The psychology of design: Models

CS774 Human-Computer Interaction
Spring 2004

Modeling an HCI task

- How did the OJ get on the cereal?
  - Intention: Pour milk
  - Action: Get milk, take to table, pour
  - Error: "Get milk" action transposed into "Get carton"
- How did the OJ get on the floor?
  - Action: "Take to table" failed because carton slipped
- Analysis
  - One error is mental, one physical
  - Analysis of HCI tasks through models helps pinpoint flaws
 - Shows us what to look at and for when watching users

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Models of HCI

■ Explanatory models - what, why, how
- Norman's seven stages of action
- Foley and van Dam's four level approach
- Shneiderman's Object-Action Interface (OAI) model
- Keiras and Meyer's EPIC cognitive model

■ Predictive models - controlled variables, statistics
- GOMS - Goals, Operators, Methods and Selection rules
- KLM - Keyboard-Level Model (a variation of GOMS)

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Norman's action model

■ To carry out a task

■ Form a goal
■ Execute the goal
■ Evaluate the result

■ HCI use as cycle of do something, check
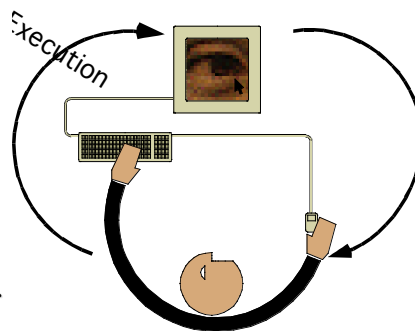
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Gulf of Execution

- How do I … ?
    - Close the Favorite tab
    - Open the door
    - Set the printer
    - Twist this cap off
- Gap between intention and action

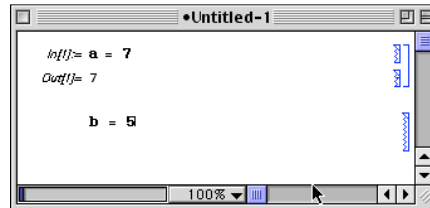# Gulf of Evaluation

- What happened?
    - Where was my file saved?
    - Is the air conditioner on?
    - Is the door locked?
    - Did you ever call a wrong number not picked up?
- Gap between perception and interpretation

Command line interfaces

- No cue as to what to do
- Gulf of Execution

- rm *
- Gulf of Evaluation

Examples?

- Can we choose the reason? UI Hall of Shame
  - The Wrong Control; Error Messages
- Norman's examples - door, fan, phone
- Your experience?
- Caveat
  - Modeling a cycle
  - One cycle's evaluation feeds into next cycle's execution
  - Line between evaluation and execution is fine
  - Ie, where did I save that file?

Refining the model -execution

■ Execution
  – Forming the intention   What actions possible?
  – Picking the action   What causes the action?
  – Executing action   Hit that @#$!% button
■ Foley and van Dam
  – Conceptual level   Goal
  – Semantic level   Intention
  – Syntactic level   Action sequence
  – Lexical level   Action components

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Refining the model - evaluation

■ Evaluation
  – Perceiving the world   What do I see?
  – Interpreting the world   What does it mean?
  – Evaluating the world   Did I succeed?
■ Foley and van Dam
  – Conceptual level   Goal
  – Semantic level   Intention
  – Syntactic level   Action sequence
  – Lexical level   Action components

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The user's mental model

Mapping

User's Model → System State
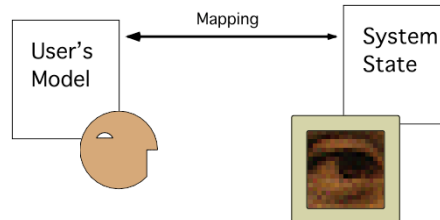
- ■ The mental model cues the user on actions/results
- ■ The model can work even if
  - – Rough, naïve, incomplete, wrong
 - – as long as mapping is close

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What's in a model? Ooh Ahh

- ■ Shneiderman's Object-Action- Interface model
  - – Objects - things we manipulate
  - – Actions - things we do to objects
- ■ System is composed of objects with states
- ■ Decompose task into Objects+Actions
  - – Natural connection with OOP

Putting it together
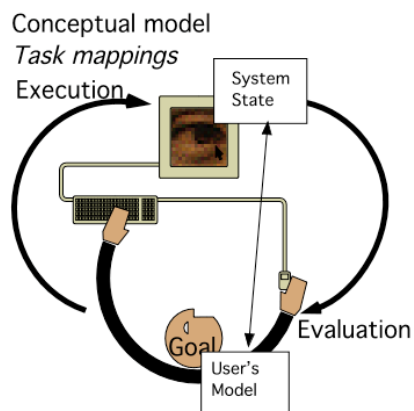
- Action model
- Classifies and decomposes actions
- Goals, intentions, actions, sequences

Action model
Task process

Execution

Evaluation

Goal
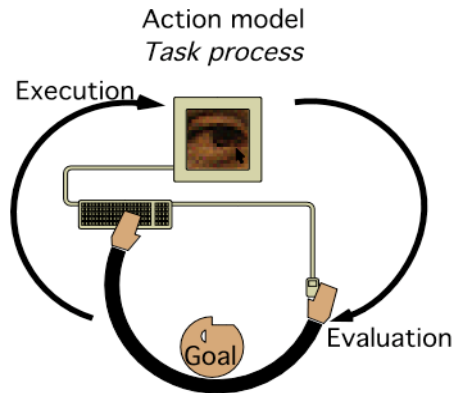
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Putting it together
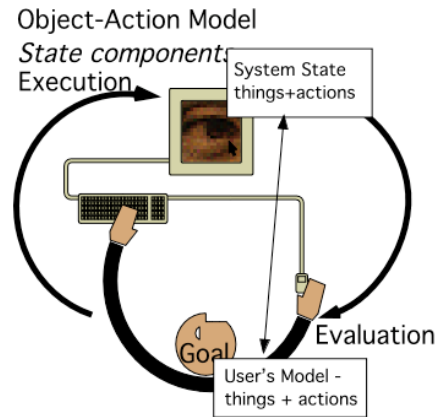
- Conceptual model
- Emphasizes the mapping between the user and the device
- Mapping levels Semantics, Syntax, Lexemes

Conceptual model
Task mappings

Execution

System State

Evaluation

Goal

User's Model

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Putting it together

- OAI model
- Describes what goes into the system state

Object-Action Model
State components
Execution

System State
things+actions

Evaluation

Goal

User's Model -
things + actions

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Examples Again?

- Can we choose the reason? UI Hall of Shame
  - Misplaced metaphors; Globalization
- Is the error best understood through …
  - The action sequence?
  - The conceptual level?
  - The specific objects and actions?
- Watching the user
  - Look for goals, intentions, mental models, understandings of action sequences, etc.

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End of class review

- What we covered:
  - Norman's Seven Stages of Action model
  - The two Gulfs - execution and evaluation
  - Foley and van Dam's Four Level model
  - Shneiderman's OAI model
  - A unified approach - tying them together

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