Introduction to Universal Design for Engineering

Professional & Personal Skills for Engineering

Dublin City University

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Contents

• What is good design
• What is Universal Design
• The Process
• Resources and tools
• Working together
What is good design
Good design enables

http://www.ud-germany.de/cms/ud/en/home/universal_design
Enables doing everyday things…
Enables cooking...
Enables work...
Enables washing...
Enables fun
Bad design excludes
Bad design excludes:

"At night I can see the writing, but by day I find it impossible to use. I know there's something written there but I don't know exactly what it says."
Bad design excludes
Diversity in normal
Diversity is normal

1.80m (max)
1.35m (min)
1.15m (min)
Diversity is normal

Children (<16 years) 20%
Older people (>65 years) 15%
Primary language not English 5%
Left-handed 10%
People with disabilities ~10%

Warning: Treat these figures solely as indicative of the order of magnitude.
Users with Problems Using ICT

- 0.4% Wheelchair users
- 5% Cannot walk without an aid
- 2.8% Reduced strength
- 1.4% Reduced co-ordination
- 0.25% Speech impaired
- 0.6% Language impaired
one in seven people has a form of disability that affects how they use ATMs and other machines.

Change in the population within each age band over time

Figure source: The government actuary’s department, via www.InclusiveDesignToolkit.com
Potential Support Ratio

- Potential Support Ratio (PSR) is the ratio of the number of 15-64 year olds who could support one person 65+
  - In 1950 the PSR was 12:1
  - In 2000 the PSR was 9:1
  - In 2050 the PSR will be 4:1
BACKGROUND AND HISTORY
Brief History of Universal Design

- Origins found in Independent Living, one of the US social movement of the 1960s. First independent standard developed in 1961.
- Further federal laws and standards throughout the 1960s and 1970s.
- State codes introduced in the 1970s.

(Duncan, 2007)
Brief History of Universal Design

• Universal Design began to develop in the mid 1980s.
• Federal laws and regulations continued to develop in the 1980s and 1990s.

(Duncan 2007)
What is Universal Design?

• Universal Design is the design and composition of an environment so that it can be accessed, understood and used to the greatest extent possible by all people regardless of their age, size, ability or disability

(Synopsis of the Disability Act 2005)
Ability as a Continuum

• “Universal design...assumes that the range of human ability is ordinary, not special” (Elaine Ostroff, Universal Design Handbook, 2001)

• Universal Design requires an appreciation of the varied abilities of every person.

• Involves designing in such a way that the resulting product, service or environment can be used by everyone regardless of age, size, ability or disability.
Universal Design aims:

• “to maximize the number of [people] who can readily use a product, building or service which may be achieved by:
• (i) designing products, services and environments that are readily usable by most users without any modification,
• (ii) by making products or services adaptable to different users (adapting user interfaces), and
• (iii) by having standardized interfaces to be compatible with special products for persons with disabilities.”
• (ISO, CEN, NSAI)
Benefits of Universal Design

• Social Drivers
  – The Ageing Population
  – An Increase in the Number of People with Disabilities

• Social Benefits
  – Independent Living
  – Social Inclusion
  – Social Wellbeing
  – Equal rights
  – Anti-discrimination
Benefits of Universal Design

• Business Drivers
  – Meeting needs and demands of consumers
  – Increase in market

• Business Benefits
  – Expansion in market potential
  – Increase in customer satisfaction and retention
  – Reduced costs of retrofitting
Legislation

• Disability Act 2005
  – Centre for Excellence in Universal Design

• Public Procurement Directives (2004/17/EC and 2004/18/EC) (toolkit)

• UN Convention on the Rights of Persons with Disabilities (Signed by Ireland March 07)

• Council of Europe
Policy – International

• UN Convention on the Rights of Persons with Disabilities 2007 – General Obligations:
  
  • State Parties are “to undertake or promote research and development of universally designed goods, services, equipment and facilities ………………… to promote their availability and use, and to promote universal design in the development of standards and guidelines.”
Policy – Europe

- Council of Europe
  - Draft Resolution Dec 2007:
    - “On achieving full participation through Universal Design”
      - Umbrella Term is Universal Design
  - EU Disability Action Plan 06-16:
    Universal Design identified as “vital element of the implementation strategy” with specific reference to curriculum, ICT, built environment, products and services.
    - New directive on equality of provision of goods and services
Irish Law

• **The Employment Equality Act 1998**
  – covers employment of people with disabilities and provision of accessible technologies to employees.

• **The Equal Status Acts 2000 & 2004**
  – The Equal Status Act covers various forms of discrimination, including discrimination on the basis of a disability. Under the Act, anyone selling goods or providing services must do all that is reasonable to accommodate the needs of a person with a disability.

• **Disability Act 2005**
  – Established the Centre for Excellence in Universal Design
  – Obligations on making information and services provided by government accessible to people with disabilities
Ireland – CEUD

UK – Inclusive Design

Europe: EDeAN EIDD

Norway:
LIST Design Council
DELTA Centre
Universal Design

Germany:
If Forum with Cebit
First UD Awards

India – Design for All Institute

Australia – Home Modification Information Clearinghouse

United States
CUD – North Carolina
IDEA – Buffalo
Trace - Wisconsin

Japan - IAUD
Aims of the Centre

Standards
- Stimulate research
- Participate in Standardisation work nationally and internationally
- Provide advice to stakeholders
- Encourage compliance

Education and Professional Development
- Incorporation into design curriculum
- Application of Universal Design for Learning approach to teaching and examinations

Awareness
- Best practice database
- Promote awareness and understanding
THE PROCESS
Universal Design process

• A design and development methodology
• Clear knowledge of user requirements
• User centred design
  – Walking a mile in the shoes of the end user
• Iterative process
• Principles and guidelines
• Tools to aid design
User centred design

1. Study the requirements
2. Understand the issues
3. Design a solution
4. Test it
5. Optimise it

http://www.bunnyfoot.com
Iterative process

- Clarkson et al 2007
Is technology aiding or hindering these people
7 principles

• Principle 1: Equitable Use
  – The design is useful and marketable to people with diverse abilities.
7 principles

• Principle 2: Flexibility in Use
  – The design accommodates a wide range of individual preferences and abilities.
7 principles

- **Principle 3: Simple and Intuitive Use**
  - Use of the design is easy to understand, regardless of the user's experience, knowledge, language skills, or current concentration level.
7 principles

• Principle 4: Perceptible Information
  – The design communicates necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities.
7 principles

• Principle 5: Tolerance for Error
  – The design minimizes hazards and the adverse consequences of accidental or unintended actions.
7 principles

• Principle 6: Low Physical Effort
  – The design can be used efficiently and comfortably and with a minimum of fatigue.
7 principles

- Principle 7: Size and Space for Approach and Use
  - Appropriate size and space is provided for approach, reach, manipulation, and use regardless of user's body size, posture, or mobility.
Wearable impairment simulators
Wearable impairment simulators
Software impairment simulator
Design processes - Vanderheiden

- Accessible design and testing in the application development process: considerations for an integrated approach proposes a 4-step methodology for the development of software application development that is closely aligned with best practices of software engineering:
  - using **use case** and **personas** to capture user requirements and make them real and comprehensible
  - **making user requirements real concrete** through the use of scenarios and guidelines
  - using manual and automated **testing techniques** based on **test cases** and **checkpoints**
  - **user testing** and **expert review**.

Universal Design Resources

Inclusive Design Toolkit -
http://www.inclusivedesigntoolkit.com/betterdesign/

Tiresais.org -
http://www.tiresias.org/
Standards, Education, Awareness

Case Study
The OXO "Good Grips" range of kitchen utensils began with a goal to produce a vegetable peeler that was easy to hold and use, regardless of strength or manual dexterity. This resulted in OXO applying a Universal Design approach when designing any of their kitchen products.

Welcome!
The Centre for Excellence in Universal Design is dedicated to enabling the design of environments that can be accessed, understood and used regardless of age, size and ability. We do this by contributing to the development and promotion of standards, education courses and awareness. More on CEUD's mission.

Explore & Discover
Discover what is Universal Design, its Principles, background and history, related policy and legislation. See the benefits of adopting Universal Design.

Teach & Learn
Find an educational or training course on Universal Design, see what current research is happening or browse publications on Universal Design.

Use & Apply
Apply the Principles of Universal Design to the Built Environment, Products and Services or in IT and the web through the use of standards and guidelines.

Get involved
» Learn about the Principle of Universal Design
» Come to an event on Universal Design
» Join the Universal Design for ICT mailinglist
» See relevant guidelines and standards

Latest
» 6th Apr: Career opening - Product designer
» 5th Mar: Published new design standards
» 11th Feb: CEUD announce 3 new educational partners

About the Centre
» What we do
» The CEUD's vision
» Main activity areas of the CEUD
CEUD IT Guidelines

- 5 technology areas
  - Web
  - Public access terminals
  - Application Software
  - Telecoms
  - Smart Card Systems
AND FINALLY...
Skills required for Universal Design

• Knowledge of good, user-centred design practices
• Good communication skills
• Working in multi-disciplinary teams
• A strong belief in good design
Let’s work together to

• Develop new project and dissertation ideas in the areas of:
  – Universal Design,
  – Accessibility,
  – Assistive Technology,
  – User Centred Design

• Encourage the development of new modules and courses (post and under graduate levels)
Universal Design Limerick

Abilities differ in all,
Sometimes we fly, sometimes fall.
The spectrum is vast,
So from first step to last,
Universal Design is our call

(Annraoi De Paor, 2007)
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