Lecture 3
Design Approaches and Methods

Lecture outline
This lecture will cover:
- Organisation of knowledge
- Gulf of execution and evaluation
- Design principles
- Methodologies for developing effective systems from HCI perspective

Recap Week 1
Covered range of theories and how they impact or influence design.
- Affordance and visibility
- Mental and cognitive models
- Knowledge in the world and knowledge in the head
- Cognitive aids and natural mappings
  - Norman’s three design principles:
    - Visceral design: appearance
    - Behavioural design: the pleasure and effectiveness of use
    - Reflective design: self-image, personal satisfaction, memories

Gulfs of execution and evaluation (Norman)
<table>
<thead>
<tr>
<th>Execution</th>
<th>Evaluation</th>
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<tbody>
<tr>
<td>How well the system allows the user to do the intended action directly without extra effort</td>
<td>Amount of effort user must exert to interpret physical state of system and determine how well expectations and intentions have been met.</td>
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Gulf of execution
- Does the system provide actions that correspond to the intentions of the person?
- Difference between intentions and allowable actions is the gulf of execution
- Measure is how well the system allows a person to do what they wanted to do without extra effort.

Gulf of evaluation
- Does the system provide a physical representation that can be directly perceived, directly interpretable in terms of person’s intentions and expectations?
- Reflects the amount of effort person must exert to interpret the state of the system and work out how well what they expected to happen has happened.
- Gulf is small when system provides information about its state in a way that is easy to interpret and matches the way the user thinks.
### Putting the theories into practice

- How then can the theories be translated into development methods?
  - Affordance and visibility
  - Mental and cognitive models
  - Norman’s three design principles
  - Knowledge in the world and knowledge in the head
  - Gulfs of evaluation and execution

### Objects and actions

- Objects and actions can be described at high and low levels.
- User may understand high level concept and refined lower level concept.
- Interface actions can also be decomposed to lower level actions.
- Object action model helps understand multiple complex processes that occur for users when trying to complete the task.

### Steps/factors in HCI

- Preece suggests considering these factors for example:
  - Users (motivation, experience, cognitive capability)
  - Customers/clients
  - User interface
  - Work activity
  - Organisation
  - Comfort
  - Productivity

### Shneiderman

- Suggests consideration must be given to:
  - Proper functionality (task analysis) – what tasks to be carried out, frequency of tasks
  - Reliability, availability, security and data integrity
  - Standardisation, integration, consistency and portability
  - Schedules and budgets

### Norman (1990) Seven stages of action

1. Forming the goal
2. Forming the intention
3. Specifying the action
4. Executing the action
5. Perceiving the system state
6. Interpreting system state
7. Evaluating the outcome. (Norman)

### How easily can one?

1. Determine the function of the device?
2. Tell what actions are possible?
3. Determine mapping from intention to physical movement?
4. Perform the action?
5. Tell if system is in desired state?
6. Determine mapping from system state to interpretation?
### Standard Systems Development Life Cycle

<table>
<thead>
<tr>
<th>Role</th>
<th>Stage</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business manager IT</td>
<td>Feasibility</td>
<td>Looks at present system and extent to which meeting business needs</td>
</tr>
<tr>
<td>Business manager IT, users</td>
<td>Investigation</td>
<td>Fact finding, look at current system, issues, gaps</td>
</tr>
<tr>
<td>Business manager, Analyst, users</td>
<td>Analysis</td>
<td>Attempt to understand all aspects of current system and changes needed</td>
</tr>
<tr>
<td>Programmers</td>
<td>Design</td>
<td>Write new system, test</td>
</tr>
<tr>
<td>Change manager, Users, Business manager</td>
<td>Implementation</td>
<td>Install new system, manage change,</td>
</tr>
</tbody>
</table>

### SDLC

- Oldest method, still most common. Weaknesses include:
  - Often does not meet management needs
  - Unambitious systems design
  - User dissatisfaction
  - Problems with documentation
  - Lack of control
  - Incomplete systems
  - Harder to maintain

### User centred development methodologies

1. **Multiview**
   - (Avison and Fitzgerald 2003, 498)
   - Technical requirements
   - Entity model
   - Primary task model

2. **Design User Interface**
   - Entity model
   - Entity model

3. **Analyse and design sociotechnical aspects**
   - Social aspects
   - Computer task requirements
   - Role set people tasks

4. **Design**
   - Computer task requirement
   - Role set people tasks

5. **Design technical aspects**
   - Technical requirements

### Weaknesses cont..

- Use of a development method is important to keep projects on time and on budget.
- Methodologies often effective in facilitating the development process.
- Most common methodologies however do not provide clear guidance on and processes for studying users, understanding their needs and creating appropriate, effective interfaces.
- User centred design only part of process, must fit with the whole development approach.
- S&P pg 118 cites example of IBM’s approach

### Multiview principles

- System described in terms of purpose of the system, stakeholders involved, perspective of the system owners.
- Strong socio-technical approach
- Functional model (stage 3) describes people’s tasks, basis of task allocation.
- Only once these are established are the technical requirements specified for the designers.
- Methodology uses entity relationship modelling and data flow modelling to develop a conceptual model before physical design takes place

### Framework - multiview

- How will the computer system further the organisation’s aims?
- How can the system fit into the working lives of the people in the organisation that will use it?
- How can the individuals concerned best relate to the system in terms of operating and using it?
- What information system processing function is it designed to perform?
- What are the technical specifications of system? (must come close enough to doing the things that have been written down in the answers to the other four questions) (499)
The star life cycle

- Was derived from actual design practices among HCI designers.
- Takes the idea of prototyping and evaluation further than other approaches.
- SDLC works from a system view to a user’s view, notion of top down, formal.
- Star suggests moving from user’s view out to the system.

Evaluation

- Evaluation is central. All aspects of the development process are subject to constant evaluation by users and experts.
- Stresses rapid prototyping an incremental development rather than top-down or analytic approach.
- Development can start at any stage, this is quite common.
- Requirements, design and product gradually evolve. (Preece et al 380-381)

LUCID (Shneiderman 119 – 122)

- Logical User-Centred Interactive Design Methodology
- Well-respected and well used methodology.
- Involves six stages:
  1. Envision: align with organisational strategy
  2. Discovery: identify high-level user requirements
  3. Design foundation: develop conceptual design, usability test and refine
  4. Design detail: high-level design converted to specifications
  5. Build
  6. Release
  (more detailed description can be found on page 120)

- Key focus is on screen prototypes that illustrate major navigational paths through the system.
- Allows users to evaluate and refine early in the development process.
- Uses rapid prototyping and iterative usability testing.
- Methodology makes a commitment to use the centre design and highlights the role of a usability engineer.
**ETHICS** (Avison and Fitzgerald 2003)

- Socio-technical view of systems, i.e., to be effective system must fit closely with the social or organisational factors.
- Suggests development is not a technical issue but an organisational one concerned with change.
- Participation key to the method

Mumford (1983) defines socio-technical approach as:

“one which recognises the interaction of technology in people and produces work systems which are both technically efficient and have social characteristics which lead to high job satisfaction.” (Avison and Fitzgerald pp 449)

- Job satisfaction is where there is a good fit between or the employee wants from his/her work and what the organisation wants from her.

**ETHICS – 15 steps**

1. Identify why there is a need for change
2. Identify the boundaries of the new system
3. Describes the existing system
4. Define the key objectives and tasks for the development process (includes steps 5 and 6)
5. Identify the deficiencies in the current system
6. Identify the needs of the employee in terms of job satisfaction and the new system
7. Identified future needs
8. Specify and weight efficiency and job satisfaction needs and objectives.
9. Organisational design of the new system
10. Identification of technical options in line preparation of the details were could design
11. Implementation
12. Evaluation

**Soft Systems Methodology**

- Developed by Checkland (1981)
- Suggests “systems analysts apply their craft” to problems which are not well or clearly defined.
- Organisations are complex and so are system problems.
- Assumes systems development is a complex problem situation and system solution more likely to be addressed using this methodology than more simplistic structural data oriented approach.
- Acknowledges the importance of people in organisations.
### Stages in SSM

1. Identify problem situation: finding out what the problem is from as many stakeholders as possible.
2. Expressing the problem situation. Can involve of drawing rich pictures.
3. Root definitions
4. Building conceptual models: usually involves a diagram of activities showing what the system, described the route definition will do.
5. Compare model with reality.
6. Assess changes
7. Action to improve situation.

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### Summary

- Need to understand gaps in users’ understanding, (gulf of execution and gulf of evaluation)
- HCI design methods seek to involve users into all aspects of systems development. Not the case with SDLC.
- Variety of different methods have evolved over time.
- Multiview is a user centred methodology whereas star lifecycle reflects what designers do and has a high focus on the evaluation.
- Design of human computer systems needs to recognise organisational as well as local needs focus on the whole work situation not on perceived problem.

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### References

- Dumas J, Redish J (1994) *A practical guide to usability testing*, Ablex publishing
- Shneiderman B. (2005) *Designing the User Interface*, Addison Wesley