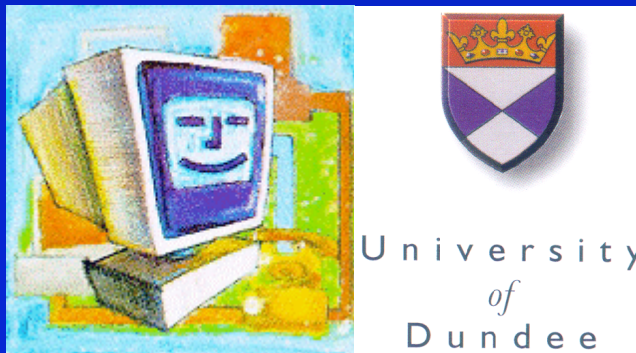


# People and Computers

**Prof. Alan F. Newell, FRSE**

Department of Applied Computing  
at the University of Dundee



[www.computing.dundee.ac.uk](http://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

**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*

# 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

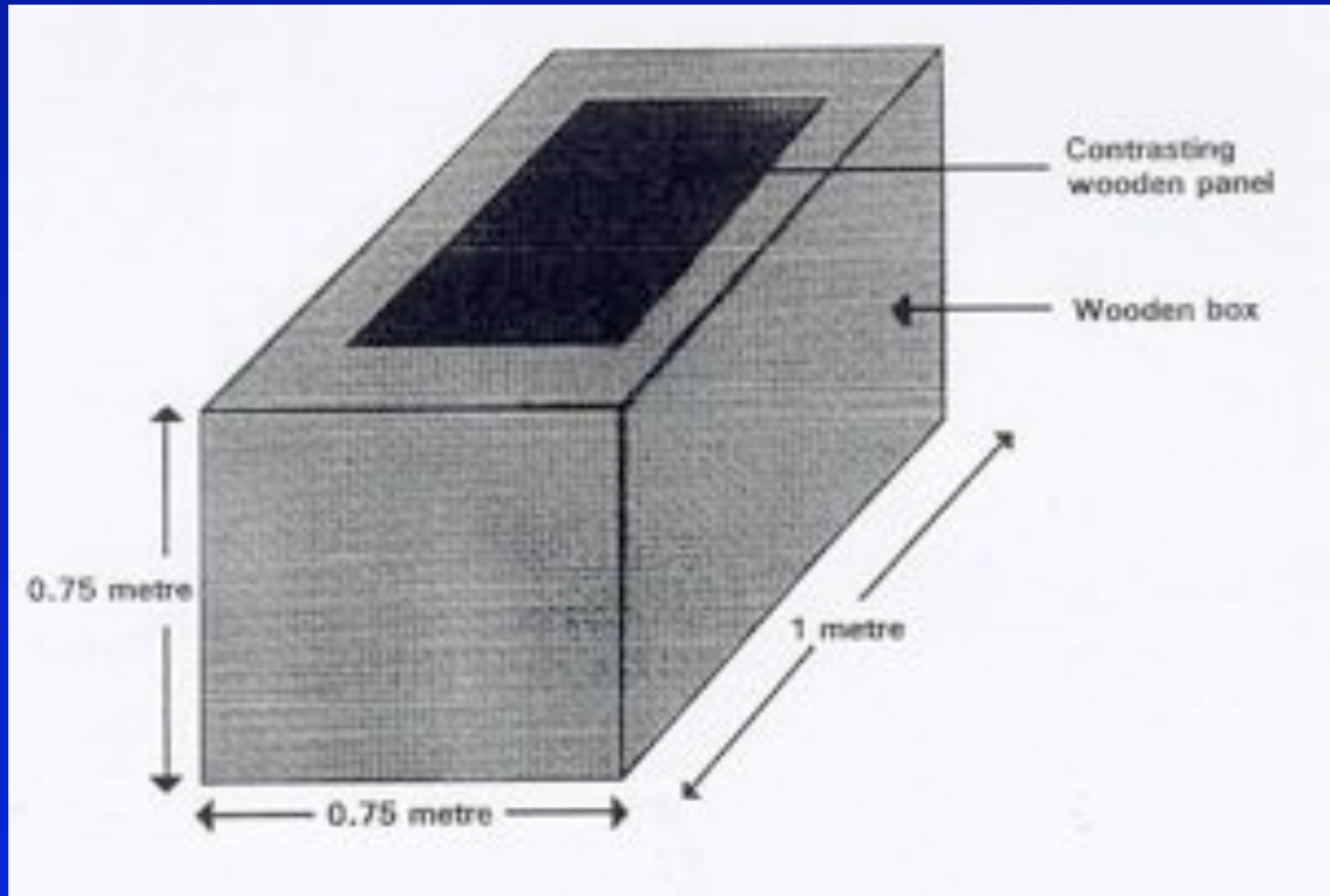
# Examples of Poor Design

- Video Tape Recorder
- Car Radio
- Teletext
- Windows

Also see *[www.baddesigns.com](http://www.baddesigns.com)*



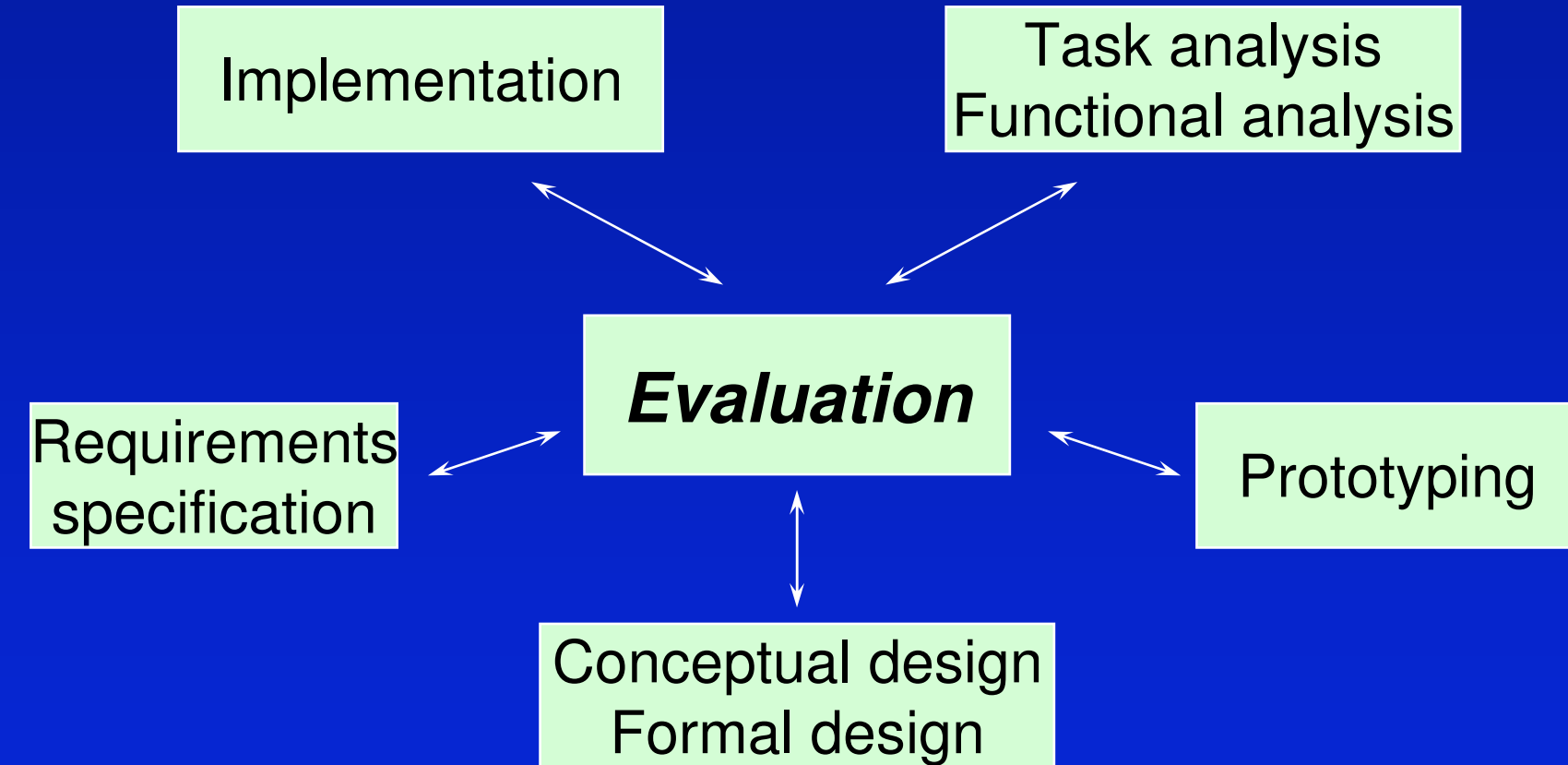
# Seen in the foyer at MIT...



# 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



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

# 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

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# 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

# 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



# Human/Computer Interaction

“The special power the computer has is to amplify all the usual problems to new levels of difficulty”

Norman

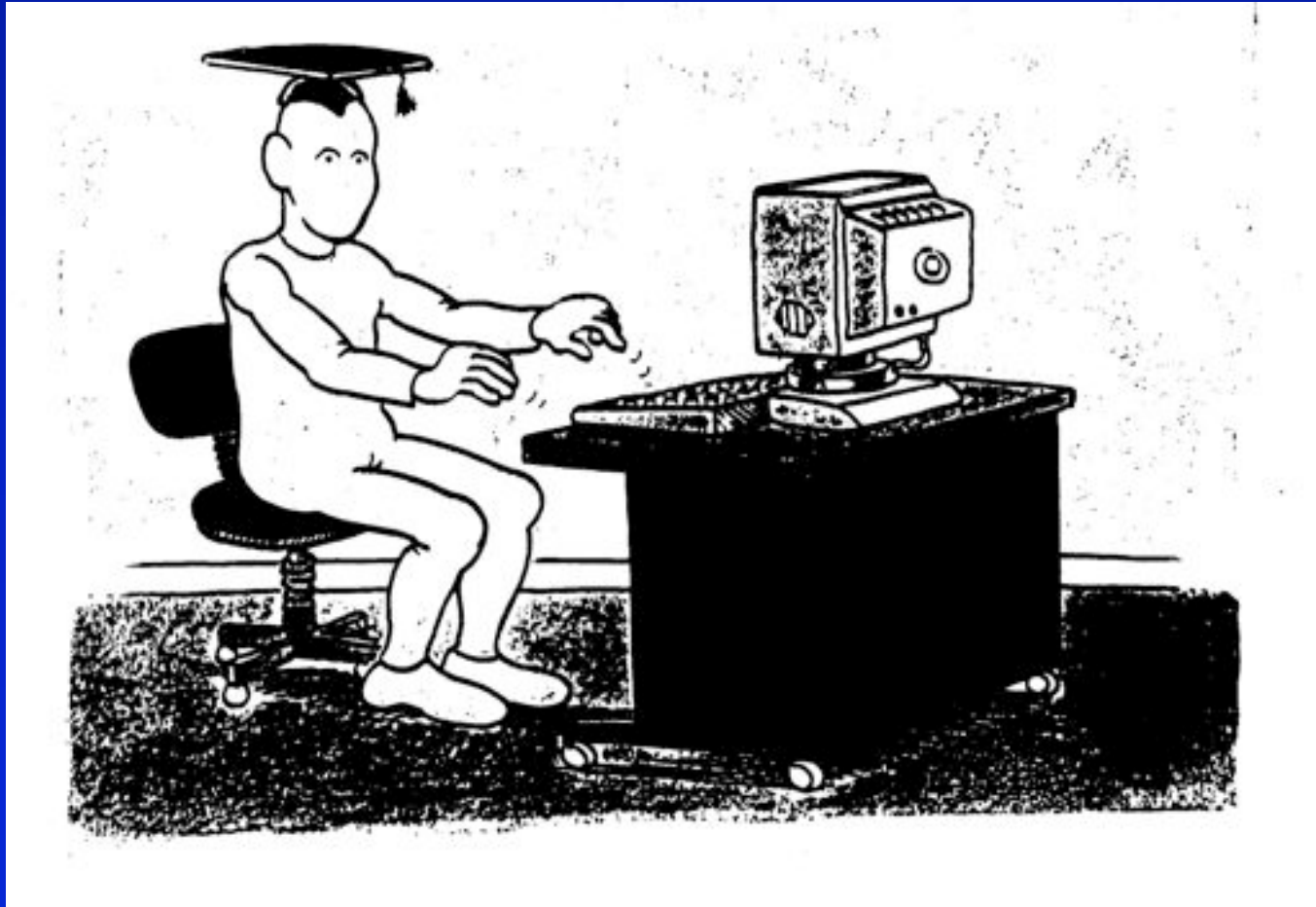
# Software is often designed by and for...

- 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

# 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

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# 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

# 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**

[www.computing.dundee.ac.uk](http://www.computing.dundee.ac.uk)

# Research Groups

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

# 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*

# 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

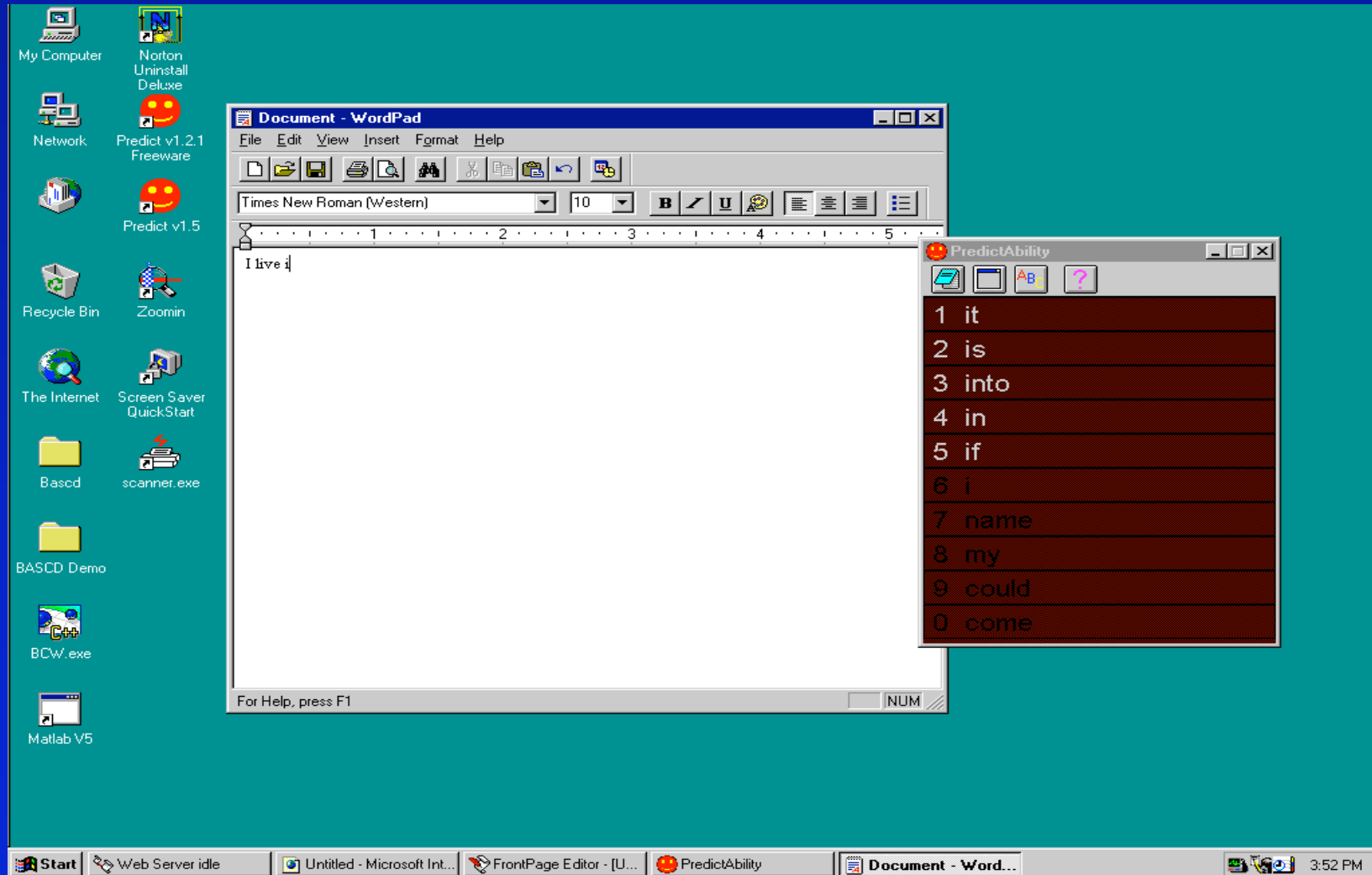
*Therefore:*

- 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

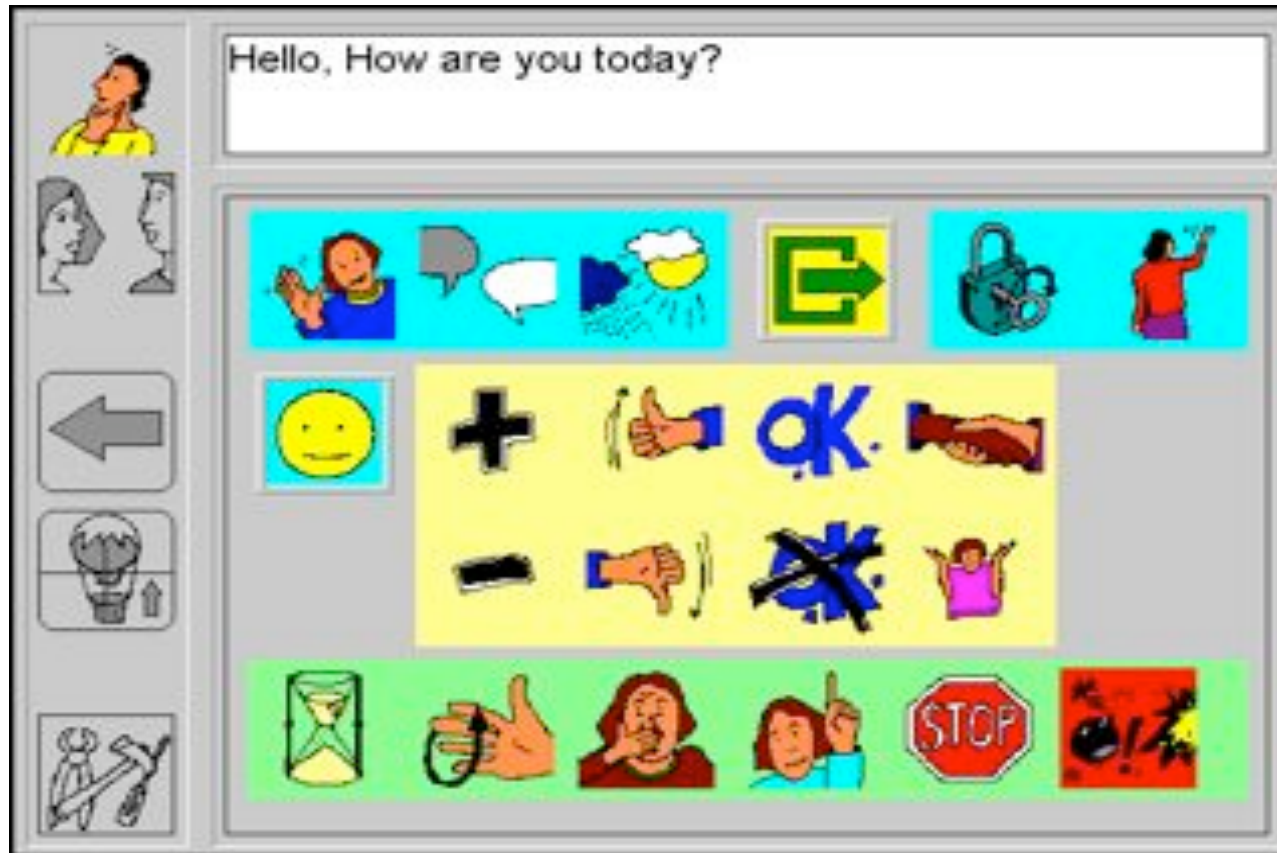
*Talk, and TALK Boards*

which incorporate  
CHAT techniques

<b>ME</b> <b>YOU</b> <b>Where</b> <b>What</b> <b>How</b> <b>When</b> <b>Who</b> <b>Why</b> <b>Past</b> <b>Present</b> <b>Future</b>	<b>Greet</b>	<b>Intros</b>	<b>New</b>	<b>Wrapup</b>	<b>Finish</b>	<b>Quest</b>	<b>Fback</b>
	Hello, my name is Sylvia Grant.	What's your name?	Hi, how are you today?	Hi, how are you today?	Hi, how are you today?	<b>Symp</b>	<b>Hedge</b>
	What's yours?	Hi, how are you?	Did you have a nice Christmas break?	Did you have a nice Christmas break?	Did you have a nice Christmas break?	<b>Saying</b>	<b>Sorry</b>
	Hi, I'm Sylvia Grant.	How are you?	I had a pretty miserable Christmas break, because I had the	I had a pretty miserable Christmas break, because I had the	I had a pretty miserable Christmas break, because I had the	<b>Uhhuh</b>	<b>More?</b>
	What did you do at Christmas and New Year?	And after dinner, we all just sat and chatted.	Fine thanks.	Fine thanks.	Fine thanks.	<b>Agree</b>	<b>Disagr</b>
	We had a nice Christmas and New Year, but they were both very	I was still full of the cold at Hogmanay, so I just went to bed.	Not bad thanks.	Not bad thanks.	Not bad thanks.	<b>Dunno</b>	<b>Thanks</b>
	We had my sister and her boyfriend, my brother and a couple of friends	Please try to forget the voice is wrong, just talk to me as you would.	Very well thanks.	Very well thanks.	Very well thanks.	<b>Again?</b>	<b>Intrup</b>
			How about you?	How about you?	How about you?	<b>Good!</b>	<b>Bad!</b>
			What about you?	What about you?	What about you?	<b>Yes</b>	<b>No</b>
						<b>Filler</b>	<b>Oops</b>
					<b>Repeat</b>		

# Re-usable Conversation

Script Talker







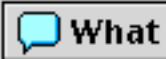
# Stories

*We are all stories,  
Just stories*

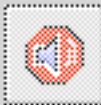
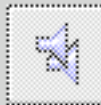
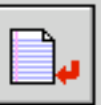
- Talk:about
- Talks:back



Who Aunt



What News



Suggested Stories

- ⌘ 1 News From ...
- ⌘ 2 Weekend News
- ⌘ 3 School News
- ⌘ 4 Work News



Weekend News

This weekend was a gas. We had lots of fun.

What did you do this weekend?



- Greetings
- Positive Resp.
- Negative Resp.
- Small Talk
- Continuers
- Wrap Ups
- Farewells
- Needs

# 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.

# 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”.

# 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

# 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*