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1 Executive Summary

This report provides descriptions of the target groups of the Internet service and specifications of the interactions between the Internet service and the users.

This report is intended as a guideline to channel designing the user interactions in the process of building the Internet services.

Chapter 2 gives an introduction into the material described in this report.

Chapter 3 describes the target user groups. The portal will be interacting with the end users, with professionals in the medical profession and hearing-aid dispensers, and with professionals who add contents to, and edit the contents of, the portal.

Chapter 4 describes the portal in functional terms, specifying the ePlatform, eDiagnostics, and eRehabilitation functions. In this chapter the standard tasks of the portal are described.

Chapter 5 deals with user accessibility and usability issues.

Chapter 6 specifies the requirements of the standard tasks to be performed by the portal.

Chapter 7 describes the procedure to evaluate look, feel, content, and function of the portal for different user groups. For this evaluation different questionnaires will be used for the different user groups.

2 Introduction

An Internet service (ePlatform) will be constructed for presenting a number of products of the HearCom project, via the Internet, to end users and to professionals in the hearing care area.

One of the target groups of the Internet service are the end users in the general public. The aim is to provide them with general information concerning hearing and hearing impairments, a number of screening tests accompanied with information about those tests, and professional diagnostic help along with information concerning that help. For this, a description of different categories of users in this group is needed, in combination with the specifications of the interaction between those user groups and the implemented hearing tests.

For professionals, the Internet service will provide up-to-date general information and materials for a number of tests along with all necessary information concerning them. To be able to build this service, a description of its general structure will be needed.

Another group consists of professionals who provide content and will require a means of executing that on the portal and of editing already present content. Specifications of the necessary tools are given in deliverables D-10-3, "Functional specification of the advanced information portal" and D-10-4, "First prototype of the advanced information portal."

3 Target user groups

Sub Project 5 of HearCom will implement a set of Internet services concerning hearing and communication and make them available to the users. These services will be aimed at:

- Individuals that experience problems with hearing and communication. The encountered problems can have a broad range from mild to profound.
- End users who desire information concerning hearing, hearing related problems, and optimal communication in different situations.
- Professionals who work in the area of hearing and communication. These can be professionals who assist persons having hearing and communication problems, but also professionals that work with requirements for optimal hearing and communication in various situations, for different types of tasks and for different types of hearing and communication abilities. The group of professionals can include, for example: audiologists, ENT-doctors, general practitioners, speech and hearing therapists, architects, acousticians, engineers, etc.

3.1 Nation, culture, and language specific requirements

The HearCom Internet services are aimed to the countries of the European Community. It will therefore be necessary to allow users to choose a preferred language for the Internet Services. Not all European languages will be available for the Internet pages, but the pages will need to be supplied in a number of languages that together cover a broad area. The hearing tests will be supplied for a number of European languages, corresponding to the countries that developed and validated those tests.

3.1.1 Nation and culture specific requirements

The focus of this section will mainly be on Germany, the Netherlands, Belgium, and the UK. For the end user, the country of residence will need to be obtained to tailor nation and, possibly, culture specific advice.

General information concerning hearing impairment, hearing aids, cochlear implants, etc, is not country specific. When referring to professional care, the advice will often differ between different countries in the path to be followed (professionals: ENT doctors, general practitioner, hearing-aid dispenser; reimbursement: health insurance, National Health Services) as is indicated in Deliverable 6-1 for Germany, The Netherlands, and the United Kingdom. Culture specific requirements might be encountered, for example in the expected role of family members and education services,

or standpoints and expectations from different religious backgrounds, etc. However, up to now no specific cultural issues have been encountered in the project.

3.1.2 Language specific requirements

For the end users, a user language profile will need to be obtained with information concerning: their native language, whether they are possibly early bilinguals or late bilingual (foreign), their level of command of those languages, and their age (child/adult). This information needs to be collected from the user via the Internet service.

Screening tests for speech reception abilities will become available for native speakers of Dutch, German, English, Swedish, and French. These tests use spoken digits and can be expected to not require extensive knowledge of the language. So, they may be applicable for second language speakers. Tests using single words can be reasonably reliable for non-native speakers; for early and late bilinguals. But perhaps the latter category will first need some training before reliable results can be obtained. Tests using sentence material are not suitable for most non-native speakers.

Tests concerning speech reception under adverse conditions and concerning speech/sound localization may or may not use sentence material. If they use separate words, for example, digits, then the test should be applicable to bilinguals as well for their second language. If sentences are used, then the test may not be reliable for second language users.

4 HearCom Internet services

During the project duration, Sub Project SP5 will develop a set of Internet services concerning hearing and communication. SP5 consists of 3 work packages with the following roles:

- WP10, ePlatform will research and develop the common components for the online services;
- WP11, eDiagnostics will provide diagnostic services that are developed in WP1 and WP2;
- WP12, eRehabilitation will provide rehabilitation services that are developed in WP6 and WP7.

The Project will develop Internet services based on the results from its sub projects. The services will be organized in 3 areas:

1. Portal (input mainly from SP5, SP2 and other);
2. Diagnostics (input mainly from SP1);
3. Rehabilitation (input mainly from SP3).

4.1 Portal

The portal will provide general and specific information, demonstrations and will direct to the specific sections for diagnostic, rehabilitative and professional services.

4.1.1 Information and awareness

The information provided at the portal will be targeted to:

- Persons that like to have general information concerning hearing and communication. For this group the following will be offered:
 - Information concerning topics like: sound, speech, the hearing organ, human sound and speech production, acoustics, etc;
 - Demonstrations concerning topics like: effect of hearing impairment, effect of acoustics and noise etc;
 - Access to simple screening tests.
- Persons that experience problems in hearing and communication and like to have more specific information concerning their

problems. The information that is offered in addition to the above are:

- Information concerning types of hearing impairment and their treatment;
 - General advice about assistive devices like hearing aids and other methods for improvement of communication;
 - Demonstrations of the effect of assisted devices and methods to improve communication (e.g. reducing reverberation);
 - Links to the diagnostic services for screening and other diagnostic tests;
 - Links to the rehabilitative services.
- Professionals like Audiologists, ENT doctors, speech therapists, of hearing-aid dispensers, architects, acousticians etc. For this the following will be offered:
 - Professional information;
 - Access to new diagnostic and rehabilitation methods;
 - Participation in validation tests for new methods;
 - Other to be defined.

4.1.2 Demonstrations

The Portal will contain a number of demonstrations. The topics are:

- Demonstrations of the effect of the acoustic environment on the ability for speech understanding. Different type of rooms, buildings and background noises will be given;
- Audio-visual demonstrations of the effects of several degrees of hearing impairment and acoustical environments.

These demos can be extended by a screening test for several environments (background noise, reverberation etc).

4.1.3 Access

The portal will give access to the Diagnostic and Rehabilitation service areas as well to Professional sections. The access method will be developed. For professional services an access/password registration method will be used.

4.2 Diagnostic services

The diagnostic services will contain a section concerning screening diagnostics and a section concerning professional diagnostics.

The screening diagnostics will consist of (several) tests to assess the degree of hearing impairment. These tests will give a first assessment of hearing problems in relation to the auditory profile. The screening diagnostic tests will consist of:

- Speech recognition test. This test will be based on the ability to recognize speech in background noise. The test will be a simple test based on the recognition of 3 digits. The test will be available in 5 languages: Dutch, German, English, French, and Swedish;
- Localization test: This Screening test will assess the ability of a person to use localization information (horizontal position, distance) for the understanding of speech with interfering sources of noise;
- Other tests as required for the first level of the auditory profile (to be defined).

Based on the outcome of the screening tests, the person will get advice for professional care when needed.

The professional diagnostic section will consist of

- Overview of recommended tests and its relation to the auditory profile;
- Standardized instructions for recommended tests. This will allow audiologists to adopt newly developed and standard methods for diagnostics;
- Speech material for tests that are recommended. In particular newly developed speech material from SP1 and SP3 will be distributed;
- Special section containing research tests. This allows groups to participate in the evaluation of newly developed tests for additional diagnostics, multi-site validation of new tests and other research purposes;
- Others to be defined.

4.3 Rehabilitation services

The rehabilitative services will contain sections concerning:

- Auditory practice material for hearing-aid and cochlear-implant users, to practice speech reception in quiet and under adverse conditions;
- Audio-visual practice material to practice lip reading;
- Others to be defined.

4.4 Planning for Month 12-36

4.4.1 Portal

The following modules are planned for the portal

Module: Platform	PORTAL
The portal platform will contain information, demonstrations and provides access to the diagnostic and rehabilitation services	
Platform prototype installed	M12
Basic information sections made	M18
Integration with 1 st demonstration	M21
Limited release to public (project information)	M24
Access to Diagnostic services (screening)	M24
Release/launch for user trials	M30
Access to Rehabilitation services	tbd

Module: ODEON (demonstration)	PORTAL
Demonstration of speech intelligibility and quality under different acoustic conditions (small, big room, cafeteria, train station, etc.), at different position of talker and background noises and for several languages.	
Stand-alone prototype (simple demo)	M12
Internet prototype	M18
Extension for intelligibility calculation	M21
Release to public	M30

4.4.2 eDiagnostics

The following modules are planned for the portal

Module: Speech recognition test (screening)	eDiagnostics
Speech recognition screening test based on the identification of 3 numbers in background noise. Available for several languages (3-5). Validated against standard test and between different languages. First a telephone version will be introduced.	
Telephone version made and launched	M12-M24
Internet implementation	M28-M31
User trials	M32
Launch to public	M42

Module: Localization test (screening)	eDiagnostics
Speech recognition for two-dimensional stimulus presentation schemes, where speech and noise may come from different directions. Different directions will be created using headphones and a simulated 2-D or 3-D environment.	
Test version made	M12
Internet implementation	M30
User trials	M30-M34
Launch to public	M42

Module: AVE (screening and demonstration)	eDiagnostics
Advanced screening test and demonstration using an Auditory Virtual Environment	
Off-line stand-alone version	M12-M24
Internet version	M22
User trials and optimization:	M23-30

Launch to public	M42
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4.4.3 eRehabilitation

Internet rehabilitation services have not yet been specified. A first stand-alone prototype is expected in M24 and Internet version in M30-36.

5 Accessibility

The HearCom portal aims to structure the available knowledge of audiologists and communication acoustics, as well as to acquire new knowledge. Furthermore, it will make this knowledge usable and accessible to various groups of users through the provided e-services.

5.1 Accessibility guidelines

Bearing in mind all target groups of HearCom, accessibility is a key issue. Accessibility will be considered by conducting the following steps:

- Creation of an Internet portal for hearing and communications related tasks which is accessible for professionals as well as for end users; e-services will be integrated into the portal, which themselves must be usable and accessible as well.
- HearCom will implement and test accessibility features with end users and professionals. The approach will be based upon previous results of projects where some partners have been involved, together with new available recommendations. In particular, we will study the following features in combination with usability and accessibility aspects:
 - Personalization and adaptation of Web content for people with hearing impairments, including profiling.
 - Influence of access devices and ubiquitous computing for accessibility.
 - Information management and search issues.

The overall objective of this work is therefore to ensure easy accessibility of e-services tools to acousticians and designers and to provide transfer of knowledge for implementation on Internet.

Focusing on the accessibility to Internet, one of the most relevant sets of guidelines are the guidelines developed by the Web Accessibility Initiative (WAI) of the World Wide Web Consortium (W3C).¹ W3C-WAI has set three sets of recommendations to improve the accessibility of the Web. They are:

- WCAG (Web Content Accessibility Guidelines), released in May 1999, which explain how to make Web sites sufficiently accessible so that people with disabilities are able to use them alongside with today's technologies. (<http://www.w3.org/TR/WCAG10>).

¹ <http://www.w3.org/WAI/>

- ATAG (Authoring Tool Accessibility Guidelines), released in February 2000, which provide guidance for software developers and used to build Web sites, so that the software will automatically ensure maximum accessibility of the code used on Web sites. (<http://www.w3.org/TR/ATAG10/>).
- UAAG (User Agent Accessibility Guidelines), released in December 2002, which explain how to make browsers and multimedia players more accessible and how to make them compatible with some of the assistive technology that people with disabilities use (<http://www.w3.org/TR/UAAG10/>).

Both the universal acceptance and the way they are produced (cooperatively) are the strengths of WAI guidelines. There are also institutions that are collecting their own guidelines related to specific groups of users,² used devices, tasks or work environments, etc.

However, as Web technology is rapidly evolving, the production of guidelines is a continuous process that periodically comes up with new versions. This has an important effect over tools or automatic accessibility evaluation.

5.2 Users with single and multiple disabilities

By classifying users according to human characteristics emerging from functional disabilities and/or handicapping situations it has also to be taken into account that most disabled people suffer from multiple handicaps which vary in degree and combination.

The work of the Web Accessibility Initiative of the World Wide Web Consortium issuing the Web Content Accessibility Guidelines 1.0 and the draft 2.0 seems to reflect most comprehensively the requirements of people with special needs accessing Internet based services. It has been acknowledged in different fora that these guidelines cover in detail the needs of people with different degrees of visual and motor impairments. However, the needs of people with cognitive impairments and/or who are hard of hearing or deaf still need to be considered more thoroughly.

Taking these premises into account the collection of user requirements in the course of the development of the guidelines consider the following user groups:

- people with cognitive impairments (in other countries referred to as people with learning disabilities) who suffer from:
 - memory impairments,

² E.g., LD Web: <http://ld-web.org/>, or Lighthouse International: <http://lighthouse.org/>.

- attention deficits,
- reading and writing problems (e.g., people with dyslexia),
- learning disabilities,
- perceptual deficits,
- illiteracy, so they use e.g. pictograms for communication, and speech problems;
- people who are born deaf;
- people who are hard of hearing;
- people with visual impairments:
 - people with low vision (loss of acuity, low perception of depth).
 - people with color blindness,
 - blind people;
- people with speech disabilities;
- people with reduced dexterity and other mobility problems;
- people with multiple impairments from all the above groups;
- people in handicapping situations accessing the Internet via different browsers.

As people age, they experience a decrease in vision, hearing, and cognitive abilities. As the HearCom portal and e-services are targeted to be used by most people, the e-services should be easy to use for most people.

Accessible Web sites as mentioned do not only help those with a disability, but also they help those surfing without graphics turned on or with text-based browsers such as Lynx, users with slower Internet connections, and people using mobile devices. Web sites that are validated from an accessibility perspective are optimized to work with any text-based browser and alternative devices.

With text-to-speech readers and programs that magnify the Web site, the Internet is more accessible than newspapers and magazines. Even with the amazing advances in devices that assist people with disabilities, they alone cannot work with the Internet.

6 Requirements of standard tasks to be performed by services

The main objective of the requirements capture of a standard task for people with special needs is to enhance the accessibility and usability of Internet based services for people encountering barriers when accessing Web Services like those of the HearCom project. These barriers are due to human characteristics determined by **individual pre-dispositions** (e.g., impairments) or **restricted usage-situations** ("functional impairments," e.g., not being able to read comprehensive textual or graphical information while driving a car). The concepts of accessibility and usability researched more closely will be presentation, interaction and comprehension as suggested in the WCAG 1.0. Requirements capture means, therefore, assessing the impact of vision, hearing, cognition and physical ability on dialogue principles, screen layout, information presentation and the like, all of them inherent to Internet services.

There should be standard tasks defined for every e-service within the HearCom project. The standard tasks should consist of the following elements:

- a. Scenario description: It should contain a description of the standard task and targeted users of the e-service. For purposes of informing users about e-services corresponding paper-flyer should be promoted as well outside the World-Wide-Web;
- b. Task description: According to the scenario description work is best being subdivided into separate subtasks;
- c. Activity description.

6.1 General recommendations

In the following sections we present the main recommendations and aspects of accessibility, which should be considered by the development of HearCom e-services:

6.1.1 Presentation

The section on layouts explains the advantages of using CSS (cascading style sheets), one of which makes it easier for people with disabilities to use the HearCom Web services, especially because it's easy to create multiple style sheets giving visitors with different and multiple disabilities the choice of font size, font type, and color that works best for them. Not only layouts should be considered, but also font type and size, colors, images, and video.

6.1.1.1 Color

About 8% of the male population and about 0.4% of the female population has a form of blindness-blindness. If the Web site's choice of colors doesn't have much contrast to a person with blindness-blindness, he won't be able to use the HearCom Web service.

- offer an alternate style sheet.

6.1.1.2 Images, Videos and Audio files

When dealing with images, audio files and videos, the following should ensure that you cover your bases:

- Use the alt attribute in the element to briefly describe the image.
- Use the longdesc attribute in the element for more complex images needing more details.
- Provide captions or a text-alternative for videos and sound files.

If there is nothing meaningful in the picture, such as a spacer (which is discouraged today, but not eliminated), use alt="" rather than omitting alt altogether. If the image is complex and needs a longer description, use longdesc, which typically links to a file with the description.

6.1.1.3 Tables

The recommendation is to use CSS for layouts instead of tables. To create accessible content tables, follow the recommended guidelines:

- Identify headers and rows by putting them in the first row and first column.
- Use header elements such as <th> for headers or <scope>, which is an alternative element to <th>. Currently, <th> is the more widely supported of the two.
- Use the <caption> element and summary attribute when possible.

There are more elements which could be used for tables. The summary attribute can be useful, but not all screen readers support it. Therefore, it's helpful to describe or summarize the table in the body of the table or outside of it. It's a lot of work to create accessible tables, which makes using CSS almost more attractive.

6.1.2 Navigation

Those with no visual challenges can quickly go exactly where they want to go on a Web site by using visual cues. In general, they expect to find the

navigation on the top, left, right, and/or bottom of the Web site. We've also become accustomed to ignoring banners on the top of the page while looking for what we need. Navigation isn't easy for those with visual impairments.

6.1.2.1 Skip Navigation

Screen readers read everything including the navigation. If the navigation is the first thing in the HTML page, then it reads that and this gets tedious after visiting the site several times. To get around it, use the "skip technique," which allows the reader to skip the navigation and go right to the content using the <a> element.

6.1.2.2 Forms

To make accessible forms, put the text prompt next to their corresponding form control. The labels should be on the left of the control for edit fields and <select> menus. For radio buttons and checkboxes, put the prompt on the right side of the control. Buttons include prompts as part of the control in the value attribute. The <label> element ensures that screen readers read the correct text with the associated form control.

The name attribute is deprecated, but older browsers don't understand the id attribute, so the solution is to include both. However, if you find the validator spits out the name attribute as a problem, just remove it. For <select>, you can use <label> and id.

6.2 Usability requirements

This section is about the human factors of the HearCom Web services. Web services should know what the user wants and provide it. Good usability is invisible because the user can get around and accomplish the tasks without fighting his way around. Usability is a formalized science that is still being defined, but has roots entrenched in the disciplines of human factors, user interface engineering, and software design.

Knowledge about users and their preferences is the best way to ensure that Web services are user-focused.

To achieve usability of Web services in HearCom the following measures should be considered:

- Find out what tasks the users want to complete with the Web service and focus on those activities.
- Offer a taste or a sample and let the user want to dig deeper. In today's fast-paced society first impressions can make or break a Web site. Determine what content and functionality the site will contain. Specify how users will find information in the site by

defining its organization, navigation, labeling, and searching systems.

- Map out how the service will accommodate change and growth over time.
- The architecture of the Web service should involve defining the audience, creating a site map or the blueprints showing a hierarchical relationship in organizing the site, designing the navigation based on the site's organization, creating a labeling system clearly illustrating the meaning of the site's navigation labels for the links.
- Integration of information about the main functions of the Web service into search engines.
- Information chunking has been around long before the Web and is essential for Web content. Readers scan chunks of information until they find what they're looking for.
- Controlled vocabularies ensure that we speak the same language and understand something to mean the same thing. Create lists of words and phrases to form labels and search terms and organize them in a controlled way. This process helps with the navigation scheme and tagging items.
- Good information architecture (IA) helps users find what they seek, whether they want to execute a search query, browse a hierarchy, or contact a human to ask for help. IA works to guide the user in a large confusing site by orienting him through good navigation design. It can help him deal with information overload by filtering out low-quality content. Good information architecture is essentially invisible. If you're struggling with a Web site, you know the IA is not well done.

6.2.1 Glossary

A glossary offers an alphabetical list of "entry point" topics through which the user may browse and select. In a glossary at the back of a book or manual, the entries are followed by page numbers. On a web site, the entry points are hyperlinked to the appropriate pages, and often to named anchors within Web pages for an even greater level of detail.

A glossary may contain multiple entries, each worded differently, that point to the same page, or page and anchor. This approach is used to cover all the different ways a user may think a topic is named, and is referred to as "double posting." It covers synonyms, such as "cars" and "automobiles," and the different word order of a phrase, such as "automobile engines" and "engines, automobile." The browsable nature of

the index solves the problems that might arise from incorrect or variant spellings, and singular vs. plural usages that the site user might choose.

In addition, there is often a second level of terms, called "sub-entries," that are listed and indented under some of the main entries.

6.2.2 Interface and Visual Design

The interface connects humans with machines so they can understand each other. Successful interface design ensures that the important stuff is up front and filters out the garbage.

Interface design overlaps between information architecture and the visual designer. A successful interface has the needed elements so the user can complete a task without a struggle. When a user can readily get the task done, the architecture has done its job.

When working on interface design, consider the user's bandwidth, his technical knowledge, and tasks he wants to accomplish. For example, a user needs to conduct a search. One search box for most pages typically works fine. Some sites, however, have multiple search boxes on a single page.

It's easy to mistake visual design as the aesthetics or the "look and feel" for the Web site. Visual design focuses on ensuring that the elements work well together supporting the site goals.

6.2.3 Navigation Design

Navigation design focuses on getting the user to move around the site through links. Sometimes people find it difficult to explain in words how to get from here to there because the visual cues are missing. Two people can get from here to there in two different ways.

When creating each page, asking four basic questions can help think like a user who arrives on the page for the first time:

- Where am I?
- Where can I go?
- How can I get back to where I came from?
- Will I know where I am when I arrive from outside sites?

A visitor may arrive at a site from a search engine or other external Web site, which renders the third question redundant; hence the need for the fourth question. The fourth question considers how a person can dig his way out after landing deep into a site's page.

Good navigation orients the user to where he is located within the site's scheme. Drop-down menus, buttons, checkboxes, radio buttons, text

fields, and scrolling lists are examples of user interface design elements. When thinking of checkboxes and radio buttons, what is the main difference between the two? Checkboxes are usually square, whereas radio buttons are round. The squares usually allow the user to select more than one item, whereas the circles limit the selection to one. All elements are acceptable for use on a Web site. The key is to use the right ones.

6.2.4 Site Mapping

It's pretty hard to create a hierarchical site map that adjusts in real time to shifting priorities, goals and needs — regardless of where they originate.

Aspects should be considered giving users options to keep them on track when traditional navigation fails. Things like:

- Proper metadata (particularly labels and page titles) for search relevancy
- Related item grouping and linking
- Indexes
- Links within content
- Faceted classification and corresponding navigation
- Personalized taxonomies
- A homepage that acts less like a landing page and more like an information hub (or site map)

A traditional hierarchal site map cannot always illustrate these things, yet it is often perceived by clients and stakeholders as the final say when it comes to organizing content.

6.2.5 Internationalization and Localization

Localization is the adaptation of a Web site to a locale, which includes cultural, technical, and linguistic modifications. An example of a technical aspect is that people of the U.S. often abbreviate dates as MM/DD/YY, which translates to 02/10/04. Many European countries do it as DD/MM/YY, which is 10/02/04. Americans translate this date to be October 2, 2004 instead of February 10, 2004.

Internationalization is building a Web site to enable it to support multiple locales. Localization is the modification of a Web site for a specific locale. Think of internationalization as a template that can be adapted for the localized pages.

7 Evaluation, verification and validation of eServices

The construction of the e-Services will be guided using user-testing schemes and user evaluations. The following planning will be followed in the construction and evaluation of the Internet Service.

- Inventory of user requirements;
- Construction of prototypes of screens and navigation structure;
- Validation of prototypes of screens and navigation structure;
- Construction of the Internet service;
- Trial period with pre-launch validation;
- Adaptation of the Internet service;
- Launch of Internet service;
- Continuous validation.

7.1 User testing

User testing has also been called usability testing, among other names. At its simplest, the test involves the user sitting in front of the computer to try to complete a set of assigned tasks while being timed or given a time limit. The person giving the test sits near the user and takes notes of the steps taken, the time it takes to complete the task, the number of clicks, and the comments he makes. The end result is to determine what areas need refining.

Encouraging the user to think out loud is a great tool in the process of understanding where the roadblocks are within the site. Obviously, the more testers who participate in the test, the better the results. If one user out of 20 has a problem with an element, it may not be an issue that needs addressing. User testing provides useful data for analyzing and improving the Web site. A second round of user testing can demonstrate whether there is an improvement over the previous iteration of the design.

To complete preliminary usability testing, monitor the user and take notes. The user will be evaluated by three things: complete specific tasks, talk about the vocabulary (asking the user what he expects to find under certain items before going there), and commenting on the overall layout and concept. For purposes of HearCom accessibility evaluation, access scenarios for using the e-services should be specified by standard tasks.

Finally accessibility evaluation has also carefully to take into account the motivational aspects of involved system evaluators for standard task accomplishment. Carrying out a standard task can be burdensome. HearCom e-services should balances these burdens.

7.1.1 Testing methodology

Testing usually occurs across many phases of the design and development of software. Testing not only makes sure that the interface of a Web service looks good, but it also checks its performance and back-end functionality. End users feedback is essential, because they will be the ones using the Web site. User testing belongs to the requirements at the beginning of the project as well as the project schedule. Measurable testing objectives and success criteria should be established early on in the project that validate the requirements are met.

7.1.1.1 Plans and Reporting Results

The first step is to define and clarify the testing team's role as early as possible, including the process of reporting of problems. To put together a testing process, the following questions could be used as a guide:

- Where do we do the testing?
- Who are the users to carry the tests?
- How do we report problems?
- How will problems be resolved and reported?
- How to categorize the problems for tracking where they occur?

The "where" focuses on the testing environment that is separate from the development and product environment on separate servers and remote sites. When the users or audience is defined, this helps identify the kind of system they use while interacting with the application. The test team mimics this environment as close as possible. Define the process for moving code to and from the test environment.

Documentation of the testing process should be defined and planned. The key is to have a process for conducting testing, reporting results, and closing issues.

7.1.1.2 Aspects of User Testing

There are many types of testing. Here are the more common testing methods: usability testing, user acceptance testing, unit testing, markup testing, load testing and security testing.

Our focus in this document lies on usability testing, it checks the HearCom Web services from a user's viewpoint and how it affects her experience. The requirements typically describe the users who will most likely visit the Web site by way of user profiling. The end result is to find out whether users can interact with the Web site to achieve their goals. A good way of doing this testing is to bring the user to use the Web site while testers or developers watch the user's moves, or ask the users during after the tests via questionnaires. Users often click the wrong button, enter the wrong information, enter the wrong URL, and so on. The aim of the test consists in finding out those pitfalls and in reporting them. A good method for doing that is automatic protocol of the test steps.

User acceptance testing involves using the application as it is intended. A common way to accomplish user acceptance testing is through a pilot test.

Markup testing validates the accuracy of the HTML or XHTML markup. World Wide Web Consortium (W3.org) has several validators: HTML, XHTML, and CSS. As accessibility checker, imergo® will be used.

7.2 Questionnaire verification

Questionnaires are used to collect user responses for the specific user groups. The questionnaires that will be used for the construction and evaluation of the Internet services are currently under development in Work Packages 11 and 12 (partners: the Royal National Institute for Deaf People (RNID) in the United Kingdom, Kompetenzzentrum Hörtech in Germany, and the Erasmus Medical Center in the Netherlands). The results of the user-requirements inventory will be used in guiding the construction of the Internet Service. These results are expected for the eDiagnostics in M14, the results for the eRehabilitation are expected around M20.

7.3 Prototype validation (by user panels)

Plan to validate prototype design using user panels. These panels will be recruited from organizations of different types of users (organizations of hearing-impaired persons, possibly of cochlear implant users and professionals). To collect their responses, the aforementioned questionnaires will be used. The evaluated prototypes will contain:

- Screen layouts:
 - Home screen;
 - Main screens of each section;
 - Examples of screens containing information;
 - Examples of screens containing tests.

- Navigation:
 - General navigation structure;
 - Menus;
 - Navigation tools;
 - Site map.

7.4 Pre-launch trial period

The user groups that participated in the prototype evaluation can be given access to trial version of the site to verify whether their suggestions have been included and their complaints have been resolved. For this it may be useful to include an online section with questionnaires (to be planned), so their responses can be collected within the service.

7.5 Continuous validation

Once the Internet service is up and running, usage statistics and a usage questionnaire section can be used to monitor the success of this Internet service.

- The usage statistics will provide information on the number of people using the service and the relative usage of the different sections of the service.
- Questionnaires (see also pre-launch trials) can be included in a “customer satisfaction” section to obtain information concerning the satisfaction of the different types of users. In addition, suggestions and tips for improvement of the service can be obtained.

8 Dissemination and Exploitation

The HearCom Internet service is one of the key results of the project and has a clear exploitation potential. Several models of exploitation are possible. For a detailed discussion of these models, please refer to Section 6 of the deliverable D-13-1 "Action Plan for Dissemination and Exploitation Activities."

9 Conclusions

This report provides the user-interaction specifications of the HearCom Internet service (ePlatform). For this, different target groups are identified; primarily end users (in the general public) and professionals. These groups are treated separately. This resulted in (1): requirements for the functional properties of the portal, in general and specifically for the eDiagnostics and eRehabilitation sections; following international guidelines in (2): functional descriptions of, and recommendations for the construction of good accessibility and usability of the site for with users with different disabilities or combinations of disabilities; and in (3): descriptions of the standard tasks to be performed by the Internet service and how their functioning can be tested. Finally, recommendations are made for the verification and validation of the Internet service.