People and Computers

Prof. Alan F. Newell, FRSE
Department of Applied Computing
at the University of Dundee

www.computing.dundee.ac.uk
Dept. of Applied Computing
Staff:

• Fifteen academic staff

• Over 20 research staff and students

• Multi-disciplinary

• An improving gender balance

www.computing.dundee.ac.uk
What is the most important characteristic of a good piece of software?
Modern Software Engineering tools mean that...

...deciding what to do can be more difficult and time consuming than implementing the design.

...increasingly with computer systems, the product is the user interface
Contents of Degree Programmes

Key parts:

- Human Computer Interaction
- Requirements gathering
- User-centred design processes

From first year through to final year project

www.computing.dundee.ac.uk
Human/Computer/Machine Interface

• What is a human being?
  – What are its characteristics?
  – What are its needs and wants?

• What is a computer?
  – Personal computer
  – Domestic equipment
  – Chemical plant
  – Aircraft
The User Interface

- The importance of good interface design
- The perils of bad interface design
- Interfaces of everyday objects
- Computer interfaces
Examples of Poor Design

• Video Tape Recorder
• Car Radio
• Teletext
• Windows

Also see www.baddesigns.com
Seen in the foyer at MIT...
User Centred Design

• The requirements of the *user* at the *centre* of the design process
• Early and continued evaluation with *real* users in *real* situations
The Star Diagram

- Implementation
- Task analysis
- Functional analysis
- Evaluation
- Requirements specification
- Conceptual design
- Formal design
- Prototyping

From Hix & Hartson (1992)
Questions to ask

- Who are the users?
- What are the characteristics of the users?
- What are the needs of the users? (Requirements Gathering)
Early and Continual User Testing

- Talk with users
- Run ideas past users
- Visit user location, observe them working
- Analyse the user’s tasks
- Try it yourself (with great care)
- “Try to destroy it”
- ITERATIVE PROTOTYPING
Iterative Prototyping

• Consider the Artillery Method
  – READY (design and redesign)
  – FIRE (prototyping and implementation)
  – AIM (evaluation and analysis)
  – and repeat...
Requirements Gathering

• Most software is a triumph of functionality over usability
• Not too much…
• …not too little
• Just the right amount *for the User*
Requirements Gathering

• Observation
• Interviews
• Usability tests
• Task analysis
• “Think aloud”
Consider the End Product

- Sketches
- Brainstorming
- Who will the end users be?
- What are their capabilities?
- What do they want to do?
- (Real) user involvement
- Usability goals

www.computing.dundee.ac.uk
Determining Usability

Measure:

• Ease of learning
• Speed of user task performance
• User error rate
• User retention over time
• Subjective user satisfaction

Shneidermann (1992)
Summary

For usable software which meets the user’s needs:
• User Centred Design
• Early and Continual User Testing
• Iterative Prototyping
• Consider the End Product
Users and Computers
The Computer and its Interface

• Interface Design
  – Analysis of task and knowledge of user
  – Educated common sense
  – Knowledge of human characteristics and good interface design pay-off
  – Awareness of own ignorance & skills of others
  – Correct methodology and attention to detail

www.computing.dundee.ac.uk
Human v Computer (1)

- Speed
- Accuracy
- Sensitivity
- Strength
- Movement
Human v Computer (2)

- Processing Methods
- Memory & Recall
- Fatigue & Emotions
- Visual, Auditory and Tactile Perceptions
- Knowledge of the world
Human v Human

Humans are not all the same!

• Physical diversity
• Non-physical differences
  – fear
  – education
  – memory ability
  – social and cultural
“The special power the computer has is to amplify all the usual problems to new levels of difficulty”

Norman
Software is often designed by and for...

- 25 year-old white Anglo-Saxon male
- holds a PhD in Computer Science
- besotted by technology
- more interested in playing with computers than using them to do something
“Average user”

- Intelligent
- male personality but otherwise sexless
- mute
- ageless
An average user?
Other Computer Users

- Females
- Different cultural backgrounds
- Elderly people
Disabled Computer Users

- Impaired dexterity and/or mobility
- Blind and visually impaired
- Deaf and hearing impaired
- Non-speaking
- Other communication or language dysfunction,
  and/or functionally illiterate

www.computing.dundee.ac.uk
In the ‘developed’ world..

- 10-20% of the population are disabled
- By the year 2000:
  10% of population over 80 years old
- Medical care increasing survival rates
- More “care in the community”
“...we should be aware of subtle design decisions that make usage more difficult for people with physical and mental difficulties, and for individuals from different cultures......and not create a situation where the disadvantaged become more disadvantaged.”

Shneidermann: CHI’86

www.computing.dundee.ac.uk
The Law

• Americans with Disabilities Act (July 26 1992)
• UK Disability Discrimination Act
• Human Rights Legislation

• “Take reasonable steps...” will become very important
Ordinary and Extra-ordinary Systems and People

• People can be handicapped by their environments in the same way as disabled people are
  – Soldier on a battlefield
  – Pilot of high performance aircraft
  – Aircraft controller
Better Systems for everyone

- Cassette Tape Recorder
- Typewriter
- ‘Sticky’ keys
- Web Pages
  - Readable
  - Rapid Access
  - Telephone access
  - Picture Navigation

www.computing.dundee.ac.uk
Conclusions

• Extra-ordinary needs are only exaggerated ordinary needs
• Most people have a mix of ordinary and extra-ordinary abilities
• In future, more people will have extra-ordinary needs
Research in the Department of Applied Computing, University of Dundee
Research Groups

• Human Centred Applications, including Elderly and Disabled
• Telecommunications and Remote Learning
• Computer Based Interviewing and Knowledge Elicitation
• Health Informatics
• Space Systems

www.computing.dundee.ac.uk
Multi-modal and Ordinary and Extra Ordinary HCI

• Communication Dysfunction
e.g. cannot speak, or hear and/or write

Utilise: Prediction, adaptive interfaces, fuzzy logic, semantic networks, conversational analysis, scripts, etc.

Leading to: Research insights & Products

www.computing.dundee.ac.uk
Normal conversation

• 180 to 200 words per minute

Plus

• Intonation, pauses, facial gestures, arm gestures, body language, touch, smell
Aided conversation

15 words per minute and “Text” only

Therefore:

• Low information rate & No control
• Poor social interaction
• Few, if any, “stories”
Solutions

• Prediction
• Adaption
• Personalisation to individual users’ needs
PREDICTABILITY at work
Higher level prediction

How can we improve speech rate?

Can we predict:

- Phrases?
- Sentences?
- Stories?
Reusable conversation

Talk, and TALK Boards

which incorporate
CHAT techniques
<table>
<thead>
<tr>
<th>ME</th>
<th>YOU</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Greet</strong></td>
<td><strong>Intros</strong></td>
</tr>
<tr>
<td>Hello, my name is Sylvia Grant.</td>
<td>What's your name?</td>
</tr>
<tr>
<td>What's yours?</td>
<td>Hi, how are you?</td>
</tr>
<tr>
<td>Hi, I'm Sylvia Grant.</td>
<td>How are you?</td>
</tr>
<tr>
<td>What did you do at Christmas and New Year?</td>
<td>We had a nice Christmas and New Year, but they were both very</td>
</tr>
<tr>
<td>Where</td>
<td>What</td>
</tr>
<tr>
<td>Quest</td>
<td>Fback</td>
</tr>
<tr>
<td>Agree</td>
<td>Disagr</td>
</tr>
<tr>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>
Re-usable Conversation

Script Talker

www.computing.dundee.ac.uk
Hello, How are you today?
Can you put my things on the counter?
Stories

We are all stories,

Just stories

• Talk:about
• Talks:back

www.computing.dundee.ac.uk
This weekend was a gas. We had lots of fun.

What did you do this weekend?
Ordinary and Extra-Ordinary HCI examples:

• Mobile Telephone
  – Predictive adaptive interface with disambiguation
  – e.g. Nokia 3210 GSM Telephone

• ACTIVE project: Advanced Camera Technology in Visual Ergonomics
  – With Daewoo Motor Company Ltd and Vision Dynamics Ltd.

www.computing.dundee.ac.uk
Telecommunications and Remote Learning

• Disabled and Elderly
  plus spin-offs to other situations
• Video Conferencing
• Email and other text messaging
  e.g. Emotion and Presence
Computer Based Interviewing and Knowledge Elicitation

- Particularly sensitive information
- Bullying, abuse, requirements gathering

- Chatterbox (commercial product)

Problem
- “user friendly” but “non-human”.

www.computing.dundee.ac.uk
Research into Technical support for Ageing

• Demographics
• Royal Commission
• Foresight Thematic Panel

Applications:
• Physical and cognitive monitoring
• Story-telling and other communication systems
• Memory aids and reminiscence therapy

www.computing.dundee.ac.uk
Older people

• Fit older people
• Disabled people who grow old
• Elderly people who become disabled
• House bound
• Institutionalised
Possible dysfunctions of older People

• Deafness
• Frailty
• Memory failure
• Language dysfunction
• Dementia
The Problem

• How do we define and develop interfaces and systems which are sensitive to the needs, wants and abilities of older people?
And there's more ...
Focussed Teaching and Research Portfolio

Particular interest in “extra-ordinary” people, leading to:

• A deeper understanding of human interaction
• Very novel human computer interfaces

We recommend the area to everyone

www.computing.dundee.ac.uk