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D2.1 – The needs of industry and future technologies landscapes and the resultant requirements for the graduate profile: update

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Abstract:
This report presents current and future technology landscapes that can be affected by design for all in the field of ICT, and how these landscapes can affect the future graduate profile. It also presents an overview of current industry awareness about the topic, and a summary of the industry needs.

Keywords: Design for All, industry needs, graduate profile, curriculum.

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1 Executive Summary

This document describes the needs of the ICT industry to comply with Design for All for social, economic and/or legal reasons. It first attempts to describe a number of recent or emerging interaction technologies that can be affected by the incorporation of Design for All: accessibility guidelines and APIs, device independence, user and device profiles, the Semantic Web and metadata, and multimodality. The next section discusses the industry's awareness and knowledge (or lack of it) about DfA. On the one hand it enumerates reasons (whether good or bad) for not applying DfA, on the other hand it presents a few major industry players who have supported DfA for many years. The next section delves deeper into the needs of the industry. It discusses the industry's criticism of existing legislation, policies and standards, what academia and the disability community can do to support them, how some companies implement DfA, issues of cost and market size, and the ideal profile of graduates and employees. The last section makes a few suggestions for organizations promoting DfA.

2 Introduction

The purpose of this document is to identify some technology landscapes that can influence the requirements for the graduate profile in the forthcoming years. The content of the deliverable reflects partially the brainstorming sessions of the first workshop organized by the network in Helsinki in February 2003, where industry and academia members exchanged experiences for two days. On top of it, we have added sections that aim to reflect problems faced by industry when adopting Design for All, extracted from network members experience, other projects and relevant publications.

It must be highlighted, that we are not aiming to identify the whole set of future needs of the ICT industry in general, as it lays outside the scope of the project, but to focus on the future needs of the ICT industry in the field of Design for All.

Design for All belongs to a group of design methodologies that try to cater for users with a wide range of qualities and capabilities. These methodologies could help to reduce the digital divide that exists between elderly people and people with disabilities on the one hand, and "information haves" on the other hand. Because Design for All takes these disadvantaged users into account, it is sometimes wrongly equated with design for the elderly or people with disabilities. However, this is only one of a number of reasons why the industry has not generally adopted Design for All. Few universities and high schools have integrated Design for All into their ICT curricula. It is still necessary to identify the core knowledge sets and skills, the components, the content and the appropriate educational methods for such curricula. Some of the findings in this report are based on publications about web accessibility, which can be seen as a subdomain of Design for All in ICT. In spite of the number of ideas and suggestions that came out of the workshop and the existing literature, only a small portion of these have direct relevance to curriculum development.

2.1 What is Design for All?

The term "Design for All" is similar to "Universal Design". The first term is more popular in Europe, the second one in the USA. Many definitions have been given to these terms. The Center for Universal Design at the North Carolina State University provides the following definition:

> Universal design is the design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design. (Ron Mace[1])

[1] http://www.design.ncsu.edu/cud/univ_design/ud.htm

The concept “Design for All” has given rise to many discussions, because designing a product or service that everybody would want to use seems an impossible task. As a consequence, new concepts, such as “inclusive design”, were introduced. “Inclusive design” is similar to “Design for All”, but the definition is less categorical with regard to potential users:

> [inclusive design is] the design of mainstream products and/or services that are accessible to, and usable by, as many people as reasonably possible on a global basis, in a wide variety of situations and to the greatest extent possible without the need for special adaptation or specialised design. (Quoted in Gill, 2003)

Other related terms are “barrier-free design”, “lifespan design” and “accessible design”. Some accessibility experts stress that “usability is also an important aspect of accessibility” (Henry, 2002; p. 8), but this relation is problematic. During the first IDCnet workshop in Helsinki, one of the industry experts questioned the connection between usability and Design for All, saying that some mechanisms related to usability are not compatible with Design for All. Another related concept is assistive technology. There is a debate over the question whether the design of assistive devices is part of Design for All or not, which in turn leads to the question whether it should be part of design curricula. Some experts consider this question as fairly insignificant as long as the needs of people with disabilities are taken into account in the design process (Abascal, 2003). For a full discussion of the terminology, see (Tahkokallio, 2001) and (Darzentas, 2003; Appendix 1).

The Design for All or Universal Design philosophy embraces a wide range of design artifacts, including the built environment and landscape architecture, biomedical and rehabilitation engineering. The Center for Universal Design has also formulated seven principles of universal design that are often quoted on web sites.[2]

2.2 Why Design for All?

The ICT market is changing so fast that ten years are considered as an eternity. It is essential for companies to be sensitive to changes and to be able to react quickly. Besides the highly publicised globalisation of markets, they also have to take into account the ageing of the population and the increasing respect for the diversity of consumers and their needs.[3]

[2] Available at: http://www.design.ncsu.edu/cud/univ_design/princ_overview.htm.
[3] Other discussion of reasons for or advantages of Design for All can be found on http://www.edf-feph.org/en/policy/is/is_pol_co.htm#design and http://www.design-for-all.info/16890449,16890459.xml.

The ageing of the population in developed countries is a very important factor. The numbers published by the I~Design project[4] about the situation in the United Kingdom are an excellent eye-opener:

> The aging population is growing inexorably. By 2020, almost half the adult population in the UK will be over 50, with the over 80's being the most rapidly growing sector. With age comes an increasing divergence of physical capability. It will become increasingly important for industry to ensure that employees' working lives are not curtailed simply because of an inaccessible work-place. Avoidable premature medical retirement costs many large companies in excess of $200,000,000 per year, but not many companies are aware of the extent of this cost. (...)
>
> New technology and products being developed by industry have the potential to improve quality of life and make working easier. However unless the technology is made available to everyone, then it also has the opportunity to alienate, so need to be as inclusive as possible. Many products continue to be designed to appeal to the younger generation and the lucrative, and growing, older market sector is being ignored. Consequently, large sections of the population are being excluded by industry attitudes. For example, of the FTSE 100 companies (the 100 largest companies traded on the London Stock Exchange) only 37% aim to produce products for the over-50's; 31% take end-user age into consideration when designing a new product or service; 29% agreed that aging will affect how they run as companies; and only 18% employ significant numbers of over-50's (Keates, Lebbon & Clarkson, 2000).

Until now, people with disabilities have relied on assistive technologies to access information and communication technologies (see http://www.abilityhub.com/ for an overview of these technologies). Most of these technologies are expensive and they are an additional cost on top of the mainstream products that everyone else uses. By applying Design for All to mainstream products and making them usable for the disabled and elderly, many additional costs may be avoided. However, there are a number of specially designed technologies (for example for Braille output) which can probably not be replaced by mainstream products. Some people expect that, as more Designed for All mainstream products become available, the market for these specialised technologies will shrink (Engelen, 2002).

Knut Nordby uses the usability pyramid as a metaphor to illustrate the role of Design for All (Nordby, 2003).

[4] http://www.hhrc.rca.ac.uk/programmes/designage/i~design/

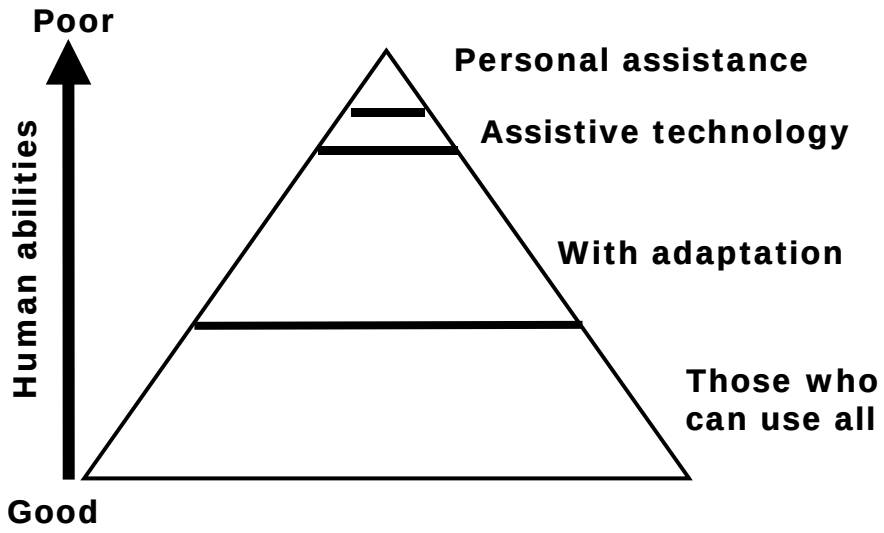

Figure 1 The usability pyramid

This pyramid represents all users of ICT products and services, with human abilities along the vertical axis, from good at the bottom to poor at the top. There is a wide base of users who can access all ICT products and services directly. Above that is a smaller section of users who can access products and services with some form of adaptation. Above this is a much smaller section of users who need some form of assistive technology. The small section at the top of the pyramid represents users who need personal assistance to access ICT products and services.

The main goal of Design for All is "to push the boundary between 'Those who can use all' and 'With adaptation' as far up as possible" (Nordby, 2003):

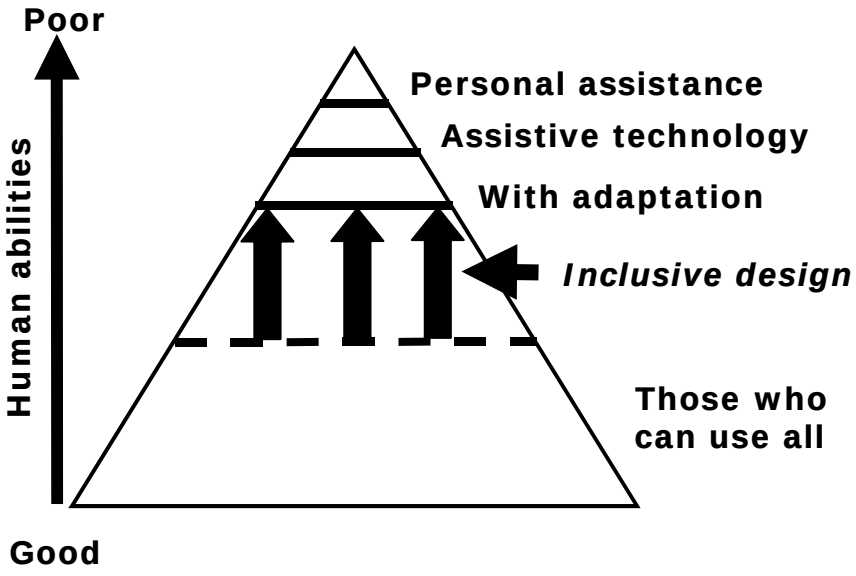

Figure 2 Inclusive Design

The general public sees disability as an attribute of a person that may be either congenital or the result of ageing, a disease or an accident. This view is too static. As Poulson and Waddell (2001) have pointed out

> disability is situation-specific. Disability is not an attribute of the individual - it is the product of the interaction between the individual and their environment. For example, someone who uses a wheelchair may be 'disabled' amongst a group of individuals climbing a mountain but perfectly 'able' amongst that same group of individuals sitting round a table having a discussion. For someone with profound hearing loss the situation may be totally the reverse. (Poulson & Waddell, 2001, p. 144.)

If we accept that disability is situation-specific, it becomes clear that Design for All does not only benefit “people with disabilities”. Several examples from the built environment and transportation illustrate this point. Curb cuts, for example, do not only benefit people in wheelchairs, but also parents pushing prams, people with heavy luggage and roller-skaters. Low-floor buses help everyone to get on the bus faster, and make bus stops shorter. Related to this is the fact that many people who can benefit from Design for All, for example elderly computer users with limited vision, don't think of themselves as having a disability.

3 Future Technology Landscapes

Within this section, we will try to outline briefly some technology landscapes that can be affected by the incorporation of Design for All in the process.

When describing future technology landscapes that can be influenced by Design for All, it is obvious that we must deal with interaction technologies, either at the software level, or at the hardware level.

In the latter, DfA must cope with the fact that the new devices that allow access to Information and Communication Products, Systems and Services are becoming smaller to support the "mobile" user (mobile phones or PDAs[5]). Therefore, this landscape demands:

- Incorporating DfA in the industrial design process, e.g.:
  - buttons design,[6]
  - handsets and displays (already tackled by some manufacturers like Nokia[7]), and
  - keyboards and keypads (see e.g. the Fastap Keypad[8]).
- Designing new multimodal interaction paradigms and interfaces to facilitate to people with special needs access via:
  - sensor-based interaction (see e.g. the IPCA project[9]), that can include EMG, skin conductance and motion biofeedback sensors;
  - speech-input technology able to cope with speech dysfunctionalities in the voices of users;
  - improvement of existing eye-tracking and gesture tracking technologies.

In regard to software-related technologies, we will describe in the following sections some relevant developments.

3.1 Design for All and the Web Accessibility Guidelines

Since Section 508[10] came into force in the USA, there has been a growing awareness of web accessibility. However, Design for All encompasses much more than web accessibility and e.g. the Web Content Accessibility

[5] Usability and Accessibility of PDAs in Education. Available at: http://www.techdis.ac.uk/PDA/front.htm
[6] John Gill, "Which button?". Available at: http://www.tiresias.org/controls/index.htm
[7] http://nokiaaccessibility.com/
[8] http://www.digitwireless.com/accessibility.html
[9] Intelligent Physiological Navigation and Control of Web-based Applications (IST-2001-37370): http://www.ipca.info/
[10] http://www.section508.gov/

Guidelines. First, the web application paradigm is not only used for public web sites, but also for e-learning applications, content management, document management and knowledge management systems. Second, not all information is available in HTML format; other formats, such as Microsoft's Office formats and Adobe's Portable Document Format (PDF), should also be accessible. Finally, ICT encompasses much more than web applications: there are also desktop applications, and a growing variety of other applications that run on smaller devices such as cell phones and PDAs. Desktop applications written in C++, Visual Basic or Java require that the programmer uses specific libraries or methods to make them accessible, and even when they are accessible they are not necessarily user friendly.

In this regard, we must consider not only general software accessibility (Bergman and Johnson, 1995) but OS accessibility issues as key parts of the technologic landscape:

- Microsoft Active Accessibility, Version 2.0 (MSAA). Set of tools of interfaces developed by Microsoft for software developers and AT vendors.[11] MSAA was released in 1997 and is integrated in Windows 98 and Windows 2000 and more recent versions. MSAA is a COM-based technology and designed primarily for C, C++ and Microsoft Visual Basic developers[12]. Microsoft provides an MSAA Software Development Kit (SDK). MSAA is not only a technology to be used by screen readers but also allows for third party manufacturers to provide information about an application and act as a MSAA server. Thus inaccesible applications with highly graphical contents can be made accessible (if keyboard access is provided).
- Macintosh Human Interface Guidelines.[13]
- GNOME Accessibility Project[14]. The GNOME project provides a fully Open Source desktop environment for XFree86 (the Open Source graphics engine for GNU/Linux and Unix). GNOME 2 is designed with accessibility in mind, and the project gets strong support for this from Sun Microsystems (Smedley, 2003, p. 14-15) Several assistive technologies are available for GNOME: an on-screen keyboard (GOK: GNOME Onscreen Keyboard), a magnifier (GMag), a screen reader (Gnopernicus) and others. The GNOME project has also published a “GNOME2 Desktop Accessibility Guide”[15]. GNOME's

[11] http://msdn.microsoft.com/library/default.asp?url=/library/en-us/msaa/msaastart_9w2t.asp?frame=true
[12] The Assistive Technology group at the University of North Carolina-Chapel Hill provides some information on using the MSAA library in the Python programming language: http://www.cs.unc.edu/Research/assist/msaa.shtml.
[13] http://www.devworld.apple.com/techpubs/mac/HIGuidelines/HIGuidelines-2.html
[14] http://developer.gnome.org/projects/gap/
[15] http://www.gnome.org/learn/access-guide/2.0/

Usability Project published version 1.0 of its Human Interface Guidelines in August 2002[16].

- KDE Accessibility[17]. KDE is a desktop environment for X11 that predates GNOME. The look and feel of KDE has been said to be more consistent than GNOME's (e.g. by Petreley, 2003), but in early 2003 its accessibility project seemed less advanced than GNOME's. In March 2003, the KDE project released version 1.0 of its accessibility aids, which include a for configuring pointing devices (KMouseTool), a magnifier (KMag) and a program that lets a computer speak (KMouth, which does not yet contain a speech synthesizer).
- Java Accessibility.[18] This covers several areas. The Java Accessibility API is a part of the Java Foundation Classes (JFC) since Java 1.2 and "defines a contract between individual user-interface components that make up a Java application and an assistive technology that is providing access to that Java application"[19]. The Java Accessibility API facilitates the creation of accessible applications with little extra effort and without much knowledge of assistive technologies or disabilities. The Java Access Bridge[20] is a bridge between the native environment of assistive technologies and the Java Accessibility support available from within the Java Virtual Machine. The Java Accessibility Utilities enable assistive technologies to access Java applications that implement the Java Accessibility API. They can also help developers to check the accessibility of a user interface. IBM has published a long and detailed document on developing accessible Java applications[21]. Sun also hosts a Java-access mailing list[22].

3.2 Device independence

The Web Accessibility Initiative (WAI[23]) of the Word Wide Web Consortium also links accessibility with device-independence. According to the Web

[16] http://developer.gnome.org/projects/gup/hig/
[17] http://accessibility.kde.org/
[18] Java Accessibility: http://java.sun.com/j2se/1.4.1/docs/guide/access/index.html, Developing Accessible JFC Applications: http://www.sun.com/access/developers/developing-accessible-apps/, How to Support Assistive Technologies (The Java Tutorial): http://java.sun.com/docs/books/tutorial/uiswing/misc/access.html.
[19] http://java.sun.com/products/jfc/jaccess-1.2.2/doc/guide.html.
[20] Java Access Bridge For Windows Operating System: http://java.sun.com/products/accessbridge/. The GNOME Accessibility Project also addresses the accessibility of Java applications; see http://wwws.sun.com/software/star/gnome/accessibility/generalfaq.html#0q5 and http://wwws.sun.com/software/star/gnome/accessibility/architecture.html.
[21] IBM Guidelines for writing Applications Using 100% Pure Java: http://www-3.ibm.com/able/snsjavag.html.
[22] http://swjscmail1.java.sun.com/java-access.html
[23] http://www.w3.org/WAI/

Content Accessibility Guidelines 1.0 “device-independent access means that the user may interact with the user agent or document with a preferred input (or output) device — mouse, keyboard, voice, head wand, or other.” (Chisholm, Vanderheiden & Jacobs, 1999) Device independence is also supposed to facilitate the reuse of content for newer types of devices, such as the wireless devices that are used in different circumstances and have different possibilities than computers. However, it has been pointed out that defining accessibility from the point of view of device-independence can lead to conflicts with the needs of people with cognitive and learning disabilities. For this type of users, textual display, as a device-independent form, may be less accessible than visual display (Torenvliet, 2003). Also, while the needs of wireless devices are being addressed quite rapidly, designers continue to ignore the needs of people with disabilities (Milliman, 2002).

There is at least one success story of accessibility and device independence: in 1999, http://www.optavia.com was designed with accessibility and usability in mind, but without considering the possibility of access by new devices. In 2001, Optavia’s president accessed the web site with a web-enabled mobile phone and was delighted to find that that the implementation of the accessibility guidelines also made the site work on a web phone (Henry, 2002; p. 18).

Also the World Wide Web Consortium has initiated activities in the Device Independence Activity[24] geared towards seamless access to the web and authoring.

3.3 User and Device Profiles

Users today access Information Services with a variety of devices and with different interaction modes that depend on personal characteristics (including disabilities) and on the context of usage. With the appearance of mobile devices, the industry has focused its efforts on the standardization of device characteristics thus giving to information providers some content adaptation facilities.

The Composite Capabilities/Preference Profiles framework (CC/PP; Klyne et al., 2003), offers the possibility to define user and device profiles for an adequate adaptation of content and presentation for Internet services. CC/PP is based upon RDF (Resource Description Framework; Lassila and Swick, 1999) a general-purpose metadata description language. RDF provides the framework with the basic tools for both vocabulary extensibility, via XML namespaces, and interoperability. RDF can be used to represent entities, concepts and relationships in the web. So far, industry effort is focused on the development of device profiles, like UAProf or User Agent Profile, by the Open Mobility Alliance (formerly the WAP-Forum) and targeted to mobile devices.

[24] http://www.w3.org/2001/di/

However, research efforts are active to complement device profiling with user profiling, providing a complete framework able to tackle accessibility issues (Velasco et al., 2004).

3.4 Semantic Web and Metadata

Since its invention, the web has been growing at an initially unexpected rate, based upon HTML.[25] However, the semantic capabilities of HTML are very limited and do not allow to define and classify information, thus making searching and data-mining difficult. Therefore, one of the key activities in the future is related to the Semantic Web, in which XML[26] and RDF[27] play a key role.

The Semantic Web Activity of the World Wide Web Consortium[28] defines it in the following way:

> The Semantic Web is the representation of data on the World Wide Web. It is a collaborative effort led by W3C with participation from a large number of researchers and industrial partners. It is based on the Resource Description Framework (RDF), which integrates a variety of applications using XML for syntax and URIs for naming.
>
> "The Semantic Web is an extension of the current web in which information is given well-defined meaning, better enabling computers and people to work in cooperation." (T. Berners-Lee et al., 2001)

The Semantic Web is also related to the existence of Metadata, Ontologies and Topic Maps.

According to Merriam-Webster, an ontology "is a particular theory about the nature of being or the kinds of existents." This rather philosophical definition can be extended to the web:

> Ontology is the theory of objects and their ties. The unfolding of ontology provides criteria for distinguishing various types of objects (concrete and abstract, existent and non-existent, real and ideal, independent and dependent) and their ties (relations, dependences and predication).

Based on RDF, the DARPA Agent Markup Language + Ontology Inference Layer (DAML+OIL[29]) provides a basic infrastructure that allows a machine

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[25] "HTML 4.01 Specification", W3C Recommendation, D. Raggett, A. Le Hors, I. Jacobs (eds.), 24 December 1999. Available at: http://www.w3.org/TR/html401/

[26] "Extensible Markup Language (XML) 1.0 Specification (Second Edition)", T. Bray, J. Paoli, C. M. Sperberg-McQueen, E. Maler (eds.), 6 October 2000. Available at: http://www.w3.org/TR/REC-xml

[27] Resource Description Framework (RDF) Model and Syntax Specification, Lassila O., Swick R. (eds.), World Wide Web Consortium. 22 February 1999. Available at: http://www.w3.org/TR/REC-rdf-syntax/.

[28] http://www.w3.org/2001/sw/

to make the same sorts of simple inferences that human beings do. A set of DAML statements by itself (and the DAML specification) can allow to deduce another DAML statement whereas a set of XML statements, by itself (and the XML specification) does not allow to deduce any other XML statements. To employ XML to generate new data, knowledge embedded in some procedural code somewhere is needed, rather than explicitly stated, as in DAML. DAML was combined with a similar effort in this space more targeted to the web environment, Ontology Interchange Language (OIL), to form DAML+OIL.

Building upon the foundations of the DAML+OIL specification, the W3C Web Ontology Language (OWL) "is intended to provide a language that can be used to describe the classes and relations between them that are inherent in web documents and applications."

The Topic Map Standard "provides a standardized notation for interchangeably representing information about the structure of information resources used to define topics, and the relationships between topics. A set of one or more interrelated documents that employs the notation defined by this International Standard is called a 'topic map'. In general, the structural information conveyed by topic maps includes:

1. groupings of addressable information objects around topics (occurrences)
2. relationships between topics (associations)

A topic map defines a multidimensional topic space - a space in which the locations are topics, and in which the distances between topics are measurable in terms of the number of intervening topics which must be visited in order to get from one topic to another, and the kinds of relationships that define the path from one topic to another, if any, through the intervening topics, if any."

Topic maps were first formalized by the International Organisation for Standardization (ISO) as ISO 13250, based on SGML and HyTime. An adaptation to XML is being defined as XML Topic Maps (XTM).[30]

Metadata is machine understandable information for the web. The acknowledged authority in this area is the Dublin Core Metadata Initiative,[31] where several documents and references are available.

[29] http://www.daml.org/language/
[30] http://www.isotopicmaps.org/ and http://www.topicmaps.org/xtm/index.html.
[31] http://dublincore.org/

3.5 Multimodality

> "The most profound technologies are those that disappear. They weave themselves into the fabric of everyday life until they are indistinguishable from it." (Mark Weiser, 1991)

The research on Multimodal Interaction (MMI) aims at improving human-machine interaction by exploiting multiple modalities (gesture, speech, hearing, vision, touch) using the five human senses, and in many cases imitating the natural interaction between human beings. Researchers and designers are typically interested in developing new technologies for, e.g., gesture recognition, gaze tracking, force feedback applications or sonification.

Multimodal interfaces aim at integrating several communication means in a harmonious way and thus make computer behaviour closer to human communication paradigms, and therefore easier to learn and use.

In February 2002, the World Wide Web Consortium set up the Multimodal Interaction Activity[32] to develop specifications that will extend the web user interface to allow multiple modes of interaction. The Multimodal Interaction working group will collaborate with other working groups, including the Voice Browser working group, which has already worked on requirements for multimodal interaction[33]. The industry has submitted several specifications to the World Wide Web Consortium for consideration by the Multimodal Interaction working group. They include XHTML+Voice[34], SALT (Speech Application Language Tags)[35] and InkML[36].

It is beyond the reach of this deliverable to do a thorough review of all the relevant activities in this area. As an interesting starting point, we refer the reader to this compilation of ongoing and finished research activities:

http://www.dcs.gla.ac.uk/~ramesh/MultiVisResource.htm

3.6 User Interface Design and the Software Development Process

3.6.1 The Software Development Process

User interface design, interaction design, user-centered design or inclusive design is always part of a larger process: a software or hardware development process. This development process is sometimes called a design method or a design methodology. The emergence and evolution of software development processes and software engineering is primarily a response to the so-called software crisis. The software crisis refers to the

[32] http://www.w3.org/2002/mmi/
[33] http://www.w3.org/TR/multimodal-reqs
[34] http://www.w3.org/TR/xhtml+voice/
[35] http://www.saltforum.org/downloads/SALT1.0.pdf
[36] http://www.w3.org/2002/08/InkXML/

problem of producing systems on schedule and to specification. According to W. Wayt Gibbs' much-quoted statistics *(Gibbs, 1994)*:

- the average software development project takes 50% longer than planned;
- approximately 75% of all large projects are “operating failures”;
- one quarter of large projects are cancelled.

Over the last thirty years, there have been many attempts to make software development more controllable: new programming languages, modelling languages, programming paradigms (e.g. object orientation), tools and development processes. According to Dianna Mullet, the two major causes of the software crisis are the following:

- Software development is seen as a craft, rather than an engineering discipline.
- The approach to education taken by most higher education institutions encourages that “craft” mentality. *(Mullet, 1999)*

Developers work like craftsmen: they rely on techniques that cannot be measured or reproduced. Engineering, on the other hand, relies on reproducible, quantifiable techniques. The development of new techniques and methods, such as CMM (Capability Maturity Model), Merise, UML (Unified Modelling Language), MDA (Model-Driven Architecture) and UP (Unified Process), is sometimes compared to the development of theories and techniques for industrial production in the 19th century (Fordism, Taylorism, …). In this industrial vision of software development, each person has a specific role in a production chain *(Chabrier, 2003)*. This evolution is mainly driven by the urge to create robust, reliable and maintainable software, not by the need to produce software that is accessible or easier to use. Handbooks on software engineering devote little to no attention to interaction design or user-centered design, even though they recognise that to satisfy the user's needs, it is important to create a shared understanding of the problem being solved.

There are several reasons why software and other ICTs are often difficult, unpleasant to use and inaccessible:

- There is no “repeatable, analytical process for transforming an understanding of users into products that both meet their needs and excite their imaginations” *(Cooper & Reimann, 2003)*.
- In many projects, especially smaller ones, engineers cannot work with a professional designer or obtain help from one, and must design user interfaces on their own. Sometimes, they need to take on other responsibilities (information architect, database administrator, project manager, trainer, …) and become the proverbial “Jack of all trades and master of none”. However, as

> Cooper and Reimann have pointed out, the people who build products must never be the people who design them. This combination of roles leads to choices between ease of use and ease of coding, and since programmers are typically judged by their ability to code efficiently and meet tight deadlines, these choices have a negative impact on the user interface.

- Sometimes user interface design is seen as a process that can be seperated from specification of functions instead of an essential part of the development process. In the worst case, software engineers believe in the "peanut butter theory" of user interface design, in which usability or accessibility is seen as "a spread that can be smeared over any design, however dreadful, with good results if the spread is thick enough" (Appendix M of *Lewis & Riemann, 1994*).

- Some development processes ignore user interface design or force it into a waterfall model instead of an iterative model. (See for example David Anderson's comments on UML and the Rational Unified Process in *Anderson, 1999* and *Anderson, 2000*.)

- Most textbooks on software engineering make only a passing reference to user interface development; for user interface development methods (User-Centered Design, Unified User Interface Development, OVID, …), engineers have to be aware of research on these subjects.

- Some software engineers think that user interface design can be included in the "design" phase (design in the sense of modelling the architecture, data structures and the internal interactions) or in the requirements phase: the decision is a question of preference (e.g. *Braude, 2001*, p. 151). However, the user interface should be considered from the early stages of development, so it must not be postponed until after the requirements phase.

- Tools for building interfaces, e.g. Microsoft Visual Studio, Borland JBuilder, NetBeans IDE, are praised for speeding up development and driving down costs, but they also enshrine existing models and thus limit the possibilities to a great extent *(Raskin, 2000)*.

According to Mullet, computer science education in most institutions teaches a "product orientation" rather than teaching software engineering skills: students are concerned with the final outcome of their assignments (does the program run efficiently, does it use the best possible algorithm?), while the focus should be on the process:

> The focus should be on the complete process from beginning to end and beyond. Product orientation also leads to problems when the student enters the work force–not having seen how processes affect the final outcome, individual programmers tend to think their work from day to day is too "small" to warrant the

> application of formal methods. To become effective software engineers, students must be taught how the process and product interact. They need to see how a good process repeatedly results in a good product. Software process engineering, is, unfortunately, not taught until very late in a computer science student's academic career (usually in graduate school), or in company sponsored classes on the job. *(Mullet, 1999).*

In addition, the education of software engineers should also include methods for testing. Such testing methods should address

- participation of heterogeneous user groups,
- functionality testing with assistive devices such as screen readers,
- full keyboard support according to CUA, Motif or Microsoft guidelines,
- (semi-)automatic validation methods according to guidelines such as WCAG 1.0.

3.6.2 Accessibility versus Usability

Accessibility can be seen as a subset of a more general goal: usability. For example, in the context of web development, important elements of usability are *(Henry, 2002)*:

- the extent to which first time visitors can use the site effectively (learnability),
- the extent to which visitors can remember how to use the site (memorability),
- the extent to which visitors can navigate the site, understand the content and determine what to do next (effectiveness),
- the time visitors need to reach their goals (efficiency), and
- how visitors feel about using the site and if they will use it again (satisfaction).

However, many designers and developers were introduced to accessibility as a consequence of legislation, and their focus is often limited to meeting standards and guidelines.

Many websites claim to be "accessible" but are very difficult to use for people who have a visual impairment. For example, it may be possible for a blind user to access all the text on a website, but the process of placing an order is so complicated that the shopper eventually gives up *(RNIB, 2002)*. This means that implementing the accessibility guidelines is not enough to ensure that people with disabilities can make full use of ICT. The inclusion of users with disabilities at every stage is a much better way

to ensure that the resulting product or service is both fully accessible to and usable by people with disabilities. However, some experts do not believe that there is a natural synergy between accessibility and usability. While Joe Clark sees only one area in web development where usability has a noticeable negative influence on accessibility and vice-versa (namely navigation), some usability experts do not believe it is possible to design a web interface that suits the needs of everyone. Research in user requirements shows that everyone does not want the same thing, and the "web experience should be delivered in the way the users want" (according to Catriona Campbell of The Usability Company). On the other hand, any interface should be consistent in its design: "When we start to offer interfaces that work in different ways we start to force different groups of people learn different ways of doing things. The aim should be to allow site users to do what ever they want while offering a user experience that is as consistent as possible" (Simon Norris of Nomensa; see *RNIB, 2002*).

4 Current Awareness and Knowledge of DfA in the Industry

The DASDA project[37] identified three major obstacles to a broad implementation of Design for All (*DASDA* Newsletter, November 2002):

- lack of awareness among users and suppliers;
- technical feasibility; and
- commercial viability.

4.1 Attitude - Lack of Awareness

While lack of awareness is no doubt an obstacle, research by the I~Design project suggests something more serious. Keates, Lebbon and Clarkson found a number of misconceptions concerning Design for All that may serve as arguments against it or that may lead to design that favours one disability while causing new problems for other disabilities.

The I~Design project wanted to examine the prevailing industry attitudes and identify the barriers to the uptake of Universal Design. In October 1999 the project was launched with a workshop with the aim to assess the level of industry awareness of the needs of the disabled and elderly communities and their openness to Design for All. There were over 150 participants with representatives from a wide range of companies, including: British Telecom, Virgin Atlantic Airways, Omron Corporation, NatWest Bank and Tesco (Keates, Lebbon & Clarkson, 2000).

> The initial stance of most of the industrial participants was that they were willing to implement Universal Design providing that it was either easy to do, or that a consultancy would do it for them, and providing that it did not increase the cost of the product or service. There did not appear to be widespread acceptance of the need for Universal Design training programs for designers or an appreciation of the potential increased market of more accessible products. The concept of 'undue burden' appeared to be anything that would cost more than the able-bodied version.
>
> Stereotyping was also a very common problem. The misconception that designing for universal accessibility was a code-word for designing for the elderly and disabled only, and that this represented designing for the institutionalized. There was little understanding of aging as a gradual process that creeps up on everyone. One transport company had claimed to have made most of their buses more accessible by including

[37] http://www.design-for-all.info/

> spaces for wheelchairs on the lower deck of their double-decker buses. This was perpetuating the image of someone who is physically impaired being a wheelchair user. A walking-stick user, however, commented that this measure actually made the buses less accessible to her and others like her, who outnumber the wheelchair users, because there were fewer seats downstairs, making it necessary for her to climb to the narrow, twisting stairs to the upper deck.
>
> However, encouragingly, there were also success stories to report. Tesco have redesigned their shopping trolleys to be shallower and more maneuverable. OXO have developed the highly acclaimed GoodGrips range of kitchen accessories. The success of these products shows that there is a demand for more accessible items, but industry is being slow to respond. The common thread behind these is that the drive has been top down, from the senior management, rather than from the bottom up, driven by designer knowledge and training. This suggests that the best way to encourage the uptake of Universal Design may be to persuade senior management of the need for it.
>
> However, awareness of the need to design for increased accessibility is not necessarily a guarantee that the goal will be achieved. In Rehabilitation Robotics, a field dedicated to design for the disabled, products have often failed because of lack of usability and accessibility (5). It is essential that designers are adequately equipped to implement Universal Design. In the second half of the I~Design workshop a number of design consultancies ran break-out sessions on designing products for the physically impaired. Those that were successful used empathic, user-centred approaches, such as design by story-telling and body-storming. Less successful were the groups who tried to design without any attempt at empathy with the end users.
>
> Other key results from the workshop included the importance of removing stigma from products designed to be more accessible. This is where both Tesco and OXO appear to have had the most success. By treating their designs as being simply more accessible mainstream products, rather than specifically developed for individual user populations, they have developed products that are genuinely more inclusive. (Keates, Lebbon & Clarkson, 2000)

The I~Design project also identified some common issues regarding inclusive design in the United Kingdom and the U.S. (Dong, Keates, & Clarkson, 2003):

- The perception that the adoption and implementation of inclusive design differs between large and small companies.
- Time and cost were regarded as the biggest constraints on adopting inclusive design.
- Most companies, whether large or small, preferred to refer to specialist organisations for support and information.
- Exemplars of good design were sought after by design practitioners as sources of inspiration.

There were also differences between the U.S. and the U.K: in the U.S. legislation was considered the most important factor which resulted in consideration of the needs of people with disabilities. However in the U.K. legislation is seen as only providing a basic platform. The study also identified a number of strategies to facilitate the adoption and successful practice of inclusive design, for example, better awareness of inclusive design, and better design tools, including more comprehensive statistical and market data.

Greg Lowney (Microsoft) has also given a short description of the barriers to the adoption of Design for All: “Business was uninterested due to low demand from the mainstream market (including employers), low visibility of the disability community as a market, and lack of formalized knowledge of the principles and benefits of accessible software design. The issue has gained prominence and we have published guidelines, but adoption is still slow because of demanding project schedules, and because the standardization called for often conflicts with the company's need to innovate in their user interface and in developing more efficient, customized implementations.” (Universal Design Discussion)

According to Professor Patricia Moore from Arizona State University, “Corporate America’s report card on inclusive design is not looking so good” (Moore, 2003). In a study of 125 companies to test their attitudes towards inclusivity in products and services, the companies’ web sites were sent a single consumer inquiry: “Do you offer universally designed products for older consumers or people with ability concerns.” Only 12 out of the entire sample made any mention of universality or accessibility on their web site. The question this study raised was “How can the consumer benefit or learn if they do not come across universal design on the web?” Moore’s study suggests that “universal design is again becoming narrowly defined in terms of accessibility and mobility – much of it tied to the ADA – rather than being part of a broader design approach.”

A number of major industry players, such as Apple, IBM, Microsoft and Sun, have been supporting Design for All for many years, and they use the terms “accessibility” and “Design for All” when they present their efforts in this area. Other companies, however, carefully avoid terms such as “barrier-free design” and “products for seniors” because of the stigma attached to them. Bosch, for example, prefers the term “easy to use”.

4.1.1 Legislation

> Industry acts in a playing field that has certain rules and those rules are set by society. Some playing fields are more regulated others less regulated – the telecoms playing field is very much regulated. Representatives of industry sometimes say, just tell us what the rules are and we will play by the rules as long as the rules are the same for everybody. (Lindström, 2001; p. 77)

The above quote, when taken out of its context, gives the impression that the industry is perfectly willing to implement Design for All and that all that is required is legislation. The necessity of legislation is also confirmed in a negative way by Osmund Kaldheim, Norway's Deputy Minister of Social Affairs. In an interview, he said that one of the reasons for bringing up anti-discrimination legislation in his country is “sheer despair and frustration at the fact that so little has been introduced so far” (Bendixen, 2002; p. 9).

Although legislation has a very strong awareness-raising effect, it is not always regarded as a good incentive. Ronald Milliman conducted a study on the accessibility of web sites in the private sector and asked web designers and web masters: “What incentives would work best for achieving compliance to accessibility standards?” The possible choices and their respective rates of response show that legal penalties are the weakest incentive of those that were suggested.

Table 1: Incentives for achieving compliance to accessibility standards (Milliman, 2002)

Incentive	Number	Percentage
Making non-compliance punishable by a substantial legal penalty	45	9.91
Only when it can be shown that compliance will result in noticeably larger website traffic	247	54.41
A government matching fund to help offset the costs	96	21.15
More education on "accessibility issues and how to make sites compliant"	66	14.54

Perrett cites an example of a company that “has an ambitious and developing strategy of service provision for disabled customers, but felt that the timing was perhaps not right, citing, amongst other things, uncertainty about the nature and extent of the legislative regime that will emerge from the Communications Bill” (Perrett, 2001; p. 51). Although his article is about telecoms and the example refers to a mobile supplier and the Communications Bill, it is conceivable that similar attitudes exist in the web domain and with laws that are relevant to web accessibility.

4.2 Technical Feasibility

Developers and designers are generally willing to take on a challenge, but there are few testimonials of their views on the technical feasibility of Design for All. The questionnaire used in Milliman's study did not even ask whether technical barriers were the cause of inaccessible web sites. An extreme view on the feasibility of Design for All was formulated by Christian Lindholm, Nokia's Director for User Interfaces:

> Design for All? There is no such thing! Could you imagine a pair of shoes being designed in such way that everybody would want to wear them? (Agergaard, 2000)

During the first IDCnet workshop in Helsinki, Klaus-Peter Wegge of Siemens said that in Germany, blind persons often use cell phones from Siemens (because of the sound cues), whereas persons with other visual impairments tend to use cell phones from Nokia (because of the readability of the screens). On the other hand, David Dzumba's presentation at the COST 219bis Conference in December 2001 shows that Nokia has made considerable efforts to improve the accessibility of a number of products. It is striking, however, that Dzumba uses the term "accessibility" instead of "Design for All" and that the term "inclusive design" figures only in the title of his presentation.

Sometimes, the guidelines or standards which must be implemented are considered too complex. For example, there are web masters who find the Web Content Accessibility Guidelines "too complex, too detailed and not accessible enough for their knowledge of the subject" (Graziani, 2001). Related to this problem is the difference between the tools and procedures for creating and maintaining web sites and those for removing accessibility barriers. There are many tools that enable authors and web developers to create and maintain web pages without knowledge of the underlying languages, but evaluation and repair tools are not as user friendly as authoring tools, the repair process cannot be automated and the tools require an adequate knowledge of the technical aspects (Graziani).

In the ICT field, companies are often dependent on other companies or communities that they cannot influence. For example, software manufacturers cannot influence the operating system (which is Microsoft Windows in most cases). Some have looked into the possibilities of Open Source software, because it is possible to influence it to some extent.

4.3 Commercial Viability

Design-for-All advocates sometimes portray design-for-all as cost-free, whereas many people in the industry see it as having extra costs in design resources that are hard to justify, both internally in the struggle for resources and externally in the market. "Would consumers see enough difference in value to pay an additional price? Even the perception of

additional cost was important for them [people from the industry] to manage." (Universal Design Research Project)

This contradiction suggests several issues: industry wants to know the real cost of design-for-all and find accurate figures on market size (figures are now available on different locations for different types of disabilities instead of one location for all the info). Perrett, by contrast, claims that companies have got statistics and information about the numbers and spending power of disabled people and about the numbers of disabled people who use telecoms (Perrett, 2001; p. 52).

> One thing that will drive industry to accept anything, whether it is Design for All or whatever, is money. There are two aspects to this. You have to try to bring it home to industry, looking at disability, for instance, that if they do it, they will make money. That is the business case. You also have to bring home to them the fact that if they don't do it, it will cost them money. And it will cost them money in two ways. One, in lost market share to the companies that actually do it and two, in terms of payment for litigation, as that must come. (Lindström, 2001; p. 76)
>
> There are two driving forces. Legislation is one and profit is another. It is not very interesting for a company to know that 10% or 20% of the population are disabled. They need more precise figures about a specific market such as 17–24 year olds, single or married, etc. They are focussed very precisely on these groups where they think they can earn a lot of money. One has to apply that philosophy also to the group of disabled people and then one will find that, unfortunately, the groups are not that large and the companies have to consider whether it is worthwhile from the economic point of view to make an investment, to conquer that little share. You have to educate people in the company, the marketing personnel, the people in the shops and everyone; it is a huge extra cost to do this. (Lindström, 2001; p. 77)

The I~Design project "seeks to promote Universal Design by providing industrial decision makers with mechanisms to: assess the market size for new products, based on the whole population as opposed to the young and able-bodied; offer designers the guidance required to design for these markets; and understand the significance of age and capability related factors." (Keates, Lebbon & Clarkson)

Chapter 2 of Joe Clark's *Building Accessible Websites* discusses a number of myths about accessibility, including its costs. He admits that accessibility is expensive.

> Yes, it is – for a large site and if you do it after the fact. Retrofitting always costs more, even at the level of adding a dimmer switch in your house. In all other cases, access may

> cost, but it is not necessarily expensive. In compensation, you gain a new audience. (Clark, 2003; p. 9)

Clark refers to the Sydney Olympics case, in which the Sydney Organizing Committee for the Olympic Games claimed that adding simple access features to its database-generated web pages would cost 2.8 million Australian Dollars. This figure is much higher than the tens of thousands of extra expenditures estimated by the expert witnesses. Building accessibility into the project from the beginning would have added 2% to the cost, according to the experts. However, many (most?) commercial web sites were not designed with accessibility in mind and will need retrofitting, unless the web masters of those sites postpone adding access features until the next big redesign. Clark points out that for every retrofitted page, the developer must evaluate the page's condition and make informed decisions to fix problems. This process is not easy and cannot be automated, but accessibility advocates are often hesitant to admit this (Clark, 2002; p. 339).

On the other hand, Clark points out that developers do many other things (custom-coding scripts, designing graphics and rollovers, creating animated GIFs, etcetera) without asking who benefits from it, but just because the client decided they were worth the money. “If you're willing to go to all that trouble, what's wrong with incorporating access techniques into your development cycle?” (Clark, 2003; p. 11)

In spite of the importance of commercial viability in the discussions quoted above, there have been cases where this issue was not a barrier. For example, when one of the departments of Nokia in the U.S.A. wanted to start its first accessibility initiative, top management was in favour of this, although there was no expectation of significant return-on-investment (Dzumba, 2001).

Some of the preceding paragraphs are about web accessibility, but it is reasonable to extrapolate some of the arguments to Design for All in general.

5 Needs of the Industry

During the Helsinki workshop, Klaus-Peter Wegge, who leads Siemens' Accessibility Competence Center, enumerated the characteristics of what he called “the battlefield of DfA”:

- incompatible definitions and terms,
- different and conflicting regulations,
- inconsistent standards and contradictory guidelines, and
- unnecessary certifications.

Some of these characteristics make operating on an international market difficult, some add to the price of the technology (certification), but the most important point is that none of these characteristics, in spite of all the good intentions, is beneficial to disabled persons.

5.1 Legislation

Recent years have seen a new awareness by the government and new laws. The USA are several years ahead of Europe, and the response of the industry to Section 255 and Section 508 provides some clues about the needs of the industry in Europe. For example, before Section 508 went into effect, industry were demanding to know what was available for them to learn how to comply (Kaplan, 2001; p. 44). They needed to know how Section 255 and Section 508 were going to be implemented and what the government was going to do to assist them to understand how to undertake implementation (Kaplan, 2001; p. 42).

Understanding the law is only part of the problem. American regulations differ from those in Europe, and there are differences between European countries. ICT products and services, however, are likely to be distributed or accessed across borders, so the industry would welcome harmonisation.

The Council of the European Union's Resolution on "eAccessibility" - improving the access of people with disabilities to the Knowledge Based Society (doc. 5165/03, 2-3 Dec 2002), under section II, paragraph 2, letter a, calls on the member states and invites the Commission "to consider the provision of an "eAccessibility mark" for goods and services which comply with relevant standards for eAccessibility"[38].

This idea is taken up by the recently established EuroAccessibility consortium[39] that aims at streamlining web testing procedures and unifying the way accessibility logos are attributed. On a longer term,

[38] http://register.consilium.eu.int/pdf/en/03/st05/st05165en03.pdf.
[39] http://www.euroaccessibility.org/.

EuroAccessibility also wishes to certify web-builders that have proven their ability to produce accessible websites.

With regard to web accessibility, it is possible to distinguish at least three types of policies (Brewer and Chuter):

- Governments can establish that individuals with disabilities have a right to certain kinds of information;
- governments can require that products or services sold within a country must meet certain criteria for accessibility;
- governments can require that information technologies and information services procured by entities such as government agencies must be accessible.

The first approach is more common; examples are Australia, Canada and the United States. Some governments combine the three approaches, e.g. in the United States. Legislation in Portugal specifically focuses on web accessibility.

The requirements for web accessibility can also differ: some governments reference the WAI guidelines generally, some specify the documents and the version number, and some write their own version of web accessibility guidelines. In Germany, for example, the Barrierefreie Informationstechnik Verordnung (Decree on Barrier-Free Information Technology) states that its guidelines are based on those formulated in the Web Content Accessibility Guidelines 1.0 published in 1999 (BITV). The most important difference is a reduction of the number of priority levels from three to two: in general, WCAG priority 1 and 2 have been combined into one level; WCAG priority 3 roughly corresponds to the second priority level in the German decree. An example of the first approach can be found in the eEurope2002 plan[40] which led to a “Council of the European Union” decision in December 2002[41].

The industry also criticizes how laws are enforced. There are several aspects to this. Firstly, legislation should be more general than particular. It should define goals, but not how they should be implemented. For example, the law may demand that all signs in buildings must be available in Braille instead of demanding that they be in a form that is accessible for blind persons. Another example: the law may demand that all phones should be TTY compatible. The first example is undesirable because not all blind persons know Braille. The second example is undesirable because it increases the price of all telephones, even for those who are not interested in TTY. Moreover, TTY is becoming replaced by fax, SMS and

[40] In order to warrant a better acceptance throughout Europe, it was suggested by the eAccessibility expert group to require only level A. This expert group was set up to prepare, together with the European Commission, the implementation of the four eEurope2002 goals that relate to persons with special needs. [http://europa.eu.int/comm/employment_social/knowledge_society/background_en.htm]

[41] Cf. footnote 38.

instant messaging. Instead of laying down specific technical requirements, laws could be frameworks that refer to standards and guidelines, which can be more easily adapted to technical evolutions. On the other hand, one of the conclusions of the Helsinki workshop was that legislation should be binding.

Companies will want to know what laws apply to whom, how laws will be enforced etc.

5.2 Technical Feasibility

5.2.1 Research and Development

According to a survey conducted by Trace Research & Development Center, "[a]lmost all interviewees wanted closer ties to organizations performing research and development in UD or accessibility. Specific comments were directed toward making research results easier to find, improved market research, and industry participation in the research agenda so that more economically viable products would result. Human factors researchers in academia and elsewhere should note this interest." (UDRP)

5.2.2 Support from Outside

According to the survey by Trace Research & Development Center quoted above, "[a]lmost all interviewees had strong opinions on what people outside their company could do (or stop doing!) that would support their own efforts to implement UD". According to Perrett a mutual understanding of the issues faced by both sides [the industry and disabled people] is important. To facilitate this, it may be useful to form an industry forum "where key players in the industry can discuss mutually beneficial solutions to issues affecting their disabled customers". "Also, industry will probably want to talk about a common approach to issues that affect all disabled people, perhaps even to discuss issues where the interests of one group of disabled people might conflict with those of others" (Perrett, 2001; p. 52). Deborah Kaplan also noted that "It is very important that there are ways for disabled consumers and activists to get together with the IT industry and with government policy makers to address this jointly and together" (Kaplan, 2001; p. 44).

5.2.3 Standards and Guidelines

During the Helsinki workshop, several participants pointed out that there are many guidelines, standards, books and reports, which results in a big "pile of paper". This situation was criticized for several reasons. Firstly, creating more documents does not work; what is needed is a usable format for the existing information. Secondly, standards should be feasible, viable and desirable, and this can only happen if the industry is represented in standardization committees. Lastly, there is no need for

more guidelines and standards but for better guidelines that help the industry understand what needs to be done. The last two criticisms were countered by one of the project officers of the European Commission, who said that it is very difficult to convince industry representatives to participate in standardization activities; the industry is only interested if there is relevant legislation.

What are “better guidelines”? One disadvantage of a set of guidelines such as the Web Content Accessibility Guidelines is that the classify accessibility issues according to their severity but give no clue to the frequency of these issues in the real world. It is conceivable that 80% of web accessibilty problems are caused by 20% or less of the check points identified by WCAG, so developers would want to address those issues first. Research in this area would benefit both developers and end-users. Developers would know what to focus on first instead of solving issues that help very few people. This would make investments in accessibility more cost-efficient. Developers using WCAG would also benefit from a test suite that that screen reader vendors, authoring tool manufactures, web accessibility checkers/repairers, and web developers can compare against (Jenkins, 2003).

Standards and guidelines are sometimes developed by groups that are not representative of the field. For example, the Web Content Accessibility Guidelines affect many overlapping fields of expertise, including page structure, multimedia, information architecture and disability-specific issues, but actual experts in many relevant fields are not involved in the development process of WCAG *(Clark, 2003b)*.

Jef Raskin has pointed out that interface guidelines (e.g. those by Microsoft and Apple) sometimes give advice that is demonstrably wrong. This is often because the organisation wants to maintain compatibilty with older versions of the interfaces and because of the misconception that users will protest against the disappearance of old, familiar interface elements *(Raskin, 2000)*.

5.2.4 How to Implement DfA in the Enterprise?

Companies that take design for all seriously generally set up special design for all services. For example, IBM has tree accessibility centres, and Siemens has an Accessibility Competence Center. ‘Advocates’ or ‘evangelists’ from such a group try to convince others or remind them about design for all in everyday projects.

In chapter 11 of *Constructing Accessible Web Sites* (Jim Thatcher et al., 2002), Mark Urban discusses “Implementing Accessibility in Enterprise”. One of the best ways to implement an accessibility solution is to set up a group or organization that will handle and support accessibility issues. This group should cut across departmental lines to maximize knowledge and awareness of accessibility (Urban, 2002; p. 284).

> Its ultimate goal should be to build a group of qualified people within the company who can manage and oversee accessibility projects, rather than overseeing them itself. To that end, the AO should be a resource within the enterprise, not a controlling organization. Its management should be carefully structured and its members should have a mix of characteristics directly related to their role in implementing accessible web technology. The membership should mostly be drawn from departments that will use it, being mostly field personnel working on implementing access web technology. Most should only work in the group part-time, having their primary responsibilities in their departments, as their understanding of departmental needs may be invaluable in achieving successful integration of accessibility into your web technology. They should also have a commitment to implementing accessibility. (Urban, 2002; p. 284)

Judy Brewer, director of WAI, has suggested that the evaluation of web sites is better performed by a review team than by an individual, and has listed the areas of expertise that such teams should have (Brewer, 2002).

5.3 Commercial Viability

5.3.1 Return on Investment

The INCLUDE project mentions the following benefits of Design for All for the industry (http://www.stakes.fi/include/pam1.html):

- Increasing ease of use and convenience for the broadest possible range of individuals will expand the potential pool of users, multiply marketability and reduce expenditures for assistive technology. Profitability is enhanced, and cost is contained.
- Europe's ICT industry must incorporate accessibility features in their products and services in order to be competitive with US industry on the world market. US companies are obliged by law to ensure that their products and services are accessible for people with disabilities.
- Incorporating disability standards at the design stage is cheap - amending products and standards or making specialist provision is expensive, time consuming and ultimately discriminatory. A recent Commission study on transport for example estimated that incorporating access features at the design stage added as little as 2% of the overall cost and that any additional costs were offset by increases in passenger revenue. It makes economic sense to ensure full accessibility of products.
- It is better to adopt DfA now than to wait until DfA legislation comes into force: those who wait risk the loss of part of their market share to those who have already moved forward.

John M. Slatin and Sharon Rush summarize the usability studies by Donahue, Weinschenk and Nowicki (1999):

- Each dollar spent on usability returns $10-100 in product benefit.
- It can cost as much as 100 times less to fix usability problems before launching a product rather than after the launch.
- Usability improvements increase user productivity by an average of 25 percent, improve user morale, reduce documentation costs, reduce training costs, and reduce customer support costs.
- Usability engineering has demonstrated reductions in product development cost and time of 35-50 percent. *(Slatin and Rush, 2003, p. 152)*

However, Daniel Rosenberg, vice president of development for usability and interface design at Oracle Corporation, says that the literature and approach to usability ROI contains flaws, and that this works to the detriment of the usability profession. In a presentation to the BayCHI[42] he described seven myths on usability ROI *(Sinkeviciute-Titus, 2003)*:

1. "Generalization is valid." Advocates present figures about user interfaces without mention whether they are talking about hardware or software, or whether the software is a web interface, a packaged application or an internal application.
2. "Calculation of ROI from the Producer Perspective." In the end, the consumer bears the costs, so costs should be calculated from the consumer perspective.
3. "You Can Ignore the Other Factors." UCD advocates ignore other factors (price of the product, size of the sales force, …) when they mention the influence of usability on the revenues generated by a new version of a product.
4. "Analog Comparisons are Not Required." Loss of online customers cannot be simply equated with loss of sales: some customers combine online searching with offline buying.
5. "All Usability Dollars are Spent Effectively." Rosenberg believes that the usability profession is not that effective in communicating the value of usability or in delivering value.
6. "Executives will Believe Voodoo Economics."
7. "User Experience Resources will Reduce the Software Schedule." Rosenberg said that he had never seen a product ship on time.

According to Rosenberg, there are three "laws of gravity" affecting ROI:

[42] The San Francisco Bay Area chapter of the ACM special interest group of Human-Computer Interaction (SIGCHI).

1. “It is cheaper to fix problems early in the design process.”
2. “Automation reduces complexity faster and in larger increments than UI design.”
3. “Globalization reduces labor costs.”

Usability should be defined by how it contributes to the customer's success—Total Cost of Ownership (TCO)—instead of the producer's ROI: what does it cost for the customer to be successful *(Sinkeviciute-Titus, 2003)*.

Others have warned against the tendency to over-measure: the various parts of a development process are so tightly integrated that awarding elements of return on investment to any particular contributor is very difficult *(Adkisson, 2003)*.

5.3.2 Time to Market versus Time to Break Even

Peter Conklin has developed a way to increase willingness to invest in product improvement by replacing the emphasis on time to market by an emphasis on time to break even. This canhelp in making people think differently about shipping dates and their significance. Companies usually prefer a project that reaches the market to one that takes longer. But the point of getting to the market is making money, so a more important target date is the time when the product wins back its development costs: the time to break even. According to Conklin, “anything that increases the rate of product acceptance, that is, the growth of sales volume, will shorten time to break even, and if the increase in acceptance is big enough, time to break even may be shorter even if time to market is longer” *(Lewis and Riemann, 1994)*. This argument can help user interface developers, because it enables more rational discussions about extra development time.

5.3.3 Demographics and Market Size

Figures and statistics about disabilities are available, but the question is not whether people with disabilities present a big enough market but whether Design for All generate enough return on investments (or reduce TCO, see Rosenberg's comments above). During the first IDCnet workshop in Helsinki, Klaus-Peter Wegge of Siemens questioned the assumption that Design for All leads to bigger market shares. The U.S.A. are in many respects several years ahead of Europe, but there are no figures that prove that sales increase when products are designed for all. Although sales of assistive technologies have increased, this is not the case for ICTs that were designed to be accessible. According to Wegge, it is still necessary to prove the economic viability of Design for All. The examples that were cited during the Helsinki workshop came from transportation (low floor buses) and other domains that have nothing to do with ICT.

Advocates of accessibility or Design for All often make broad statements about market size. For example, Stephanidis and Emiliani point out that disabled and elderly people make up about 20% if the market in the European Union; moreover, with the ageing of the population, this share will grow to 25% by 2030 (Stephanidis and Emiliani, 2003). Figures like this look very impressive at first sight, but they ignore the complexity of the market. The following factors need to be taken into account:

1. The use of the Internet and IT generally is not the same in each age group. For example, a study in Japan found 79.4% Internet usage in the age group 20-29 and 15% in the age group 60-69 (Sekine and Sakakibara, 2003).
2. Low internet usage among elderly people may not be very strongly correlated with (technical) accessibility or costs. A study in Sweden found that in the age group 55-79, 50% of those who do not have access 69% lacked interest or could not see any real use for it, whereas 8% found the technology too expensive and 8% though that the technology was too complicated (Männikkö-Barbutiu, 2002).
3. Not all disabilities have an impact on access to ICT, yet many "statistics" speak only of disabilities generally.
4. Surveys could also take gender and level of education of disabled or elderly persons into account.
5. Many studies only "measure" people who consider themselves as disabled or are registered as having a disability. A recent study commissioned by Microsoft measured people who experience difficulty in performing daily tasks and found that "the majority of working-age adults are likely to benefit from the use of accessible technology" (Forrester Research, 2004).
6. Shrink-wrapped software accounts for only 10% of software production, so the accessibility of software affects professional users differently than home users (children, students, hobbyists and retired persons).

5.4 Employee/Graduate Profile

There are few sources of information about the industry needs with regard to the required Design for All knowledge and skill for designers and engineers. This section relies on information from related or broader domains and compares the findings with comments made during the Helsinki workshop.

5.4.1 Industrial Requirements on HCI Education

In 1998, a workshop during the annual STIMDI conference (Swedish Interdisciplinary Interest Group for Human-Computer Interaction) reviewed the contents of HCI courses in Sweden. The workshop also

addressed the promotion of HCI in the industry. One of the participants had practiced HCI education for industry for several years. This section summarizes his main points of view (Gulliksen & Oestreicher, 1999, p. 6):

- There is a greater need for HCI experts than for methods and tools.
- The industry prefers pragmatic knowledge and hands-on advice and guidelines to perfectionism.
- HCI education should train people to be sensitive to good and bad design. This ability can be trained by taking realistic problems and applying HCI knowledge to improve the design. Don Norman's book *The Design of Everyday Things*, for example, could be useful for a practical design course.
- HCI is best promoted by applying it in projects and simply showing that it works.
- Learning on the job and using your skill and expertise in projects is one of the best ways to learn.
- Inviting guest lecturers from companies can increase credibility.
- "Usability should be a major goal in all development within a company, rather than being a goal to evaluate against in the end."

Case studies ("sunshine and disaster histories") are useful but difficult to find:

- It can be difficult to actually tell whether a project has succeeded or failed.
- Evaluation is often performed by others than those who have done the work.
- The industry does not want to get an image of a company that failed or shared a winning concept. (Gulliksen & Oestreicher, 1999, p. 6)

Work is currently taking place in this area which should help to fill this gap. For example, the RSA Inclusive Design Toolkit will later this year provide a unique resource for designers, students and business people (http://idesign.wiredesign.net/new).

It is useful to train the student's ability to see the benefits and drawbacks of everyday designs. For example, one can give them a small practical design task (e.g. design functional salt and pepper packages for airline passengers) and let them work simultaneously and independently of each other for 15 minutes. Then they can discuss each other's solutions and ideas. (This method is know as parallel design and is used to generate diversity in design solution; see Winberg, n.d.)

Another question is how one can teach innovation. Brainstorming is a useful technique for creativity. Observing how users actually use the system can make developers understand the benefits and drawbacks of their design and motivate them to correct it (Gulliksen & Oestreicher,

1999, p. 6). (These two methods were also mentioned by Johan Molenbroek during the Helsinki workshop.)

People educated in HCI in Sweden until 1998 mostly became teachers because of the increasing interest in the subject. Those who chose a commercial career usually ended up as consultants. However, there is a need for HCI education for people who end up in supervisory or strategic decision making situations (Gulliksen & Oestreicher, 1999, p. 6). (The same conclusion was drawn during the Helsinki workshop concerning design-for-all education.)

5.4.2 Requirements for Human Factors/Ergonomics versus DfA

However, the HFES (Human Factors and Ergonomics Society) has published “Quick Tips for Finding A Human Factors/Ergonomics Job in Industry” that provide interesting hints:

> Candidates must understand specifics about the employer's industry, but they should also be able to see the big picture involved in a project and to know how to apply human factors principles, frameworks, and techniques. Candidates should have a record of accomplishments, even while in graduate school, such as publications, presentations, and leadership assignments. In all cases, leadership and communication abilities are crucial. (...)
>
> Learn to manage your time efficiently, and set priorities for what you need to accomplish in and out of the classroom. In your industry career, you will frequently be working on multiple projects and will be required to set priorities in order to meet your deadlines.
>
> Consider taking courses outside your major department that may help you in your career. Examples include computer science/software engineering, marketing, industrial design, or aviation, depending on your interests. In your career, you'll often be part of a multidisciplinary team, and having taken courses in other departments will prepare you for the different approaches others bring to the work. (...)
>
> Be prepared to speak in many “languages.” You will often be working in multidisciplinary teams. If you are able to speak and understand the jargon of your teammates, you will have a much better chance of implementing user-centered design features into your product. For example, if you demonstrate a knowledge of coding concerns while working with software engineers, you will be far more successful than if you understand only the user interface. (Young and Shapiro, 2001)

Although Design for All or accessibility are never mentioned, the relevance of some of the points quoted above was confirmed during the Helsinki

workshop. Marja-Riitta Koivunen, representing the Education and Outreach Group of W3C WAI, presented the results of a mini-interview with a few people from industry about the kind of properties that are needed when doing DfA. These properties include:

- sociality with emotional intelligence,
- flexibility when dealing with different people with different skills,
- with customers and inside company: open attitude, curiosity, questioning and accepting different terms, and methods when talking about accessibility and usability because the field is young and there are many approaches depending on people's backgrounds,
- ability to do teamwork with many different kinds of people,
- independence and stamina, often need to convince many people before things start going forward,
- good communication and presentation skills when presenting for nonexperts.

(Koivunen, 2003; slide 9)

Marja-Riitta Koivunen also mentioned the knowledge and skills that are required for all employees (including managers), for evangelists and change agents, for designers and evaluators, and for developers (Koivunen, 2003; slides 5-8). Lilian Henze of P5-Consultants mentioned that professionals in human-centred design needed knowledge of ergonomics, product development and marketing. She also mentioned that their skills should go beyond traditional market research. Referring to a Bell curve that represented the diversity of users, she said that quantitative research is not sufficient: when one goes to the extremes of the Bell curve, it is possible to get a lot of qualitative information that is useful in the design process. She also pointed out that graduates should be aware of their responsibility in their future role in interdisciplinary teams (Henze, 2003). This has several implications for DfA education. Firstly, students are now mostly focused on their subjects instead of the people they will co-operate with later. Secondly, it would be useful to find out how students choose their subjects and to use this knowledge to find better ways to motivate them to study design for all.

Some companies incorporate accessibility or Design for All into their training for new employees. For example, at Nokia in the U.S.A., accessibility is one of the induction training modules and it is offered to all employees three times per year. This module includes a ten-minute video “Design for All”. In addition, there is also an employee manual “Meeting the Needs of a Diverse Marketplace” (Dzumba, 2001; PPT).

5.4.3 Interaction Design

In their afterword to *About Face 2.0: The Essentials of Interaction Design* (2003), Alan Cooper and Robert Reimann discuss the subject of training as a designer. They state that interaction designers do not often come from the ranks of programmers, but nonetheless need technical knowledge. Non-technical persons are less suited for this job, because “it is not obvious what computers can do for us” *(Cooper & Reimann, 2003)*.

It is possible to pursue academic training, but interaction design is a new discipline that is taught at only a few institutions. There is no agreement on what the core knowledge sets and skills of an interaction design curriculum should be, or on how to approach the teaching of such a curriculum, although this is starting to change. Some of these programs were developed at art schools and tend to emphasize personal or brand expression rather than product definition and usability problems. Other interaction design programs are outgrowths of technical departments and concentrate more on technologies than on human goals. Programs that emphasize human-computer interaction techniques tend to concentrate more on cognitive theory and user research than on design methods and practices.

It is also possible to become an interaction designer through other paths, for example studio training combined with a sufficient breadth of courses (Cooper and Reimann cite art, business, humanities and science). However, there are a number of skills and attitudes that are difficult to teach, for example empathy with users and the ability to conceptualize working solutions. According to Cooper and Reimann, people considering to shift their career to interaction design should keep a few things in mind:

- “Designers seldom code”. Trying to do interaction design and development at the same time will be to the user's disadvantage. There is a conflict of interest.
- “Usability research is tremendously important, but it isn't design.” Usability research identifies problems but can only suggest solutions when working at the most detailed level. Interaction design requires the ability to envision and refine broad and detailed solutions. Persons who feel more at home with extracting facts from known solutions may find usability research a more natural choice.
- “Temperament is important. The best interaction designers are interested in everything and willing (even eager) to immerse themselves in unfamiliar territories to learn and absorb. They are also very concerned about people as individuals and the human condition in general.”
- Interaction designers also need some basic skills: they should be able to draw or write well, and they need excellent communication

skills. The best interaction designers combine creative insight with analytical thinking.

Interaction designers need to work closely with people in other roles in a larger team. In many cases, the interaction designer will also have the role of reminding other team members of thinking in a goal-directed fashion. *(Cooper & Reimann, 2003, p. 502-504)*

5.4.4 Employing People with Disabilities

People with disabilities have difficulty finding jobs. In 1994-1995, the Urban Institute conducted a survey in the U.S.A., which found that 79 percent of adults without disabilities were working at the time they were interviewed and only 37 percent of those with disabilities were employed (*Win with Ability*). The same survey also asked employers about the possible barriers to employment and advancement of people with disabilities. Lack of related experience and lack of required skills or training were seen as the biggest barriers. However, according to the National Organization on Disability, “People with disabilities have equal, or higher, job performance ratings, higher retention rates, and lower absenteeism.” (National Organization on Disability 2001, quoted in Moulton et al, p. 12)

During the Helsinki workshop, one of the participants said that legislation about quota for employing people with disabilities has not worked. Employing people with disabilities is difficult (for reasons that were not mentioned during the workshop). On the other hand, Design for All benefits from involving disabled users, and for some companies it is best to do this inside the company, because they want to protect the innovations that are not yet on the market.

5.5 Facilitating the Adoption of DfA

5.5.1 What can I do to adopt Design for all as a policy?

(Quoted from the DASDA website, at http://www.design-for-all.info/200035,14099925.xml)

> “So how do I start to make Design for All a fact of life in my organisation? It's all very well having the ideas but putting them into practice won't be easy.”
>
> Start with the ideas but follow with the practical steps that will ensure that Design for All is adopted in an appropriate manner:
>
> Ensure that all relevant colleagues are aware of the importance of the subject, are full appraised of what you stand to gain by adopting Design for All and, just as important, what you could lose if you ignore the subject. You must be fully committed to the approach as an organisation if you are going to make it work for you.

> Appoint one or more people to champion the subject within the organisation. Give them access to the people they need to guide and ensure they have the resources to make their case full and persuasively.
>
> Place an obligation on those involved to include Design for All in new product/services specifications and to demonstrate that their work has been carried out according to the principles it embodies.
>
> See that systems are created to monitor progress, examining all development and design work for positive Design for All attributes.
>
> Ensure that validation work on the organisation's products and services includes achievement of Design for All principles. Measure, where possible, market effects of the inclusive approach and feed back into discussions on new products and their prospects.
>
> (...)
>
> Finally, congratulate yourself on seeing the commercial benefits of an approach that far too many still see as an imposition. Your efforts deserve praise, as well as the rewards that, without doubt, they will receive.

5.5.2 Design for All and Business - why you need action now

(Quoted from the DASDA website, at http://www.design-for-all.info/200039,14177299.xml)

> Whether you know it or not there is a strong market demand for more inclusive design. Whether you see it or not, some of your competition is already improving its prospects by adopting a more inclusive approach to design. Plus, legislation is under discussion in Europe - following the moves in the US - to make inclusive design a feature of public purchasing. These are the facts that you need to understand and lay before your colleagues.
>
> It is worth elaborating on certain aspects to provide the stimulus to action:
>
> Demand - some 16 million people in the EU have hearing impairment, 3 million have visual impairment, 7 million have limited dexterity and 9 million have cognitive impairment; nearly 40% of people over the age of 50 have difficulty with small print; even allowing for duplication between categories, these are people who can be excluded from use of products or services;

they need design that will include them and they will respond by purchasing.

Legislation - US public purchasing is now subject to inclusivity criteria based on legislation that equates discrimination against the disabled with discrimination on the grounds of race or gender; around 10% of IT sales are to US government departments; consideration of similar legislation has already started in the European Parliament and could affect future public procurement; those who cannot comply will be excluded.

E-commerce - trumpeted as the future for a significant proportion of sales activity, e-commerce operates through a medium that is accented towards the young and the able; those not schooled in IT, or working outside a context in which they can keep skills fresh, will not be part of the potential market; a decision to pursue e-commerce exclusively can be a decision to exclude a large number of potential customers unless web accessibility guidelines are followed.

Public awareness - the successful court challenge to the official web site for the Sydney Olympics illustrated that consumers are no longer prepared to be excluded; it is far better to be praised for inclusion than fined for exclusion.

Inaction is not an option for a number of different reasons. Action is made easier by the Design for All web site and the information, guidance and links to other resources to be found on it. The idea of being 'exclusive' can have attraction for a small number of customers; being inclusive has great attraction for many more.

DfA thought: 8.5% of men have some form of colour blindness, a constraint that cannot be seen by others. This can make the difference between seeing the 'buy now' button on your web site or seeing nothing. Can you afford that risk with the people you have worked so hard to bring to your web site?

6 What Organizations Promoting DfA Can Do to Facilitate its Adoption

- The term Design for All should be defined more precisely; many people now use the term because it is a nice buzzword.
- Design for All should be promoted with cutting edge technology, for example ambient computing.
- A Design for All portal where designers can find references to legislation, guidelines, tools, educational material, information about methodologies and other resources. This idea is not new; it was also brought up by Everard van Kemenade of DASDA during the Helsinki workshop, and the DASDA web site (www.design-for-all.info) aims to be a resource for people who want to promote for DfA. The proposed DfA portal, however, should do more than providing materials for people who want to promote DfA.
- Design competitions may speed up design developments because they provide a forum for ideas that are already present in the minds of designers but not fully formulated or tested out. [See Argergaard, 2002.]
- Metrics, measures and evaluation procedures are necessary to give DfA more validity.
- There should be more incentives for the industry.
- Practise what you preach. Organizations that promote Design for All should use accessible formats. A large number of documents are only available in Adobe PDF, Microsoft PowerPoint or Microsoft Word. For example, during the preparation of this deliverable, the query '"Design for All and Assistive Technology" market' in Google retrieved 39 documents: 26 were PDF documents (at least one of which was generated from MS PowerPoint), 9 were MS Word documents and the remaining four documents were in HTML (none of which passed WCAG A conformance in A-Prompt or Accessibility Valet).
- Governments and local authorities should make accessibility an integral part of activities such as town planning, so as to demonstrate the advantages of Design for All for everyone and to raise awareness.

7 Conclusions and Next Steps

The literature survey and the workshops organised by IDCnet lead to the impression that the industry does not quite know what they need with regard to Design for All (except for a few enlightened individuals) and that they need to be educated. Awareness of accessibility and Design for All is growing, which is mainly due to legislation, but surveys have shown that there are still many barriers besides lack of awareness. The industry is much more willing to invest in new technologies (e.g. i-mode, MMS) and fancy web sites than in Design for All. To win over the industry, several things are necessary:

- Provide realistic, complete and business-related figures and statistics to support the argument that Design for All can be commercially viable, both with regard to the market size and the return on investment for Design for All.
- Overcome prejudice (“DfA is only design for the disabled and elderly”).
- Legislation should be feasible; it should define goals rather than implementations.
- Design for All should be part of company values; all levels will need some form of education, strategic levels included.
- Promotion of and information on DfA need to be co-ordinated; a portal could be the appropriate solution.

The next step for IDCnet is the identification of the optimal graduate profile for DfA based on the needs of industry and the possibilities of within educational institutions.

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9 Appendix A: 1st IDCnet Workshop – 14-15 February 2003, STAKES, Lintulahdenkuja 4, FIN-00531 Helsinki, Finland: "Design for All Curriculum: Towards a synergy of the needs of ICT industry and education"

The meeting opened with a statement from Paivi Tahkokallio, organiser of the event, member of the IDCnet consortium and President of the European Institute for Design and Disability. She explained the logistics for the two-day event and pointed out that there were 60 participants present representing 12 member states of the EU. The first day would focus on the industrial perspective with talks from key speakers, followed by brainstorming/round-table sessions to be facilitated by Jim Sandhu who was representing the European Disability Forum. The second day would focus on the educational perspective with key speakers followed by brainstorming/round-table sessions to be facilitated by Lilian Henze of P5 Consultants.

Ron Wiman followed by welcoming the participants on behalf of STAKES. He outlined the importance of the two-days' proceedings to DfA education and its knock-on impact on industry. He spelt out the role and policy of STAKES in the context of broader implications and applications of the IDCnet developments.

In the absence of Carlos Velasco, the project leader from the Fraunhofer Institute, Sankt Augustin, Yehya Mohamad followed by giving a crisp and clear overview of the strategic goals of the IDCnet. He spelt these out as: to integrate information and identify core knowledge sets and skills for model curricula for DfA for ICT and related services. Yehya explained the broad implications of the IDCnet; that it embraced a wide range of design artefacts, including the built environment and landscape architecture, biomedical and rehabilitation engineering. IDCnet's prime focus would be on the design of information and communication products, systems and services.

He briefly outlined the prime objectives of the project, which were:

- Integrate relevant information to understand the ICT design education culture and industry needs in Europe.
- Identify knowledge sets and skills that should be part of a curriculum for DfA in ICT.
- Integrate R&D products that contribute to DfA within the design and learning processes.
- Influence education and research policies.
- Help to mainstream DfA in the education sector.

Yehya went on to elaborate the key actors and sectors which could significantly benefit from IDCnet membership and collaboration. These were:

- Companies and industry-based groups.
- Professional associations.
- Design and engineering departments of universities.
- Research groups actively working on standards, guidelines, specifications and technologies.
- End-users organisations.

Finally, he emphasised that the activities of the IDCnet were geared to support the objectives of eEurope and the European Secretariat for the Design for All e-Accessibility Network (EDEAN, http://www.e-accessibility.org).

Jan Engelen and Christophe Strobbe, project partners from KU Leuven started by outlining some key questions for industry generally and participants in particular. These were:

- Did your industry have any DfA strategies?
- Did your industry have any awareness of disability legislation?
- What had been actioned in the past, is being actioned now and what plans are there for the future?
- Who were the relevant players?
- What were the needs of industry with regards to employment of graduates?
- What did you need, and what do you get in terms of employees with DfA experience?
- Did you have special teams/individuals with DfA experience?
- What skills gaps did you perceive?

Jan stated that answers to and discussions on the above questions plus the report resulting from the workshop would stand as a reference for the second IDCnet workshop.

He stressed that the definition of disability had become much broader than before. It was not only an attribute of a person but was also situation-specific, such that a badly designed artefact or environment could disable all users, irrespective. In this sense the benefits of a DfA approach were applicable to a broader range of people and was not simply a euphemism for focussing on the older and disabled people. In the context of web accessibility DfA covered not just public web sites but also content, knowledge management and document formats, for example VoiceXML & tools.

Market sectors still tended to focus on younger generations, largely ignoring an ageing population which presented an increasing divergence of physical capability. Given the increasing need to retain more older people in employment accessible workplaces were a priority.

In order to progress ICT/DfA curriculum it was critical to establish closer ties with organisations performing research and development.

This would enable research results to be easily accessible. Market research needed to be improved and verifiable. Industry participation in the research agenda could result in more economically viable products.

The Leuven team concluded by stating that all actors involved with ICT/DfA should be sensitised for judging good and bad design. HCI education should be made compulsory for people who finally end up in supervisory or strategic decision making situations.

Jim Sandhu, Director of Inclusive Design Research Associates Limited and official representative of the European Disability Forum stressed the importance of the workshop. Its success could make significant impact on European industries, the educational sector and ultimately on the quality of life of European citizens. Inclusion was both a concept and a social objective. It meant all citizens should have the right to participate fully in society without discrimination or environmental, services, products or ICT barriers.

Maximised accessibility was simply a logical extension of inclusion. It meant transparent access to all forms of the designed environment and services in order to maximise choice and the exercise of citizenship by everyone.

His recent travels in North America, Asia, Australia and Japan had convinced him that Europe was blessed by the widest possible range of networks of professional expertise such as EIDD, AAATE, COSTbis, EDF, ANEC, EDEAN, the various CEN Workshops, the EU Intergroup, etc. These should be used to maximise awareness, dissemination and feedback.

In DfA curricular terms, he explained, EIDD had long ago recognised the need to push the frontiers as far back to the schools as possible. The Institute organised a conference of European Design Promotion Organisations in Dublin in 1995. Seventeen senior representative attended and signed a memorandum of understanding. One of the items was on the promotion of DfA education. The following year the Italian network of EIDD organised a pan European conference in Bologna called “Teaching for Tomorrow”. In 1997 EIDD’s German network organised an important workshop in Traben-Trabach focussing on the minutiae of curriculum components for DfA education. As all these activities were funded by the Commission they were fully documented. He stressed that although some things had changed there was the need to keep one’s feet firmly on the

ground, to relate to what had gone before and not to reinvent the wheel. This was a sure way to expedite developments.

In summing up Jim made a plea that curricular activities should also encapsulate principles of sustainability, transparency, seamlessness; mechanisms that enable technology transfer, maximum user involvement, the iterative process and legal issues such as public procurement. These worthy efforts should not only utilise but also conform to the best principles of DfA. (For comprehensive ICT/DfA guidelines see: http://www.tiresias/guidelines/cenisss)

Jean-Louis Carves from the IBM Accessibility Centre, Paris, started by giving a historical overview of IBM's involvement with access issues starting with developments in the 70s and the advent of the PC. Aside from the Paris centre which had a European, Asian and African remit, IBM,s main Accessibility Centre was in Austin, Texas. The main objective of both centres was to mainstream access issues, to work with communities, and to co-ordinate and collaborate.

Jean-Louis described IBM's action plan for EYDP which comprised of four objectives:

- Generate awareness.
- Enhance web access.
- Implement better design assessment.
- Focus on training personnel.

The success factors for the above objectives were:

- Enhancement in user needs knowledge.
- Developments in R&D.
- Awareness and education.
- Partnerships with universities.
- Training people for hire.

He concluded by recommending IBM's website: www.ibm.com/able

Marja-Riitta Koivunen who was representing the W3C consortium outlined the main objectives of her organisation which were:

- Sustain activities focussed on the WAI initiative.
- To act as an education and outreach group.
- To develop resources and strategies to promote web access.

She maintained that the predominant issues as far as the W3C consortium was concerned were:

- Industry needs - which largely hinged on a thorough understanding of usability needs and usability evaluation.

- Market Place Issues - such as planning, policy, understanding demography and market sectors.
- Training – which comprised of clear objectives, curriculum development, outcomes, assessment and feedback.

Marja-Riitta strongly emphasised that without basic understanding at all levels of an organisation, accessibility would not work. Furthermore, there was a need for a designated person to remind the key actors in a corporation of their responsibility for accessibility at regular intervals. These attributes should be part and parcel of any business marketing plan and be integral to the corporation's value system – including being an essential part of sub-contracted work.

Designers and evaluators needed deep and holistic understanding of a range of key topics such as: psychology, graphic design, ergonomics, relevant software, etc., and usability should be integral to the design process. In this context, developers needed wide experience of the range of users and their difficulties.

Marja-Riitta concluded by summing up the qualities required to foster DfA, such as: flexibility of approach, emotional intelligence, open attitudes, independence and stamina, networking skills, etc.

Werner Groh representing BASF of Germany focussed on the role of eLearning in his company. Based on the Internet and BASF's Intranet networks the employees were largely responsible for their own training which was aimed at a range of relevant qualifications. As a result they were better trained than staff in most other related companies.

BASF's approach was modular, with tried and tested concepts. One example was "Blended Learning" which utilised online modules with tutor guidance which alternated with classroom sessions. Integral to this process were crucial elements such as: vision, strategy, goals, evaluation, outcomes. He followed this up with a description of the eLearning hierarchy which managed all aspects of the training, starting with the Steering Committee, Managing Team, Team Leader, Specialist Trainer followed by the participant.

He stressed that professionals working in the field needed to be familiar with ergonomics, disability demographics and to focus on the 'borderline' of users. From his perspective DfA not only meant the maximum number of people to include but critically and crucially who to exclude. Crucial other components of DfA were:

- Interdisciplinary team work.
- Market Research.
- Create value for business.
- Managing design teams.
- Communications within team.

He stressed that user involvement and effective communications was the key. eLearning concepts had to be introduced gradually. In some cases cost-benefit effects could take place in the introductory phase as savings in the medium to long term were considerable due to independent study.

Werner concluded by emphasising the role of the learning environment itself in meeting the educational objectives. The education centre had to be clearly identifiable and should have good information and reference resources as well as all the requisite teaching equipment. It should also be possible to extend these to individual homes in order to maximise choice.

(Further information can be obtained from: www.gp.basf-ag.de)

Lilian Henze of P5 Consultants focussed on Professionals in Human-Centred Design and stated that P5's mission statement was, "to be consumers' advocates and designers' facilitators". It was crucial to understand consumers in all their varied roles as buyers, users and owners – roles that went beyond conventional stereotypes and usability issues.

As design facilitators the P5 team were not concerned with solutions but with outcomes. For the professional to realise these outcomes it was critical to have knowledge of ergonomics, product development, marketing and to have a clear idea of what was meant by DfA. A good definition was, " the inclusion of the maximum possible number of diverse human beings". The converse of this process was a consciousness as to who was being excluded and who was on the borderline.

In the context of design practice it was important:

- to work as a interdisciplinary team.
- to undertake market research.
- to create value for the business or client.
- to have good team management.
- to have excellent communication within the team.

In emphasising user involvement, Lilian, then characterised the design process and its interaction with the user – breaking down both into their discrete components. She described this interaction as the "Ping-Pong Model". At the hub of this Model was a unique process which she termed the "P5 Scripts". This referred to a method to clearly visualise future usage to enable the designer to imagine the potential impact of the object being designed. The method entailed objective research material, observations, a cast of 'archetypes of users' and the physical and social context of use. All interactions, events and dialogues were described and visualised in scenes and story boards.

Lilian concluded by stating that there was a need for graduates who were aware of their responsibilities in their future role in interdisciplinary teams. All curricular efforts should reflect this aspect. (www.p5consultants.com)

Klaus-Peter Wegge representing Siemens stated that his company was primarily concerned with designing and manufacturing products for world markets. Largely due to its awareness of an ageing population the company had recently started to take an interest in DfA. All DfA activities were coordinated through Siemens' Access Initiative (SAI). The main objectives of SAI were:

- to exchange information.
- to coordinate Siemens' activities on accessibility.
- to contribute to the process of standardisation.
- to maintain product and service quality utilising DfA.
- to manage Siemens' Internet network.
- to undertake external coordination.

SAI also managed the company's Accessibility Competence Centre which was the main conduit for DfA and training. The target groups of the Centre were specialists, end users, third parties and disability organisations.

In the context of DfA the company preferred to use 'Easy-to-use' rather than 'Barrier-free' which was considered imprecise. Fundamentally, the company's approach to DfA was pragmatic rather than purist. In some ways it considered DfA as a battlefield due to:

- incompatible definitions and terms.
- different and conflicting regulations.
- inconsistent standards.
- contradictory guidelines.
- unnecessary certifications.

He concluded by maintaining that there was no clear information either on market sectors or the impact of DfA on market sectors. This needed to be addressed urgently in order to strengthen the case for DfA.

9.1 Brainstorming – Round Table Discussion on Industry Needs (Facilitator Jim S Sandhu)

Participants were divided into four groups of approximately ten members each, with at least two industrial partners in each group. Each group was given a specific question to consider. In addition each group also had to consider "Lessons to be learned from your practice".

- Group 1. How can your industry evolve DfA Strategies?

- Group 2. How can the needs of industry and the needs of the professions be made to converge?
- Group 3. What kind of professionals does industry require to progress in the field?
- Group 4. How can your industry have greater awareness of disability legislation?

9.1.1 Group 1 – How can your industry evolve DfA strategies?

- Standards should be feasible, viable and desirable.
- Guidelines needed to be harmonised and condensed – there were too many defuse guidelines presently.
- The costs of DfA needed to be established and verified.
- Rationalised integrated marketing needed to be considered by industry.
- Legislation should not be limiting but provide an impetus for developments.
- Developments should be customer and not user driven.
- Over-regulation was counter productive (eg. in the UK window and switch heights did not consider those in electric wheelchairs).
- Work done under Mandates EU273 and EU283 was exemplary.
- Whilst US telecom legislation was specific to the US it could also be globally useful.
- In industry user involvement could not be a blanket requirement – it was time-consuming and often users did not know what they wanted.

Lessons to be Learned

- Low floor buses were a prime example of DfA.
- There should be greater focus on open source, non-commercial type of developments eg. Linux.
- Patents made products more expensive.

9.1.2 Group 2 – How can the needs of industry and the needs of the professions be made to converge?

- Students should learn about recommendations and standards for DfA.
- Students should participate actively and not just as consumers (more practice).
- Educate not only technicians and engineers but also other professions like business administration students etc.

- Professors of all faculties at universities should get an overview about DfA.
- Managers at companies should also learn about DfA.
- More courses needed for students and professionals where they could try out DfA products to learn about special needs and how the products worked.
- The concept of DfA should still be defined more precisely, there should be more case studies of good practice.
- Legislation should be developed, improved and harmonised in all EU countries.
- Social awareness should be created and taught to students.
- Need to create inter-disciplinary discussion groups in education.
- Students should learn interdisciplinary skills rather than only for one profession.
- Teach students the benefits of DfA products especially the improvement of the commercial possibilities for such products or services
- Promote flexibility to meet not only the demands of DfA but also the diversity of devices, ubiquitous computing etc.

Any lessons to be learned from your practice?

- Making schools and workplaces accessible would have a big impact on the acceptance of the DfA in other areas.
- DfA should be integrated in all general curricula.
- Better Integration of disabled people in companies would help in promoting DfA products and services.

9.1.3 Group 3 – What kind of professionals does industry require to progress in the field?

- The focus should be the ICT professionals but also on all others that impact on it.
- A key skill was social awareness which was crucial to teamwork.
- Understanding of multiple disciplines and how they related was important.
- Marketing skills were crucial to benefiting a company.
- The ability to prototype and story board with disabled users was useful.
- Professionals needed the ability to evaluate accessibility.
- There need to be greater visibility for trained expert professionals.

- A major problem was that human resource people may not know who to hire.

Lessons to be learned from your practice.

- There was important awareness needed at many levels.
- There was a crucial lack of openness to innovations.
- It was important to recognise that progress was often slow.
- Incentives such as binding legislation were important.
- It was important to establish metrics for evaluation and measurement problems.
- It was crucial to eliminate compartmentalisation in all DfA issues.

9.1.4 Group 4 - How can your industry have greater awareness of disability legislation?

- Wherever there was binding legislation industry was fully aware.
- High profile cases helped in raising awareness.
- It was crucial to listen to all players within a community.
- Legislation should not be built up from stereotypes.
- Legislation was an important tool for control and implementation.

Lessons to be learned from your practice.

- The stick and carrot approach was important in generating awareness.
- Designers need to practice in real circumstances and understand fully the concept of DfA – it was the key to professionalism.
- It was crucial for designers to ask the right questions and for companies to create useful and effective project briefs.
- There was a need for an identifiable centre of competence within each company.

Reported and Edited by Professor Jim S Sandhu, Inclusive Design Research Associates Limited & EDF Representative.

26/02/03

10 Appendix B: Related Networks, Projects and Organizations

In the field of Design for All, there are several projects and organizations with similar but slightly different goals. To clarify this confusing situation, some of these initiatives are briefly described here.

10.1 EDeAN: European Design for All e-Accessibility Network

Web site: http://www.e-accessibility.org/.

This Member States and EU-promoted network held its kick-off meeting in late November 2002. Its scope is wider than ICT. It has national contact centres in 15 European countries and more than 100 members. New network members are still welcome to join. The EDeAN web site also has a section Design for All curriculum material examples.

> The (EDeAN) secretariat was created to aid and support the newly formed network of European National Contact Centers (NCCs), which are working with Design for All, e-Accessibility and Assistive Technology issues. The 15 European National Contact Centers form the primary nodes of the EDeAN network. Each NCC is also responsible for a national Design for All e-Accessibility network in their own country.
>
> This European Network has been primarily created to provide:
>
> - input for European Curricula in Design for All
> - a forum for Design for All issues
> - idea sharing through joint activities such as conferences, symposia and exchanges of students and scholars.
>
> The network is also charged with fostering awareness and promoting changes of culture in the public and private sectors. It will also establish links with appropriate education channels to embed Design for All best practices in new curricula. Through a series of common activities and proposals, it is hoped that the network will become a cohesive group that can effectively work toward the advancement and excellence of Design for All.

Contact: EDeAN Secretariat - Danish Centre, Gregersensvej 38, Dk-2630 Taastrup, Denmark; phone: (+45) 43 32 22 06, email: edean@hmi.dk.

10.2 DASDA: Dissemination Activity Supporting Design-for-All

Web site: http://www.design-for-all.info/.

EU-funded project (IST-1999-14166, 1 December 2000 - 31 July 2003).

The objective of DASDA is to increase the awareness and knowledge about Design for All amongst key stakeholders such as developers, procurement professionals and marketing staff through production and dissemination of a set of multimedia based products, ranging from short awareness-focused products to full courseware.

10.3 D4ALLnet: Design for ALL NETwork of excellence

Web site: http://www.d4allnet.gr/.

This is a EU-funded thematic network (IST-2001-38833, 1 January 2003 - 31 December 2005).

> D4ALLnet aims to set-up a thematic network of centres of excellence in Design for All (DfA) in Europe, in order to promote and advance DfA practices in the Information Society, and in particular to contribute to the efforts of EDeAN and of EC the eAccessibility Expert Group towards the implementation of the eEurope 2005 Action Plan. D4ALLnet will build the necessary infrastructure to enable systematic cooperation amongst members and with other networks, stakeholders and actors in the field, to advance common objectives, including DfA policies, standardisation, benchmarking for assessing and validating DfA experiences, proactive assessment on DfA, study of required and recommended features for an interdisciplinary program of study on DfA. The consolidated experience will become part of a DfA Resource Centre, aiming to facilitate knowledge sharing amongst DfA practitioners. The project will pursue a range of outreach activities in liaison with the National Contact Centres of EDeAN to raise awareness on DfA and facilitate the longer-term operational and policy objectives in this field.
>
> (quoted from the Cordis database)

Contact person: Constantine Stephanidis, tel: +30-2810-391741, fax: +30-2810-391740, email: cs@ics.forth.gr.

10.4 EIDD: European Institute for Design and Disability

Web site: http://www.design-for-all.org/.

This is a European network of design professionals, whose main objective is to enhance the quality of life through Design for All.

EIDD celebrated its tenth anniversary in 2003 with a conference in Dublin on Friday 4 April: "Equality, Design and the Future".

10.5 CEN/ISSS Workshop in relation to Design-for-All and Assistive Technologies for ICT

Web site: http://www.cenorm.be/isss/Workshop/dfa/default.htm and http://forum.afnor.fr/afnor/WORK/AFNOR/GPN2/Z62B/index.htm.

CEN (Comité Européen de Normalisation) is the European Committee for Standardisation. ISSS stands for Information Society Standardization System. “The mission of CEN/ISSS is to provide market players with a comprehensive and integrated range of standardization-oriented services and products, in order to contribute to the success of the Information Society in Europe.” The CEN/ISSS DfA workshop is a forum for discussing and developing new standards. The workshop has produced guidelines for standardizers: Guidelines to Standardisers of ICT products and services in the CEN ICT domain - 3rd draft: http://www.tiresias.org/guidelines/cenisss/index.htm.

10.6 DATSCG: Design for All and Assistive Technologies Standardization Co-ordination Group

Web site: http://www.ictsb.org/DATSCG/TOR.htm.

“The DATSCG is formed as a subgroup of the ICTSB to ensure effective co-ordination between the various ICT-related standardization activities at European level in relation to design-for-all and assistive technologies.”

The objectives of DATSCG, as described on their web site, are:

- To ensure co-ordination of the relevant standardization work, by taking an overview of existing and proposed programmes, avoiding overlapping activities, making proposals for liaison on work items, etc.;
- To act as an overall focal point on design-for-all and assistive technology standardization, ensuring an overall interface with the technical experts within the ESOs and consortia;
- To maintain dialog with the various DGs of the European Commission involved in Accessibility, in order to understand their priorities, to receive policy statements and plans regarding DFA regulations in the ICT context, and to inform them on standardization initiatives;
- To assist in organizing public open meetings or other promotional activities on design for all and assistive technologies standardization requirements in ICT;
- To promote the knowledge and awareness of existing guidelines and tools by the market-players, e.g. the WAI-guidelines towards SMEs.

10.7 AAOutils: Architecture et Accessibilité - Outils pour une information

Web site: http://anlh.be/aaoutils/.

This project is about Universal Design in the built environment.

“The main objective of the AAOutils project is to design innovative teaching tools based on the concept of architecture accessible to all (and thus also to handicapped or people or people with limited mobility) in an extension of the spirit of ‘Design for All’. Using these tools, training schemes can be implemented both at nationwide and at the European level.”

10.8 UDEP: Universal Design Education Project

Web site: http://www.uoregon.edu/~sij/udep/.

This project was concerned with curriculum development, but not with regard to ICT.

“The Universal Design Education Project (UDEP) is a national effort organized by Adaptive Environments Center in Boston, MA to challenge existing values in design education by supporting curriculum development and teaching interventions that incorporate the principles and values of universal design. During the 1993-4 academic year, twenty two design schools across the U.S. were funded to undertake innovative teaching in the areas of architecture, landscape architecture, interior design and industrial design. Support came from the National Endowment for the Arts, the Disability Rights Section of the US Department of Justice, and private foundations.”

10.9 I~Design

Web site: http://rehab-www.eng.cam.ac.uk/projects/include/index.htm.

This British multi-disciplinary project wants to “[provide] industrial decision makers with mechanisms to assess the market size for new products, based on the whole population as opposed to the young and able-bodied, and designers the guidance required to design for these markets and understand the significance of age and capability related factors”.

The principal objectives of the research are:

1. to understand independence at home and access to work for all;
2. to quantify the range of capabilities across the population;
3. to classify approaches to inclusive design;
4. to develop a graphical model for inclusive design;
5. to identify industry barriers to inclusive design;

6. to develop inclusive design guidelines;
7. to disseminate the results.[43]

[43] Quoted from the project web site.

11 Appendix C: Guidelines, Standards, Regulations

11.1 Existing guidelines and standards

11.1.1 Guidelines by Industry Consortia and Professional Organizations

- ANSI/HFES-200 Software User Interface Standard.
- Apple:
  - Accessibility: http://developer.apple.com/documentation/Cocoa/Conceptual/Accessibility/index.html#//apple_ref/doc/uid/10000118i.
  - Apple Human Interface Guidelines. http://developer.apple.com/documentation/UserExperience/Conceptual/OSXHIGuidelines/index.html#//apple_ref/doc/uid/20000957 or http://developer.apple.com/documentation/UserExperience/Conceptual/OSXHIGuidelines/OSXHIGuidelines.pdf.
  - Making Carbon Applications Accessible to Users With Disabilities. http://developer.apple.com/documentation/Carbon/Conceptual/MakingAppsAccessible/index.html or http://developer.apple.com/documentation/Carbon/Conceptual/MakingAppsAccessible/accessibility.pdf.
- California Community Colleges. Guidelines for Producing Instructional and Other Printed Materials in Alternate Media for Persons with Disabilities. April 2000. http://www.htctu.net/publications/guidelines/altmedia/altmedia.htm (formerly at http://www.htctu.fhda.edu/amguidelines/am33000.htm).
- CAST. Tips on Presenting Alternatives to Sound. http://www.cast.org/udl/index.cfm?i=352#tips.
- http://www.esat.kuleuven.ac.be/teo/docarch/projecten/harmony/harmony.en.htm; the guidelines for the production of accessible web pages have been largely incorporated in the WAI guidelines of the W3C.
- IMS Global Learning Consortium: IMS Guidelines for Developing Accessible Learning Applications. Version 1.0 White Paper. 27 June

2002.
http://www.imsglobal.org/accessibility/accessiblevers/index.html.

- IBM:
  - Developer Guidelines for Web Accessibility: http://www-3.ibm.com/able/guidelines/web/accessweb.html (formerly at http://www-3.ibm.com/able/accessweb.html).
  - Developer Guidelines for Software Accessibility: http://www-3.ibm.com/able/guidelines/software/accesssoftware.html (formerly at http://www-3.ibm.com/able/accesssoftware.html).
  - Developer Guidelines for Java Accessibility: http://www-3.ibm.com/able/guidelines/java/accessjava.html (formerly at http://www-3.ibm.com/able/snsjavag.html).
  - Developer Guidelines Lotus Notes Application Accessibility: http://www-3.ibm.com/able/guidelines/notes/accessr5.html (formerly at http://www-3.ibm.com/able/accessr5.html).
  - Developer Guidelines for Hardware Accessibility: http://www-3.ibm.com/able/guidelines/hardware/accesshardware.html (formerly at http://www-3.ibm.com/able/accesshardware.html).
  - Developer Guidelines for Hardware Peripherals Accessibility: http://www-3.ibm.com/able/guidelines/peripherals/accessperipherals.html (formerly at http://www-3.ibm.com/able/accessperipherals.html).
- IEEE - Internet Best Practices Standards Working Group: Recommended Practice for Internet Practices - Web Page Engineering - Intranet/Extranet Applications" IEEE Std. 2001-1999, March 1999. http://computer.org/standards/Internet/webeng.htm.
- Microsoft:
  - Guidelines for Accessible Web Pages: http://www.microsoft.com/enable/dev/web/guidelines.htm (URL outdated).
  - The Microsoft Windows Guidelines for Accessible Software Design
- Sun: Java Look and Feel Design Guidelines: http://java.sun.com/products/jlf/ed2/book/index.html (contains only a few notes on accessibility).
- Trace Research & Development Center.

  - Application Software Design Guidelines. http://trace.wisc.edu/docs/software_guidelines/toc.htm.
  - EZ Access®. http://trace.wisc.edu/world/kiosks/ez/. (A set of interface enhancements which can be applied to electronic products and devices so that they can be used by more people including those with disabilities.)

- World Wide Web Consortium (W3C):
  - Web Content Accessibility Guidelines (WCAG): http://www.w3.org/TR/WCAG10/ (these have emerged as a de facto standard).
  - User Agent Accessibility Guidelines (UAG): http://www.w3.org/TR/UAAG10/.
  - Authoring Tool Accessibility Guidelines (ATAG): http://www.w3.org/TR/ATAG10/.
  - Ruby Annotation: W3C Recommendation 31 May 2001. Considerations for non-visual rendering. http://www.w3.org/TR/ruby/#non-visual.
- XML Accessibility Guidelines (XAG): http://www.w3.org/TR/xag.html (working draft).

11.1.2 Guidelines by Governments and Standards

- ISO 13407:1999 - Human-centred design processes for interactive systems. (Focusses on design processes, not design as such. See http://www.usabilitynet.org/tools/13407stds.htm.)
- ISO/TS 16071: 2002 - Ergonomics of human-system interaction — Guidance on accessibility for human-computer interfaces: http://www.stcsig.org/sn/PDF/SC4_WG5 N0660 ISO_PRF_TS_16071.pdf.
- Section 508 of the Rehabilitation Act (US Congress, 1998):
  - Summary of Section 508 Standards: http://www.section508.gov/index.cfm?FuseAction=Content&ID=11.
  - Section 508 Standards: http://www.section508.gov/index.cfm?FuseAction=Content&ID=12.
  - Electronic and Information Technology Accessibility Standards: http://www.access-board.gov/sec508/508standards.htm.

(Also available in text format, PDF, Digital Talking Book and Brailler Format, and in Spanish and Japanese.)

- Accessible Telecommunications Product Design: Technical Assistance: http://www.access-board.gov/sec508/telecomm-course.htm.
- Section 508 Tutorial: Developing Accessible Software: http://www.access-board.gov/sec508/software-tutorial.htm. (Tutorial with examples in Visual Basic 6.)
- e-Learning: Conforming to Section 508: http://www.access-board.gov/sec508/e-learning.htm.

- Nordic Cooperation on Disability: Nordic Guidelines for Computer Accessibility (1998).
- Ireland: guidelines aimed at procurers and developers of ICT products and services and initially cover the following technologies (http://accessIT.nda.ie/):
  - public access terminals (ATMs, information kiosks, ticket vending machines, card readers, etc.);
  - web (web sites, online applications, online forms);
  - telecoms (fixed phones, mobile phones, Interactive Voice Response (IVR) systems);
  - application software.
- Portuguese Accessibility Special Interest Group (PASIG): PASIG Internet Accessibility Guidelines - Final version. (1998)
- Guidelines for UK Government Websites: http://www.e-envoy.gov.uk/oee/oee.nsf/sections/webguidelines-handbook-top/$file/handbookindex.htm (May 2002).
- Canada: Treasury Board Secretariat's Federal Identity Programme - Common Look and Feel Working Group: Common Look and Feel for the Internet/Normalisation des sites Internet: http://www.cio-dpi.gc.ca/clf-upe/.
- Oregon State University Web Accessiblity Guidelines: http://tap.oregonstate.edu/Policy/web.html.
- Usability and Human Factors: International Standards: http://atwww.hhi.de/USINACTS/adopt.html#4.

According to Usability Net, standards related to HCI and usability can be categorised as primarily concerned with:

- the use of the product (effectiveness, efficiency and satisfaction in a particular context of use);
- the user interface and interaction;
- the process used to develop the product;
- the capability of an organisation to apply user centred design[44].

11.1.3 Other Relevant Documents

- Creating an Accessible Website & Evaluating an Existing Website for Accessibility: http://www.santarosa.edu/access/tutorial/index2.html (tutorial).
- Design for All in Standardisation - September 2002: http://www.diffuse.org/dfa.html.
- Readability is a frequently overlooked aspect of accessibility. There are several measures: Flesch Reading Ease, Flesch-Kincaid Grade Level, the Gunning Fog Index and the Smog Readability Formula.
    - WATS.ca: "Readability and its Implications for Web Content Accessibility." http://www.wats.ca/resources/determiningreadability/1.
    - "Readability formulas." http://csep.psyc.memphis.edu/cohmetrix/readabilityresearch.htm.
    - "The Smog Readability Formula." http://www.med.utah.edu/pated/authors/readability.html.
- Laurie Harrison: Accessible Web-based Distance Education: Principles and Best Practices: http://www.utoronto.ca/atrc/rd/library/papers/accDistanceEducation.html
- NCAM:
    - Chris Schmidt and Tom Wlodkowski. A Developer's Guide to Creating Talking Menus for Set-top Boxes and DVDs. July 2003. http://ncam.wgbh.org/resources/talkingmenus/.
    - Creating Captions for Rich Media. http://ncam.wgbh.org/richmedia/tutorials/captioning.html (formerly at http://ncam.wgbh.org/richmedia/captioning.html).

[44] Usability Net: http://www.usabilitynet.org/tools/r_international.htm.

  - Creating Audio Descriptions for Rich Media. http://ncam.wgbh.org/richmedia/tutorials/audiodesc.html (formerly at http://ncam.wgbh.org/richmedia/audiodesc.html).
  - Setting Tab Order in Flash MX. http://ncam.wgbh.org/richmedia/tutorials/tabindex.html.

- Sun. The Java Tutorial - How to Support Assistive Technologies. http://java.sun.com/docs/books/tutorial/uiswing/misc/access.html.
- Trace Research & Development Center. V2 Support Project at Trace - Toward an Alternate User Interface Standard. http://trace.wisc.edu/world/v2/index.htm. (The V2 committee of the US National Committee for Information Technology Standards (NCITS) is charged with developing national standards for Information Technology Access Interfaces.)
- WATA: Tips for Designing Accessible Web Sites: http://wata.org/resource/internet/html-tips.htm.
- World Wide Web Consortium (W3C):
  - Accessibility Features of SMIL. W3C Note 21 September 1999. http://www.w3.org/TR/SMIL-access/.
- Accessibility Features of SVG. W3C Note 7 August 2000. http://www.w3.org/TR/SVG-access/.

11.1.4 Other Lists of Guidelines

- Links to guides on designing accessible HTML pages: http://waicent.fao.org/tour/tour/tools/U-GUIDES.HTM.
- Trace Research & Development Center. Accessible Software Guidelines. http://www.trace.wisc.edu/world/computer_access/software/.

11.2 Legislation and Policies

11.2.1 Useful Resources

- European Disability Forum: Policy Issues (http://www.edf-feph.org/en/policy/policy.htm): this section of the EDF web site contains news about policies in the following areas: non-discrimination, employment, public procurement, the fight against social exclusion, the EU charter of fundamental rights, human rights, information society, standardization, barrier-free Europe and transport.

- Policies Relating to Web Accessibility (http://www.w3.org/WAI/Policy/): this page provides information on government policies relating to web accessibility in Europa, the United States of America, Canada, Australia, New Zealand and Japan.
- Guided Tour for Marketeers - The Legal Perspective (http://www.design-for-all.info/200078,319857.xml): this page contains references about initiatives in the U.S.A., the European Union and the Council of Europe (which should not be confused with the Council of the European Union).
- A Review Of Legislation Relevant To Accessibility, edited by André Gubbels and Erkki Kemppainen (Final draft, November 15, 2002, http://www.docarch.be/europe/LegislationReport-final.doc): this report was produced in the framework of the eAccessibility expert group and aims at finding out to what extent existing European accessibility legislation is limited to physical access or is covering also access to ICT.
- Webtoegankelijkheid en wetgeving (http://www.accessibility.nl/informatie/wetten/index.html, in Dutch): discusses the initiatives in the U.S.A., Australia, Canada, Europe (the Council of the European Union, the European Commission, the European Parliament and the European Ecomic and Social Committee), Denmark, Germany, the United Kingdom, Portugal, the Netherlands and other member states of the European Union and contains a section with useful links (http://www.accessibility.nl/informatie/wetten/wet9.html).
- Gesetzestexte und Verordnungen: http://wob11.de/links/gesetze_verordnungen.html: a collection of German national legal documents related to disability.
- Dokumente zur Gleichstellung auf Länderebene: aktuelle Regelungen und Berichte: http://www.netzwerk-artikel-3.de/wsite/laand.php: details all corresponding laws for 14 Germany lands.

11.2.2 Existing Policies and Legislation by Country

- Australia: Disability Discrimination Act (http://www.austlii.edu.au/au/legis/cth/consol_act/dda1992264/); Human Rights and Equal Opportunity Commission: World Wide Web Access: Disability Discrimination Act Advisory Notes: http://www.hreoc.gov.au/disability_rights/standards/www_3/www_3.html.
- Portugal:

  - Petition for the Accessibility of the Portuguese Internet (Parliament Report): http://www.acessibilidade.net/petition/parliament_report.html ;
  - Resolution of the Council of Ministers Concerning the Accessibility of Public Administration Web Sites for Citizens with Special Needs: http://www.acessibilidade.net/petition/government_resolution.html;

- United Kingdom:
  - Disability Discrimination Act 1995 (http://www.hmso.gov.uk/acts/acts1995/1995050.htm; for related issues see http://www.disability.gov.uk/dda/);
  - SENDA: Special Educational Needs and Disability Act 2001 (http://www.hmso.gov.uk/acts/acts2001/20010010.htm ; see also “The Special Educational Needs and Disability Act: Guidance for Teaching Staff”: http://jarmin.com/demos/course/senda/);

- Germany: Verordnung zur Schaffung barrierefreier Informationstechnik nach dem Behindertengleichstellungsgesetz (Barrierefreie Informationstechnik-Verordnung - BITV). 17 July 2002. http://www.bmi.bund.de/Annex/de_22681/Barrierefreie_Informationstechnik-Verordnung_BITV_als_PDF-Download.pdf;

- Switzerland: Gleichstellung der Behinderten: http://www.ofj.admin.ch/themen/behinderte/intro-d.htm. This page links to the Behindertengleichstellungsgesetz, which came into force on 1 January 2004.Article 10 of the accompanying Behindertengleichstellungsverordnung concerning implementation of the law, refers to the Guidelines of the World Wide Web Consortium.

- United States of America:
  - Rehabilitation Act Amendments of 1998, Section 508;
  - Americans with Disabilities Act;
  - Federal Acquisition Regulations: http://www.section508.gov/index.cfm?FuseAction=Content&ID=13.
  - 1998 Amendment to Section 508 of the Rehabilitation Act: http://www.section508.gov/index.cfm?FuseAction=Content&ID=14.

- Canada: “Common Look and Feel for the Internet” (http://www.cio-dpi.gc.ca/clf-upe/; since May 2000; policy, not legislation). The first section addresses accessibility (http://www.cio-dpi.gc.ca/clf-upe/1/1_e.asp): all federal government organizations are required to conform to W3C WCAG Priority 1 and 2 Checkpoints by 31 December 2002.
- United Nations: World Programme of Action Concerning Disabled Persons (1998; http://www.un.org/esa/socdev/enable/diswpa01.htm)
- EC Mandate 273 (1998): *Standards for disabled and elderly peoples' access to information and communications technologies (ICT) products and services including 'design for all'*. (http://www.etsi.org/public-interest/mandate/M273.pdf).
- EC Mandate 283: *Mandate to the European Standards Bodies for a guidance document in the field of safety and usability of products by people with special needs (e.g. elderly and disabled)* (http://www.etsi.org/public-interest/mandate/M283.pdf). One of the three tasks in this mandate was the creation of a guidance document, which was published in January 2002: *CEN/CENELEC Guide 6: Guidelines for standards developers to address the needs of older persons and persons with disabilities* (http://www.cenorm.be/BOSS/supmat/refdoc/resources/c_clcgd006.pdf).

12 Appendix D: List of Strategies For Facilitating the Adoption and Successful Practice Of Universal Design by Consumer Product Manufacturers

(Source: http://www.trace.wisc.edu/docs/univ_design_res_proj/udrp.htm)

12.1 To Improve Awareness of Universal Design

- Introductory materials on universal design (including print, video, and web-based materials) for use by internal advocates.
- Articles on universal design in the periodicals read by your upper management and product designers.
- Presentations or exhibits at key industry or professional conferences by experts and advocates of universal design.

12.2 Design Tools and Procedures (for specific product types and industry segments)

- Checklists of what to look for.
- Ideas and strategies for meeting needs and guidelines.
- Procedures that can be used to evaluate product designs and identify problem areas to address prior to prototyping and/or testing with consumers.
- Case studies and specific examples of good universal design process and commercial products.
- Designs and feature sets, agreed on (consensus) as acceptable by consumer groups.

12.3 Statistical / Market Data

- Demographic data re the number of people with different types of disabilities.
- Demographic data re the number of people with functional limitations that would benefit from universal design. This would include people with temporary limitations (e.g., a broken leg) and situational limitations (e.g., a noisy environment).
- Statistical and other data regarding the performance level of individuals with different types of disabilities.
- Data re the number of people that have problems with different product features.

- Method of estimating the number of new customers (individuals and institutions; with disabilities or not) that might result from a particular design decision or features.

12.4 Training / Education

- Training courses for members of design and development teams.
- Training courses for marketers and product managers.
- Incorporation of universal design into professional training programs in design and development of products and services.

12.5 Consumers

- Awareness by advocacy groups of business constraints and methods.
- Positive advocacy by disability groups (balancing criticism of shortcomings with acknowledgment of effort and progress).
- Consumer groups that will keep the pressure up until products are accessible.
- A knowledgeable consumer base, where consumers with disabilities readily communicate with companies about their products, offering detailed criticism and suggestions.
- Assistance with product testing by consumer with disabilities, including recruitment of test subjects.

12.6 Regulation / Requirements

- Appropriately written federal regulations requiring accessibility of products and services.
- Inclusion of disability access requirements in specifications by large buyers (e.g., federal and state government, large volume or group buyers).
- More opportunities to communicate, consult, and negotiate with regulators in advance.
- Involvement of companies in developing the research (and funding) agenda

12.7 Consultants / Experts

- Availability of experts to assist with specific universal design issues on specific products.
- Availability of consultants to facilitate implementation of universal design in product development.

- Availability of consultants to facilitate implementation of universal design in marketing.
- A widely accepted rating system or "seal of approval" based on expert judgment.