COM201: System Analysis and Design

Lecture 6: User Interface Design

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1. **Title**
2. **Overview**
3. **Human Computer Interaction**

   Purpose: Define HCI and the three contributing elements.

   Notes:

   What is Human Computer Interaction (HCI)?

   "… Involves the design, implementation and evaluation of interactive systems

1- **Who are the users (humans)?**

   - Performing tasks or processes

   - As far as HCI goes it is not necessarily a single user:

        i.   **individual** user: not just a user with a desktop

        ii. **group** of users working together

        iii. **sequence** of users: performing parts of tasks or processes

2- **Computers**
   - **Computer/technology**

   - But can include non-computerized parts of a system.

   - Desktop computer and other technology (e.g. mobile devices, etc.)

3- **What is meant by interactions?**
   - **Communication between the a user and computer**

   - Direct: involves dialog with feedback and control throughout the performance of tasks

   - Indirect: involves background or batch processing

4. HCI: Multi-Disciplinary Subject

   Purpose: HCI is a multi-disciplinary subject with influence from a number of areas.

   Notes:

==Origins== of Human Computer Interaction (HCI)

- Roots from more established disciples (e.g. Ergonomics: study of the human factors with interaction with machines and systems)

==Multi-disciplinary subject==: ideal design of interactive system would have expertise from a range of fields

- ==Psychology and cognitive science==: provides knowledge of the user's ==perceptual==, ==cognitive== and problem-solving skills

- ==Ergonomics==: for the user's physical capabilities

- ==Sociology==: contributes to an understand of the wider context of the user's interactions

- ==Computer science and engineering==: skills to build the necessary technology

- ==Business==: able to market it, etc.

- ==Graphic design==: to produce an effective interface presentation

- ==Technical writing==: production the manuals

- Others …

- Have expertise in all areas is ==too much== for one person, even too much for the average design team

  - Therefore, although it is recognised as an interdisciplinary subject, in practice people tend to ==adapt== to the field they come from

  - Need to remember that ==input== is need from all sides

  - e.g. it may look beautiful (graphics design), but can it be used (psychological limitations of the user).

  - We of course are looking at this field as ==computer scientists==

5. Human: Capacities and Limitations

Purpose: In order to design something for humans we need to understand their ==capabilities and limitations== to enable use to produce an Interface suited to them.

Describe some of the ==considerations== of humans that we need to consider in interface design.

Notes:

==Perceptual system==

- Handling sensory stimulus from the outside world.

- Input: Senses: sight, hearing, touch, taste, and smell

  e.g. visual processing systems (primary sense for most people):

  - Perceiving size and depth, brightness, colour, etc

- **Limitations of design**

    - **Optional illusions: context of how an object appears (e.g. B or 13)**

    - **Colour: 8% of males 1% of females are colour blind**

Motor skills → Human output

- **Motor control and how the way we move and affects our interactions with computers.**

- **Simple actions: hitting a button on a keyboard involves a number of processing stages.**

Movement time:

- **Depends on the physical characteristics of the subjects: their age and fitness.**

- **Need to be considered when designing systems for different group of people (e.g. elderly people)**

Reaction time:

- **Sound in 150 ms, visual signal in 200 ms, and pain in 700 ms. However faster in combined signals (e.g. sound and visual signals).**

- **Factor such as skills and practices can increase, fatigue can decrease**

Speed and accuracy:

- **Movement are important consideration in the design of interactive systems.**

- **e.g. time taken to move and hit objects on the screen (design to reduce movement and enlarge objects).**

Human memory

- **Short term memory: temporary recall of information**

- **e.g. remember sequence of digits → the average person can remember 7 +/- 2 digits.**

- **423432465543 → 026 5566 6565 → this is why digits are grouped or placed in chucks.**

6. Computer: Capacities and Limitations

Purpose: Describe the other side of the equation. How technology limits the user interface design …

Notes:

Input

Keyboard

- **e.g. QWERTY design: subject to variations e.g. pound sign and dollar sign**

- QWERTY arrangement is not optimal for typing with the reason for the layout back to the days of mechanical typewriters.

- Therefore the reason for no change is social: the vast base of trained typists would be reluctant to relearn their craft.

- Other layouts like the "alphabetic keyboard" are good for notice users.

Handwriting recognition

- Handwriting is a common and familiar activity therefore attractive as a text entry method

- Is intuitive and simple way of interacting with computers

- Disadvantages are technology not there yet. Inaccurate and so makes a significant number of mistakes in recognising letters and therefore slow.

- Another disadvantage is speed of physical handwriting (25 words a minute) compared to typing

Speech recognition

- Promising area of text entry. Some applications exist but much development required.

- Will greatly improve HCI.

- Examples: telephone information systems, access for the disabled and in hands-occupied situations.

Positioning and pointing devices

- Most common device used is the mouse

Output devices

Computer screens

- Raster format, which is made up of pixels and has a resolution and colour limitations

- There are also health hazards for using computer screens and for that manner with input devices as well

- 3D displays (Virtual Reality). Can use and perceive depth

Printing

- Readability of text can vary with different fonts and styles

Memory and Processing

- Limitation on HCI design (e.g. speed limiting factors)

  - Computation bound (e.g., find and replace in large documents)

  - Storage channel bound (i.e. storage speed)

- Graphics bound (i.e. what can actually be displayed)

- Network capacity (i.e. speed over networks)

7. Interaction: Different Styles

Purpose: So taking the limitations (both humans and computers) into consideration what interaction styles are used to facilitate this communication between humans and machines?

Notes:

The field on HCI is not about looking at human and computer in isolation but the "interaction" between the two.

1- Direct manipulation

- Interaction with objects on the screen instead of typing"

- User tasks can be greatly simplified and speed up. " User also observe the results of their actions immediately

- Keyboard and mouse replaced with cursor-motion devices to select from a visible set of objects and actions

- First application using this interaction style was VisiCalc (1978)

    - *Notepad, calendar, calculator, folders containing documents*

2- Menu selection

- Selects from lists of items most appropriate for the task at hand

- If the terminology and meaning of the items is understandable and distinct then users can accomplish their tasks with little learning or memorization

- Appropriate for intermittent users. Could also appeal to frequency users if rapid

- Designer need to be careful that all functions are supported.

3- Form filling (also fill in the blanks)

- When data entry is required, menu selection usually becomes cumbersome, and form filling is appropriate.

- Users see a display of related fields and associated labels that let the user know the permissible values

- Most suitable for knowledgeable intermittent users or frequent users

4- Command language

- Good for frequent users as command languages provides a strong feeling of control and initiative

- Users learn the ==syntax== and can often express complex possibilities rapidly without having to read distracting prompts

- ==Error rates are high==, training is necessary, and retention may be poor.

5- ==Natural languages==

- Computers responding to natural language sentences or phrases engages – still ==being developed==

==8.==

9. ==User Profiles: Human Diversity==

Purpose: Describe some of the major difficulties in the human abilities, backgrounds, motivations, personalities, and work styles that influence user interface design.

Notes:

==**Physical abilities and physical workplaces**==

- Accommodating the diverse human ==perceptual==, ==cognitive==, and ==motor== abilities.

- Physical ==abilities== of users drives the use of things like ==keyboards== (e.g. most of the population it works for, but people with large and small hand may have problems)

- May need to consider ==eye disorders==, damage, need for classes, ==colour blind==.

==**Cognitive and perceptual abilities**==

- Human have different: short-term / long-term memory / problem solving / decision making / attention and set (scope of concern) / search and scanning / time perception

- Factors that affecting perceptual and motor performance: Arousal and vigilance / fatigue / perceptual (mental) load / knowledge of results / sensory deprivation / sleep deprivation anxiety and fear / isolation / aging / drug and alcohol

- These things have a profound effect on design

==**Personality differences**==

- Some people ==dislike== or get anxious by ==computer== and others are ==attracted== to or are eager to use computers

- Different ==preferences== for interaction styles, pace of interaction, ==graphics== versus ==tabular== presentation

- Fundamental difference is one between ==men and women==, but no clear pattern of preferences has been documented (e.g. young males are more computer games. command like KILL or ABORT are unlike by women)

- ==**Cultural and international diversity**==

- Different <mark>cultural</mark>, <mark>ethnic</mark>, racial, or linguistic background

- For example: <mark>Language</mark>

    - Applications can have local versions in other languages (text, instructions, help, error messages, labels)

    - Characters, numerals, and special characters

    - Left-to-right vs. right-to-left reading

    - Date, time, currency, measures formats

<mark>Users with disabilities</mark>

- Flexibility of computer software make it possible for designers to provide <mark>special services</mark> to users who have <mark>disabilities</mark>

- There are effective <mark>designs</mark> for vision or <mark>blind</mark> users and for those with <mark>hearing impairments, and mobility impairment</mark>

- e.g. enlarging portions of a display

<mark>Elderly users</mark>

- Negative physical, cognitive, and social consequences of aging

- Similar <mark>design</mark> considerations as with users with <mark>disabilities</mark>

10. User Profiles: Diversity of Users

Purpose: Describe how the difference experience with applications needs to be considered when designing applications

Notes:

<mark>Novice or first-time users</mark>

- Assumed to know <mark>little</mark> of the task or interface concepts

- <mark>Anxiety</mark> about using computers that inhibit learning

- Overcoming these <mark>limitation</mark> is a serious <mark>challenge</mark> to the designer of the interface

- Including things like <mark>instructions</mark>, dialog boxes, and online <mark>help</mark>,

- Restricting <mark>vocabulary</mark> to a small number of familiar, consistently used terms is essential to developing the user's knowledge.

- Number of actions should also be smalls. <mark>System</mark> needs to provide: <mark>Reduce anxiety</mark> / Build <mark>confidence</mark> / Gain positive reinforcement

Knowledgeable intermittent users

- Many people are knowledge but **intermittent** users of variety of systems

- Board knowledge of interface concepts, but have difficultly **retaining** the structure of menus or **location** of features.

- Burden on their **memories** lightened by structure in menus, consistent terminology.

- Protect against user partially **forgetting sequences** of actions

Expert frequent users

- "**Power**" user: seek to get their work done **quickly**.

- Demand for **rapid** response time, brief and non-distracting feedback.

- Like to create **macro** or other abbreviated form to **reduce** the number of steps.

- **Shortcuts** through menus and other accelerators are **requirements**