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THE IDCNET APPROACH: EDUCATING STUDENTS AND PROFESSIONALS IN ‘DESIGN FOR ALL’

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One of the questions this conference should address is whether we have the structures in place which will enable people with impairments to move through life with appropriate Assistive Technology to meet their changing needs. A key requirement within such an infrastructure is education. The Inclusive Design Curriculum Network (IDCnet) is a Thematic Network financed by the Information Society Technologies (IST) Programme of the European Commission (http://www.idcnet.info/). The aim of the project is to integrate information and identify core knowledge sets and skills for model curricula in Design for All (DfA) specifically for information and communication products, systems and services. This presentation will present some ideas which are still under discussion and will invite further contributions, both now and as the project progresses.

Inclusive design, Design for All, curricula, ICT, HCI

1. INTRODUCTION
One of the questions this conference should address is whether we have the structures in place which will enable people with impairments to move through life with appropriate Assistive Technology to meet their changing needs. A key requirement within such an infrastructure is education:

- educating our students in design, ergonomics and technology in the principles of inclusive design
- educating professionals in industry in the need for inclusively designed products and technologies and the methods and tools to put it into practice, and finally
- educating consumers to demand what they need and want.

An EU project called IDCnet is focusing on educating the students and professionals who are learning and working in the area of information and communication technologies (ICT) to include the requirements of older and disabled people. The Inclusive Design Curriculum Network (IDCnet) is a Thematic Network financed by the Information Society Technologies Programme of the European Commission (http://www.idcnet.info/). The aim of the project is to integrate information and identify core knowledge sets and skills for model curricula in Design for All (DfA) specifically for information and communication products, systems and services. As a thematic network, a major aim of the project is also to support the creation of a European network to promote these interests, following the e-Europe objectives (http://europa.eu.int/information_society/eeurope/index_en.htm) and coordinating our efforts with the European Design for All eAccessibility Network (EDeAN, http://www.e-accessibility.org) and its supportive infrastructure represented by the Design4All project (http://www.d4all.gr/).

ICT, ranging from, for example, computers to mobile telephones, are important in many sectors of society today. Such technologies enable participation not only in tele-working and tele-education, but also in e-health, leisure, e-shopping and other consumer activities. In many cases, older and disabled people may be the most likely to benefit from such new technologies, products and services. However, in reality they may have difficulties in taking advantage of the systems due to limitations in their physical, sensory or cognitive abilities. Thus, as advances are made in ICT, older and disabled people may lag behind—unless technologies are designed with their requirements in mind.[1] In principle, professionals may want to design more inclusively (and know in many cases that they may have to do so to comply with legislation), but they are likely to be struggling with exactly how to go about it.
Education in the principles of inclusive design and the needs of older and disabled people is key to achieving this ‘how’.

Many people think of accessibility as being firmly tied in with disability, and that accessibility is usability for people with disabilities, often using assistive technology. However, the relationship between Human Computer Interaction and Design for All in ICT is very close, with technical accessibility seen as a pre-condition for usability, which is one of the central rationales of HCI. ISO TS 16071 clearly defines accessibility in relation to usability as a measurable entity [2], defining accessibility as:

The usability of a product, service, environment or facility by people with the widest range of capabilities.

This becomes clear if one thinks of using a mobile phone. If a particular user cannot access the functionality because the buttons are too small, then it is not accessible—nor is it usable if that person cannot perform the tasks easily, effectively and efficiently.

Design for All, or Inclusive Design, is very much concerned with ‘a priori’ design with a diverse range of users in mind. This concept of Design for All can, and should, be introduced as early as possible in a professional’s career. In addition, training and competence in the use of appropriate user research methods and tools for inclusive design are needed. Ensuring that any materials, methods and tools for inclusive design are accessible and usable will also be crucial to their uptake. This all clearly emerged during discussions on obstacles and solutions for more inclusive design at the first Include 2001 Conference in London (April 2001, see http://www.hhrc.rca.ac.uk/events/include/), later to be emphasised at Include 2003 (http://www.hhrc.rca.ac.uk/events/include2003). However, in a survey with professional designers from the Design Business Association in the United Kingdom, there were few respondents from the communications industries who felt that inclusive design was particularly relevant to them, despite the implications of the Disability Discrimination Act.[3]

Differences in attitude towards inclusive design are evident between the U.S. and the U.K. In the U.S. legislation is considered the most important factor which results in consideration of the needs of people with disabilities. However, in the U.K. legislation is mainly seen as providing a basic platform on which to build, and knowledge is considered the key factor.[4] The study by Dong, et al. [4] 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. Likewise, these same strategies have also been identified and further extended by IDCnet.

2. IDCNET’S STRATEGY

IDCnet wished to have a better idea of industry’s perception of inclusive design, their strategies for promoting inclusive design, and how much industry knows about disability legislation. In addition, in order to develop successful curricula in Design for All, it is necessary to know what industry wants from graduates with inclusive design knowledge, and what they actually end up getting.

One of the first major activities of IDCnet was a workshop held in Helsinki in February 2003 called ‘Design for All Curriculum: Towards a synergy of the needs of ICT industry and education.’ The workshop brought together experts from industry (e.g., software and hardware designers) to discuss what they would expect from graduates who claim a proficiency in Design for All. In addition, experts from the academic world, with teaching or research interests in DfA, presented their own experiences in the field to suggest key knowledge sets and skills that they feel are necessary for curricula in this area.

As well as attempting to answer these questions, the workshop was also to focus on one of the key points of the eEurope 2002 action plan, in particular, to “Ensure the establishment and networking of national centres of excellence in design-for-all and create recommendations for a European curriculum for designers and engineers.”

3. A TAXONOMY OF KNOWLEDGE AND SKILLS

The workshop noted that there is a great deal of information around on inclusive design (including, e.g., research projects, websites, networks, etc.), but it was felt that these receive minimal interest from industry.[5] Various categories of knowledge and skills were identified as being important to include in modules and courses with DfA content, e.g., how to raise awareness, what legislation and guidelines are important to consider, and what useful resources can be made available to ICT students.

These categories and some suggestion of the content of courses in inclusive design for ICT are discussed below, suggesting what to teach and why it is important. The first four categories would be relevant to a wide range of application areas, whereas the remaining ones would apply mainly to the ICT sector. The hope would be that as the philosophy of inclusive design becomes more well established as a part of design, the first two categories (Awareness Raising and Why Design for All) may be able to receive less emphasis. On the other hand, other categories may grow in importance, e.g., as there are new advances in networked and wireless technology.[6, 7]
Each set is capable of having several topics in it. The sets could be taken as a whole making a complete course, although, as they do not include topics like design processes, they would not be able to be stand alone. The more flexible approach would be to take topics in a ‘mix and match’ style to blend into ongoing courses. This could be done at a module level, or even at a unit level, and topics could be inserted and blended into ongoing courses. In the subsections that follow, each category/area is described briefly, and indicative learning outcomes are associated with each.

3.1 Awareness of Design for All
This knowledge category serves most often as an introduction to Design for All. By various means students are encouraged to think of users in a wider category than just mirror images of themselves, to understand how barriers are unintentionally put up when user needs are not sufficiently understood. Practical exercises can be used here, like empathic modelling [8] or encouraging students to seek out examples of bad design.[9]

3.1 1 Learning outcomes
Students are made aware of problems faced by users in various contexts, e.g. access to the built environment, products and services, and to information sources especially on the Web. Students understand that Design for All does not mean one universal solution, but the inclusion of accommodations that serve all situations and users, i.e., both those with disabilities and those in handicapping situations.

3.1 2 A practical example
Raising awareness of the needs of older and disabled users can take many different forms—from case studies and examples of good practice to empathic modelling, which we include in our module called Ergonomics of Disability and Ageing, taught by ergonomists at ESRI (Ergonomics and Safety Research Institute) at Loughborough University. This module is offered as a final year option for one semester to students in ergonomics, psychology, human biology, design and information technology, as well as to the MSc programme. The aims of this module are for the student to:

- Develop an awareness of ageing and disability and explore how ergonomists can play a part in the design of products, services and the built environment for elderly people and people with disabilities
- Explore the concepts of ‘universal’, ‘inclusive’ and ‘barrier free’ design, as applied to particular applications (both low and high technology)
- Examine the role of ergonomists in the development and evaluation of adaptations, generic or individual solutions.

The first lecture of this module includes a session on empathic modelling whereby an individual, using various props and scenarios, attempts to simulate the deterioration of physical and perceptual abilities in everyday scenarios, for example, by using spectacles that decrease visual acuity. In addition, the person is encouraged to attempt coping strategies and adaptation techniques that older and disabled people might use in specific situations.[10] The aim is to encourage students to think about how we take our senses and abilities for granted and how the reduction or removal of a sense or ability can drastically change our perception of an environment or activity. For more detail, Nicolle and Maguire [8] provide a description of the steps and ‘props’ that have been used successfully to carry out a simulation workshop with our university students.

3.2 Why Design for All? Ethical, Legal and Commercial Considerations
Under this knowledge category students are introduced to three complementary rationales for Design for All:

3.2.1 Ethical considerations
The case of a citizen’s rights towards an enhanced quality of life seems to be unopposed, but we are still faced with the reluctance of industry to focus on products for older and disabled people (Engelen et al, 2003). The philosophy of equal opportunities for all and non exclusion are vital, and there is also a need to ensure that products and technologies do not stigmatise users. As Patricia Moore said at the Include Conference recently, ‘If we remind people of their disability through our designs, then we should consider the product a failure.[11]

3.2.1.1 Learning outcomes
As part of ethical considerations, students learn about the history of Design for All, the move from segregation to integration, from specialised solutions to inclusive solutions and equal opportunities for all.

3.2.2 Legal considerations
A theme which kept recurring throughout the IDCnet workshop was that the majority of companies will only spend time and money on DfA when forced to do so by law.[5] However, it was suggested that large companies are becoming more and more interested in international standardisation of DfA related guidelines. The reasoning behind this was that standards describe exactly what they are required to do, but can also fix the limits of the requirements imposed on companies. Nordby [12] also stressed this point: “If older and disabled people are ever to have ICT facilities and services that are adapted to their needs, the only certain way will be through legislation.” However, it is important that students in ICT appreciate and understand the spirit of the law, and not just the letter of it.[13]
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3.2.2.1 Learning Outcomes
As part of legal considerations, students learn about various pieces of legislation, how they have come about, their impact, and what is set to happen in the future.

3.2.3 Commercial considerations
An argument needs to be made that DfA will increase the potential user base. However, during the IDCnet workshop a representative from industry questioned the assumption that Design for All leads to bigger market shares. He claimed that there is no evidence of increase in sales when ICTs are designed to be accessible, and it is still necessary to prove the economic viability of Design for All in this application area, although this may not be the case in other domains such as the low-floor bus.[13]

3.2.3.1 Learning Outcomes
As part of commercial considerations, students are introduced to the commercial benefit of Design for All and various supporting arguments, such as the problem of retro-fitting design. Other requirements, such as the importance of making sure that products appeal to all and do not carry stigma are re-iterated since the ‘specialised solution’ design that is non-aesthetic is often rejected, even though it may fulfil its functional requirements.

3.3 Recommendations
This knowledge category is a ‘catch all’ for work such as Principles, Guidelines, Standards, Recommendations, and Specifications that have a bearing on Design for All.

As noted above, curricula need to include knowledge and understanding of legislation and guidelines, not just the letter of the law but also the spirit of it. In the ICT area, these will range from the Americans with Disabilities Act in the U.S. (http://www.usdoj.gov/crt/ada/adahom1.htm) and the Disability Discrimination Act in the UK (http://www.disability.gov.uk/dda/index.html), to application specific guidelines, e.g. the Web Content Accessibility Guidelines from the World Wide Web Consortium–Web Accessibility Initiative (W3C–WAI) (http://www.w3.org/TR/2003/WD-WCAG20-20030624/).

3.3.1 Learning outcomes
Students are made aware that such bodies of knowledge exist. They should be encouraged to search for such work and consult them as a first step. At the same time, it is acknowledged and explained/illustrated that these are not always easy to find, and rarely will be in a format that is easy for them to use and implement in specific contexts. The ‘jargon’ of each type of recommendation is also a consideration.

3.4 Interpersonal Skills for Teamwork
This category is slightly different from the preceding ones because it centres on skills rather than on knowledge. However, it can be stressed to students that behavioural skills such as team work, communication skills, information representation, information retrieval, etc., are very important to design work practice in general (see Career Space: Curriculum Development Guidelines. Available at: http://www.careerspace.com/) and to Design for All in particular. This is because Design for All is not widely understood or accepted as yet. Designers with an understanding of Design for All may find themselves the only person in the team with this knowledge. They will have to work to convince their co-workers at many different levels within the organisation of the importance of Design for All.

For this area, the actual teaching strategies are the most useful way to give students the opportunity to learn these skills, by organising team work, presentations and critical evaluations/critiques. These can, for example, include experience using inclusive design guidelines and discussing examples of good and bad design in a multidisciplinary setting.[1] In particular, students who are to work as agents of change or ‘evangelists’ for Design for All should be able to demonstrate their skills of convincing the unwilling/disbelieving/unaware with sound argument and efficient persuasion.

3.4.1 Learning outcomes
Students are made aware of the existence of these skills, their importance to the workplace, and to Design for All, and that they should practise them.

3.5 Accessible content: knowledge about documents and multimedia
As its label implies, this category refers to making sure that ‘content’ (mostly information and interactive Web sites) are accessible. The content can be all types of media, and one of the first rules of accessibility is that alternate forms of media be available. Topics can include: making content accessible in the sense of structuring documents, or making Web content accessible in the sense of what content goes in, or even in the sense of Web content management. The learning outcome is generalised. Depending upon the type of students, whether they are Web designers with training in information design or computer programmers, the topics and their related objectives can become more specific, for instance, understanding how to code for accessibility, etc.
3.5.1 Learning outcomes
Students develop the ability to understand when content is problematic and why. They learn about current methods and techniques to produce accessible content or to convert content. Depending upon the type of student or course, they develop the ability to produce accessible content or to convert content.

3.6 Accessible interaction: input and output
This label is subtitled ‘input and output’ to delineate the category from accessible content. This category is for the hardware and software enablement of interaction. Topics here would include:

- Knowledge about assistive and adaptive devices that enable alternative input and output, e.g. speech synthesisers, screen reader software, screen magnifiers, alternative keyboards, etc., as well as different types of browsers and operating systems that allow different manipulation of the content, etc.
- Knowledge about different types of modalities: speech, haptics, gesture, sketch, scanning, bio-sensors, etc.
- Knowledge about different bandwidths, device capabilities, etc.

A case study to illustrate this category could be research and development projects with near-to-market software, for example, the EU WWAAC project (World Wide Augmentative and Alternative Communication) (www.wwaac.org). This project aims to make the electronic highway more accessible to people with complex communication needs, in particular those using symbols instead of text to communicate. The project, which began in January 2001, has been engaged in a number of research and development activities, including the:

- Development of Internet applications, including an adapted Web browser, tailored to the needs of people with complex communication needs, who may also be using scanning interfaces
- Contribution to the development of Web accessibility guidelines (see section 3.3), and
- Development of a communication infrastructure and protocol to support symbol-based communication on the Web, based upon open-sourced concept coding.

Such developments emphasise the importance of alternative input and output and how an adapted Web browser and email application can lead to more accessible interaction to meet the diverse and varied needs of end users.[14]

3.6.1 Learning outcomes
Students are introduced to a range of different input and output modalities and considerations. As with other categories, depending upon the specific course objectives and the background of the students, the material can range from ‘knowledgeable about’ to ‘knowing how to’—that is, competent to talk about these topics and understanding at a general level how they function, to being able to actually develop them and to work on developments with them.

3.7 New paradigms of interaction
This category was created for the work that is mostly in the research state currently, but within the next four or five years—the typical time span of an undergraduate+master’s university education—could breakthrough into mainstream development. Topics that could currently be included here are affective and social computing, a range of smart computing applications, smart homes, clothes, cars, ambient intelligence, etc.

3.7.1 Learning outcomes
Students become familiar with the emerging paradigms, understanding how they have evolved from current paradigms. Further specialisation depends upon both the background of the students and degree of emergence of the paradigm. In each case, students must be encouraged to view these developments through the ‘lens’ of Design for All.

3.8 User centred design
This category is the one into which go all the human, user, usability/accessibility philosophies, methodologies and techniques that apply to requirements and evaluation phases of design, etc. Many of these are routinely taught as part of HCI courses (e.g., individual and group interviews, observation, using subjective and objective evaluation criteria, etc.), but they do not always include guidance on the diversity in users and situations.

3.8.1 Learning outcomes
Students are made aware of the work in this area, the methods and tools available, and the way these can be used to capture requirements and to evaluate designs for e-inclusion. Students are also required to actively use these techniques.

3.9 Application domains and research
This label can refer to ‘application domains’, and separately to research issues and challenges that go with them, or it can view these two activities as related, dependent upon the case. This category includes a wealth of areas, such as public access to information, authoring environments, health monitoring, etc. One of the most important
areas for the contribution it is bringing to the field as a whole, is that of technology enhanced learning, and for this reason it is described in more detail below.

3.9.1 Learning outcomes
As with paradigms of interaction, application domains within the ICT sector need to be followed by students, and they need to bring to them the Design for All perspective, perhaps carrying over lessons from one application into another.

3.9.2 eLearning
Ensuring that a website is accessible has certainly become a very important issue with regard to eLearning and the provision of information to students. According to the UK’s Special Educational Needs and Disability Act (SENDA), from September 2002 students with disabilities should have the same opportunities as everyone else to benefit whenever possible from whatever education or other related provisions are available. So we should not just consider the content of the courses in Design for All, but also how it is made available, accessible and usable to the students.

The education sector, and in particular the higher education eLearning sector, is well advanced in its considerations of what it means to have accessible eLearning. It is in this domain that one finds courses built around Web technologies, making content accessible and making interaction accessible. Typically the development of accessible instructional materials is a distributed process, where course materials are a combination of instructor created materials, including assessment/evaluation materials (tests and quizzes); existing materials that an instructor links to; and the organisational and evaluation capabilities of some course management tools. In addition, classroom collaborative activity is simulated by some kind of synchronous or asynchronous conferencing system.

4. AVAILABLE RESOURCES
A Joint Workshop of IFIP WG 13.1 on Education in HCI and HCI Curriculum and IFIP WG 13.3 on HCI and Disability, recently held at Interact 2003, discussed the topic of ‘Including Accessibility and Inclusive Design in the Curriculum for Human Computer Interaction’ (INTERACT 2003, the IFIP TC13 International Human-Computer Interaction Conference, Zurich, Switzerland, 15 September 2003.) It was evident that the participants needed more than what to teach and why, but also how to promote and present these concepts to students. There was an interest to know more about:

- sharing materials rather than ‘re-inventing the wheel’
- basic usability principles stating the minimum that should be taught, and applying usability principles in the wider context
- practical exercises to improve awareness raising
- recommendations on how to work more effectively with industry

This paper has attempted to provide a few suggestions in this regard, although how to teach these core knowledge sets and skills is not within the remit of the IDCnet project. Furthermore, the IDCnet workshop agreed that there is much information available, and noted that more case studies for ICT products and services are needed that will demonstrate best practice, e.g., from mobile phone industry. There have been initiatives in compiling case studies in various application areas, but there is still a need for not only a greater number of them, but more suitable case studies for ICT. Case studies form a part of the i~design toolkit,[3] a resource developed by the Helen Hamlyn Research Centre at the Royal College of Art, with funding from the UK Engineering and Physical Sciences Research Council (http://idesign.wiredesign.net/). The purpose of the toolkit is to connect designers, design managers, and other decision makers to key concepts, information sources, design and research methods and contacts in the field of inclusive design. A section on case studies includes a limited number relevant to ICT, e.g.

- An accessible website design for a sports-based web channel that appeals to all and includes the needs of visually impaired users.
- A computer interface for internet shopping which downloads images as 3D objects so that people of different abilities can make more informed choices.

However, it is clear from the number of case studies available that there are few available in the ICT area, most concentrating on applications such as consumer products, packaging, and the built environment. Further examples which demonstrate good practice in the inclusive design of ICT products would be very welcome.

5. CONCLUSIONS AND NEXT STEPS?
The work of IDCnet is to identify core knowledge and skill sets, in discussion with industry and academia, by carrying out teaching pilots, and by communicating the results to Education Policy and Strategy bodies.

Insofar as teaching inclusive design, this tackles some of the fundamentals of the issue, but leaves out questions of accreditation, how to train the trainers, etc. We also need to discover how we can best promote industry-academia co-operation on Design for All curricula in ICT. What is certain is that inclusive design is here to stay. Although industry may not be featuring it in its advertisements, this should not deter us. After all, after so many
years of HCI, industry, in its documents addressing the ICT skills gap, did not mention HCI! (www.career-space.com)

Thus, IDCnet is still discussing whether everything we want to teach is covered in the categories mentioned above, and we are looking for those involved in teaching to contribute with their experiences. We invite you to participate in the project’s discussion list at helsinki@listserv.cc.kuleuven.ac.be, and if interested to participate in future network activities—more information at www.idcnet.info/

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