Coordination Action in R&D in Accessible and Assistive ICT

Grant Agreement: 248582

CARDIAC

Coordination Action in R&D in Accessible and Assistive ICT

FP7-Coordination Action

D3.1 Report with background material needed to support the SDDP-2 Meeting

Background material to support the SDDP-2 Meeting

held on June 28-29, 2011 in Donostia-San Sebastián

Iosif Klironomos
Foundation for Research and Technology
Hellas, Institute of Computer Science
Julio Abascal
Laboratory of HCI for Special Needs
University of the Basque Country/Euskal Herriko Unibertsitatea

Date of preparation: 5th of October 2011

Table of Contents

1 Working summary

This document aims to introduce and explain the SDDP methodology and to establish a common ground on accessible HCI concepts and to provide information about the practical arrangements for the SDD attendees.

SDDP is a relatively new methodology which is still evolving. It was chosen in the context of this Coordination Action for its strength in finding links and generating influence maps. To ensure the complete success of the workshop, it is imperative that you understand the process completely before participation[1].

Accessible HCI is deeply routed in the Human Factors field and has close relationships with Assistive Technology, Universal Accessibility and Design for All theories and developments. This document does not intend to serve as a complete survey of all the advancements in these areas. To the contrary, in this document specific trends and objectives are presented, with the aim to propose a common language or understanding of the concepts that will serve as a basis for the discussions in the SDDP seminar. Therefore, the information provided is not complete, nor consolidated, and we explicitly tried to avoid any dogmatism or preconception that can restrict or condition the freedom of the participants to propose new, non-standard ideas or proposals. In fact, using the SDDP methodology to gather experts' opinions, we aim to encourage their creativity and (scientifically supported) imagination. In this way, we expect participants to contribute with innovative proposals to the results of otherwise standard prospective methodologies, usually based on interviews with experts, pools participation and filing forms.

[1] If you have any questions, please email Yiannis Laouris at <laouris@futureworldscenter.org>. Also, prior to the workshop, there will an opportunity to participate in a bi-weekly conference call dedicated to answering any queries that you may have in advance.

2 Background

2.1 Introduction

The CARDIAC Project is a Coordination Action funded by the EU's 7th Framework Programme which aims to improve the overall success of Challenge 7, ICT 2009 7.2 'Accessible and Assistive ICT' by preparing research agenda roadmaps that highlight research priorities that will favour eAccessibility.

It aims to do this by looking into the wide range of issues that play a role in the availability of accessible and assistive ICT. The issues range from future research priorities, development and design aspects, right through to making the business case and the adoption or non-adoption of a particular technology or service.

In recent years, a large number of international projects had to address the need for guaranteeing accessibility and usability in Human Computer Interaction. To this end, a number of diverse approaches, methodologies and technologies have been proposed. Many research and development activities have been carried out on different aspects of accessibility of ICT equipment and services with an Assistive Technology (AT) approach, and more recently, the Design for All approach has been explored.

Positive results have been achieved combining both approaches. In particular, accessibility problems of specific groups of users have been addressed through AT based adaptations, and systematic Design for All approaches have been elaborated and applied in various domains at a research level.

Still, the field is currently in need of a breakthrough towards the adoption in practice of design approaches, based on the accumulated knowledge, leading to accessible and usable inclusive interfaces.

One of the main objectives of the CARDIAC project is to generate a roadmap identifying issues in the area of Inclusive Human Computer Interaction (HCI) research and development priorities. This roadmap will be a document outlining essential areas and subsequent types of research missing that could facilitate the development of inclusive HCI technologies.

The purpose of this document is to provide a background and context to the second Structured Dialogue Design Process (SDDP) co-laboratory of the CARDIAC Project, which is scheduled for the 28th – 29th of June in Donostia-San Sebastian, Spain. The purpose of this event is to generate an influence map in response to the Triggering Question "What type of research is missing that could facilitate development of inclusive HCI".

When considering the various methodologies for generating roadmaps, the Structured Dialogic Design Process methodology was selected due to its robustness and efficiency in gathering the collective wisdom of a wide range of different stakeholders. The SDDP methodology supports democratic and structured dialogue among a group of stakeholders and is especially effective in resolving multiple conflicts of purpose and values, and in generating consensus on organizational and inter-organizational strategy. A full description of the methodology and how exactly the methodology will guide the process of generating a roadmap is presented in a separate document.

2.2 Scope of the SDDP in Inclusive Human-Machine Interaction

Several research activities in the field of Ambient Assisted Living (AAL) focus on more user involvement in the design process. The ISO standard 13407 Human-centred design process for interactive systems provides guidance on human-centred design activities throughout the life cycle of interactive computer-based systems (see figure 1). However also other research methods are available, for instance participatory and co-design. These approaches have in common that they all express the belief that all people have something to offer to the design process.

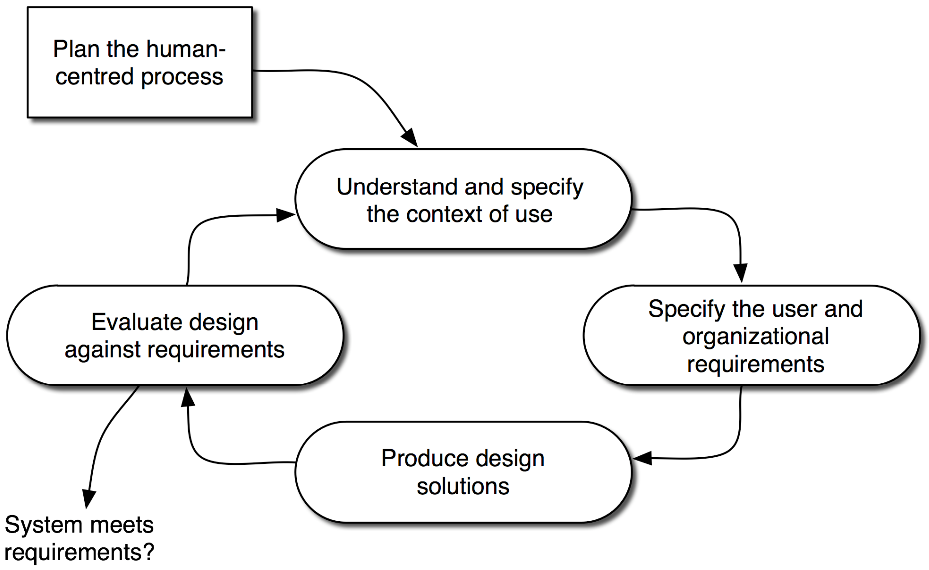

Figure1. The human-centred design process, ISO-13407 (ISO 1999), taken from [Lindström 2008]

Moreover, adaptivity/intelligence on the one hand, and the analysis of the implications, from an eAccessibility perspective, of the emerging Ambient Intelligence (AmI) paradigm (with a clear orientation to creating "natural" interfaces) on the other, are becoming increasingly important aspects. The main difficulty lies in understanding and utilising the whole range of possibilities for inclusive Human-Computer Interaction.

Therefore, it seems necessary to propose a road map towards achieving inclusive HCI based on the accumulated experience by diverse European actors. This could be addressed through a network of multidisciplinary experts, who can bring in their expertise in the different aspects of the issues involved, as well as propose solutions, in order to elaborate a balanced model incorporating different approaches.

2.3 Accessible Human-Machine interaction and Assistive Technology

According to the Wikipedia[2], **Assistive technology** or adaptive technology (AT) is an umbrella term that includes assistive, adaptive, and rehabilitative devices for people with disabilities and also includes the process used in selecting, locating, and using them. AT promotes greater independence by enabling people to perform tasks that they were formerly unable to accomplish, or had great difficulty accomplishing, by providing enhancements to or changed methods of interacting with the technology needed to accomplish such tasks. Likewise, disability advocates point out that technology is often created without regard to people with disabilities, creating unnecessary barriers to hundreds of millions of people. Even the makers of AT technologies will often still argue that universal design is preferable to the need for AT and that universal design projects and concepts should be continuously expanded.

People with disabilities usually need assistive devices and programs that have been specifically designed to cover their needs taking into account their capabilities. These devices (e.g. Braille lines) are frequently used to access services or other devices (e.g. computers) that have not being specifically designed for them. The later also have to be designed in a way that does not impose extra barriers to people with disabilities.

Therefore, it is crucial to determine what are the technologies, methodologies and tools that allow the design of accessible and inclusive human interaction systems. These accessibility procedures must be applied to the design of both assistive technologies and mainstream technologies in order to avoid any type of barrier or exclusion.

2.4 The human factor

The most distinctive characteristic of the accessible human-machine interaction is the critical importance of the human. Systems designed without taking into account the characteristics, needs, interests, likes, behaviours, etc, of the users are bound to the failure. Unfortunately, generally interaction technologies are designed for the mythical "normal user" ignoring the huge human diversity. One of the reasons may be the designers' deficient awareness of methodologies and tools to include the users in the whole process of design and development. Another reason may be the complexity of applying existing methodologies. For this reason, CARDIAC aims to propose a road map on inclusive and accessible human-machine technologies, methodologies and tools that are rooted and centred in the users.

[2] http://en.wikipedia.org/wiki/Assistive_technology

2.5 Preparations

The SDDP seminar that will be held in June 2011 in San Sebastián is only a part of a much broader process. Comprehensive preparation started in September 2010 which should ensure that optial results are obtained for the face-to-face meeting. After the two-days intensive seminary, extra virtual meetings, aiming to solve any issue that is not completely clarified in the seminar will be conducted. In addition a rigorous exercise of analysis, evaluation and conclusions extraction will be carried out following these meetings. Therefore, we expect to be able to report the consolidated results from this task at the end of 2011.

2.5.1 Pre-meeting activities

- October 27, 2010: Discussion and approval at the CARDIAC Consortium meeting (Paphos, CYPRUS) of the list of experts to be invited, seeking for a balance among users' representatives, industry, academy and policy makers.
- February 5, 2011: Invitations sent to the first group of experts
- April 5, 2011: Opening of the Wiki and invitations to contribute sent to CARDIAC partners, the CARDIAC Advisory Board and Invited experts.
- April 20, 2011: Invitations sent to the second group of experts
- May 12, 2011: Discussion and approval at the CARDIAC extraordinary meeting (after the first Annual Review, Brussels) of the additions to list of experts to be invited, in order to include the suggestions from the reviewers and to substitute people that declined the previous invitations.
- May 18, 2011: Invitations sent to the third group of experts
- From April 5 to June 25, 2011: Discussions in the wiki. Topics included:
    - World Report on Disability - How do we incorporate their findings?
    - Scrutinizing the triggering question
    - What type of answers to the TQ is required?

From this last discussion, the following guidelines arose:

Answering the triggering question we should be able to deliver:

1. Clear proposals on what technologies need to be supported. E.g.: Eye tracking, Voice/gesture recognition, wearable devices, smart displays, etc.

2. Clear inputs on what methodologies have to be investigated. E.g..: Adaptive UI design, Accessibility evaluation guidelines (for devices, services and applications)

3. Clear contributions on what kind of tools should be developed. E.g..: Automatic accessibility verification/design tools, Accessible User Interface Description Languages, etc.

Work in SDDP-2

The SDDP preparations carried out through the wiki followed these steps:

- Round One: Participants generated their ideas and entered responses and explanations of the meanings of their statements in the wiki's discussion tab.
- Round Two: Participants studied each other's statements and asked for clarifications and proposed new statements.
- Round Three: The Knowledge Management Team organized all of the statements into clusters, maintaining similar meanings of statements together. Participants reviewed them, and added suggestions for modifications of the clusters.

2.5.2 Post-meeting activities

The Round Four: “Voting (Each expert votes for five statements)” and Round Five: “Enhancement Mapping”, will be performed in the San Sebastian seminar.

After the two-day SDDP meeting in San Sebastián, further clarifications and analysis of the ideas included in the 'influence tree' for the 'road-map' will be collected via the Wiki. Special focus will be given to the ideas at the root of the influence tree which have the most influence.

If it necessary extraordinary virtual meetings with the experts will be organized, in order to clarify or complete issues that could remain unclear before the SDDP-2 seminar is closed.

After closing SDDP-2 the Knowledge Management Team will analyze and interpret the results in order to produce a detailed report that will be used for the proposal of a roadmap for European research on inclusive HCI.

3 A brief guide to the Structured Dialogic Design Process (SDDP)

3.1 1 Introduction

The Structured Dialogic Design Process (SDDP) is a methodology that supports democratic and structured dialogue among a group of stakeholders. It is especially effective in resolving multiple conflicts of purpose and values, and in generating consensus on organizational and inter-organizational strategy.

The SDDP is specifically designed to assist non-homogeneous groups to deal with complex issues, in a reasonably limited amount of time. It enables the integration of contributions from individuals with diverse views, backgrounds and perspectives through a process that is structured, inclusive and collaborative. A group of participants, who are knowledgeable and have a stake in a particular situation are engaged in collectively developing a common framework of thinking based on consensus and shared understanding of the current and of a future ideal state of affairs.

The SDDP promotes focused communication among the participants in the design process and their ownership of and commitment in the outcome. The SDDP produces roadmaps, which are efficient, but moreover are supported by those who have developed them.

3.2 The SDDP Methodology

Figure 1 illustrates the basic phases of this methodology.

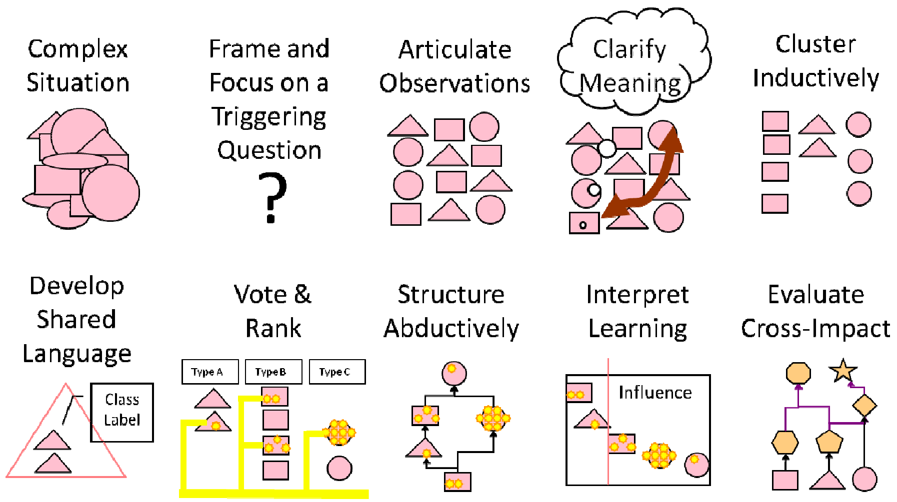

Figure 1: The SDDP Process.

The "Triggering Question" (TQ) is used in order to constrain the breadth of the dialogue. One-sentence responses to this TQ are posted on the Wikispace ahead of the meeting. No arguing over content is allowed at this stage as the intention is to understand each other, however a further opportunity to articulate additional responses as well as give clarifications to any questions is provided later during the process. The next phase involves a bottom-up approach towards clustering the ideas according to common attributes. This and the previous processes support stakeholders gradually developing a common approach, and a shared understanding of the complex problem, highlighting small but sometimes very important distinctions in the meaning of individual contributions. All participants then vote on which observations they consider most important. Usually they are given five coloured dots that they can stick on the observations of their choice, which are posted on the wall. These votes are tallied.

The structuring phase includes only ideas that have received at least 1 vote. With the help of pairs of observations projected on the screen, the participants decide by super majority whether achieving observation A (or making progress in resolving the particular problem) would significantly help in achieving observation B. The exploration of influences of one idea on another is extremely important because it gradually produces consensus as to the leverage points on which investments would provide the maximum return. The otherwise exhausting task of comparing thousands of pairs is simplified by the transitive logic of supporting software, so that approximately 150 votes do the job in about 4 hours. In this process, the stakeholders are not burdened with trying to keep track of the bigger picture because the software manages the mechanical logic of how their decisions fit together. At the end of this process the stakeholders collectively produce an influence tree that graphically presents the conclusions they have reached. This 'tree' or roadmap reveals the leverage points for applying effective action to work out their complex situation.

3.3 How SDDP Works

The detailed breakdown of the various phases of the process can be summarised as follows:

- Phase 1: Identification of relevant stakeholders. This process is initiated several months ahead of the SDDP workshop proper. The importance of inviting relevant and appropriate stakeholders is of paramount importance. Stakeholders that accurately represented elements of the Accessible and Assistive ICT Industry and are willing to positively contribute to the process are key to ensuring that the outputs of the SDDP will be of value.
- Phase 2: Engagement and consultation with the relevant stakeholders in order to draft the triggering question. For the purposes of this process, it was decided that a full range of collaborative technologies such as Wiki's etc., be employed to ensure that the Triggering Question was identified ahead of the face to face element of the SDDP. Due to the importance of the TQ in the whole process, it is imperative that it has been reasoned and reflects the input of the project team as well as the external participants. A summary of this discussion can be found in

Appendix II.

- Phase 3: Drafting of report with background material (this deliverable D3.1). Following definition of the TQ, it is important to provide the participants with the information required to fully engage in the face-to-face element of the process. This includes provision of any background reading materials, any required resources, the TQ itself, and any information supporting how the TQ was defined.
- Phase 4: Preparation of the SDDP Meeting. This report along with all the supporting material on the CARDIAC Wikispace will serve as background material to help the participants draft responses to the Triggering Question. All participants can post their responses to the Triggering Question under the "Round-1 Generation" heading on the CARDIAC Wikispace. There will be a further opportunity to propose responses at the beginning of the 2-day meeting.
- Phase 5. The actual SDDP Meeting. The SDDP meeting will last two days during which the following tasks are carried out:
    - Collection and clarification of the additional mechanisms using the Nominal Group Technique (NGT). All participants will be given the opportunity to propose new responses to the Triggering Question and give additional clarifications. The participants will then cluster all the mechanisms into meaningful groups. This will give a further opportunity to understand all the various dimension and perspectives of the different mechanisms before the voting stage
    - Voting by participants on what are the most important mechanisms.
    - Exploration of links between mechanisms using the Interpretive Structural Modelling (ISM) method, which uses mathematical algorithms to minimize the number of queries necessary for exploring relationships between mechanisms
    - Production of draft influence map
    - Discussion and possible amendment of resulting roadmap
- Phase 6: Production of influence map report
- Phase 7: Dissemination of results

3.4 What is expected from SDDP participants? Techniques and actual Process of the meeting

The main aim of this workshop is to propose a roadmap on the types of research missing that could facilitate the development of Inclusive HCI.

Discussion is thus generated on the basis of this Triggering Question:

"What type of research is missing that could facilitate development of Inclusive HCI?"

The actual process followed before and during the SDDP meeting is summarized in the following steps:

Generating Observations – Initial responses to the Triggering Question (and further clarifications after the meeting) are collected in the CARDIAC Wikispace[3]. All the participants have an additional opportunity to propose their responses to the triggering question at the start of the SDDP meeting in "round robin" style (following the traditional SDDP procedure). Their responses are entered into a computer, projected onto a screen, and posted on the wall of the meeting room. These observations (and all subsequent products) are printed out and shared with participants in real time.

Clarifying Observations – Stakeholders clarify their observations and answer questions of clarification. If some participant does not understand the meaning of a statement proposed by a member of the group, this is the opportunity to ask questions for clarification of meaning. No arguing over content is allowed at this step as the intent is to understand each other. Any dissent is accommodated by stakeholders posting dissenting observations.

Grouping Observations – The observations are grouped on clusters on the wall on the basis of their likeness to each other and given titles. Participants then review the clusters and discuss possible modifications. For example, a statement in the discussion tab might have a title/subject that says: "Move #25 to Cluster 3" and the suggestion could be: "I propose that statement #25 should be assigned to Cluster #3 instead of Cluster #1."

Or

(Title/Subject) 35 should be in Cluster 5 "I am the author of statement #35 and my meaning fits better with the inhibitors assigned to Cluster #5."

Participants are invited to read the various amendments and make their comments, if they so desire.

Importance Voting – Individual stakeholders vote on which observations they consider most important. Usually participants are given 5 coloured dots that they can stick on the observations of their choice, which are posted on the wall. These votes are tallied

Influence Voting – Stakeholders then work with the observations receiving the most votes. With the help of pairs of observations projected on the screen, they decide by super majority whether achieving observation A would significantly help in achieving

---

[33] Note after the meeting: For the SDDP-2 in San Sebastian, 193 contributions were received ahead of the seminar (with 73 of them being direct responses to the Triggering Question). The contributions came from 16 different participants, five of whom did not attend the meeting. Overall there have been 1,829 viewings of the contributions.

observation B. Then:

- Would achieving B help in achieving A?
- Would achieving A help in achieving C?

and so on.

The otherwise exhausting task of comparing thousands of pairs is simplified by the transitive logic of specialised software, simplifying the process of keeping track of the bigger picture because the software manages the mechanical logic of how decisions fit together.

The Influence Tree – At the end of the second day the stakeholders will receive a computer printout of an influence tree that graphically presents the conclusions that have been reached. This tree reveals the leverage points for applying effective action to work out the complex situation.

Evaluating the Influence Tree - Stakeholders will have the opportunity to discuss whether the computer-generated tree accurately represents their perception of the situation. Participants can make any revisions they deem necessary and any follow-up actions will be discussed at this stage.

3.5 What types of answers to the Triggering Question are required?

In order to be able to draw a useful Influence Tree at the end of the SDDP, it is important to produce responses that are:

- Straightforward, clear and easily understandable
- Specific (focussed solutions to precisely defined problems)
- Feasible and realistic (avoiding "magical" and technically or economically unaffordable solutions)

When answering the triggering question, and during the whole duration of the workshop - particularly the discussion/clarification stage- it is important and very helpful for all participants to keep in mind the specific objectives of this exercise, i.e.:

- To formulate clear proposals on what technologies need to be supported, e.g., Eye tracking, Voice/gesture reckoning, Wearable devices, Smart displays, etc.
- To provide input on what methodologies have to be investigated e.g., Adaptive UI design, Accessibility evaluation guidelines (for devices, services and applications)
- To formulate clear contributions on what kind of tools should be developed, e.g., Automatic accessibility verification/design tools, Accessible User Interface

Description Languages, etc.

Keeping the focus on the above objectives will not only help concentrate on the main goal of the workshop but also ensure that all responses are on-topic and focused, thus providing valuable responses that will be used as the core content for the roadmap to be produced at the end.

3.6 Summary

The information presented here provides a background to the SDDP, by way of preparation for participation in such an event. However, the process is quite “experiential” as such doing it justice in such a way is difficult. There is no substitute for the actual full SDDP experience itself.

4 A review of the advancements in the field of inclusive HCI from past and current European projects

Universal Access implies the accessibility and usability of information and telecommunications technologies by anyone at any place and at any time and their inclusion in any living context. This can be considered as the right for all citizens to be granted availability of all information and communication facilities in the Information Society. This can be partially addressed by making them accessible to all citizens. Therefore access and accessibility are used as an approach toward eInclusion. Traditionally, accessibility problems have been solved with adaptations and the use of Assistive Technology products has been a technical approach to obtain adaptations. Presently, there is a shift toward the "Design for All" approach.

Numerous projects funded by European Commission Programmes, for almost 20 years, have pursued an evolutionary path, initially adopting reactive, and subsequently advocating proactive strategies to accessibility. It is important to notice that these projects have progressively shifted towards more generic solutions to accessibility.

The purpose of this section (prepared in the context of CARDIAC task 3.2) is to provide a summary of the advancements in the field of inclusive Human Computer Interaction, carried out by past and current European EC funded projects. This overview aims to offer a basis for the elaboration of a catalogue of HCI methodologies and tools developed and/or used by European projects in the e-Accessibility area. A number of pioneering projects in the field is first presented, followed by the presentation of recently completed and currently running projects.

4.1 Pioneering projects in the field of inclusive HCI

As an exploratory activity, the **IPSNI** project (Integration of People with Special Needs in the Broadband Communication Network) investigated the possibilities offered by the multimedia communication network environment, and in particular B-ISDN (Broadband Integrated Services Digital Network), for the benefit of people with activity limitations.

Different types of solutions were proposed, addressing the specific user abilities and requirements, at three different levels:

- Adaptations within the user-to-terminal and the user-to-service interface, through the integration of additional input/output devices and the provision of appropriate interaction techniques, taking into account the abilities and requirements of the specific user group;
- Service adaptations through the augmentation of the services with additional components capable of providing redundant or transduced information [Emiliani 1999];
- Introduction of special services, only in those cases where the application of the

two previously mentioned types of adaptation are not possible or effective.

The **IPSNI-II** project built on the results of the IPSNI project, and demonstrated the technical feasibility of providing access to people with activity limitations to multimedia services running over a broadband network. Adaptations of terminals and services were implemented and evaluated. Special emphasis was placed on the adaptation of the user interfaces, and for this purpose, a user interface design and construction tool was designed, named INTERACT [Stephanidis 1995]. INTERACT takes into account the interaction requirements of impaired users and builds on the notion of separating an interactive system in two functional components, namely the application functional core and the user interface component, thus allowing the provision of multiple user interfaces to the same application functionality.

The IPSNI-II project allowed an in-depth analysis of services and applications for the broadband telecommunications environment from the point of view of usability by people with activity limitations, leading to the identification and testing of necessary adaptations and/or special solutions. This work led to the conclusion that if emerging services, applications and terminals were designed considering usability requirements of users with activity limitations, many of their access problems would be automatically reduced with a negligible expense.

The **TIDE-GUIB** and **TIDE-GUIB-II** projects aimed to identify and provide the technological means to ensure continued access by blind users to the same computer-based interactive applications used by sighted users. The short-term goal of the GUIB project was to improve adaptation methodologies of existing GUIs. The GUIB approach to interface adaptation for blind users was based on a transformation of the desktop metaphor to a non-visual version combining Braille, speech and non-speech audio. Access to basic graphical interaction objects (e.g., windows, menus, buttons), utilisation of the most important interaction methods, and extraction of internal information from the graphical environment were investigated.

The GUIB project also investigated a variety of issues related to user interaction in a graphical environment, particularly for users who cannot see. For example, the project investigated different input methods that can be used instead of the mouse. It also studied the problem of how blind users can efficiently locate the cursor on the screen, and examined issues related to combining spatially localised sounds (both speech and non-speech) and tactile information in order to present available information. Finally, the project addressed the design and implementation of real-world metaphors in a non-visual form and the development of an optimal method to present graphical information from within applications.

The **ACCESS** project (Development Platform for Unified ACCESS to Enabling Platforms) aimed to develop new technological solutions for supporting the concept of User Interfaces for all, i.e., universal accessibility of computer based applications, by facilitating the development of user interfaces automatically adaptable to individual user abilities, skills, requirements, and preferences. The project approached the problem at two levels:

- the development of appropriate methodologies and tools for the design and implementation of accessible and usable User Interfaces;
- the validation of the approach through the design and implementation of demonstrator applications in two application domains, namely interpersonal communication aids for speech-motor and language-cognitive impaired users, and hypermedia systems for blind users. The ACCESS approach enables designers to deal with problems of rehabilitation and access to technology in a consistent, systematic and unified manner.
- The ACCESS project has proposed the concept of Unified User Interface development (U2ID), with the objective of supporting platform independence and target user-profile independence, i.e., possibility of implementation in different platforms and adaptability to the requirements of individual users [Stephanidis 1997].

The EC ACTS **AVANTI**[4] project (Adaptive and Adaptable Interactions for Multimedia Telecommunications Applications) developed a new approach to the implementation of Web-based information systems, by putting forward a conceptual framework for the construction of systems that support adaptability and adaptivity at both the content and the user interface levels [Emiliani 2001]. The AVANTI framework comprises five main components:

- A collection of multimedia databases, which contain the actual information and are accessed through a common communication interface (Multimedia Database Interface - MDI);
- The User Modelling Server (UMS) [Kobsa1995], which maintains and updates individual user profiles, as well as user stereotypes;
- The Content Model (CM), which retains a meta-description of the information available in the system;
- The Hyper-Structure Adaptor (HSA) [Fink 1997], which adapts the information content, according to user characteristics, preferences and interests;
- The User Interface (UI) component [Stephanidis 1998], [Stephanidis 2001], which is also capable of adapting itself to the users' abilities, skills and preferences, as well as to the current context of use.

PALIO (Personalised Access to Local Information and Services for Tourists) was a project funded by the EC's IST Programme. The main challenge of the PALIO project was the creation of an open system for accessing and retrieving information without constraints and limitations (imposed by space, time, access technology, etc.). The PALIO system envisaged the adaptation of both the information content and the way in which it is presented to the user, as a function of user characteristics (e.g. abilities, needs, requirements, interests); user location with the use of different modalities and

[4] http://eilab.ifac.cnr.it/avanti/contents/contents/over.htm

granularities of the information contents; context of use; the current status of interaction (and previous history); and, lastly, the technology (e.g., communications technology, terminal characteristics, special peripherals) used.

2WEAR[5] (A Run Time for Adaptive and Extensible Wireless Wearables) was a project aiming to explore the vision of a distributed personal computing system that is built on-the-fly by combining several different devices. The project developed and experimented with a wearable system, focusing on extensibility and adaptation issues.

4.2 State of the art of recently completed or running projects in the area of e-Inclusion

It is interesting to observe that in most EC funded projects in the area of eInclusion and e-Accessiblity attention is not only focused on Human-Computer interaction per se, but most of them are based on the concept of services and applications set up in order to support people (including people with activity limitations). Many of the projects are not aiming to offer specific solutions for single groups of people with activity limitations, but to the production of platforms for implementing systems and applications that are accessible and supportive, and to the development of methodologies for developing and evaluating accessibility technologies.

The list of recently completed and currently running projects that follows is by no means exhaustive, however the aim is to provide a concise picture of the recent developments in the area of Inclusive HCI, as a result of these activities.

4.2.1 Projects addressing Personalisation according to the user characteristics and/or the context of use

Many projects have recognised and investigated further the concept that systems, services and applications must be able to behave differently with different users and in different contexts is recognised in.

ASK-IT[6] (Ambient intelligence system of agents for knowledge-based and integrated services for mobility impaired users) aimed to enable the provision of personalised, self-configurable, intuitive and context-related applications and services, with a self-configurable User Interface.

DIADEM[7] (Delivering Inclusive Access for Disabled or Elderly Members of the community) plans to produce an adaptable web browser interface, to enable people who suffer a reduction in cognitive skills to remain active and independent members of society both at work and at home.

---

[5] http://2wear.ics.forth.gr/
[6] http://www.ask-it.org/
[7] http://www.project-diadem.eu/

I2HOME[8] (Intuitive interaction for everyone with home appliances based on industry standards) aims to provide intelligent and adaptable interfaces that are particularly targeted to persons with cognitive disabilities and older persons, using multi-modal communication and activity management.

SHARE-IT[9] (Supported Human Autonomy for Recovery and Enhancement of cognitive and motor abilities using information technologies) aimed at the development of adaptive systems as transparent and easy to use to the person as possible, making significant contributions to fundamental, long-term research in: (i) verifying system adaptation to persons with special needs: both at design and run-time - as operating conditions and governing norms change - to establish e.g. safety, regulatory and security requirements; (ii) incorporating shared autonomy: ensuring that individual components can be designed to operate in a given intelligent ambience and adapt to possible changes both in the needs of the user or in the environment.

SOPRANO[10] (Service oriented programmable smart environments for older Europeans) is focusing on the design and development of highly innovative, context-aware, smart services with natural and comfortable interfaces for older people, meeting requirements of users, family and care.

AEGIS[11] (Open accessibility everywhere: groundwork, infrastructure, standards) identifies user needs and interaction models for several user groups, (users with visual, hearing, motion, speech and cognitive impairments as well as application developers) and develops open source-based generalised accessibility support into mainstream ICT devices/applications: (i) desktop, (ii) W3C/WAI standards-abiding accessible rich web applications and (iii) embedded generalized accessibility in terms of user interfaces and applications running into standard as well as rich features cell phones and PDAs. The

GUIDE[12] **(**Gentle User Interfaces for Disabled and Elderly Citizens) project develops a toolbox of adaptive, multi-modal user interfaces (UIs) that target the accessibility requirements of elderly users in their home environment, making use of TV set-top boxes as processing and connectivity platform beside the common PC platform. With its software, hardware and documented knowledge, this toolbox aims to put developers of ICT applications in the position to easier implement truly accessible applications using the most recent user interface technologies with reduced development effort.

4.2.2 Projects developing platforms for integrated solutions

A second very important aspect is that many projects do not aim to produce single solutions addressing the requirements of a group of users, but the trend is toward the

---

[8] http://www.i2home.org
[9] http://www.ist-shareit.eu/
[10] http://www.soprano-ip.org/
[11] http://www.aegis-project.eu
[12] http://www.guide-project.eu/

use of platforms on which solutions are implemented.

In the context of **ASK-IT**[13] content and tools developed are integrated within an Ambient Intelligent Framework, by a Multi Agent System of Intelligent Agents that offer service personalisation according to user profile, habits, preferences and context of use.

EU4ALL[14] (European Unified Approach for Accessible Lifelong Learning), is an integrated project that seeks to make a widespread impact on the way universities and educational institutions deliver lifelong learning services to the whole population. Support services and a technical open service infrastructure will enable teaching, technical and administrative staff of educational institutions to offer their teaching and services in a way that is accessible to disabled learners. The goals of EU4ALL are to:

- Design an open service-oriented architecture for ALL
- Develop the software infrastructure for ALL services (content, support and access services)
- Provide technical standards/specifications for ALL applications integrated with current and emerging eLearning standards
- Validate the results in large-scale higher education settings

I2HOME[15] (Intuitive interaction for everyone with home appliances based on industry standards) uses an architecture with a Universal Control Hub (UCH) as core component that communicates to networked (off-the-shelf) home appliances and consumer electronics devices.

MONAMI[16] (Mainstreaming on Ambient Intelligence) is focusing on services, platforms and usability: and the technology platform is being derived from mainstream technology.

eMPOWER[17] (Middleware platform for eMPOWERing cognitively disabled and elderly) defines and implements an open platform for the integration of the smart house and sensor technology and the interoperability between profession and institution specific systems (e.g. Hospital Information System), in order to simplify and speed up the task of developing and deploying services for persons with cognitive disabilities and elderly.

PERSONA[18] (Perceptive spaces promoting independent aging) is aiming to develop a technological platform that allows the seamless and natural access to services. It will develop a scalable open standard technological platform to build a broad range of AAL Services, to demonstrate and test the concept in real life implementations, assessing their social impact and establishing the initial business strategy for future

---

[13] http://www.ask-it.org/
[14] http://www.eu4all-project.eu
[15] http://www.i2home.org/
[16] http://www.monami.info/
[17] http://www.ep-empower.eu/
[18] http://www.aal-persona.org/

deployment of the proposed technologies and services

OASIS[19] (Open architecture for accessible services integration and standardization) aims to introduce an innovative, Ontology-driven, Open Reference Architecture and Platform, which will enable and facilitate interoperability, seamless connectivity and sharing of content between different services and ontologies in all application domains relevant to applications for the elderly and beyond. The OASIS platform is supposed to be open, modular, holistic, easy to use and standards abiding. It includes a set of novel tools for content/services connection and management, for user interfaces creation and adaptation and for service personalization and integration.

4.2.3 Projects setting up Platforms for the development of accessible software

Another stream of activities aims to the set up of platforms for the development of accessible software.

The ***Æ*GIS**[20] project seeks to determine whether 3rd generation access techniques will provide a more accessible, more exploitable and deeply embeddable approach in mainstream ICT (desktop, rich Internet and mobile applications). It develops and explores this approach with the Open Accessibility Framework (OAF) through which aspects of the design, development and deployment of accessible mainstream ICT are addressed. The OAF is supposed to provide embedded and built-in accessibility solutions, as well as toolkits for developers, for "engraving" accessibility in existing and emerging mass-market ICT-based products, thus making accessibility open, plug & play, personalised & configurable, realistic & applicable in various contexts.

The goal of **ACCESSIBLE**[21] (Accessibility assessment simulation environment for new applications design and development) is to improve the accessibility of software development products, by introducing a harmonised accessibility methodology into the software design and development processes, using significantly better measurement strategies and methodologies. It develops a process for collating and merging different methodological tools, checking the coherence with the W3C/WAI ARIA and other standards in order to produce an Open Source Assessment Simulation Environment. This is supposed to enable large organisations, SMEs or individuals (developers, designers, [22]etc.) to produce software products of superior accessibility and quality, accompanied with appropriate measures and proposals for best practice.

HAPTIMAP[23] (Haptic, audio and visual interfaces for maps and location-based services)

[19] http://www.oasis-project.eu/
[20] http://www.aegis-project.eu

[21] http://www.accessible-eu.org/
[22] http://www.eaccessplus.eu
[23] http://www.haptimap.org

is supposed to embed accessibility into digital mainstream maps and mobile location-based services, firstly developing tools that make it easier for developers to add adaptable multimodal components (designed to improve accessibility) to their applications; and secondly, raising the awareness of these issues via new guidelines and suggesting extensions to existing design practices so that accessibility issues are considered throughout the design process. The concrete outcomes of the project will be an open, interoperable and standardized adaptable toolkit together with a set of design guidelines that help developers of mainstream applications make maps in general more accessible and easier to use (not only for disabled users but for everyone.

The goal of **eACCESS+,** (The eAccessibility Network) is to create a platform for collecting and providing guidance on how to use in practice the body of knowledge on eAccessibility**.** eAccess+ is a best-practice network to facilitate co-operation between the community of practitioners (found in research institutions and consultancies) and all the other stakeholders (policy makers, administrators in the public sector, technical staff in the private sector…). The purpose is to accelerate the take-up of e-accessibility specifications and technical solutions, and to contribute to a common approach at European level. The network will support the development of common guidelines and standards, and, where needed, will provide rationale for harmonised political and legal measures. The main focus is on web accessibility, however digital TV and self-service terminals are also addressed.

4.2.4 Projects involved in the Development of evaluation - assessment Methodologies

A cluster of European projects (The WAB Cluster[24] – Web Accessibility Benchmarking Cluster) has recently completed activities to develop a harmonised European methodology for evaluation and benchmarking of websites. The primary goals of the Cluster are:

- to develop a EU-harmonised assessment methodology for Web accessibility, based on W3C/WAI and to be synchronised with the foreseen migration from WCAG1.0 to WCAG2.0.
- to ensure that evaluation tools and methods developed for global monitoring or for local evaluation, are compatible and coherent among themselves (and with WAI)
- to provide a strong European feedback and contribution to WAI and others for future guidelines or versions of guidelines.

The WAB Cluster involved the following activities/projects:

- **EIAO (www.eiao.net)**

[24] http://www.wabcluster.org/

The European Internet Accessibility Observatory (EIAO) concerns the preparation of a platform for a possible observatory (measurement machine with modular tests, site inventory for jurisdictions, results management and aggregation). The platform prototype, once sufficiently advanced, will provide a facility for testing aspects of the WAB Cluster methodology

- **BenToWeb (www.bentoweb.org)**

BentoWeb refers to the production of test suites for evaluation tools, and evaluation modules for checkpoints difficult to automatise. Research into integration of testing modules in CMS and issues related to dynamic multiversion webpages

- **SupportEAM (www.support-eam.org)**

Support EAM (Supporting the creation of a e-Accessibility Quality Mark) has proposed a certification mechanism and authority, training material and tools supporting a unified European approach to Web Accessibility evaluation. This includes third party and self-certification

- **UWEM (www.wabcluster.org/uwem/)**

Accessibility checks can be carried out in different ways even if the checks are based on the same guidelines. The Unified Web Evaluation Methodology (UWEM1.1) is the result of a joint harmonisation effort by 23 European organisations of the three European projects mentioned above. They have developed UWEM to ensure that large scale monitoring and local evaluation are compatible and coherent among themselves and with the Web Content Accessibility Guidelines from W3C/WAI. The UWEM methodology has already incorporated support for the migration from WCAG 1.0 to WCAG 2.0. Thus, UWEM is the ideal instrument to support evaluation, (self)certification, and benchmarking of web content in Europe and beyond. The WAB Cluster is building an observatory for large scale European evaluation and benchmarking of website accessibility. This supports large scale and local evaluation. The UWEM methodology is conformant with the W3C Web Content Accessibility Guidelines and based on an interpretation of WCAG agreed among stakeholders. In this way, it can offer unprecedented guidance for evaluation and benchmarking.

The Web Cluster has delivered a European instrument for evaluation and benchmarking of websites to the EU.

The UWEM methodology contains a complete methodology including detailed tests for the evaluation of websites for WCAG1.0 conformance. The document is separated into a Core document and a Tests document. The UWEM has been developed in order to improve the Tool and Browser Independence, the Unique Interpretability, Repeatability and Translatability of the WCAG1.0 guidelines. The Methodology can be downloaded from: http://www.wabcluster.org.

4.2.5 Projects investigating future technology developments

Finally, a number of projects are addressing technologies important for the emergence of the Ambient Intelligence environment. In that respect, the aim is at highly innovative ICT-based solutions that are cost effective, reliable and user friendly for assisted living taking into account design-for-all principles where applicable, with the goal to lead to integrated environments bringing together progress in various ICT building blocks and responding to key user requirements.

EASY LINE+[25] (Low cost advanced white goods for a longer independent life of elderly people) foresees using the integrated RFID, Neuronal Networks and HMI technologies to build a system that can capture data of the home environment, and can control via wireless communication (Zigbee) or the mains electricity (EMS PLC), any white good in the home. The users, elderly persons, may actuate by themselves any white good in the home, or may leave the "e-servant" to do the actuation. The e-servant is a white good control system, based on the sensor information and the habits of the user that can program any application without/or with user cooperation.

VAALID (Accessibility and usability validation framework for AAL interaction design process) aims at creating new tools and methods that facilitate and streamline the process of creation, design, construction and deployment of technological solutions in the context of AAL (Ambient Assisted Living) assuring that they are accessible and usable for senior citizens. The main objective of the project is to develop a 3D-Immersive Simulation Platform for computer aided design and validation of User-Interaction subsystems that improve and optimise the accessibility features of Ambient Assisted Living services for social inclusion and independent living. The simulation environment is composed by software and hardware components that constitute a physical ensemble that in conjunction allow the ICT designer to implement actual Virtual Reality and Augmented Reality scenarios of AAL. It can be used to verify interaction designs and validate the accessibility of the AAL products by means of immersing the users in 3D virtual spaces.

COMPANIONABLE[26] (Integrated cognitive assistive and domotic companion robotic systems for ability and security) explores the synergetic combination of the strengths of a mobile robotic companion with the advantages of a stationary smart home, since neither of those approaches alone can accomplish the demanding tasks to be solved. Positive effects of both individual solutions are supposed to be combined to demonstrate how the synergies between a stationary smart home solution and an embodied mobile robot companion can make the care and the care person's interaction with her assistive system significantly better.

The **UNIVERSAAL**[27] **(**The UNIVERsal open platform and reference Specification for

[25] http://www.easylineplus.com/
[26] http://www.companionable.net
[27] http://www.universaal.org/

Ambient Assisted Living) project aims to produce an open platform providing a standardised approach to make it technically feasible and economically viable to develop AAL solutions. The platform will be produced by a mixture of new development and consolidation of state-of-the-art results from existing initiatives. Work on establishing and running a sustainable community will achieve attention, with promotion of existing results gradually evolving into promotion of the universAAL platform, as it develops into one consolidated, validated and standardised European open AAL platform. The platform will provide runtime support for the execution of AAL applications in accordance with a reference architecture, development support through core AAL services and an online developer depot of various development resources. universal results will be standardised in European (CEN) and international (OMG, Continua) standardisation bodies.

The **VAALID**[28] (Accessibility and Usability Validation Framework for AAL Interaction Design Process) research project aims at facilitating and streamlining the process of creation, design, construction and deployment of technological solutions in the context of AAL. A 3D-Immersive Simulation Platform for computer aided design and validation of User-Interaction subsystems will support the design of the Human Interaction aspects in all the stages of user centred design, putting in practice the guidelines for verification and validation of the accessibility and usability facets. Virtual Reality and Augmented Reality scenarios will be used to verify interaction designs and validate the accessibility of the AAL products. The overall goal is to help European industry, ICT companies specialized in Human Factors and User Interaction design, Research and Academia in streamlining their respective business for the Independent Living and Inclusion.

VERITAS[29]**,** (Virtual and Augmented Environments and Realistic User Interactions To achieve Embedded Accessibility DesignS) aims to develop, validate and assess an open framework for built-in accessibility support at all stages of ICT and non-ICT product development, including specification, design, development and testing. The goal is to introduce simulation-based and VR testing at all stages of product design and development into the automotive, smart living spaces, workplace, infotainment and personal healthcare applications areas. The goal is to ensure that future products and services are being systematically designed for all people including those with disabilities and functional limitations.

Although this does not claim to be an exhaustive account of every project in the field, it nevertheless gives a concise picture of the recent developments in the area of Inclusive HCI as a result of these activities. It has to be stressed that the purpose of this document has not been to evaluate the actual impact of these tools and methodologies, but rather to list relevant and important advancements in the field of inclusive HCI, and to provide a basis for the elaboration of a catalogue of HCI methodologies and tools developed and/or used by European projects in the e-Accessibility area.

[28] http://www.vaalid-project.org
[29] http://veritas-project.eu/

5 A review of the advancements in the field of inclusive HCI outside Europe

This section outlines the research activities related the field of inclusive HCI outside Europe. It is a brief summary of the results reported in the context of Task 3.4 on gathering "factsheets" on what is being done in other major countries outside Europe[30].

5.1 Design and evaluation of solutions

A number of large companies outside Europe invest a considerable effort in inclusive HCI and have their own accessibility specialists, such as Google, Apple, HP, Microsoft, IBM and Xerox. The following paragraphs briefly gather some statements that these companies have published about their policy with regards to accessibility.

- Google's[31] mission is to organize the world's information and make it universally accessible and useful.
- Apple[32] offers guidelines for developers that they can use to design for example apps on Apple products: "iOS Human Interface Guidelines"[33].
- HP[34] promotes universal access to basic technologies and involves people with disabilities in the development of accessibility guidelines and in the design and testing of products and services.
- Microsoft wrote a vision document called "Being Human – Human computer interaction in the year 2020"[35]. The aim of this report is to reflect upon the changes afoot and outline a new paradigm for understanding our relationship with technology.
- IBM states that accessibility means that anyone can access computerized devices and information without problems. The Accessibility Research group at IBM Research - Tokyo[36] focuses on users who cannot access computers and information by using standard interfaces. They have been working on systems for the visually disabled for twenty years. More recently, they have started studying how we can build on our experience and create various types of fundamental technologies at IBM Research - Tokyo for a wide range of users such as other kinds of disabled people and senior citizens.

---

30 Compiled by Ilse Bierhof (SmH).
31 http://www.google.com
32 http://www.apple.com
33 http://developer.apple.com/library/IOS/documentation/UserExperience/Conceptual/MobileHIG/Introduction/Introduction.html
34 http://www.hp.com/hpinfo/abouthp/accessibility/index.html
35 http://research.microsoft.com/en-us/um/cambridge/projects/hci2020/downloads/beinghuman_a4.pdf
36 http://www.trl.ibm.com/projects/acc_tech/index_e.htm

- The mission of Xerox is to become the vendor of choice for customers seeking accessible solutions[37]. In addition to the award-winning Xerox Copier Assistant, Xerox provides additional accessories for people with disabilities; for example: Braille enablement: pressure sensitive labels allow Braille to be added to almost any copier control console. Angled console: this kit, which is currently available for a number of models, inclines the copier console, allowing wheelchair users to view and reach the controls. Footswitch: an electrically operated switch, which is available on many models, can be used to actuate the "Start Print" button.

Other companies are specifically targeting products on users with limitations and developed only products for these target groups. To assist people in finding the assistive technology they need initiatives like Closing The Gap[38] and Enablemart[39] who make it their job to cluster products of different manufacturers to make it easier for people to find what they are looking for.

5.2 Collaboration

5.2.1 Policy making

One of the main reasons for networks and organizations to collaborate is to have the power to influence policy making. The American Association of People with Disabilities (AAPD) for example clearly states this intention on their website: “We live in a wireless, touch-screen, Internet world where new ways to communicate seem to pop up around us almost daily. To make sure people with disabilities are not left out or left behind, AAPD created a Telecommunications and Technology Policy Initiative (TTPI) to ensure that we, the disability community, are not forgotten and that we are included as policy is made. The mission of our TTPI program is to ensure that all technology products and services are designed with disability users in mind. This means AAPD looks at accessibility, usability and affordability within the total technology ecosystem, whether it’s in the area of communications, health care, rehabilitation and assistive technologies, or other technology policy areas. It’s a big dream, but we’re making it happen.”

Another initiative is the Assistive Technology Industry Association (ATIA) which is a not-for-profit membership organization of manufacturers, sellers and providers of technology-based assistive devices and/or services. ATIA represents the interests of its members to business, government, education, and the many agencies that serve people with disabilities. Its mission is to serve as the collective voice of the Assistive Technology industry so that the best products and services are delivered to people with disabilities.

[37] http://www.xerox.com/about-xerox/citizenship/section-508/enus.html
[38] http://www.closingthegap.com
[39] http://www.enablemart.com/

5.2.2 Involving end users

To gain a better understanding of the needs and wishes of people with disabilities end users should be involved in the design process. To facilitate their involvement laboratories are set-up, where developers can come in and test for accessibility during their development cycle.

Furthermore end users can also be involved in the very early design stages when there is no prototype but just a design ides. Autodesk Labs for example is home to innovative new technologies and collaborative development. Its mission is to involve the customer in the progress of design technology solutions. We're not a beta program (although Autodesk does have an active beta community), or a usability team, because the technology we work with is too new to be a product. The user feedback that you provide to Labs is really on product ideas, while they're still in an early conceptual stage.

5.2.3 Discussion

On a more general level collaboration takes place on sharing knowledge about existing solutions and discussing how to make best use of those solutions. Some examples of websites that share information and facilitate discussion:

- Special Needs Opportunity Window (SNOW): http://snow.idrc.ocad.ca/component/option,com_frontpage/Itemid,1/
- Web accessibility and inclusive design in Australia: http://inclusive-design.meetup.com/
- Australian Network for Universal Housing Design: http://www.anuhd.org/
- Online community of and for disabled people: www.yourable.com
- The power of Technology for people with disabilities: www.unleashwebaccess.com
- The Canadian Abilities Foundation: www.abilities.ca
- Interaction Design: http://www.interaction-design.org/

5.3 Research topics

Some of the recent research topics in the area of inclusive design include:

- Novel input and output:
    - Multi-touch
    - Bi-manual input
    - Mobile projectors
    - Large displays
    - Continuous view glass-free 3D

- Next generation displays
- 3D user interfaces, 3D control and feedback
- Seamless collaboration, augmented reality
- Natural voices text to speech

- Entertainment/multi media
    - Multimedia processing technologies
    - Electronic programming guide
    - eReader
    - Adding comments to videos of others
    - Virtual exercise, augmenting exercise system
    - In-flight communication and entertainment
    - Access to digital cinema systems
- Data mining/information visualization
    - Flag unexpected events
    - Insight in trends
    - Information visualization research
- Mobile scenarios
    - Navigation
    - Context and location aware mobile technologies
    - Health information technology
    - Electronic Patient File
    - Health information and services
- User related
    - Accessible personas
    - Digital human model

5.4 Further reading

This section provides an overview of organizations outside Europe that are involved in the field of inclusive HCI. This list is a selection of all organizations that exist and is not meant to provide a complete overview but an impression of the organisations, networks and conferences in this area.

USA

- The RL Maze Universal Design Institute: http://www.udinstitute.org/index.php
- The Center for Universal Design in Education: http://www.washington.edu/doit/CUDE/
- Center for Universal Design at NC State University: http://www.ncsu.edu/project/design-projects/udi/

- The Rehabilitation Engineering Research Center on Recreational Technologies (RERC RecTech) at University of Illinois-Chicago: http://www.rectech.org/contact/index.php
- IDeA Center, Center for Inclusive Design and Environmental Access: http://www.ap.buffalo.edu/idea/home/index.asp
- Universal Design Education, University of Buffalo: http://www.udeducation.org/home.html
- Institute for Human Centered Design: http://www.adaptenv.org
- Centre for Applied Special Technology: http://www.cast.org
- The Carl and Ruth Shapiro Family National Center for Accessible Media (NCAM): http://ncam.wgbh.org/
- National Resource Center on Supportive Housing and Home Modifications: http://www.homemods.org
- Trace R&D Center: http://www.trace.wisc.edu/
- Accessible technology in the workplace: http://www.accessibletech.org/
- American Association of People with Disabilities: http://www.aapd.com/
- Association of Assistive Technology Act Programs: http://www.ataporg.org/

Canada

- Inclusive design institute (OCAD University): http://inclusivedesign.ca/
- Canadian Centre on Disability Studies: http://www.disabilitystudies.ca
- Graduate Program in Critical Disabilities Studies, York University, Toronto: http://www.yorku.ca/gradcdis/
- MA (Critical Disability Studies) York University: http://www.atkinson.yorku.ca/cdis/
- School of Disability Studies, Ryerson University, Toronto: http://www.ryerson.ca/ds/
- Media Access Canada: http://www.mediac.ca/default.asp
- Advanced Man Machine Interface (AMMI) Laboratory, Faculty of Science, University of Alberta: http://spaces.facsci.ualberta.ca/ammi/
- National Research Council Canada: http://www.nrc-cnrc.gc.ca/index.html
- Environment Canada: http://www.ec.gc.ca/aatia-aaact/default.asp?lang=En&n=EDE49A88-1
- The Health Technology Exchange: https://www.htx.ca/default.aspx

Australia

- Media Access Australia: http://www.mediaaccess.org.au/about
- Disabilities service commission: http://www.disability.wa.gov.au/aud/planningbetteraccess/universaldesign.html
- Curtin University of Technology: http://ot.curtin.edu.au/research/index.cfm

Japan

- The Accessible Design Foundation of Japan: http://kyoyohin.org/eng/
- Kyushu University: http://www.inclusive-d.com/
- Ritsumeikan University: http://www.ritsumei.ac.jp/eng/html/research/areas/feat-projects/other/05-08-discover.html/

China

- Shanghai, Tongji University: http://www.tongji-di.org/en/index.asp

Other

- Design and Interaction Research Lab at the University of Trinidad and Tobago: http://www.designinteractionlab.com/sample-page/

5.4.1 Related Conferences

- CSUN Conference on Technology and Persons with Disabilities. Every Spring in Los Angeles, California in the USA: http://www.csunconference.org/index.cfm?EID=80000300
- Closing the Gap Conference on Microcomputer Technology in Special Education and Rehabilitation: http://www.closingthegap.com/
- RESNA. Conference on rehabilitation and assistive technologies: http://www.resna.org/
- ASSETS: The International ACM SIGACCESS Conference on Computers and Accessibility: http://www.sigaccess.org/conferences/assets/
- 13th International Conference on Mobility and Transport for Elderly and Disabled Persons (TRANSED 2012): http://www.transed2012.in/
- The International Conference on Aging, Disability and Independence (ICADI): http://icadi.phhp.ufl.edu/
- Festival of International Conferences on: CAREGIVING, DISABILITY, AGING AND TECHNOLOGY: http://www.ficcdat.ca/main.cfm?cid=1559

- Universal Design Conference: http://www.ud2012.no/home.cfm
- International conference on Inclusive Design, HHC, RCA, UK – April 18 – 20, 2011: http://www.hhc.rca.ac.uk/2968/all/1/include-2011.aspx
- Assistive Technology Industry Association - ATIA 2011 Conference: http://atia.org/i4a/pages/index.cfm?pageid=3733
- International Conference on ICT & Accessibility: http://www.icta.rnu.tn/
- Inclusion Community Action: The Accessibility Conference: www.accessconf.ca/
- 9th International Conference on Smart Homes and Health Telematics: "Toward useful services for elderly and people with disabilities.": http://pages.usherbrooke.ca/icost2011/
- 5th International Conference on Rehabilitation Engineering and Assistive Technology: http://www.icreateasia.org/
- The Inclusive Learning Technologies Conference: http://www.spectronicsinoz.com/conference/2012/

5.4.2 Related Networks of Interest

- IFIP WG 13.3 Human Computer Interaction and Disabilities: http://hciaccess.inf.tu-dresden.de/
- ISAAC: http://www.isaac-online.org/en/home.shtml
- Assistive Technology Industry Association: http://atia.org/i4a/pages/index.cfm?pageid=3267
- Australian Network for Universal Housing Design: http://www.anuhd.org/article/inclusive-design-products-all-consumers
- Global Universal Design Educator's Network: http://www.universaldesign.net/index.php
- Universal design alliance: http://www.universaldesign.org/about.htm
- Independent living Canada: http://www.ilcanada.ca/article/home-125.asp
- China Disabled Person's Federation: http://www.cdpf.org.cn/english/home.htm
- International Usability Partners: http://www.international-usability-partners.com/
- The Usability Professionals' Association: http://www.usabilityprofessionals.org/
- Independent Living Centre WA: http://www.ilc.com.au/
- Continua Health Alliance: http://www.continuaalliance.org/index.html

6 HCI and Accessibility

In recent years, many research activities have focused on design that aims to produce universally accessible systems, taking into account special needs of various user groups. These special needs are associated with many user factors, such as impairments of speech, hearing or vision, cognitive limitations, aging, as well as with various environmental factors (see also Table I). Fields that address this problem, such as Usability, Universal Accessibility, Universal Design, or Inclusive Design have been developed as relatively independent domains, but they share many aspects with other HCI disciplines. However, researchers and practitioners are often not aware of interconnections among concepts of universal accessibility and "ordinary" HCI. From this circumstances, Obrenovic et al [Obrenovic 2007] showed that there is a fundamental connection between multimodal interface design and universal accessibility, and that awareness of these links can help both disciplines. Researchers from these areas may use different terminology, but the concepts they use often have essentially the same meaning.

6.1 Human-Computer Inclusive design

Experience shows that a large amount of HCI systems are designed for someone conceived as the "standard man" leaving out the scope all the people with different physical, sensory or cognitive features. Having in mind that the most common human characteristic is just variety, most designs do not completely fit individual user's needs.

The problem of matching product features with users' characteristics is most frequently addressed by the own user adapting himself or herself as much as possible to the interface. As a consequence, people that are no able to adapt themselves are simply left out of the possibility of using these products or services.

There exist design techniques and methodologies able to address users' diversity, by means of modelling and adaptation [Kules 2000]. Nevertheless, they are not enough known and used. In fact, the marginalization of large sectors of users was –and frequently is– justified by limitations of technology. Nowadays we know that technology can be designed in a most inclusive way avoiding the inclusion of unnecessary barriers. Inclusive Design aims to consider the needs of all the users in mainstream applications and not only in the systems especially designed for people with physical, sensorial or cognitive restrictions.

Table 1: Impairments and technological solutions			
Impairment	**Specific conditions**	**Effects on Universal Access**	**Solutions**
Physical disabilities– motor impairments	• Quadriplegia • Arthritis • Cerebral palsy	• limited or no use of hands • tremor • limited range of movement	• Simple uncomplicated design • large buttons • alternative content scanning techniques • Alternative input devices and methods (i.e. voice) • Adaptations to the conventional input devices (keyboard, access keys, switches, operating system based keyboard filtering, onscreen keyboards, word prediction, cursor control modifications, trackballs, keyguards, joysticks, headsticks, speech recognition systems, haptic force feedback, Alternative browsers (AVANTI, WebForward, etc)
Situational - induced impairments	• Noisy working environment • visual distractions • uncomfortable temperature/conditions • technology itself (device and interface design)	• increasing feeling of stress • influencing quality of interaction	• Designing with as many possible contexts/environments of use in mind helps in the development of technology that can be widely and well-used
Sensory impairments	• difficulties in seeing • visual impairments or loss of vision	• Inability/difficulty to use mouse, keyboard for input inability / difficulty to see screen • may need magnification/colour contrast	• Provision of multi-modal feedback technologies (auditory, haptic, visual) • use of touch based interfaces • providing reference points on the screen • incorporating additional color palettes (for people with colour vision deficiencies) • braille displays, screen magnifiers, screen readers, voice output
	• Loss of hearing	• Inability/difficulty to hear audio, video, system alerts or alarms	• Inclusion of caption-text in video • use of simultaneous sign language • Video transmission, text-based descriptions of audio • “flash screens” • “Perceptual design”
Learning disabilities	Dyslexia, autism	• difficulties in reading and comprehending information • difficulties in writing	• understanding the unique needs of such users, i.e. understanding the mental models that are used by such users • using spell checkers, word prediction aids, reading/comprehension aids • providing users time to read and use content

6.1.1 Advantages of Inclusive Design

Inclusive Design is based on the convincement that humans are naturally very diverse. The partition into "normal users" and "other users" is artificial and the frontiers between both populations are arbitrary. In fact, there are abundant examples where technology eliminated or alleviated these frontiers. Something as simple as glasses –nowadays of common use– allow several people with eyesight restrictions to enhance their vision. More complex technologies, such as computers, give people with motor and speech impairments a way to personal and remote communication, and to control their environment.

Evidently, Inclusive Design has ethic and social fundaments. Universal Accessibility is supported by the convincement that all the human beings have the same rights. In practical terms this means that they should be able to access to the same services and to enjoy the same opportunities. Technological designs that unnecessarily establish barriers to universal use effectively exclude users with physical, sensory or cognitive restrictions.

In addition, to its ethics roots, inclusive technology is highly practical and useful. It frequently has a higher impact over the market because accessible products are directed to a broader population of potential consumers. In fact, people without disabilities usually find inclusive technology easier and more usable. On the other hand, the new ways to interact with mobile and ubiquitous technology frequently require hand and sight free interaction, and as a result they can very much benefit from Inclusive Design. For instance, people wanting to read their email while they drive to work do need auditory interfaces, similarly to several vision impaired people. In addition they will need voice input to enter commands to the system, similarly to many people with severe motor restrictions.

It is frequently argued that Inclusive Design (for instance accessible web design) is not more expensive that standard design. We cannot deny that accessible design requires higher effort from the designer. That means the need of knowledge and experience on this kind of design, longer development periods, etc. Nevertheless, it is proved that accessible products are of higher quality. In fact, usability and accessibility are included as quality measurement figures of merit in a number of software methodologies (for instance, [ISO 2008a] and [ISO 2008b]).

6.1.2 Current barriers for Inclusive Design

Even if Inclusive Design advantages have been frequently acknowledged, there is little advancement in Inclusive Design of commercial ICT products. This may be due to a combination of factors, such as:

- The lack of awareness of universal design. Numerous HCI designers frequently ignore that they can design for a broader population simply avoiding the inclusion of certain features that put difficulties to the accessibility by a number of users.
- *The lack of knowledge about user needs*. Most HCI professionals usually design without having a previous analysis of the users needs. Their designs are frequently based in their own mental model of the task, their own capabilities and likes, etc.

6.1.3 Conditions for Inclusive Design

There are numerous ethical and social risks that must be taken into account when Inclusive Design paradigm is adopted [Abascal 2005]. For instance:

- *User autonomy*: Avoid taking automatic decisions about the user without her or his consent.
- *User privacy*: Avoid to store, transmit or process data about the user or his/her activities that are not strictly necessary for the current application.
- *User consent*: Always ask for the informed consent from the user.
- *Human contact*: Compensate the social impact of services that produce isolation.

Finally, Inclusive Design is hardly possible without the full participation of the users in the whole design and development process. That means that the users must be present: In all the phases of the process; as full participants; being paid; under a code of conduct for experiments.

6.2 Web accessibility

It is well known that the web has spread over the last few years in an unexpected way. The Web has become a major part of many people's everyday life since it facilitates the fulfilment of daily tasks related to communication, entertainment, work, study, etc. In addition, the number of eServices that, in many cases, substitute or complement traditionally delivered services.

One of the human groups that may easily suffer exclusion is that of people with disabilities, as in their case many commercial interfaces fail to prove accessible. Different initiatives have been taken in order to avoid this situation, such as inclusive laws promulgated in several countries. However, these efforts are insufficient if technological advancements do not support universal design. For this reason, many national authorities are supporting projects to achieve web accessibility.

Even if designers are convinced (or compelled) to create accessible products, they usually have to face a lack of knowledge and experience on accessible design. Therefore, methods, tools and guidelines, are needed to help designers in this difficulty. Guidelines have frequently been used to collect design knowledge and experience. Even if they may present problems, such as incoherence and unreliability, and be difficult to handle (when the set of guidelines is too large), guidelines nevertheless prove to be the best method in order to transmit satisfactory design experiences within large design groups or for to the external world [Nicolle 2001].

For this reason, a crucial advance in web accessibility is the provision of sets of guidelines and tools to apply them. Since web technology is rapidly changing, and web accessibility guidelines have to be frequently updated, appropriate tools must be able to easily modify the existing, or include new, sets of guidelines. The most relevant sets of guidelines are those developed by the Web Accessibility Initiative (WAI) of the World Wide Web Consortium (W3C). W3C-WAI has established three sets of W3C recommendations to improve the accessibility of the Web. These are:

- WCAG[40] (Web Content Accessibility Guidelines), which concern how to make Web sites sufficiently accessible so that people with disabilities are able to use them alongside with today's technologies. The version 2.0 was released on December 2008.
- ATAG[41] (Authoring Tool Accessibility Guidelines), which provide guidance for software developers in designing authoring tools that produce accessible web content and in creating accessible authoring interfaces. A working draft of ATAG 2.0 was released on July 2010.
- UAAG[42] (User Agent Accessibility Guidelines), released in December 2002, which concern how to make browsers and multimedia players more accessible, as well as compatible with some of the assistive technology that people with disabilities use. A working Draft of UAAG was released on June 2010.

Nevertheless, guidelines compliance does not guarantee web accessibility. Users and experts' evaluations are required to find accessibility barriers that are hardly specified by guidelines.

The strengths of WAI guidelines are both their universal acceptance and the way they are produced (cooperatively, in a limited period of time and in a clear way). However, these broadly accepted and used guidelines are far from being definitively established. As web technology is rapidly evolving, the production of guidelines is a continuous process that periodically offers new versions. However the paramount importance of WAI guidelines cannot be ignored. In addition to their contribution to web accessibility, WAI guidelines are an incredible pioneering experience of advancement towards Universal

[40] Web Content Accessibility Guidelines (WCAG) 2.0: http://www.w3.org/TR/WCAG20/
[41] Authoring Tool Accessibility Guidelines (ATAG) 2.0 (Working Draft): http://www.w3.org/TR/ATAG20/
[42] User Agent Accessibility Guidelines (UAAG) 2.0 (Working Draft): http://www.w3.org/TR/UAAG20/

Accessibility that has to be taken into account for all the other actions in favour of the accessibility.

6.2.1 Mobile Web

The mobile web has become more widespread as the computing performance of mobile devices and their availability has steadily increased over the last few years. Mobile devices such as PDAs, mobile phones, videogame consoles and a number of home appliances (TV, video, etc.) currently have XHTML (and similar) browsers, thus enabling the advent of the ubiquitous web. Even if these devices have very dissimilar input and output modalities, the fact that several of them have reduced keyboards and small screens causes poor interactive experience. Low input rate, lack of a pointing device and low bandwidth are the key factors that cause a decline in the quality of interaction.

Since mobile devices are used in everyday situations they may cause the so-called situationally-induced impairment and disabilities. For example, users interacting with a touch screen while experiencing turbulence during a flight or texting while hands are busy can be considered temporary impaired. Therefore, there is a strong relationship between web accessibility and the mobile web because the problems encountered while interacting with the Mobile Web can be referred to as accessibility barriers for the able-bodied. Similarly, the existence of an overlap between mobile web usability recommendations and guidelines for physically impaired users is evident. Consequently by applying accessibility-related good practices, navigation in the WWW can be enhanced for a wider audience, reinforcing the experience showing that content accessibility benefits all users.

Therefore, the problems that able-bodied individuals encounter in the Mobile Web and the barriers found by users with physical, sensory or cognitive disabilities while browsing the Desktop Web are related to: Small display size; No support for mark-up, scripting or data formats.

Mobile web guidelines aim at providing developers with guidance to develop web content suitable for mobile devices. Yet, a number of mobile web guidelines refer to specific device features such as screen size, support for particular picture formats or support for pointing device.

Even if there are some concerned developers who follow Design for All principles and methods to ensure that all resources are accessible by everyone, it is not always possible to accomplish the Design for All paradigm, given the diversity of users and access devices that exist. An alternative approach is the personalization of user interfaces, thus interfaces should be adapted considering users' specific needs. Systems that adapt websites to handheld device constraints (screen size, etc.) have been developed. Others adapt a determined type of web pages to users with visual impairments. Additionally, users' preferences, as well as access device's features are taken into account for adaptation purposes. Nevertheless, none of them considers a wide range of disabilities, and they are focused on adapting user interfaces of a determined type of web pages or standalone applications.

6.2.2 The adaptive web

The possibility to access to Information and Communication technologies is frequently challenged by diverse factors such as (a) characteristics of the user (including physical, sensory or cognitive restrictions and literacy problems); (b) limitations of the equipment (obsolete devices or applications, narrow band access, small displays or keyboards); (c) barriers imposed by context of use (noisy or dark environments; performing parallel activities, such as working or driving). Frequently these issues have a deep root in social causes such as poverty and limited access to education.

The design of effective adaptive user interfaces may help in closing the digital divide. These interfaces usually allow automatic adaptation to the user considering user's own characteristics, the context where the interaction is carried out, the task to be performed, the technology being used, etc. These methods may give people suffering restrictions higher opportunities to access to ITCs.

Currently, classic user modelling techniques are being extended to model the environment and the technology involved in the process. The supporting paradigms are evolving to the use of advanced technologies, such as ontologies, which are extremely useful to store and process the information for modelling. In addition, machine-learning techniques allow the compilation of user models with information obtained by data mining of interaction logs. But, while current technology allows for more effective personalization systems, some issues, such as privacy impact, condition the applicability of these techniques.

6.2.3 Web personalization

The main objective of Web personalization is to adapt the browsing or navigation, the presentation and the contained information of the web pages to the needs of the user without him or her doing an explicit demand. The goal is to enhance the speed and the achievement using the web and to decrease the physical and cognitive effort to perform it. Therefore, adaptation becomes especially helpful when the users have special needs.

Web personalization seeks for the adaptation to the user in three areas [Brusilowsky 2007] that in the case of users with disabilities are crucial in order to easy and speed up the interaction:

- *Navigation*. Browsing pages is the most common task when using the web. This task can be slowed, for instance, if the page contains a high number of links that are not interesting for the user. Knowing the objectives and interests of the user the browser can make easier the navigation task giving more emphasis to the most interesting or probable links for a specific user. The inclusion of a specific navigation menu with selected links is another navigation facilitating possibility.

- *Presentation*: The presentation of a web page can be adapted to the specific needs of each user applying cascading stile sheets (CSS[43]). The most convenient stile sheet(s) may be stored in the (static) model of the user.
- *Content*. Even if it is not convenient to automatically change the content of a web page, some inclusions may enhance its readability. For instance, the automatic inclusion of text captions in simple language used to explain longer and more difficult texts are useful for people with reading difficulties.

Web personalization is based on modelling user features such as interests, navigational behaviour, preferences, physical sensory or cognitive restrictions, etc. The information stored in the model is used to make assumptions about the current user-system interaction that allows adapting the system to the actual user needs or preferences. User adaptation methods have been frequently adopted by intelligent interface designers to adjust the interface to the user (contrarily to the usual situation where the user adapts him or herself to the interface). These models could be directly designed by experts in the area (rule based approach), they can be built based on previous information from that user such as the logs of previous navigations (content based approach) or they can be induced from information about groups of users with similar characteristics (collaborative approach). The first approach is somehow static and requires previous knowledge of the users and redesigning when new behaviours appear in the users. However, the last two approaches focus on automatic techniques for user characterization. Currently the user component is usually built by means of ontologies that allow storing, manipulating, and extracting assumptions from data about the user, its context, tasks, etc. [Miñón 2010].

6.2.4 Data mining for web personalization

In order to be able to model the user, the modelling component must collect information about a number of observable parameters such as interest, characteristics, etc. This information can be requested to the user in a previous session, but this is annoying, disruptive and can produce false assumptions. Another option is to collect this information while the user is accessing the web. In this way the system can learn its interests, likes, etc. Learning from the own interaction allows maintaining a dynamic profile of the user, avoiding the application of all assumptions when the interest, characteristics or circumstances of the user change.

Data mining for web personalization has many advantages. It is not disruptive, is based in statistical data obtained by real navigation exercises (decreasing the possibility of false

[43] Cascadins Style Sheets home page: http://www.w3.org/Style/CSS/

assumptions) and is itself adaptive (when the characteristics of the user change, collected data allows the automatic change of the interaction schema). When the user is a person with physical, sensory or cognitive restrictions, data mining is the easiest (and frequently almost the only) way to obtain information about the uses of the person.

Data mining in this context has also some drawbacks. The most important one is its impact over privacy, due to the need of storing large quantities of data about the users. Diverse laws in different countries protect user rights for privacy. Even if it is difficult to reach a balance among privacy and personalization, some appealing proposals have been recently published.

6.3 Human interfaces for accessible Ambient Intelligence system

The advances in networking, computing and sensing technologies allow the design of intelligent environments able to give support to people located inside them. The Ambient Intelligence paradigm benefits from ubiquitous and wearable computers, communicated by wireless networks with static computers –which can be also connected to wired networks–, that are able to process enormous quantities of contextual information coming from networks of sensors. This technological infrastructure will allow the deployment of intelligent applications that proactively give support to the users [Streitz 2006].

Ambient Intelligence obviously provides an extraordinary opportunity to develop assistive environments for people with sensory, physical or cognitive restrictions due to aging, disability, illness, etc. All these intelligent environments perform several supportive activities that are usually ignored by the user, such as adjusting the temperature, humidity, lights, etc., or verifying the safety of gas, electricity or water installations. In addition, intelligent environments have to communicate with the user to provide information or to request commands. The user interfaces are supposed to be as natural as possible, allowing a communication similar to the interaction between humans. That means that the system should be able to produce voice messages –and maybe to display some of them via wall screens or data glasses– and to recognize natural language and gestures. Nevertheless some of these communication methods may not be appropriate for people with specific sensory or cognitive restrictions.

6.3.1 Accessible AmI supporting technology

Elderly and disabled people belong to a segment of the population that would profit very much from Ambient Intelligence if it were accessible. This is only possible if accessibility barriers are early detected in the evolution of the Ambient Intelligence concept and opportune standardization measures are provided.

Autonomy and quality of life of elderly and disabled people living in smart private or public homes designed under the Ambient Intelligence paradigm can experience significant enhancements due to the increased support received from the environment. This support includes facilities for environmental control, information access, communication, monitoring, etc., built over diverse technologies and using different operation ways. Nevertheless, users can find accessibility barriers frequently related to the diverse user interfaces with heterogeneous devices and procedures. These problems include both, physical difficulties to handle the devices, and cognitive barriers to understand use procedures and navigation. As a result, accessible unified interfaces to control all the appliances and services are needed. This is only possible if the network technology used for smart homes is able to support interoperability and systems integration. Therefore, the needs of senior and disabled users can only be provided by means of interoperable systems in an integrated intelligent environment. Consequently, only a convergence policy based on inclusive design guidelines and standards can guaranty the accessibility of the future intelligent ambient [Sevillano 2004] [Emiliani 2008a].

6.3.2 Accessible adaptive interfaces for AmI

As previously mentioned, the growing ubiquitous computing paradigm allows the provision of context-aware services to mobile users. In addition to the usual computing requirements, these environments entail wireless network infrastructures and special management software, usually called middleware. When a mobile computing device (smart phone, PDA, etc.) enters into an Ambient Intelligence environment the middleware establishes the communication with the local network in a way that is transparent to the user. After the "discovering" and "presentation" phases, the available local services are offered to the user. In order to be operated some of them may require a specific user interface that is downloaded to the user's mobile device.

This type of environment can be extremely helpful for people with disabilities who have mobile devices adapted to their characteristics. In this way, using their own device they can access several local services that can otherwise be inaccessible to them, such as ATMs, vending machines, information kiosks, smart home appliances, etc. This is only possible if the downloaded user interface is rendered to the mobile device in an accessible mode. The large variety of user characteristics and restrictions (due to the broad range of disabilities) and the peculiarities of the devices used by them makes it necessary to adapt the "basic" user interface supplied by the service provider to the specific needs of the user and his or her device. Therefore the system has to automatically generate user interfaces adapted to the features and preferences of users with disabilities. To automatically adapt the interface to the user characteristics, it is necessary to take into account what the most suitable communication modalities are for each user, mapping them to the appropriate media.

Ubiquitous systems handle a huge quantity of information that can be used to infer knowledge about the user, the environment and the tasks. Modelling this knowledge would contribute to enhancing the generation of adapted user interfaces. Ubiquitous

Computing itself frequently includes user modelling and personalization as a goal, in order to take into account the human context. This goal requires a component that can manage the adaptation of the information resources and make the interaction comfortable for each user of the ubiquitous environment.

6.4 Interfaces for robot control

Mobile Robotics has experienced a notable development in recent years. For instance, sensors are more and more reliable and accurate at lower prices. In addition, processors are also more powerful and memory availability is larger and cheaper. For these reasons, it is possible nowadays to speak about "consumer robotics". Similarly to the evolution of personal computers, robots are finding new applications in the home, outside of the factories. One of the most promising fields among the non-industrial applications of robots is Assistive Robotics. Assistive Robotics is proposing new ways of supporting people with motor restrictions to develop tasks that were previously impossible for them. Among the diverse applications that are being developed, assisted mobility and manipulation stand out [Abascal 2008a].

Augmentative and Augmentative Mobility, AAM, (similarly to Augmentative and Alternative Communication44) attempts to provide people with methods and devices to enhance or restore their mobility. The application of the advancements in Mobile Robotics to AMM allowed the design of very advanced assisted mobility systems. Among them the most sophisticated are smart wheelchairs [Abascal 2008b]. Smart wheelchairs are intended for people with severe motor restrictions that experience great difficulty in driving standard electric wheelchairs. They are usually provided with diverse types of sensors and embedded computers that receive information from the sensory system, handle the interaction with the user and control the motors through the power stage. The number and quality of the sensors determine the accuracy of the control. For this reason many experimental Smart Wheelchairs are provided with extremely advanced and expensive sensors that convert them into impressive mobile robots but are too expensive and sophisticated to be marketed.

The interaction between the user and the wheelchair is again a key factor. As previously mentioned, users of smart wheelchairs are people with severe motor restrictions that impede the use of standard input devices. Therefore, the design of interfaces for AAM has also to take into account specific guidelines to satisfy the needs of the users.

Another important human need is to manipulate objects in the surroundings. There are specific technologies applicable to people with severe motor disabilities or to people with amputations. Light articulated arms come from the adaptation of articulated

[44] Augmentative and Alternative Communication (AAC) are extra ways of helping people who find it hard to communicate by speech or writing. More information in http://www.isaaconline.org/en/aac/what_is.html

industrial manipulators to allow people with severe hand movement restrictions to grasp and move objects. It is evident that is not possible just to use industrial robots at home. There are problems of size, height, security (the user and the robot share the work space), etc... Nevertheless, the most important barrier is human-robot interaction. Robots are designed to handle objects based on their position and orientation, using diverse types of coordinates. Users describe objects in terms of names, properties (colour, shape, size...), function, etc. In the user's mind positions are usually related to other objects or to the room. It is not expected that a user should have to give numeric parameters with the position, orientation and size of the object to be manipulated. Therefore, intelligent mediator applications are necessary to understand object description in natural language and to translate this into coordinates.

6.4.1 Requirements of the Human-Robot Interface

Some basic principles have to be taken into account in designing the interface to control both robotic assistant devices and intelligent environments. The first one is the rehabilitation goal. Numerous people with disabilities are able to enhance their cognitive abilities, personal attitudes and social integration when they are provided with adequate user interfaces. To this end the interface must encourage the use of all the capabilities of the user, and avoid taking decisions on behalf of the user when it is not absolutely necessary.

For instance, in the case of autonomous smart wheelchairs, they are able to automatically navigate requiring little or no interaction from the user. After the destination is somehow specified, the wheelchair is able to take all the necessary decisions to arrive at the selected place. Although this procedure is very convenient for people with extreme motor restrictions, many users have some remaining abilities that could be lost if they are not used. These abilities may even be enhanced when they are trained. Therefore the interface must facilitate, as much as possible, user participation in order to enhance their cognitive abilities, personal attitudes and social integration. In addition, the user must feel that he or she is the one who controls the device in order to avoid frustration and passivity. That includes ease of switching between automatic/assisted/manual functioning.

Safety and reliability are also important requirements. Several of these systems interact with the environment in various ways that could be dangerous in the case of failure or malfunction. The designer must ensure that the system is safe, reliable and fault tolerant.

Another key issue is the final price. Inexpensive solutions are needed to prevent unaffordable systems. In the case of AAM, that means using cheap sensors (for example, infrared and ultrasonic sensors instead of laser, to measure distances). Currently processors are cheap and the inferior quality of the sensors can be balanced by a much greater processing capacity. Moreover, since most intelligent wheelchairs are built on commercial electric wheelchairs, carrying out any major changes in order to facilitate its future potential marketing by the industry without making large investments should be avoided.

7 A summary of Current Research Trends in HCI Design

7.1 Some Design Frameworks and tools

Modern user interface builders provide graphical environments for user interface prototyping, usually following a WYSIWYG ("What You See Is What You Get") design paradigm, and offering graphical editing facilities that allow designers to perform rapid prototyping visually. Such editors may be standalone or embedded in integrated environments (IDEs), i.e., programming environments, which allow the direct development of the application functionality for the created prototypes. Commonly used IDEs are Microsoft Visual Studio, NetBeans, and Eclipse. IDEs are very popular in application development because they greatly simplify the transition from design to implementation, thus speeding up considerably the entire process, while also supporting look-and-feel consistency through the availability of common sets of UI widgets.

Research efforts related to frameworks and tools for user interface design include a reference framework proposed by Calvary, Coutaz and Thevenin [Calvary 2001], which follows a model-based approach and that structures the development process of plastic user interfaces. Based on this proposed model, a design tool, named ARTStudio, has been implemented to support the development process. TERESA is another tool, which supports the design and development of nomadic applications, providing general solutions that can be tailored to specific cases [Mori 2003]. Through TERESA designers can either specify the appearance of common UI elements for the supported platforms or even modify some general design assumptions.

Several research efforts have suggested a variety of components and tools to facilitate the development of user interfaces capable of adaptation, including accessibility features:

- MENTOR, is a tool providing (a) practical integrated support for all phases of adaptation design, through appropriate editing facilities; (b) practical support for a 'smooth transition' from design to development through the availability of automated verification mechanisms for the designed adaptation logic, as well as the automated generation of 'ready-to-implement' interface specifications; and (c) support for the progressive accumulation of design cases and of the related design experience and knowledge, in particular regarding adaptation [Antona 2006].
- EAGER is a toolkit built to support WUI (Web User Interface) adaptation and facilitate the design of web interfaces that can adapt to the diversity of the target user population [Doulgeraki 2009]. By means of EAGER, a developer can produce Web portals that have the ability to adapt to the interaction modalities, metaphors and UI elements most appropriate to each individual user, according to profile information containing user and context specific parameters.

On the other hand, MAID is a multi-platform accessible interface design framework, facilitating the development and customization (through skins) of structured User Interfaces (templates) through the use a set of predefined UI components (widgets), while promoting reusability and supporting dynamic content population [Korozi 2009].

7.2 Current research trends

Research efforts in recent years have elaborated comprehensive and systematic approaches to user interface adaptations in the context of Universal Access and Design for All [Stephanidis 2001]. The Unified User Interfaces methodology was conceived and applied [Savidis 2004] as a means to efficiently and effectively ensure, through an adaptation-based approach, the accessibility and usability of User Interfaces to users with diverse characteristics, supporting also technological platform independence, metaphor independence and user-profile independence. In such a context, automatic UI adaptation seeks to minimize the need for *a posteriori* adaptations and deliver products that can be adapted for use by the widest possible end user population (adaptable user interfaces).

This implies the provision of alternative interface manifestations depending on the abilities, requirements and preferences of the target user groups, as well as the characteristics of the context of use (e.g., technological platform, physical environment). The main objective is to ensure that each end-user is provided with the most appropriate interactive experience at run-time.

In more detail, a unified user interface comprises a single (unified) interface specification that exhibits the following properties:

- It embeds representation schemes for user- and usage-context- parameters and accesses user- and usage-context- information resources (e.g., repositories, servers), to extract or update such information.
- It is equipped with alternative implemented dialogue artefacts appropriately associated to different combinations of values for user- and usage-context-related parameters.
- It embeds design logic and decision making capabilities that support activating, at run-time, the most appropriate dialogue patterns according to particular instances of user- and usage-context- parameters, and is capable of interaction monitoring to detect changes in parameters.

As a consequence, a unified user interface realises:

- User-adapted behaviour (user awareness), i.e., the interface is capable of automatically selecting interaction patterns appropriate to the particular user.
- Usage-context adapted behaviour (usage context awareness), i.e., the interface is capable of automatically selecting interaction patterns appropriate to the

particular physical and technological environment.

At run-time, the adaptations may be of two types:

- adaptations driven from initial user- and context- information known prior to the initiation of interaction, and
- adaptations driven by information acquired through interaction monitoring analysis.

The former behaviour is referred to as adaptability (i.e., initial automatic adaptation) reflecting the interface's capability to automatically tailor itself initially to each individual end-user in a particular context. The latter behaviour is referred to as adaptivity (i.e., continuous automatic adaptation), and characterizes the interface's capability to cope with the dynamically changing or evolving user and context characteristics.

7.3 HCI and AmI

While many problems connected with interaction with the present Information Society are actually linked to a suitable structuring of information and an accessible human system interface, integration within the ambient intelligence environment is much more complex, due to the interplay of different levels, e.g. the physical level with a multiplicity and heterogeneity of intelligent objects in the environment and their need for a continuous and high-speed connection, the level of identification and consideration of the variety of contexts of use, and the level of elicitation of the diversity of user goals and help in their fulfilment [Emiliani 2008b].

Thus, in the context of the emerging paradigm of AmI, current research trends have to address:

- The diversity in the User Population
- Diversity in the enabling technologies for AmI
- The need for research on the Lifecycle of User Interfaces (requirements in AmI Environments, Design for All, Development requirements, user experience evaluation)
- User Interface Development (architectures, Components, Tools) itself
- Interaction Techniques and Devices
- The variety of Application Domains
- A number of non-technological issues (social, ethical, legal issues, privacy, security)

Ambient Intelligence is defined according to its properties as technology, which is:

- Embedded in the physical and social environment of people;
- Context Aware - employing machine perception a model of activities of people and their social and physical context can be obtained;
- Personalized - addressing each user as an individual person;
- Adaptive to context and activities of the person;
- Anticipatory - predicting user's needs and taking action to support them.

In that respect, the different approaches to Ambient Intelligence are themselves challenging areas for research in HCI, such as:

- Ubiquitous Computing and communication
- The disappearing computer and Calm Technology
- Pervasive and Embedded Everywhere Computing
- Internet of Devices and Web of Things
- Ubiquitous Networking
- Ambient Computing and Ambient Displays
- Tangible Interfaces

With regards to User Interfaces in particular, an interesting approach could be based on the introduction of the Ambient User Interfaces (AmUIs) paradigm. In contrast to typical graphical user interfaces (GUIs), which are always instantiated on a computer screen, AmUIs can take advantage of the available Ambient Intelligence Infrastructure, in order to support interaction that is tailored to the current needs and characteristics of a particular user and context of use. Thus, they could be multimodal and distributed in the environment (e.g., employ the TV screen and stereo speakers to provide output, and get input through both speech and gestures). These interfaces could allow the interaction between humans and the ambient technological environment in an efficient, effective and intuitive way which also guarantees their well-being, privacy and safety, while on the other hand they could creatively combine the available, dispersed computing devices in order to provide useful, added-value, services. This could support seamless, high-quality, unobtrusive, and fault-tolerant user interaction, by creating software frameworks for developing and orchestrating ambient interactions, and by designing and developing useful ambient interactive systems that cater in the best possible way for the real needs of their users [Emiliani 2009].

7.4 Emerging Issues

Lastly, a number of emerging key issues that arise from the evolution of the Information Society towards Ambient Intelligence environments have to be considered [Stephanidis 2009]. These include:

- The investigation of human characteristics, abilities, and requirements in the context of AmI
- Suitable approaches to non-functional characteristics such as accessibility, privacy, security, safety
- Suitable models of the context of use
- Appropriate interaction devices and techniques for diverse users and contexts of use,
- Interaction Design for continuous and implicit interaction
- Elaboration of design methods suitable for very complex interactive environments,
- Mechanisms for interaction adaptation,
- A balance of policy, standardisation and legislation intervention

8 Roadmapping the development of inclusive accessible technology

The CARDIAC project aims to propose a roadmap to guide the European Commission in the development of R&D policies that promote accessibility and inclusion. There exist several other initiatives that, using diverse methods, have conveyed to prospective studies, roadmaps or guidelines with similar purposes. Far to be ignored, all the results from these efforts must be also used as an input to CARDIAC discussions. They can provide inspiration and orientation to the CARDIAC work.

Here we have listed a number of reports from diverse institutions that can serve as examples of technological prospective and roadmapping for the development of accessible and inclusive human-machine interaction.

D6.1 Interim Roadmap for ICT and Ageing. BRAID European Project. [Camarinha-Matos 2011]

This document first introduces the general roadmapping method adopted in BRAID, giving the context for the work done in WP6. The synthesis of the baseline and gap analysis is then introduced in order to facilitate the identification of needed research. A set actions per life setting is then proposed and a preliminary validation is made, focusing the coverability of the vision facets and the feasibility of each action. Finally, an overview of ongoing and future steps is introduced in order to give the reader a comprehensive understanding of the planned activities and expected outcomes of WP6.
BRAID considers four perspectives or life settings, namely "Independent Living", "Healthy Living", "Occupation in Life", and "Recreation in Life", which are followed along the various phases of theroadmapping process. BRAID proceed with a vision-driven roadmapping approach in order to derive a plan of actions that, if successfully implemented, will help us achieve the established vision.with a systematic approach is applied: addressing: (i) synthesis of the baseline and trends according to the selected life settings and vision facets, (ii) gap analysis, aiming at achieving a qualitative perception of how far we are from achieving the vision, (iii) proposition of a plan of actions, and (iv) preliminary validation of the proposed actions. The proposed action plan is stated at a high level, which represents a basis for a first validation with stakeholders, while a detailed research agenda and implementation plan are the focus of the next phase of the project.

Inclusive E-Services for All: Identifying Accessibility Requirements for Upcoming Interaction Technologies. [Rodriguez-Ascaso 2010]

Information and Communication Technologies (ICT) have the potential of facilitating the lives of citizens. However, experience consistently shows that user-interface innovations for consumer products are being researched and developed without taking into account the needs of people with disabilities. This situation is not helped by the fact that product and service developers can be unaware of the requirements of customers with impairments and therefore lack the insight into appropriate design solutions that may not be very demanding in terms of R&D and production costs. ETSI, the European Telecommunications Standards Institute, has established a Specialist Task Force (STF) 377 on "Inclusive eServices for all: Optimizing the accessibility and use of upcoming user interaction technology". The aim of this working group is to systematically evaluate ongoing and forthcoming interaction technologies to sketch a 10-year roadmap of foreseen technological enablers.

AALIANCE Ambient Assisted Living Roadmap. [van den Broek 2010]

AAL refers to intelligent systems of assistance for a better, healthier and safer life in the preferred living environment and covers concepts, products and services that interlink and improve new technologies and the social environment. It aims at enhancing the quality of life (the physical, mental and social well-being) for everyone (with a focus on elder persons) in all stages of their life. AAL can help elder individuals to improve their quality of life, to stay healthier and to live longer, thus extending one's active and creative participation in the community.

Currently there is a vast number of (more or less linked) European and national research activities in the field of AAL involving various technology areas and innovative technology approaches. There is missing however a common vision of AAL that provides and defines the necessary future R&D steps and projects on the way to Ambient Assisted Living. In order to close this gap the AALIANCE project aims at developing such a roadmap and strategic guidance for short-, mid- and long-term R&D approaches in the context of AAL related.

The third part of the document also provides a broad and detailed description of the technologies, on which the applications and functionalities of the previous domains are based. These technologies include intelligent interaction with systems and services is a very important aspect for applications and will have specific requirements in order to cope with the abilities of users.

This document also covers the system integration and interoperability. In AAL these different functions, provided by a heterogeneous set of disciplines (e. g. advanced human/machine interfaces, sensors, microelectronics, software, web & network technologies, energy generation or harvesting, control technologies, new materials and robotics), have to be integrated in a system that offers applications and services in a user-centred way.

While ICT-enabled products in the field of walking aids or telemonitoring could be developed along already existing technological paths in the field of gerontechnology, more ambitious AAL solutions raise specific challenges regarding system integration and the design hierarchy. In AAL system integration is dependent not only on technical and functional integration factors, but has to take into account user needs and user knowledge. This emphasises the importance of user involvement and user perspective in AAL-related research and innovation activities which have already been tackled by a number of R&D projects.

Inclusive eServices for all: Optimizing the accessibility and the use of upcoming user-interaction technologies. [ETSI EG 202 848-2011]

This document provides guidance for the user interaction design of telecommunication devices and services that are likely to become available for large-scale rollout to consumers in the next five to ten years. In particular, it identifies provisions that have to be made in order to ensure that forthcoming interaction technologies deployed in devices and services will be usable by all users including older people and/or people with disabilities.

The document lists user interaction technologies likely to be employed in future devices and services in the form of a technology roadmap. For each identified technology, key characteristics specified include: user requirements impacted by the technology; benefits and accessibility barriers that will result from deployment; solutions related to accessibility barriers (both those benefiting disabled users only as well as those being useful for all users in different contexts). Measures are identified that need to be addressed prior to the large-scale implementation of those technologies in order to ensure their usability by users with the widest range of characteristics.

Accelerating the development of the eHealth market in Europe. [EC 2007]

This report on lead market opportunities for eHealth proposes actions aiming at accelerating the development of the European eHealth market, increasing economic benefits and simultaneously developing the quality of health products and services.

The main outcome of this paper is a roadmap on policy recommendations, directed at specific stakeholders, including industry representatives, EU Commission working groups, the i2010 group on eHealth, Member States and various eHealth stakeholder groups. The recommendations highlight the main areas of intervention over the period 2008-2010, and focus on dealing with the identified obstacles.

D2.1 Report on the impact of technological developments on eAccessibility [Emiliani 2008b]

This deliverable aims to discuss the present situation and the possible impact of the ongoing technological developments in ICT on the inclusion of people with activity limitations. It is based on the main assumptions that: (i) the correct definition of eInclusion is the one published in the 2006 Riga ministerial declaration1; (ii) adaptations through Assistive Technologies are not sufficient to capture the potentialities of ICT in supporting people's inclusion, but a shift toward the "Design for All" approach, based on the conceptual principle that all users must be taken into account in the design of new products and on suitable technical approach(es), is necessary; (iii) the European society is migrating toward an information society, described by the Ambient Intelligence (AmI) paradigm; (iv) there will be a (long) transition to a complete AmI implementation, when many inclusion feature will be included in the mainstream developments; (v) and, therefore, the Assistive Technology and Design for All approach will need to coexist and cooperate in the short/medium term to grant as much as possible the inclusion of people with activity limitation.

The conceptual scheme and the steps leading to AmI deployment is assumed the following. The main Design Approach is Design for All, whose definition is presently being refined in connection to its use in the ICT environment. The same is true for the AmI concepts that are presently under discussion. In the near future, ICT will continue to develop with a Design for All approach, therefore producing more accessible mainstream technology. This will cause not only the emergence of intelligent objects but also their inclusion into AmI-like environments, i.e. environments that incorporate partially and in interconnected islands AmI concepts. AmI will materialise when the individual AmI-like islands will merge and when enough intelligence will be available to guarantee functionality and security of the infrastructure and the corresponding services throughout the entire society.

9 SDDP-2 Participants

Brief information about the confirmed SDDP participants is provided below. There may be last minute changes and additions seminar. There may be last minute changes and additions[45].

9.1 Invited experts

Jon Azpiroz. Vodafone (E)

R&D Project Management at Fundación Vodafone España.

Luis Azevedo. Anditec (P)

Is a researcher at the Center for Analysis and Signal Processing, the Technical Institute, Technical University of Lisbon in the area of Assistive Technology. Hi is the Director of ANDITEC-Rehabilitation Technologies Ltd, a company specializing in marketing, training and development in assistive technologies. His teaching experience includes courses as a Visiting Professor of the Master of Clinical Engineering, Faculty of Engineering, Catholic University, of the Masters in Lusophone University Augmentative Communication, Lecturer's Degree in Occupational Therapy, School of Health Alcoitão, Guest Lecturer for Courses / Seminars on "Assistive Technology for Persons with Disabilities in foreign universities, including Spain, Brazil, Argentina, Chile, Colombia, Ecuador and Costa Rica. He is Scientific Coordinator of National and International Projects in Technologies for Rehabilitation. Invited Expert of the European Commission to evaluate projects in the area of Assistive Technology, Founding member and Board of Directors of the Association for the Advancement of Assistive Technology in Europe (1995 - 1998). He was a member of the Board of Directors of ISAAC - International Society of Augmentative and Alternative Communication (1995 - 2000). Member of the Rehabilitation Engineering Society of North America. Founding Member and Vice President of AITADIS - Ibero-American Association of Assistive Technology. Advisor specialized in the field of Assistive Technology in various Rehabilitation Centres and Hospitals. Author of more than 150 communications to national and international congresses

Stephan Carmien. Fatronik (E)

Dr. Stefan Carmien holds a Ph.D. In Computer Science with certificate in Cognitive Science from the University of Colorado (Boulder) 2006. He currently holds the

[45] Dr. Azevedo, Mr. Chandler, Dr. Martínez Usero, Ms. Rodríguez-Porrero and Mr. Tyler, cancelled their participation prior to meeting for work-related reasons. Dr. Martínez Usero was substituted by his collaborator Mr. Torena.

position of staff scientist at the Fatronik?Tecnalia foundation in San Sebastian Spain. Dr. Carmine's work focuses the study of the socio-technological environment formed by a technological system, its context and the human user. In systems he has developed he has emphasized deep personal configuration (meta-design) and end-user programming as a solution to technology abandonment.

Mr. Edward Chandler. RNIB (UK)

Ergonomist, Royal National Institute of the Blind (RNIB), has played a central role in the evaluation of products and systems within the Royal National Institute of the Blind for over four years. He has extensive experience in performing expert evaluations, identifying the usability and accessibility issues of complex products and systems; as well as conducting evaluations with disabled end users. He has performed evaluations in Europe and the UK, and has worked with a number of manufacturers to make their products and systems more inclusive. He has worked on a wide variety of projects, including, evaluations of chip and pin devices, Interactive Voice Recognition systems and real time information systems. His current focus is on: mobile email solutions, mobile phones, access to digital TV and evaluation methodologies. Edward holds a Masters in Science in Human Factors in Manufacturing Systems and is a registered member of the Ergonomics Society. RNIB (UK)

Ginger B. Claassen. Siemens IT Solutions and Services GmbH (D)

He studied computer science at the University of Paderborn (Germany) and the School of Computer Science at Carleton University (Ottawa, Canada). For more than 10 years Mr. Claassen worked as a research assistant for the C-LAB, a joined research and development laboratory of Siemens AG and the University of Paderborn, with special focus on "accessibility" respectively "Design for All". Mr. Claassen is blind, and therefore knows from his own living and working the problems and barriers persons with disabilities are facing in our modern information and communication society. Since 2008 he works for the Siemens "Accessibility Competence Center" and for the "Siemens Access Initiative". He has been involved in various commercial and research projects, provides "Design for All" training to colleagues and customers and presents various accessible solutions at international exhibitions and congresses.

Simon Harper. University of Manchester (UK)

Since January 2006, he has been a member of the School of Computer Science in the position of Career Development Fellow in the Human Centred Web; part of the Information Management Group. He is interested in how disabled users interact with the World Wide Web (Web) and how the Web, through its design and technology, enables users to interact with it. He believes that by understanding disabled-user's interaction the understanding of all users operating in constrained modalities where the user is handicapped by both environment and technology is enhanced. He sees fundamental research into users with disabilities as a natural preface to wider human factors research. He is currently investigating and modelling user experience to formulate solutions which will enhance Web accessibility for visually disabled users and the usability of small-screened mobile devices. He is mainly working in the Web's, so called, 'long-tail' creating novel methods of making obfuscated structure, information, and semantics more explicit.

Adamantios Koumpis. ALTER (Gr)

Adamantios Koumpis heads the Research Programmes Division of ALTEC S.A., which he founded at 1996 (then as independent division of Unisoft S.A.). His research interests include quantitative decision making techniques and Info Society economics. He successfully lead many commercial and research projects in Greece in the areas of E-Commerce, public sector and business enterprise re-organisation and information logistics, concerning linking of data/information repositories with knowledge management and business engineering models.

José Ángel Martínez Usero. Technosite - ONCE Foundation (E)

R, Martinez Usero is currently the Director of International Projects and Relations at Technosite - ONCE Foundation. He holds a PhD in Information Science (Hons) from Madrid’s Universidad Carlos III and a MSc in Corporate Networks and Systems and a Postgraduate Course in Information Science. At present, José Angel Martínez is the Director of international projects and relations at Technosite-ONCE Foundation (Spain). He is the project coordinator of two major European studies, “Monitoring eAccessibility in Europe” and “Economic Assessment for Improving eAccessibility Services and Products”; and two major ICT-PSP projects in the field of eInclusion APSIS4all European pilot on Accessible and Personalised Public Digital Terminals for all and ATIS4all, Thematic Network on Assistive Technologies.

Roberto Torena. Technosite - ONCE Foundation (E)

At present, Roberto Torena is the manager of Technosite’s Brussels Office for the internationalization of the INREDIS research results and the establishment of European eAccessibility networks. He is also coordinator of the group Accessibility + Interoperability + Ubiquity on the Plataforma Tecnológica eVIA. In 2008, he was a protocol researcher for the INREDIS project “Relation interfaces between users with disabilities and different environments” and managed the Interoperability Protocol Work package.

Cristina Rodríguez-Porrero. CEAPAT (E)

Ms. Rodríguez-Porrero is the Managing Director of CEAPAT, National Centre for Personal Autonomy and Technical Aids under the National Institute for Migrations and Social Services IMSERSO. Its mission is to contribute to improving the quality of life of all citizens, with special support to people with disabilities and elderly people, by means of accessibility, design for all and assistive technology.

Steve Tyler. RNIB (UK)

Head of Innovation and Development. Royal National Institute of the Blind.

Prof Gregg Vanderheiden[46]

Professor Vanderheiden is the Director of the Trace R&D Center and a Professor in both the Industrial & Systems Engineering and Biomedical Engineering Departments at University of Wisconsin-Madison. Dr. Vanderheiden has been working on technology and disability for just under 40 years. He was a pioneer in the field of Augmentative Communication (a term he coined in the 1970's) before moving to computer access in the 1980s. Many of the accessibility features that are now built into every Macintosh, Windows and Linux computer were created by his group in the 1980s. He has worked with over 50 companies, served on numerous governmental advisory and study committees on both sides of the ocean, and has chaired and/or edited many of the early accessibility standards. He is co-founder of "Raising the Floor" (http://raisingthefloor.net) and initiated the international efforts to build National and Global Public Inclusive Infrastructure (gpii.org).

Prof. Gerhard Weber. Technical University Dresden (D)

Professor Gerhard Weber is since 2007 Chair for Human-Computer Interaction at the Institute for Applied Computer Science, Technische Universität Dresden. He has more than 25 years work experience in the field of assistive technology as researcher, as teacher at Overbrook School for the Blind, Philadelphia, as scientist at F. H. Papenmeier GmbH, and recently as professor teaching on this subject. Topics include tactile graphics, screen reader, web accessibility, personalization of electronic books for blind and deaf people, and accessible ubiquitous systems. He is an expert for ISO on haptics and the current Chair of IFIP Working Group TC13.3 "HCI and disabilities".

9.2 Members of the CARDIAC consortium[47]

Prof. Julio Abascal

Dr. Abascal is a Professor of the Computer Architecture and Technology Department at the University of the Basque Country located in Northern Spain. He co-founded the Laboratory of Human-Computer Interaction for Special Needs that has participated in several R&D projects at national and international level.

---

[46] Professor Vanderheiden will attend the full SDDP-2 meeting from Wisconsin by videoconference.
[47] Ms. Bitterman and Prof. Civit had to cancel his participation prior to meeting for work –related reasons. Dr. Civit was substituted by his collaborator Rocío Garcia-Robles.

Ms. Gunela Astbrink

Ms. Astbrink is based in Australia and she is the Principal of GSA Information Consultants an organisation specialising in conducting research and policy development in many facets of ICT for people with disabilities.. She has 20 years of international experience in research and policy with a focus on regulatory processes to benefit people with disabilities.

Ms. Ilse Bierhoff

Ms. Bierhoff is a research project manager at Smart Homes, an independent expert centre for smart houses and smart living based in the Netherlands. She graduated as human-technology engineer and has specialised over the past 8 years in user centred design and technology for older persons. Her main activities at Smart Homes are in the field of the use of smart home technology for independent living and more efficient care delivery

Dr. Noemi Bitterman

Dr. Bitterman is the head of industrial design in the Faculty of Architecture & Town Planning at Technion - Israel Institute of Technology, Israel's primary technological university. The research interests of her group include "Social Design"- addressing the needs of special populations, such as elderly, disabled and the ill.

Ass. Prof. Kjell Åge Bringsrud

Dr. Bringsrud is employed as an associate professor in the research group for distributed multimedia systems at the Department of Informatics, University of Oslo, Norway.

Dr. Anton Civit

Professor Civit is the director of the Department of Computer Architecture at the University of Seville in Spain. He is author of over 100 publications in the fields of embedded systems, bioinspired systems, robotics and accessibility.

Prof. Pier Luigi Emiliani

Professor Emiliani works at the Institute of Applied Physics (IFAC) in Florence, Italy. The IFAC Department on Information Theory and Processing is involved in research on the theory and applications of signal and image processing and information technology (communications, biomedicine, non-destructive testing, user interface and aids for disabled persons).

Prof. Cristina Espadinha

Professor Espadinha is a doctor in the area of special education and rehabilitation and is a teacher at the Faculdade de Motricidade Humana at the Technical University of Lisbon, Portugal. She also worked as a junior researcher several European projects, including two of the COST219 actions

Rocío Garcia-Robles

Ms. Garcia-Robles is a lecturer at the Department of Computer Architecture of the University of Seville. Her publications are mainly related to e-learning standards, accessibility, usability and user-interface design.

Dr. John Gill, OBE DSc FIET

Dr. Gill has worked for over 37 years in the area of scientific and technological research for people with disabilities. Based in the U.K. his research has included the design of fonts, public access terminals, tactile communication, orientation systems, automated production of braille and large print, and access to telecommunication systems and services.

Dr-Ing Helmut Heck

Dr. Heck coordinates R&D projects at the Research Institute for Technology and Disability at Evangelische Stiftung Volmarstein, Forschungsinstitut Technologie und Behinderung in Germany. His current interests relate to computer/robotic applications, human-machine-interaction for people with disabilities, accessibility of IT systems, as well as AAL.

Mr. Sifis Klironomos

Mr. Klironomos is a member of the Human-Computer Interaction Laboratory and Centre for Universal Access and Assistive Technologies of ICS-FORTH – Hellas, one of the largest research centres of Greece. Laboratory carries out research activities focused on developing user interfaces for interactive applications and services that are accessible, usable, and ultimately acceptable for all users.

Prof. Yiannis Louris

Professor Louris has over 15 years of experience in designing and implementing structured dialogue design systems. He works at the Cyprus Neuroscience & Technology Institute which conducts research in areas related to the human brain and learning, technology and social change, accessibility, Web 2.0, global society, conflict transformation and global peace. Dr. Louris will take a lead role in facilitating this Co-Laboratory

Prof. Leonor Moniz Pereira

Professor Pereira is a doctor and teaches in the area of special education and rehabilitation and is the president of the scientific board of Faculdade de Motricidade Humana at the Technical University of Lisbon, Portugal. She is the coordinator of the Interdisciplinary Center of Human Performance, Coordinator of FCT rehabilitation evaluation panel (the national organization that promotes the advancement of scientific and technological knowledge). She also worked as a senior researcher on several European projects including the three COST219 Actions.

Ms. Mary Nolan

Ms. Nolan has worked at the CRC for the past four years in the Assistive Technology & Specialised Seating department working on various AT research projects and developing the European Seating Symposium. Prior to joining the CRC, Mary was Head of Group Marketing & Communications at one of Ireland's largest commercial banks, where one of her key roles was to develop the bank's †e-commerce strategy based on key findings from consumer research for disabled and elderly customers.

Prof. Patrick Roe

Professor Roe works with the Acoustic Group of the Laboratoire d'Electromagnétisme et d'Acoustique (LEMA) at EPFL, one of the two Ecoles Polytechniques Fédérales in Switzerland. He worked as a senior researcher on several European projects including the three COST219 Actions, where he acted as Chairman for five years of the COST 219ter Action "Accessibility for All to Services and Terminals for Next Generation Networks".

9.3 External experts collaborating in the pre-seminar discussions

Some experts have committed themselves to participate in the pre-seminary discussions and preparations through the SDDP2 wiki at http://www.cardiac-eu.org/user_interfaces/. Brief information about collaborating experts is provided below.

9.3.1 Collaborating Experts

Mr. Shadi Abou-Zahra. WAI

Mr. Abou-Zahra coordinates WAI outreach in Europe, and accessibility evaluation techniques. He is the Activity Lead of the WAI International Program Office, which includes groups that are responsible for education and outreach, coordination with research, general discussion on Web accessibility, coordination with the WAI Technical Activity, and WAI liaisons with other organizations including standards organizations and disability groups. Mr. Shadi chairs the W3C Evaluation and Repair Tools Working Group

(ERT WG), is a staff person of the WAI Ageing Education and Harmonisation (WAI-AGE) project, and participates in the W3C Education and Outreach Working Group (EOWG).

Mr. Robert Hecht. PTS

Mr. Hecht works with the Swedish Post and Telecom Agency and is intimately involved in the process of public procurement.

9.3.2 CARDIAC Scientific Advisory Board

Prof Ricardo Baeza-Yates. Yahoo.

Professor Baeza-Yates is the VP of Research for Europe and Latin America, leading the Yahoo! Research labs at Barcelona, Spain and Santiago, Chile, and also supervising the lab in Haifa, Israel. Until 2005 he was the director of the Center for Web Research at the Department of Computer Science of the Engineering School of the University of Chile; and ICREA Professor and founder of the Web Research Group at the Dept. of Information and Communication Technologies of Univ. Pompeu Fabra in Barcelona, Spain. He maintains ties with both mentioned universities as a part-time professor for the Ph.D. program. His research interests include algorithms and data structures, information retrieval, web mining, text and multimedia databases, software and database visualization, and user interfaces.

Ms. Chiara Giovannini

Ms. Giovannini holds Bachelors and Masters degrees in law. She is Research & Innovation Manager, responsible for the management of the ANEC research & testing projects as well as the sectors of Design for All and Information Society.

Mr. Hiroshi Kawamura

Mr. Kawamura is the chairperson of the DAISY Consortium. Previously he was a director of the Department of Social Rehabilitation/NRCD Research Institute. Prior to that he was Director of the Information Center, Japanese Society for Rehabilitation of Persons with Disabilities.

Mr. Peter Korn

Mr. Korn is the Sun Microsystems' Accessibility Architect and Sun' primary representative to the US Access Board Telecommunication and Electronic and Information Technology Advisory Committee. Mr. Korn co-chairs the OASIS OpenDocument Accessibility subcommittee. He helped design and implement the Java Accessibility architecture, and he also developed technology that allows assistive technologies for the Microsoft Windows platform to access Java applications. Mr. Korn is one of the designers of the open source GNOME Accessibility architecture used on Solaris, GNU/Linux, and other UNIX systems. He consults with the Star Division of Sun Microsystems in Germany on the development of an accessible edition of the StarOffice and OpenOffice.org suite of application productivity suite, with the Mozilla and Evolution accessibility teams, as well as other software application groups both within and outside of Sun. Prior to his work at Sun, Mr. Korn spent five years in the assistive technology field at Berkeley Systems, Inc., inventors of the first graphical screen magnification and screen reading technologies. There, he designed the first cross-platform Accessibility toolkit, lead the team which developed outSpoken for Windows - a Windows screen reader for the blind - and managed the development of several other assistive technology products for the Macintosh and Microsoft Windows. Mr. Korn successfully transitioned these access technologies to ALVA BV in the Netherlands, and assisted them in setting up a US subsidiary. His most recent previous position was that of President of the Berkeley Access division of Berkeley Systems.

Prof Zhengjie Liu

Professor Liu is the Founder and Director of Sino European Usability Center (SEUC), Professor at School of Information Science & Technology of Dalian Maritime University (DMU), Director of NCR-DMU HCI Research Center, Co-founder and Co-chair of ACM SIGCHI China. Former Chinese National Representative (1999-2005) to IFIP TC.13 Committee on Human-Computer Interaction. His areas include usability/user experience, user-centered design (UCD), accessibility and human-computer interaction (HCI).

Dr Mathijs Soede

Dr. Soede is a founder of the Association for Advancement of Assistive Technology in Europe and first president of the AAATE. Editor of the AAATE's Journal "Technology and Disability". Chairman of the AAATE2011 conference, 30 Aug – 2 September 2011, in Maastricht. Background is in human factors (Cybernetic Ergonomy) The focus in his career is on technology for enhancing independence and participation of persons with a disability. Subjects of R&D has been Innovation stimulation in Assistive Technology, Communication aids for speech and motor impaired persons, Robotic Manipulators, Interfaces and accessibility and finally involvement of end-users in Standardization. Main positions have been at the Delft University of Technology, TNO Organization for Applied Scientific Research-Delft, iRv-Institute for Rehabilitation Research- Hoensbroek as managing director and at present a part-time professorship at the Zuyd University for professional education-Heerlen.

10 References

[Abascal 2005] Abascal J., Nicolle C. Moving towards inclusive design guidelines for socially and ethically aware HCI. Interacting with Computers. 17(5), 2005. Pp. 484-505.

[Abascal 2008a] Abascal J. Users with Disabilities: Maximum Control with Minimum Effort. In: Perales F. J., Fisher R.B. (Eds.) AMDO 2008, LNCS 5098, Springer-Verlag, Berlin, 2008. Pp. 449–456.

[Abascal 2008b] Abascal J., Bonail B., Cagigas D., Garay N., Gardeazabal L. Trends in Adaptive Interface Design for Smart Wheelchairs. In: Lumsden, J. (Ed.) Handbook of Research on User Interface Design and Evaluation for Mobile Technology. Idea Group Reference, Pennsylvania, 2008.

[Antona 2006] Antona M., Savidis A., Stephanidis C. A Process–Oriented Interactive Design Environment for Automatic User Interface Adaptation. International Journal of Human Computer Interaction, 20 (2), 2006. Pp. 79-116.

[Bergman 1995] Bergman E., Johnson E. Towards Accessible Human-Computer Interaction. In Nielsen J. (ed.) Advances in Human-Computer Interaction, V. 5, 1995. https://labs.oracle.com/features/tenyears/volcd/papers/Johnson.pdf

[Brusilowsky 2007] Brusilowsky P. Adaptive Navigation Support. In: Brusilovsky P., Kobsa A., Nejdl W. (Eds.) The Adaptive Web. Methods and Strategies of Web Personalization. Springer-Verlag, Berlin-Heildeberg, 2007. Pp. 263-290.

[Calvary 2001] Calvary G., Coutaz J., Thevenin D. A Unifying Reference Framework for the Development of Plastic User Interfaces. In Proc. Eng. Human-Computer Interaction Conf, 2001. Pp. 173-192.

[Doulgeraki 2009] Doulgeraki C., Partarakis N., Mourouzis A., Stephanidis C. Adaptable Web-based user interfaces: methodology and practice. eMinds, Vol 1, No 5 (2009).

[EC ISTP] European Commission – Information Society Thematic Portal: Overview of ongoing Projects FP6 – FP7 – CIP, available at: http://ec.europa.eu/information_society/activities/einclusion/research/projects/index_en.htm

[Emiliani 1999] Emiliani, P. L., Hine N., Stephanidis, C. (1999), Definition of Models of Interactions, IPSNI Project, Deliverable 2.2.

[Emiliani 2008a] Emiliani P. L., Billi M., Burzagli L., Gabbanini F. Design for All in the Ambient Intelligence Environment. Computers Helping People with Special Needs. LNCS Vol. 5105, Springer-Verlag, Berlin-Heildeberg, 2008.

[Emiliani 2008b] Emiliani, P., L., Burzagli, L., Billi, M., Gabbanini, F., Palchetti, E. (2008).

Report on the impact of technological developments on eAccessibility. DfA@eInclusion Coordination Action, Deliverable D2.1. Available at: http://www.dfaei.org/deliverables/D2.1.pdf

[Emiliani 2009] Emiliani, P., L., Aalykke, S., Antona, M., Burzagli, L., Gabbanini, F., Klironomos, I. (2009). Document on necessary research activities related to DfA. DfA@eInclusion Coordination Action, Deliverable D2.6. available at: http://www.dfaei.org/deliverables/D2.6.pdf

[Fink 1997] Fink, J., Kobsa, A., & Nill, A. (1997), "Adaptable and Adaptive Information Access for All Users, Including the Disabled and Elderly", In A. Jameson, C. Paris, & C. Tasso (Eds.), Proceedings of the 6th International Conference on User Modelling (UM '97), Sardinia, Italy (pp. 171-173), New York: Springer-Verlag.

[ISO 2008a] ISO 9241-20. 2008. Accessibility guidelines for information/communication technology (ICT) equipment and services.

[ISO 2008b] ISO 9241-171. 2008. Ergonomics of human-system interaction -- Part 171: Guidance on software accessibility.

[Kobsa 1995] Kobsa, A., & Pohl, W. (1995), "The user modelling shell system BGP-MS", User Modelling and User-adapted interaction, 4 (2), 59-106.

[Korozi 2009] Korozi M., Leonidis A., Margetis G., Stephanidis C. MAID: a Multi-platform Accessible Interface Design Framework. In: C. Stephanidis (Ed.) Universal Access in Human-Computer Interaction -Applications and Services– Vol. 7 Procs. of the 13th Int. Conf. on Human-Computer Interaction (HCI International 2009), San Diego, CA, USA, 2009. Pp. 725-734.

[Kules 2000] Kules, B. User Modeling for Adaptive and Adaptable Software Systems (2000), http://www.otal.umd.edu/UUGuide

[Lindström 2008] Lindström H., Malmsten M. User-Centred Design and Agile Development: Rebuilding the Swedish National Union Catalogue. Code4Lib Journal. Issue 5, 2008-12-15. Available at: http://journal.code4lib.org/articles/561

[Miñón 2010] Miñón R., Aizpurua A., Cearreta I., Garay N., Abascal J. Ontology-Driven Adaptive Accessible Interfaces in the INREDIS project. In: Procs. of the Int. Workshop on Architectures and Building Blocks of Web-Based User-Adaptive Systems, Hawaii. CEUR Workshop Proceedings Vol. 609, 2010. Pp. 37-39.

[Mori 2003] Mori G., Paterno F., Santoro C. Tool Support for Designing Nomadic Applications. In: Proc. of 7th ACM Int. Conf. on Intelligent User Interfaces IUI'2003. ACM Press, New York, 2003. Pp. 141–148.

[Nicolle 2001] Nicolle C., Abascal J. (Eds.) Inclusive design guidelines for HCI. Taylor &

Francis, London, 2001.

[Obrenovic 2007] Obrenovic Z., Abascal J., Starcevic D. Universal Accessibility as a Multimodal Design Issue. Comms. of the ACM. 50(5), 2007. Pp. 27-29.

[Savidis 2004] Savidis A., Stephanidis C. Unified User Interface Design: Designing Universally Accessible Interactions. Interacting with Computers, 16(2), 2004. Pp. 243-270.

[Savidis 2005] Savidis A., Stephanidis C. Distributed Interface Bits: Dynamic Dialogue Composition from Ambient Computing Resources. Personal and Ubiquitous Computing, 9(3), 2005. Pp. 142-168.

[Sevillano 2004] Sevillano J. L., Falcó J., Abascal J., Civit-Balcells A., Jiménez G., Vicente S., Casas R. On the Design of Ambient Intelligent Systems in the Context of Assistive Technologies. In: Miesenberger, K., Klaus, J., Zagler, W., Burger, D. (eds.) ICCHP 2004. LNCS vol. 3118, Springer, Heidelberg, 2004. Pp. 914–921.

[Stephanidis 1995] Stephanidis, C., Mitsopoulos, Y. (1995), "INTERACT: An interface builder facilitating access to users with disabilities", HCI International '95, Tokyo, Japan,, pp. 923-928.

[Stephanidis 1997] Stephanidis, C., Savidis, A., Akoumianakis, D. (1997), "Unified Interface Development: Tools for Constructing Accessible and Usable User Interfaces", Tutorial Notes 13, 7th International Conference on "Human-Computer Interaction" (HCI International '97), San Francisco, California, USA.

[Stephanidis 1998] Stephanidis, C., Salvendy, G., Akoumianakis, D., Bevan, N., Brewer, J., Emiliani, P. L., Galetsas, A., Haataja, S., Iakovidis, I., Jacko, J., Jenkins, P., Karshmer, A., Korn, P., Marcus, A., Murphy, H., Stary, C., Vanderheiden, G., Weber, G., Ziegler, J. (1998a), "Towards an Information Society for All: An International R&D Agenda", International Journal of Human-Computer Interaction, vol. 10(2), pp. 107-134.

[Stephanidis 2001a] Stephanidis C. The concept of Unified User Interfaces. In: Stephanidis C. (Ed.) User Interfaces for All - Concepts, Methods, and Tools. Mahwah, NJ: Lawrence Erlbaum Associates, 2001. Pp. 371-388.

[Stephanidis 2001b] Stephanidis, C. (ed.) (2001), "User Interfaces for All – Concepts, Methods and Tools", Mahwah, NJ: Lawrence Erlbaum Associates.

[Stephanidis 2009] Stephanidis C. Emerging Challenges. In: Stephanidis C. (Ed.) The Universal Access Handbook. Taylor & Francis 2009. Pp. 61-1 - 61-9.

[Streitz 2006] Streitz, N. A. From Human–Computer Interaction to Human–Environment Interaction: Ambient Intelligence and the Disappearing

Computer. In: C. Stephanidis and M. Pieper (Eds.) Universal Access in Ambient Intelligence Environments. Procs. of the 9th ERCIM Workshop on User Interfaces for All. Königswinter, Germany, 2006. Pp. 3-13.

[Vogel 2004] Vogel D., Balakrishnan R. Interactive Public Ambient Displays: Transitioning From Implicit to Explicit, Public to Personal, Interaction with Multiple Users. In: Procs. of the ACM Symp. on User Interface Software and Technology (UIST'04), 2004. Pp. 137–146.

[Camarinha-Matos 2011] Camarinha-Matos L. M., Rosas J. D6.1 Interim Roadmap for ICT and Ageing. BRAID European Project. http://braidproject.eu/sites/default /files/BRAID-D6.1final.pdf

[Rodriguez-Ascaso 2010] Rodriguez-Ascaso A., Zetterström E., BöckerM., Hüttenrauch H:, Pluke M., Schneider M. Inclusive E-Services for All: Identifying Accessibility Requirements for Upcoming Interaction Technologies. In Miesenberger K. et al. (Eds.): ICCHP 2010, Part I, LNCS 6179, pp. 135–138. Springer, Berlin, 2010.

[van den Broek 2010] van den Broek G., Cavallo F., Odetti L., Wehrmann C. (eds.) AALIANCE Ambient Assisted Living Roadmap. IOS Ppress, 2010.

[ETSI EG 202 848-2011] Human Factors; Inclusive eServices for all: Optimizing the accessibility and the use of upcoming user-interaction technologies. ETSI EG 202 848 V1.1.1, 2011. http://www.etsi.org/deliver/etsi_eg/202800_202899/202848/01.01.01_60/eg_202848v010101p.pdf

[EC 2007] European Commission. Accelerating the development of the eHealth market in Europe. Luxembourg: Office for Official Publications of the EC. 2007. KK-70-07-022-EN-C. http://ec.europa.eu/information_society/activities/health /docs/publications/lmi-report-final-2007dec.pdf

10.1 Further readings

[Ahonen 2008] Ahonen P., Alahuhta P., Daskala B., Delaitre S., De Hert P., Lindner R, Maghiros I., Moscibroda A., Schreurs W., Verlinden M. Dark scenarios. In: Safeguards in a World of Ambient Intelligence. The International Library of Ethics, Law and Technology, Vol. 1, 2010. Pp. 33-142.

[Ferscha 2006] Ferscha, A., Resmerita, S., Holzmann, C. Human Computer Confluence. In C. Stephanidis and M. Pieper (Eds.) Universal Access in Ambient Intelligence Environments. Procs. of the 9th ERCIM Workshop on User Interfaces for All. Königswinter, Germany, 2006. Pp. 14-27.

[ISTAG 2001] IST Advisory Group. "Scenarios for ambient intelligence in 2010" Final Report. Compiled by K. Ducatel, et al. Feb-2001. EC. Brussels, 2001.

[Klironomos 2006] Klironomos I., Antona M., Basdekis I., Stephanidis C. Promoting Design for All and e-Accessibility in Europe. Universal Access in the Information Society, 5(1), 2006. Pp. 105-119.

[Murugesan 2006] Murugesan, S. Understanding Web 2.0. IT Professional 9(4), 2006. Pp. 34-41.

[Roe 2006] Roe, P. (Ed.) Towards an Inclusive Future: Impact and Wider Potential of Information and Communication Technologies. COST219ter, Brussels, 2006.

[Savidis 2010] Savidis, A., Stephanidis, C. A unified software architecture for user interface adaptation. In: C. Stephanidis (Ed.) The Universal Access Handbook. CRC Press, 2010. Pp. 21-1/21-17.

[Stephanidis 1998] Stephanidis C., Akoumianakis D., Sfyrakis M., Paramythis A. Universal accessibility in HCI: Process-oriented design guidelines and tool requirements. In: Stephanidis C., Waern A. (Eds.) Procs. of the 4th ERCIM Workshop on User Interfaces for All, 1998. [http://ui4all.ics.forth.gr/UI4ALL-98/proceedings.html]

[Stephanidis 1999] Stephanidis, C., Salvendy, G., Akoumianakis, Arnold, A, D., Bevan, N., Dardailler, D., Emiliani, P. L., Iakovidis, I., Jenkins, P., Karshmer, A., Korn, P., Marcus, A., Murphy, H., Oppermann, C., Stary, Tamura, H., Tscheligi, M., Ueda, H.,G., Weber, G., Ziegler, J. Toward an Information Society for All: HCI challenges and R&D recommendations. International Journal of Human-Computer Interaction, 11(1), 1999. Pp. 1-28

ANNEX I

Agenda of SDDP co-laboratory in San Sebastian

Tuesday 28th of June 2011

Time	Structured Dialogic Design Process
09:00 09:30	**Welcoming addresses:** Patrick Roe **Overview of day's events by local Coordinator:** Julio Abascal Overview of SDD Process by Yiannis Laouris **Introduction Round**
09:30 10:00	**Presentation: Framing of the problem, context situation and Triggering Question by Patrick Roe**
10:00 11:00	**TQ** Defining the *vision/problématique* **Idea Generation**
11:00 11:15	***Coffee break***
11:15 13:00	**TQ** Defining the *vision/problématique* **Idea Clarification and clustering**
13:00 15:00	***Lunch at the hotel***
15:00 16:30	**TQ** Defining the *vision/problématique* **Clustering – voting**
16:30 16:45	***Coffee break***
16:45 18:30	**TQ** Defining the *vision/problématique* **Structuring**
18:30 20:00	
20:00	***Dinner: TBA Group dinner in Golf Basozabal restaurant, by invitation of Vicomtech [http://www.vicomtech.es/ingles/html/IK4/index.html]***

Wednesday, 29th of June 2011

Time	Structured Dialogic Design Process
09:00 11:00	**TQ** Defining the *vision/problématique* **Structuring**
11:00 11:15	***Coffee break***
11:15 13:00	**TQ** Defining the *vision/problématique* **Structuring (continues)**
13:00 15:00	***Lunch at hotel***
15:00 16:30	**TQ** Defining the *vision/problématique* **Discussions of Road-Map and presentation of individual interpretations**
16:30 16:45	***Coffee break***
16:45 18:30	**Strategy generation and planning of next steps**
18:30	***End of session***
20:00	***Dinner: TBA Group dinner in Saizar Sagardotegia restaurant [http://www.sidrassaizar.com]***

CARDIAC

ANNEX II

Local arrangements for SDDP2 meeting in Donostia-San Sebastián

Some suggestions for practical arrangements can be found in: http://sipt07.si.ehu.es/Cardiac/DIF/.

Donostia-San Sebastián

Tradition and modernity go hand in hand in this "small" big city with touches of the Belle Époque (Golden Age) that has a top-flight cultural agenda with its international film and jazz festivals and its first-class cultural programme. More than that, San Sebastian is the world capital of the *pintxo*. Gastronomy rivals nature as the most attractive feature of this city that's world famous for its cuisine and chefs, and boasts 16 Michelin stars.

Official website for tourism in San Sebastian: http://www.sansebastianturismo.com/info/sansebastianturismo/turismo_ss.nsf/fwHome?ReadForm&idioma=ing&id=T430632

Reaching Donostia

From San Sebastián (EAS) airport

San Sebastián airport is located in Hondarribia at about 26 km from San Sebastián (You can see here the way from Hondarribia to San Sebastián). It receives flights from Madrid and Barcelona.

By Bus: Company: INTERBUS-IPARBUS. Line I-2 San Sebastián (Plaza Guipuzkoa) - Aeropuerto (Hondarribia) Direct in 30 minutes. 1.9 €. See here the timetable

By Taxi: Taxi lane is in front of the terminal A ride to Donostia-San Sebastián costs about 30 €

Private transfer from San Sebastián Airport to the hotel in San Sebastián: The transfer from San Sebastián Airport to the hotel in San Sebastian (in a Mercedes E class, with driver) costs 29 € (up to 4 people). Suital Company. Form to book the transfer: http://sipt07.si.ehu.es/Cardiac/DIF/SUITAL_Transference_Form.doc

From Bilbao (BIO) airport

Bilbao airport is located in Loiu at about 100 km to Donostia-San Sebastián (You can see here the way from Bilbao Airport to San Sebastián)

Bilbao Airport-San Sebastián by bus: The direct service departs from the airport every day, once an hour, between 7:45 am and 11:45 pm (on Saturdays, Sundays and public holidays there is an additional service at 6:45 am). From San Sebastian, it departs every hour from 5:00 am to 9:00 pm. See the timetable. Customer assistance: 902 101 210

Bilbao Airport-Hotel in San Sebastián by private Transfer: The transfer from Bilbao Airport to the hotel in San Sebastian (in a Mercedes E class, with driver) costs 128 € (up to 4 people) Suital Company. Form to book the transfer: http://sipt07.si.ehu.es/Cardiac/DIF/SUITAL_Transference_Form.doc

From Biarritz (BIQ) airport

The Airport of Biarritz-Anglet-Bayonne is located in La Negresse, at about 53 km from San Sebastián. (You can see here the way from Biarritz Airport to San Sebastián)

Biarritz Airport to San Sebastián by taxi and train: 1. Take a taxi to Biarritz railway station (About 10€). 2. There take a train to Hendaye. 3. In Hendaye take the local train (known as "Topo") to San Sebastián (22 Km.) run by "Eusko Tren" Company. The station is located just next to Hendaye railway station. Services to Donostia-San Sebastián every 1/2 hour. The journey lasts about 45 min. 4. In Amara railway station (San Sebastián), take a taxi to your hotel (about 10€)

Biarritz Airport to the hotel in San Sebastián by private transfer: The transfer from Biarritz Airport to the hotel in San Sebastián (in a Mercedes E class, with driver) costs 83 € (up to 4 people). Suital Company. Form to book the transfer: http://sipt07.si.ehu.es/Cardiac/DIF/SUITAL_Transference_Form.doc

Hotel

The Barceló Costa Vasca**** hotel is located in the residential district of Ondarreta, in San Sebastián , near the beach which happens to have the same name as the hotel and next to the Miramar Palace gardens. The hotel has an outdoor swimming pool with a garden (open in summer), spacious facilities and a welcoming atmosphere. A visit to Donostia-San Sebastián is a must, together with its beaches, hills, museums... and so is pursuing your favourite sports or relaxing in the city's marvellous spas. The hotel has been awarded with the Q Tourism Qualilty Certificate. Barceló Costa Vasca. Avda. Pío Baroja, 15. 20008. San Sebastián. http://www.barcelocostavasca.com.

Hotel Reservation Form for invited experts (experts are expected to stay from June 27 to 29, at least):

http://sipt07.si.ehu.es/Cardiac/DIF/Cardiac_HotelBookingFormGuests.doc

Hotel Reservation Form for CARDIAC Members (Cardiac members are expected to stay from June 26 to 29, at least)

- http://sipt07.si.ehu.es/Cardiac/DIF/Cardiac_HotelBookingFormMembers.doc