).
- Proceed to the other tasks.
- Ask user to complete SUS.
- Talk with user about the product/tasks/technology (open ended, primarily user-directed)
- Thank user and ask them to leave.

I.8.2 Instructions

We are asking you to participate in evaluating a prototype. By participating in this evaluation, you will help us improve this prototype and fulfill our course requirements. We will observe you and record information about how you work with the product. We may also ask you to fill out questionnaires and answer interview questions. We will treat all results anonymously. The results of this study will only be used in the context of the Interface and Interaction Design course and not for any other purpose.

This session is intended to have you help us evaluate the design and usability of the product, in order to determine the strengths and weaknesses. Note that the prototype is still in an early phase of development, you will not be evaluating a functional software application.

It is important to remember that you are helping us to evaluate the material and that we are not evaluating you. In the event that you have some difficulty with some of the tasks, this is actually a good thing because it means we have found something that can be improved.

If you need a break, just tell us. You may withdraw from this evaluation at any time. If you have any questions, you may ask at any time.

I.8.3 Participant agreement form

Please read this page carefully.

We are asking you to participate in evaluating a prototype, created for the course Interface and Interaction Design. By participating in this evaluation, you will help us improve this prototype and fulfill our course requirements.

We will observe you and record information about how you work with the product. We may also ask you to fill out questionnaires and answer interview questions.

We will videotape all or some of the interview and your work. By signing this form, you give your permission to use your voice, verbal statements and videotaped pictures for the purpose of evaluating the product and showing the results of these evaluations. We will not use your full name.

If you need a break, just tell us.

You may withdraw from this evaluation at any time.

If you have any questions, you may ask at any time.

Please print your name:

Signature:

Date:

I.8.4 Video prototype questions

1. What is your first impression about the product?
2. Do you like the idea of this product? Why?
3. Would you use this product yourself?

- (a) (If yes: Can you name someone (real or fiction character) who would never use this product. Why?)
- (b) (If no: Can you name someone (real or fiction character) who would use this product. Why?)

I.8.5 Background questions

Information about the participant:

- age
- gender
- profession

Familiarity with the task domain and with technology:

1. How often do you go out into nature?
2. How do you go into nature, e.g. hiking or by bike?
3. Do you own a (smart)phone or PDA, if so what kind?
4. Do you have accounts on social networking sites?

I.8.6 Task descriptions

Task 1: Discover the different views

Imagine that you are walking around in the Ledeboerpark, with the Discoverijssel application on your iPhone. You see a large tree. Now look at your iPhone.

1. You see the map screen, can you point out where you are?
2. Try to find another view which displays point of interest in a list form.
3. Describe what you can see in this view.
4. Go back to the map screen.
5. Explore the information about nature presented on the screen. Can you get more information about the huge tree?

Note to interviewer: Participant is supposed to find more information about the "Giant Sequoia"

Task 2: Search Content

A couple of days ago you saw a mushroom. Try to search for information about this mushroom. You do not remember the exact name of it.

Note to interviewer: When the participant has found the information on mushrooms indicate to him or her to get a detailed view on "Oyster mushroom"

1. Check what other people have commented.
2. How can you make your own comment?

Task 3: Discover the lens metaphor

1. Return to the map screen .

A friend told you that it is possible to show more information on the map. Try to find out how.

Note to interviewer: So far the only lenses that are activated are the one that gives information about Landschap Overijssel, the walking trails and map.

1. Try to find out how to activate user photos.
2. Can you find a cycling route lens?

Note to interviewer: Completed when "download" is pressed.

Task 4: Share Content

While walking around in a park you see a couple of beautiful horses.

1. Can you take a picture and add it to the map for everyone to see.
2. Add the title "Horse" to the picture without any description.

I.8.7 Observation coding form

The observation coding form is shown in Figure I.1

I.8.8 SUS

1. I think that I would like to use this system frequently
2. I found the system unnecessarily complex
3. I thought the system was easy to use
4. I think that I would need the support of a technical person to be able to use this system
5. I found the various functions in this system were well integrated
6. I thought there was too much inconsistency in this system

Usability Test Observation Coding Form		
Date: _____	Participant ID: _____	Task #: _____
Start Time: _____	End Time: _____	Observer: _____
Verbal Behaviors	Notes	
<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Strongly positive comment	_____	
<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Other positive comment	_____	
<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Strongly negative comment	_____	
<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Other negative comment	_____	
<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Suggestion for improvement	_____	
<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Question	_____	
<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Variation from expectation	_____	
<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Stated confusion	_____	
<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Stated frustration	_____	
Other: _____	_____	
Non-verbal Behaviors	Notes	
<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Frowning/Grimacing/Unhappy	_____	
<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Smiling/Laughing/Happy	_____	
<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Surprised/Unexpected	_____	
<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Furrowed brow/Concentration	_____	
<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Evidence of Impatience	_____	
<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Leaning in close to screen	_____	
<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Variation from expectation	_____	
<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Fidgeting in chair	_____	
<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Random mouse movement	_____	
<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Groaning/Deep sigh	_____	
<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Rubbing head/eyes/neck	_____	
Other: _____	_____	
Task Completion Status:	Notes:	
Incomplete:	Complete:	
<input type="checkbox"/> Participant gave up	<input type="checkbox"/> Fully complete	
<input type="checkbox"/> Task "called" by moderator	<input type="checkbox"/> Complete with assistance	
<input type="checkbox"/> Thought complete, but not	<input type="checkbox"/> Partial completion	

Figure I.1: Usability test observation coding form, to facilitate notation of verbal and non-verbal behaviors and of task completion status.

7. I would imagine that most people would learn to use this system very quickly
8. I found the system very cumbersome to use
9. I felt very confident using the system
10. I needed to learn a lot of things before I could get going with this system

Items are rated on a 5-point Likert scale (strongly disagree, disagree, neither agree nor disagree, agree, strongly agree). Even-numbered items are reversely keyed. Scores are calculated on a 100-point scale.