

Cognitive aspects in HCI

From the Theory to the Practice

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Outline

- 1 **Introduction**
 - IT Evolution and HCI
- 2 **Cognitive aspects in HCI**
 - Perception
 - Memory and Attention
 - Mental Models and Learning
- 3 **Applying the Rules: Swansea University WebSite Analysis**
 - Analysis Methodology and Results
 - Error Examples
- 4 **Conclusion**
 - Key Points

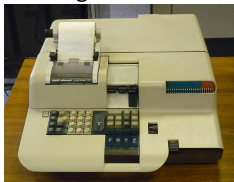
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IT Evolution

- IT development has been very fast during the last decades
 - Moore's law:** performance double every 2 years [4]

Programma101



1964

CommodorePET



1983

Tablet HP



now

- Today devices need to be **easy** to use, **pleasant** to use
 - Human Computer Interaction**

HCI as Group of Several Disciplines

- HCI is a **multidisciplinary** discipline:

Philosophy

- creating consistency

Sociology

- groupware

Art

- aesthetic appeal

AI

- help facilities
- modelling the user

Cognitive psychology

- understanding user
- modelling the user

Engineering Computer Science

- faster machines
- faster systems
- means of building better interfaces

Design

- user interface layout

Anthropology

- user body shape

Linguistic

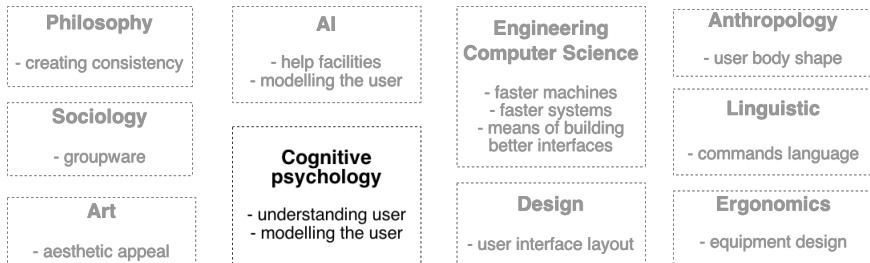
- commands language

Ergonomics

- equipment design

HCI as Group of Several Disciplines

- HCI is a **multidisciplinary** discipline:



- Cognitive psychology aspects: **perception, memory, attention, learning, mental models [6].**

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What is Perception (Sight)?

- Human senses: sight, hearing, touch, taste and smell

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- Two steps to see :
 - Physical reception:** light is translated by the eye in signals which are sent to the brain [3]
 - Why don't we see upside down?*

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- Two steps to see :
 - Physical reception:** light is translated by the eye in signals which are sent to the brain [3]
 - Why don't we see upside down?*
 - Processing the information:** *raw information* is elaborated to make sense of the received signals.

Rules for Perception (Sight)

Design Implications for Perception [5]

- ① Consider the **human sight's limits** in terms of physiology
 - no too fine details, do not rely only on colours, consider external condition (illumination), etc..
- ② Always remember the '*information processing*' phase
 - careful use of colours, some **dangerous wrong association** between objects can be made

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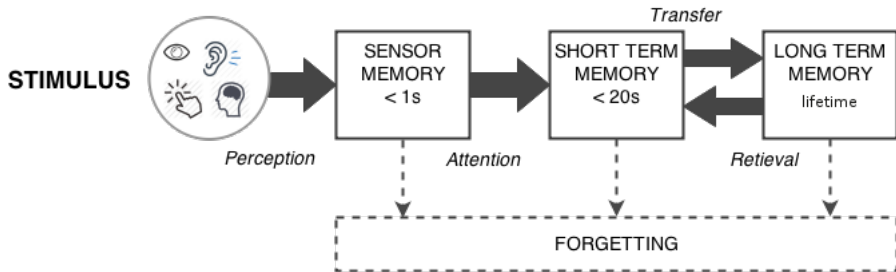
STOP!

GO!

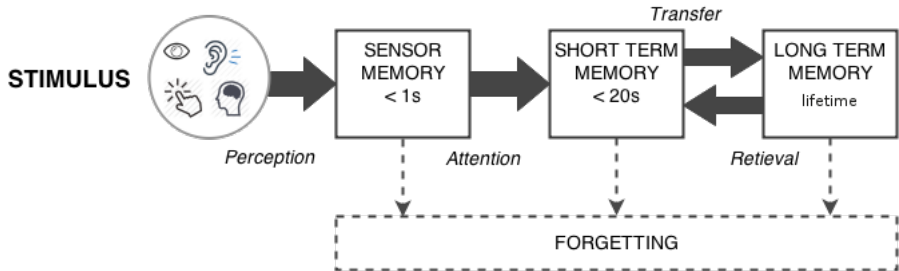
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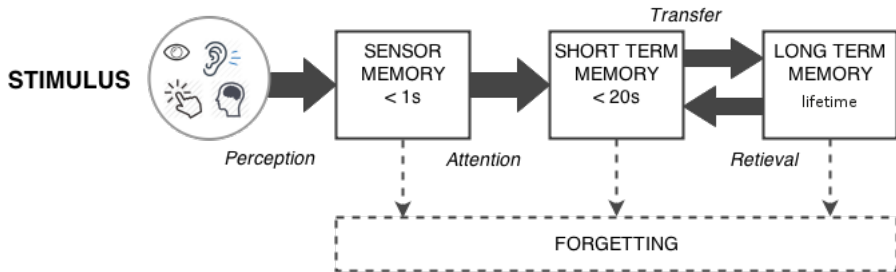


What are Memory and Attention?



- To access the **long term memory** [1]:
 - **Recalling**: trying to remember without any clue
 - **Recognition**: trying to activate a memory using clues

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Example. Looking for a website:

- typing the exact name in the address bar
- using a web search engine

Rules for Memory and Attention

Design Implications for Memory and Attention

- ① Provide mechanisms to **encourage recognition over recalling**
 - but even **better** use both **together**
- ② **Don't overwhelm** the user with **too much information** or annoying signals
 - such as too many colours, flashing lights, etc

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What are Mental Models and Learning?

- Interacting with a system we create a **mental model** [2]:
 - explains **how** the system **works**
 - allows to make prediction about its **future behaviour**
- We use several **strategies** for **learning**:
 - **making mistakes**: we update our mental model everytime we do something wrong



Rules for Mental Model and Learning

Design Implications for Mental Model and Learning

- ① Make self explaining interfaces
 - usually nobody reads the manual
 - ② Error messages informative and clear
 - ③ Reuse knowledge from the real world
 - use of **metaphors**, do not reinvent the wheel every time
- Example.** The Desktop metaphor

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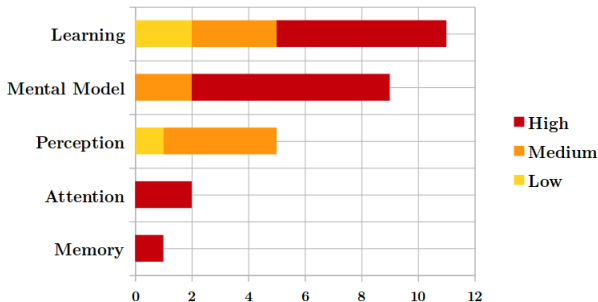
Analysis Methodology

- Only two pages of the MyUni section (note that the website has changed since the last time I performed the analysis)
 - MyUni Home Page (<https://myuni.swan.ac.uk/>)
 - MyUni Login Pop-Up



Analysis Methodology and Results

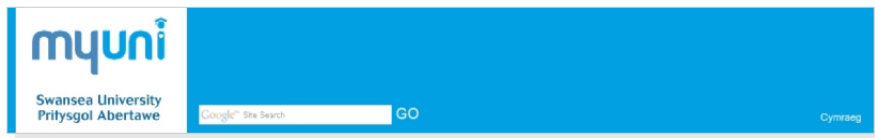
- Errors categorized for **cognitive aspect**
- Error **severity** categorized as **high, medium, low**
 - **28 errors total** in only 2 pages
 - **16 errors** are **high** severity



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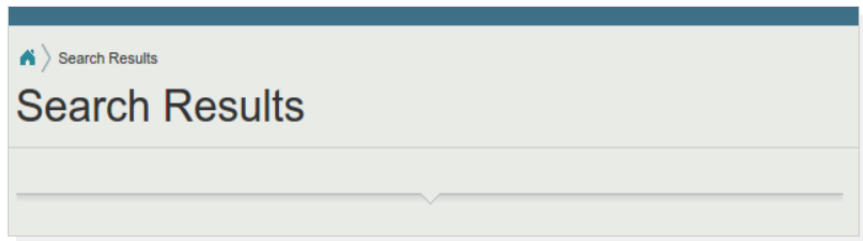
Examples (1)



- The *Google Site Search Box* is good for the explained mechanism of recalling and recognition (**Memory**) however..
 - font inside too small (**Perception**)
 - label not self explaining: 'search' would have been better (**Learning**)
 - and...

Examples (2)

- ...it doesn't work!

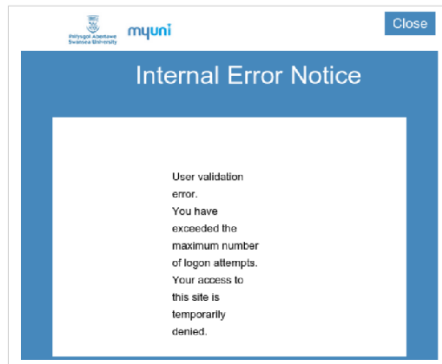
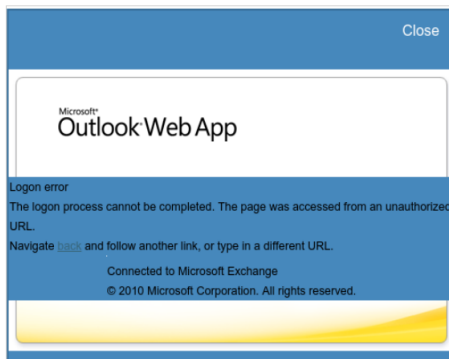


Results for the search of 'Student' keyword

- no meaningful error message (**Learning, Mental Model**)
 - 0 results?
 - ...or **not working**?

Examples (3)

- Error messages are often not meaningful enough

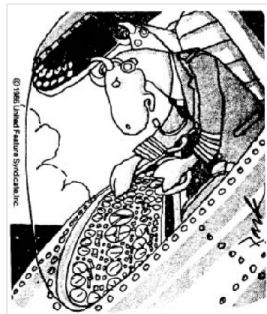


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Key Points

- Knowing **how** the **human operates** (Perception, Memory, Attention, Learning, Mental Model) in terms of:
 - **capabilities**
 - **limits**
- allows us to **derive rules** to apply to the interface design.
- Even the **best system** in terms of **performance, speed, security** could be **useless** if it is **not usable** for the final user.



“Darn these hooves! I hit the wrong switch again! Who designs these instrument panels, raccoons?”

For Further Reading I



Raluca Budiu.

Memory Recognition and Recall in User Interfaces, 2014.



Dedre Gentner and Albert L Stevens.

Mental models.

Psychology Press, 2014.



Gazzaniga Michael, Richard Ivry, and George Mangun.

Cognitive neuroscience, the biology of the mind.

W.W.Norton, 2014.



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Cramming more components onto integrated circuits, 1965.



Jenny Preece, David Benyon, et al.

A guide to usability: Human factors in computing.

Addison-Wesley Longman Publishing Co., Inc., 1993.

For Further Reading II



Jenny Preece, Yvonne Rogers, Helen Sharp, David Benyon, Simon Holland, and Tom Carey.

Human-computer interaction.

Addison-Wesley Longman Ltd., 1994.