IE 403/476

Human-Computer Interaction
Week 5-Lec 1

Recap

- User Centered Design
- Process involved in interactive system design (ISLC)
  - Highly iterative
  - requirement identification, design, prototyping and evaluation

Drawbacks of ISLC

- Iterative life cycle
  - time consuming & expensive

- Alternative
  - Model Based design

Why model based design?

- User requirements phase
  - Wider scope – diversity of users
  - Time constraints
- How about a model of the user?
  - representation of
    - user's interaction behavior under certain assumptions
    - Extensive experimental studies
      - Behavior of average users and not specific individuals.

  - Evaluation purposes also
    - Capture end user characteristics

Human as a processor

Human Information processing Model (HIP)

Sensory information flows into Working Memory through the Perceptual Processor. The Working Memory consists of activated chunks in Long-Term Memory.

Human Information processing Model

STSS

LT M

- High level
  - Numerical parameters of behavior
- STSS
- Perceptual Proc
  - LTM
- Cognitive Proc
  - WM
- Motor Proc
  - Feedback
- Attention

Capacity of working memory is roughly 7 ± 2 things

Processors

- Cycle Time : Accept input and produce output
    - Ranges shown vary
        - Perceptual processor
            - Bright Vs dark environment
        - Cognitive processor
   - Driving, playing video games
                        Vs
            - Idle or reading

The Psychology of Human-Computer Interaction, Card, Moran and Newell, 1983

HIP used to understand and model how user interacts with an interface

Approaches to model cognition

Models

- Formal
  - Interface & interaction using formal specification techniques
    - State transition networks – PETRINETS
      - network of screens , links – How they are connected?
    - Interaction assumed to be transition between states
      - FILE ⬚ OPEN
- Predict : If the sys Is Usability-enhancing or not?

Cognitive (User) models

Higher complexity ⬇ Usability

Greater number of steps ⬆ Complex Cognitive activities
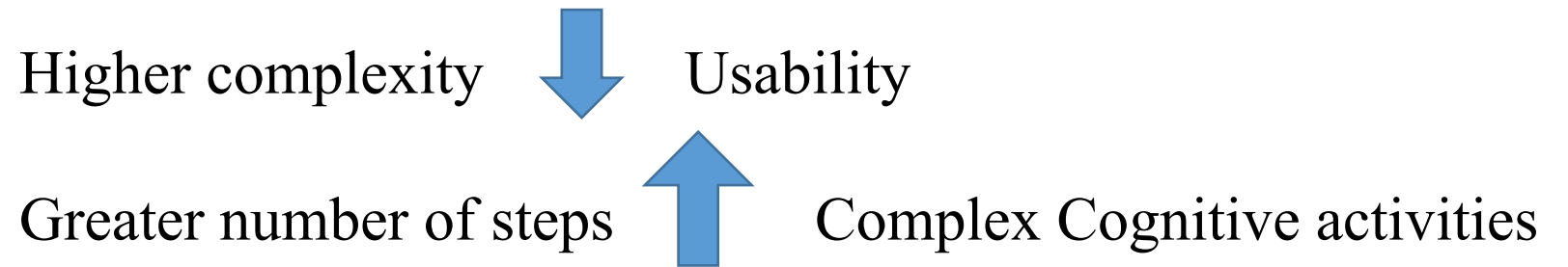
Predict: how many cognitive steps required?

What do cognitive models actually model?

Perceiving the interface

Thinking

Hand
movements

Keystroke Level Model (KLM)

- Predictive model
  - Time taken for avg user to execute through
    - Interface
    - Interaction method
      - Eg: close editor, save file, open document etc.,
- How it works?
  - Break down into simple steps
    - Operators

- How to use it?
  - Focus on task
    - Encode as sequence of steps
  - Calculate time
    - Using operators for each step
    - Sum all time values

Physical Motor Operators

Mental operator

- Core thinking process (M)
- Decision making

Response operator

- Sys response time
  - Key press ⬜output

How to use KLM

- Focus on task
  - Replace a word
  - Encode as sequence of steps
    - K, B, P, H, D (if any)
    - Mental operator time (Operator times)
- Cognitive Task Analyis

Different styles of Keyboard typing

Avg Motor Operator times

Mental Operator time

Example

Suppose a user is writing some text using a text editor program. At some instant, the user notices a single character error (i.e., a wrong character is typed) in the text. In order to rectify it, the user moves the cursor to the location of the character (using mouse), deletes the character and retypes the correct character. Afterwards, the user returns to the original typing position (by repositioning the cursor using mouse).

Calculate the time taken to perform this task (error rectification) following a KLM analysis.

Building KLM for the Task

- Step 1: user brings cursor to the error location
  - To carry out step 1, user moves mouse to the location and 'clicks' to place the cursor there

- Operator level task sequence

Description	Operator
Move hand to mouse	H
Point mouse to the location of the erroneous character	P
Place cursor at the pointed location with mouse click	BB

Building KLM for the Task

- Step 2: user deletes the erroneous character

  – Switches to keyboard (from mouse) and presses a key (say "Del" key)

- Operator level task sequence

Description	Operator
Return to keyboard	H
Press the "Del" key	K

Building KLM for the Task

- Step 3: user types the correct character
  - Presses the corresponding character key

- Operator level task sequence

Description	Operator
Press the correct character key	K

Building KLM for the Task

- Step 4: user returns to previous typing place

  – Moves hand to mouse (from keyboard), brings the mouse pointer to the previous point of typing and places the cursor there with mouse click

- Operator level task sequence

Description	Operator
Move hand to mouse	H
Point mouse to the previous point of typing	P
Place cursor at the pointed location with mouse click	BB

What Is missing ?

- What about M (mental operator) – where to place them in the list?