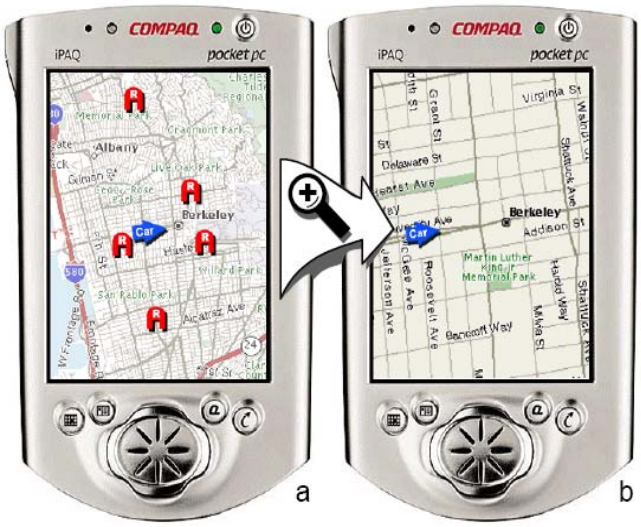
Conceptual Models I

CS160: User Interfaces

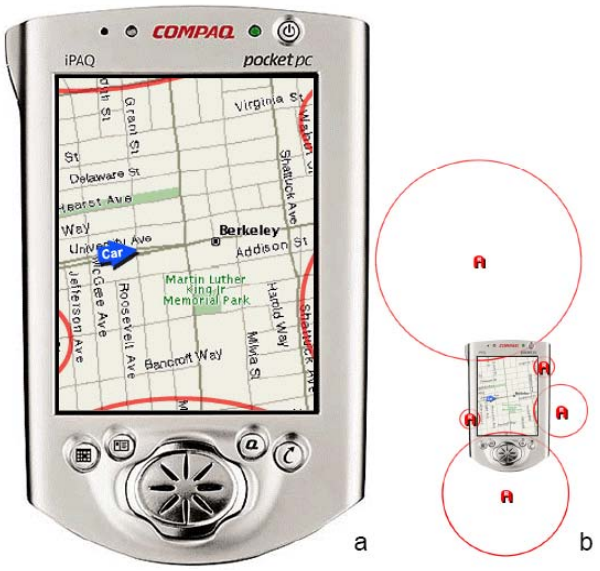
Maneesh Agrawala and Jeffrey Nichols

How to Display Multiple Destinations?



Halo - A Virtual Periphery for Mobile Devices

http://patrickbaudisch.com/projects/halo/index.html



[Baudisch 03]

Can Halo Be Improved?

Wedge

http://research.microsoft.com/users/baudisch/projects/wedge/index.html

[Gustafson 08]

Review

Task Analysis

1. Who is going to use system?
2. What tasks do they now perform?
3. What tasks are desired?
4. How are the tasks learned?
5. Where are the tasks performed?
6. What's the relationship between user & data?
7. What other tools does the user have?
8. How do users communicate with each other?
9. How often are the tasks performed?
10. What are the time constraints on the tasks?
11. What happens when things go wrong?

Review

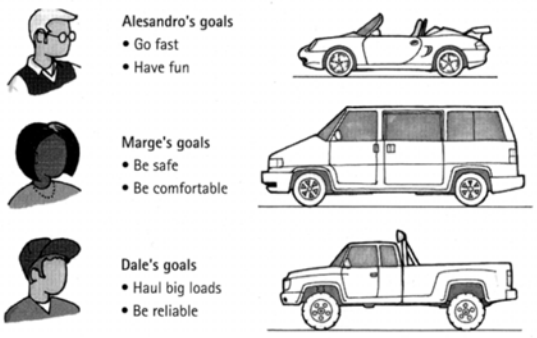
Contextual inquiry

- Helps answer the task analysis questions
- Hybrid between interview and observation
- Use master-apprentice model to get them to teach you

Review

Personas

- Specific archetype of user you will target your product to
- Build based on contextual inquiries/interviews



Design Assignment (due Feb 18)

Design an MP3 playing interface for a discount mobile phone

•Media player has:
- Play/pause
- Fast forward/rewind or manual scan
- Next track/previous track
- Volume (1-10)
- Random playback (on/off)
- Repeat (on/off)

•Goals
- Creativity!!!
- Minimize button presses
- Balance ease of use for expects/novices
- 3 alternatives, pick a favorite

Note: Design assignments will be announced/due on Wednesdays from now on

Project Assignment (due Feb 18)

Contextual Inquiry and Task Analysis
- A lot to do so get started ASAP
- Should be lining up subjects to interview

Topics

- Conceptual Models
- Design Principles
- The Action Cycle

Conceptual Models

Mental Representations

Users' understanding of how interface works

People have preconceived models
- Infix notation: 1 + 5 * 7 =

Changing mental models can be difficult

Interfaces Must Communicate Model

Online help / documentation useful (but shouldn't be necessary)

Affordances

Clues about how object/interface works

Affordances

Clues about how object/interface works

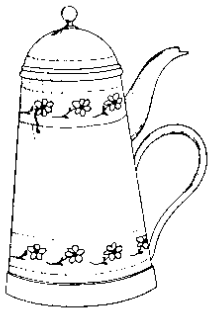
Affordances

- holes for insertion of fingers
- blades for cutting

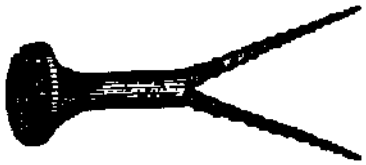
Implications clear for how operating parts work

Affordances

Clues about how object/interface works or doesn't

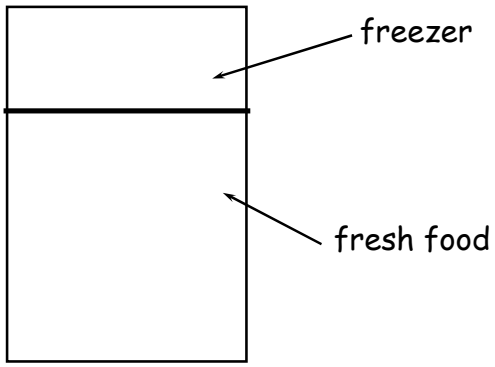


Teapot



Screw

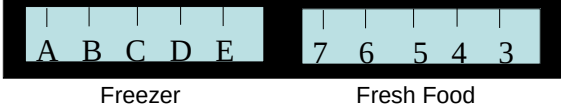
Refrigerator



Problem: freezer too cold, but fresh food just right

Refrigerator Controls

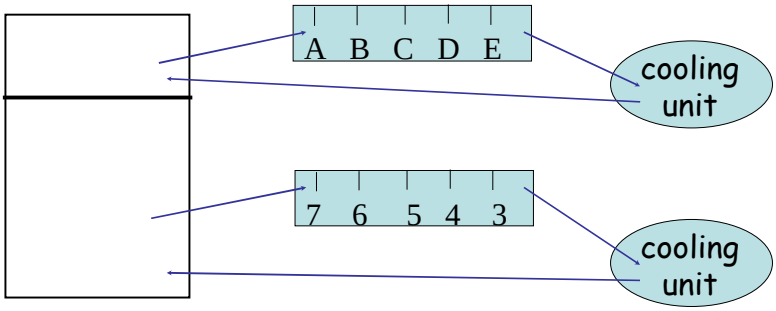
Normal Settings	C and 4
Colder Fresh Food	C and 5-6
Coldest Fresh Food	B and 7
Colder Freezer	D and 6-7
Warmer Fresh Food	C and 3-1
OFF (both)	0



Freezer Fresh Food

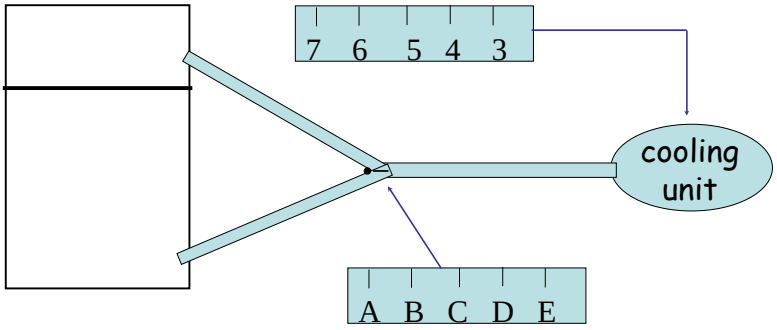
What is your conceptual model?

Most Likely Conceptual Model



Independent Controls

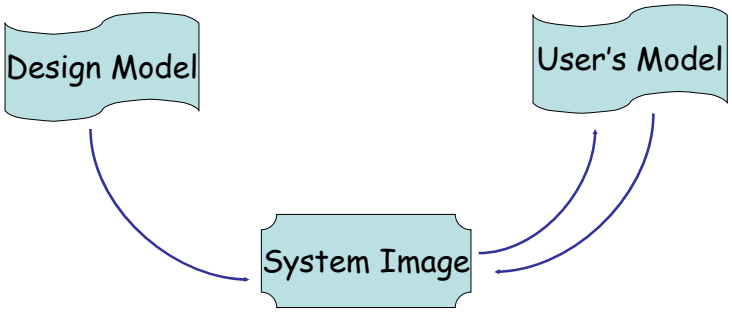
Correct Conceptual Model



Possible solutions:

- Make controls map to user's model
- Make controls map to actual system

Conceptual Models



- Designers model may not match user's model
- Users get model from experience & usage
  - Users only work with system image, not with designer
- What if the two models don't match?

Mismatches between models

- Errors
- Slow
- Frustration
- ...

Preconceived Models

People have preconceived models of how things work:

- how does your car start?
- how does an ATM machine work?
- how does your computer boot?

Allows us to predict how things will work or not work

Based on slide by Saul Greenberg

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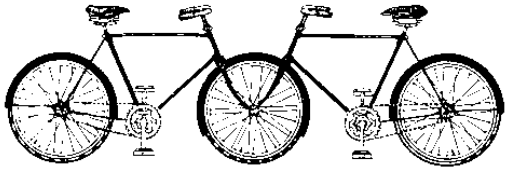
Allows us to predict how things will work



Based on slide by Saul Greenberg

Preconceived Models Often Wrong!

Extracted from fragmentary evidence

People find ways to explain things

- Computer terminal breaks when accessing the library catalog
- Certain you're driving on the correct road

Design Principles

1. Make Controls Visible

Poor Visibility (BMW's iDrive)

How do you put someone on hold?

How do you set the alarm?

- Primary controls visible
- But how to set a radio station preset?

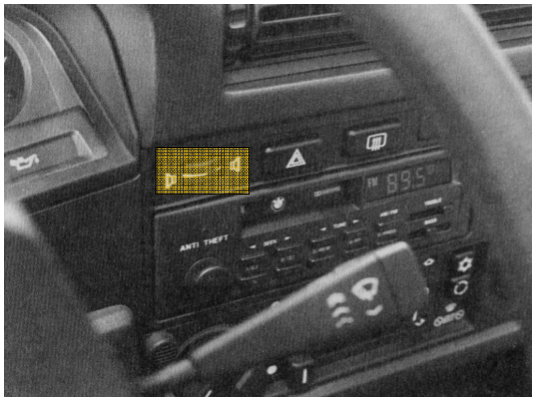
Too Much Visibility?

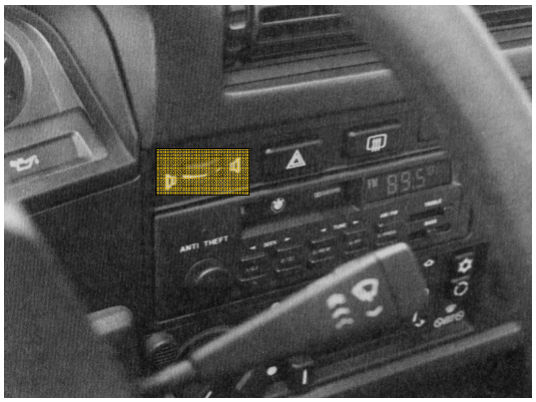
6 remote controls for "modest" home theater

2. Make Sure Mapping is Clear

Mapping: Relationship between controls and their result

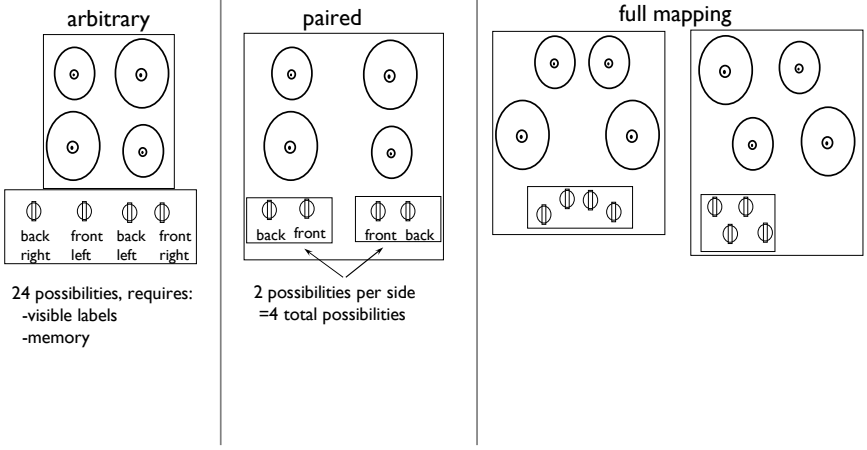
Mercedes Seat Adjustment





Does it control moving sound left/right or front/back?

Stovetop Controls



24 possibilities, requires:
-visible labels
-memory

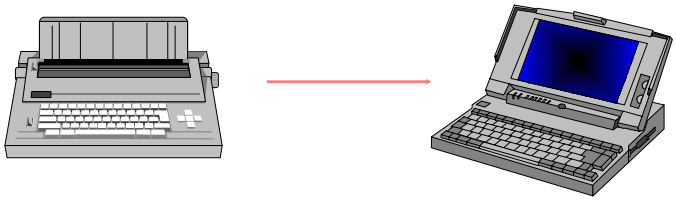
2 possibilities per side
=4 total possibilities

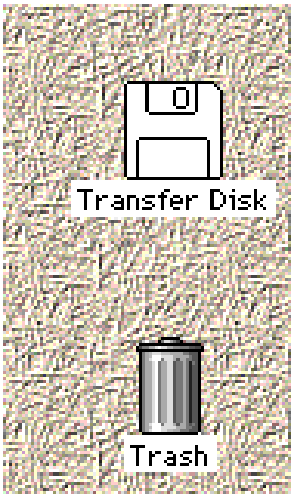
Slide adapted from Saul Greenberg

Transfer Effects

People transfer expectations from known objects to similar new ones

- Positive: previous experience applies to new situation
- Negative: previous experience conflicts with new situation





What happens when disk is dragged onto trash can?

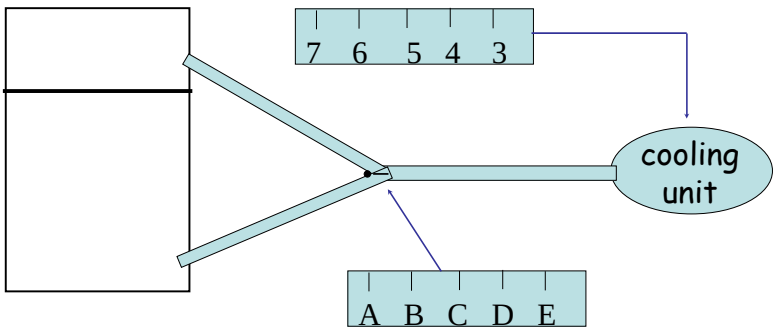
3. Provide Feedback

People press >> 1 time

- Unclear if system has registered the button press

Elevator buttons light up → reducing multiple presses

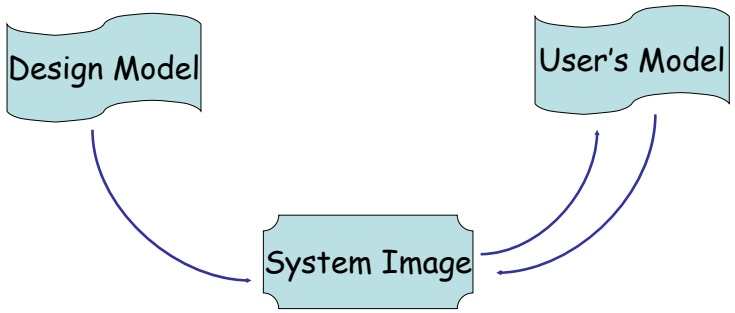
Poor Feedback



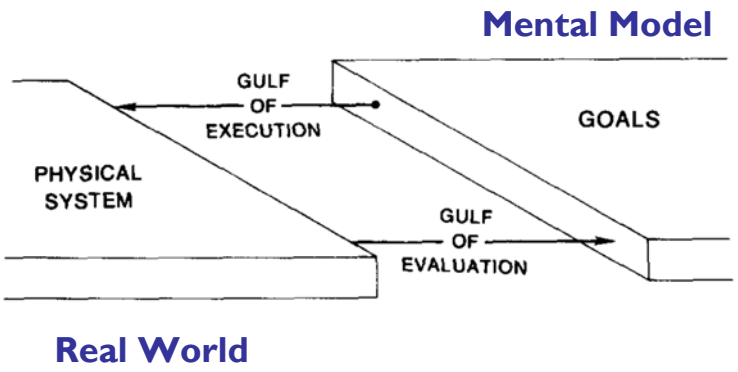
Took a day for refrigerator to adjust to new settings

The Action Cycle

Conceptual Models



Gulfs of Execution & Evaluation

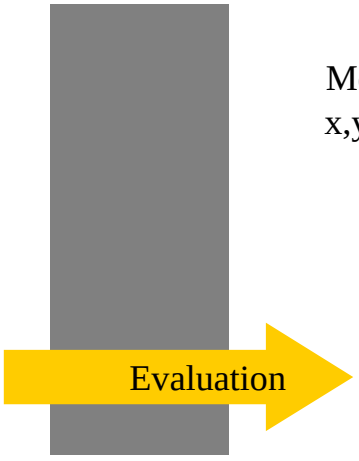


Gulf of Evaluation

Gulf

Real world:

X	Y
0.67	0.79
0.32	0.63
0.39	0.72
0.27	0.85
0.71	0.43
0.63	0.09
0.03	0.03
0.20	0.54
0.51	0.38
0.11	0.33
0.46	0.46

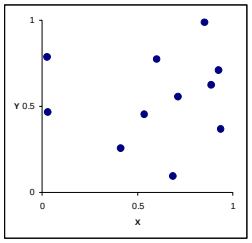


Mental model:
x,y correlated?

Gulf of Evaluation

Gulf

Real world:



Mental model:
x,y correlated?

Evaluation

Gulf of Evaluation

Gulf

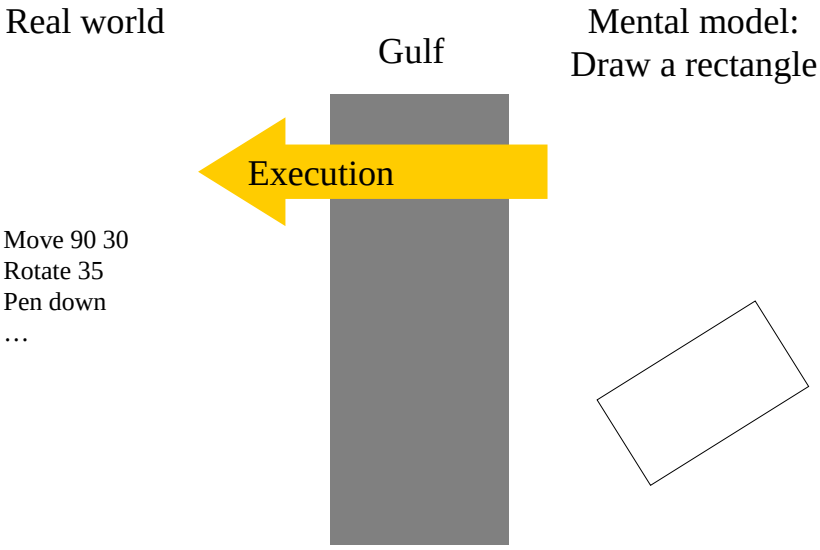
Real world:

$\rho = -.29$

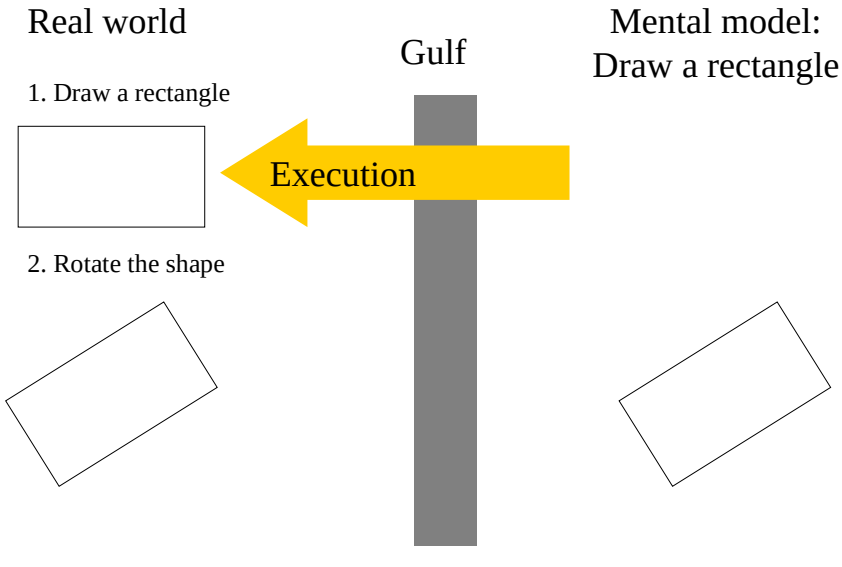
Mental model:
x,y correlated?

Evaluation

Gulf of Execution



Gulf of Execution



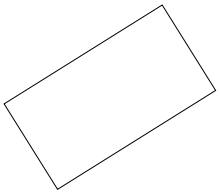
Gulf of Execution

Real world

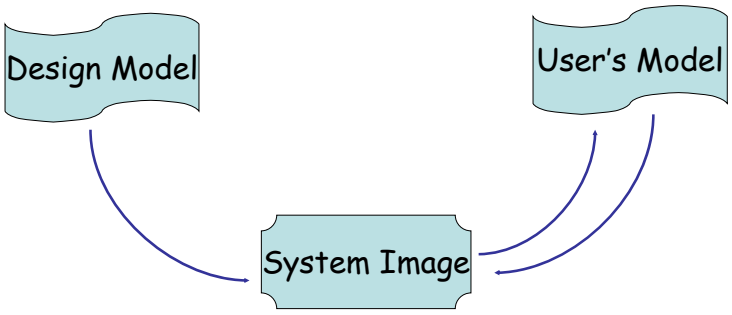
Gulf

Mental model:
Draw a rectangle

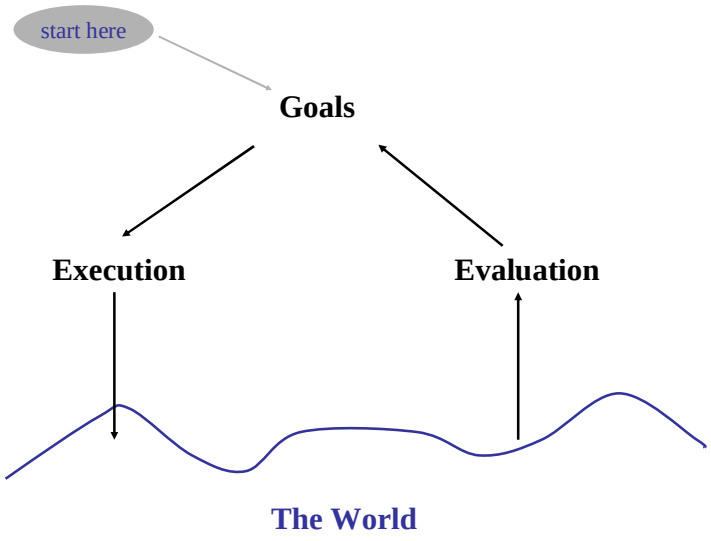
Execution



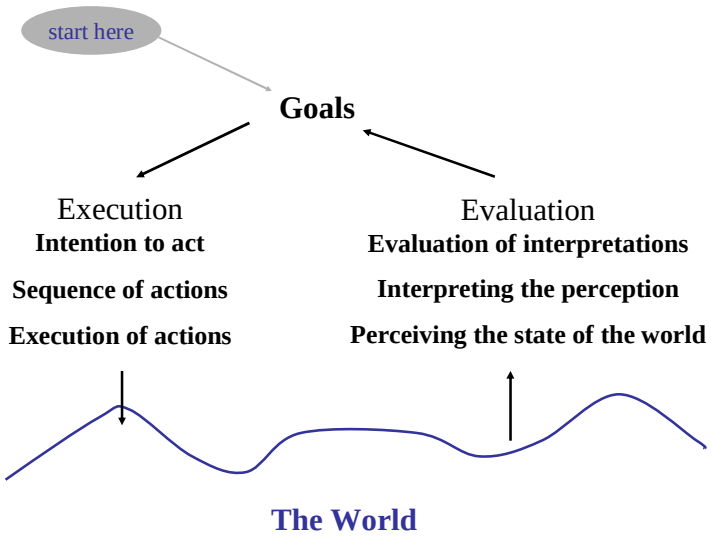
Conceptual Models



Action Cycle

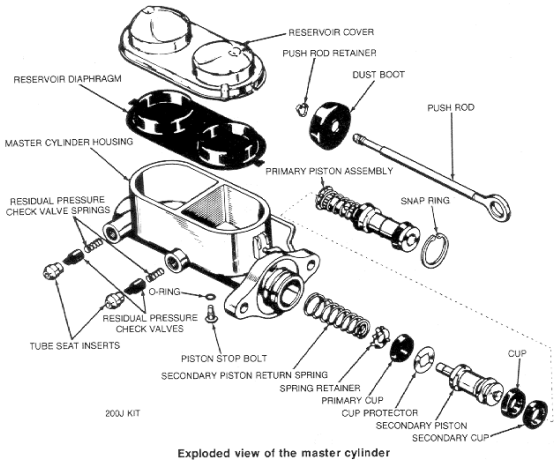


Action Cycle



Direct Manipulation

Manipulating Exploded Views



Exploded view of the master cylinder

Interactive Image-Based Exploded View Diagrams. Wilmot Li, Maneesh Agrawala and David Salesin. Graphics Interface 2004.

Viewing and Direct Manipulation

Definitions

Direct Engagement

- The feeling of working *directly* on the task

Direct Manipulation

- An interface that behaves as though the interaction was with a real-world object rather than with an abstract system

Central ideas

- Visibility of the objects of interest
- Rapid, reversible, incremental actions
- Manipulation by pointing and moving
- Immediate and continuous display of results

Almost always based on a metaphor

- Mapped onto some facet of the real world task semantics

The Metaphor

Computer objects as visible, moveable objects

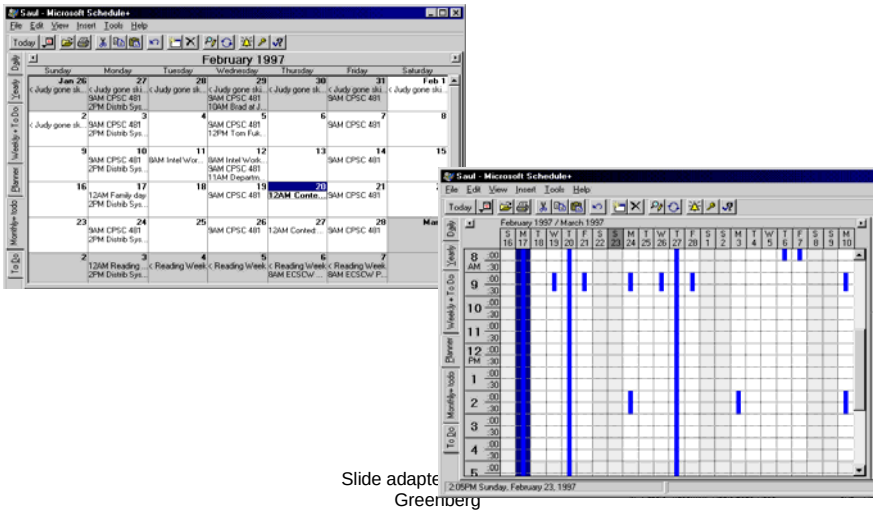
Consequences

- Items represented as icons
- Items can be "picked up" and "moved" on a surface
- Items can be "thrown out"
- Items can be "copied"
  - Do we really want to have to drag them to a photocopier?

How much is too much?

Visual Representation

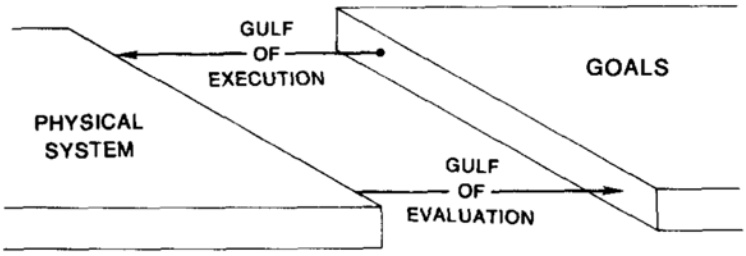
To manipulate an object it must be visible



Slide adapte
Greenberg

Reduce Distance

Decrease gulfs

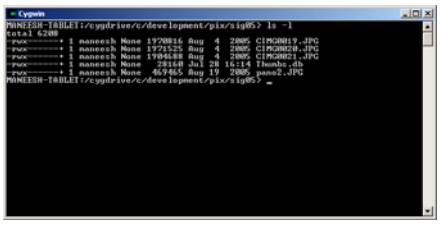


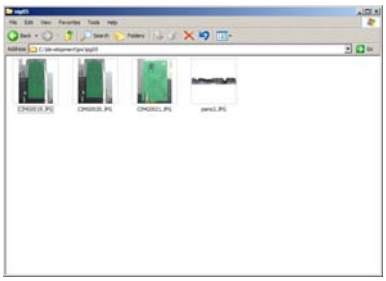
Increase Engagement

Conversation vs. Model world

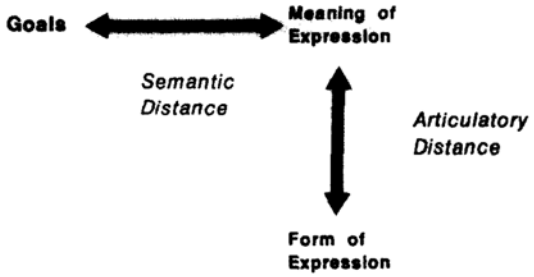
- Abstraction uses language vs. directly operating on objects
- Describe actions of interest vs. performing actions directly

Model world: Output can serve as input expression
Conversation: Cannot operate on what has been said





Semantic & Articulatory Distance



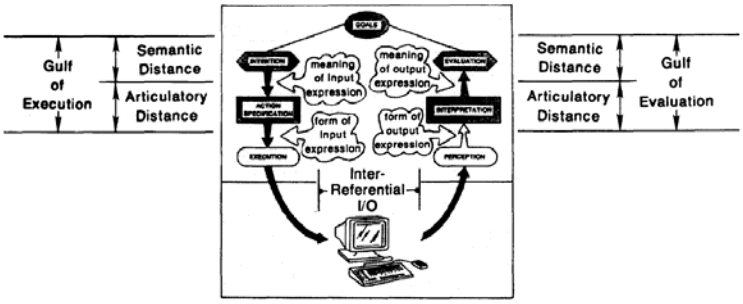
Semantic
- Is it possible to say what one wants to say
- Can it be said concisely

Articulatory
- Make form of expression similar to meaning of expression
- Onomatopoeia
  - "Boom" of explosion, "cock-a-doodle-doo" of roosters

The Gulfs & Semantic Distance

Gulf of Execution
- Match description level of interface language to level at which person thinks of the task (often interface is much lower)

Gulf of Evaluation
- Match output to the form user requires for checking that goals have been met



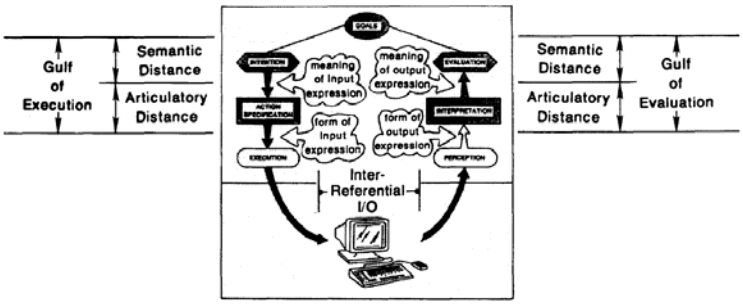
The Gulfs & Articulatory Distance

Gulf of Execution

- Permit specification of action by mimicking it (i.e. move pointer with mouse, pointing with finger, lightpen, …)

Gulf of Evaluation

- Depict output so that relationships between input action and output is obvious and easy to perceive (i.e. graphical chart vs. table of numbers)



Issues

Some Disadvantages

- Ill-suited for abstract operations
  - Spell-checker?
  - Search database by scrolling or by query?

Solution: Combine direct manipulation & abstractions

- Word processor:
  - WYSIWYG document (direct manipulation)
  - Buttons, menus, dialog boxes (abstractions, but direct manipulation "in the small")

Slide adapted from Saul Greenberg

Summary

Conceptual model is the user's mental model of how the interface works

Perceived affordances help users form this model

Designers must provide clues in system to make conceptual model clear
- Make controls visible
- Make sure mapping is clear
- Provide feedback

Gulfs of Execution and Evaluation
- Action cycle involves bridging gulfs between user & system
- Reduce semantic and articulatory distances

Next Time

No class on Monday 2/16 due to President's Day

Assignments Due Wed 2/18
- Design Assignment: Cell Phone Music Player
- Contextual Inquiry and Task Analysis

Reading

Meanings, Modes, Monotony and Myths. *The Humane Interface.* Chap 3. Raskin.