

DESIGN CONCEPTS

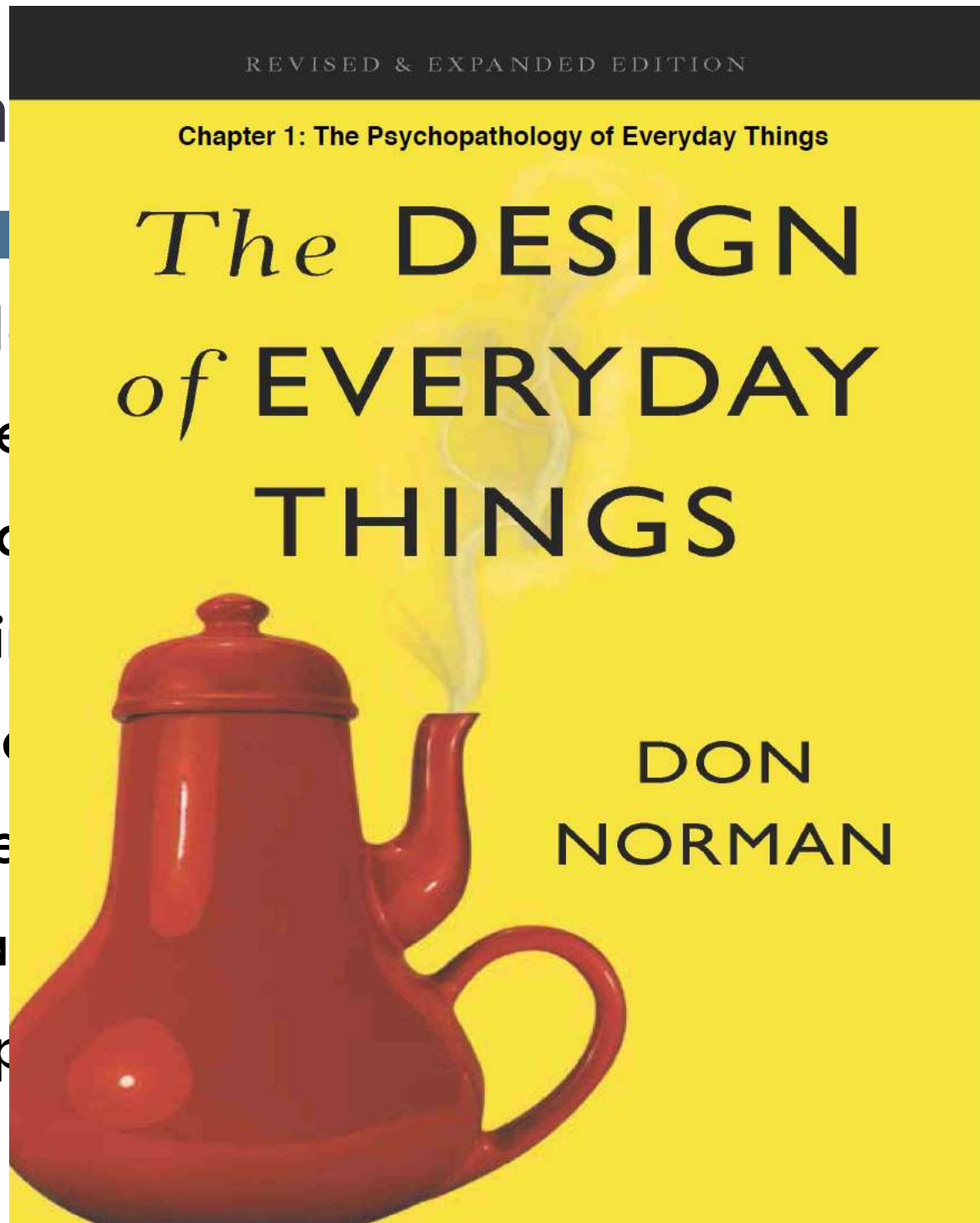
CMPT 381

Outline

- Affordances
- Signifiers
- Constraints
- Mapping
- Feedback
- Transfer effects
- Population and cultural differences
- Conceptual models

Outline

- Afford
- Signifie
- Constr
- Mappi
- Feedb
- Transfe
- Popula
- Concep



Outline

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- Conceptual models

Affordances

Affordances

- The perceived and actual fundamental properties of an object that determine how it could possibly be used (Gibson, 1977)

Affordances

- An on/off button:



Affordances

- Another on/off button:



Affordances

- A handle:



Affordances

- Another handle?



Affordances



Buttons afford pressing



Holes afford insertion
Handles afford grasping



Chairs afford sitting



Computers afford...



Switches afford toggling



Doorknobs afford twisting

Affordances

- The perceived and actual fundamental properties of the object that determine how it could possibly be used (Gibson, 1977)
- Complex things may need explaining, but simple things should not
 - When simple things need instructions, then the design has failed

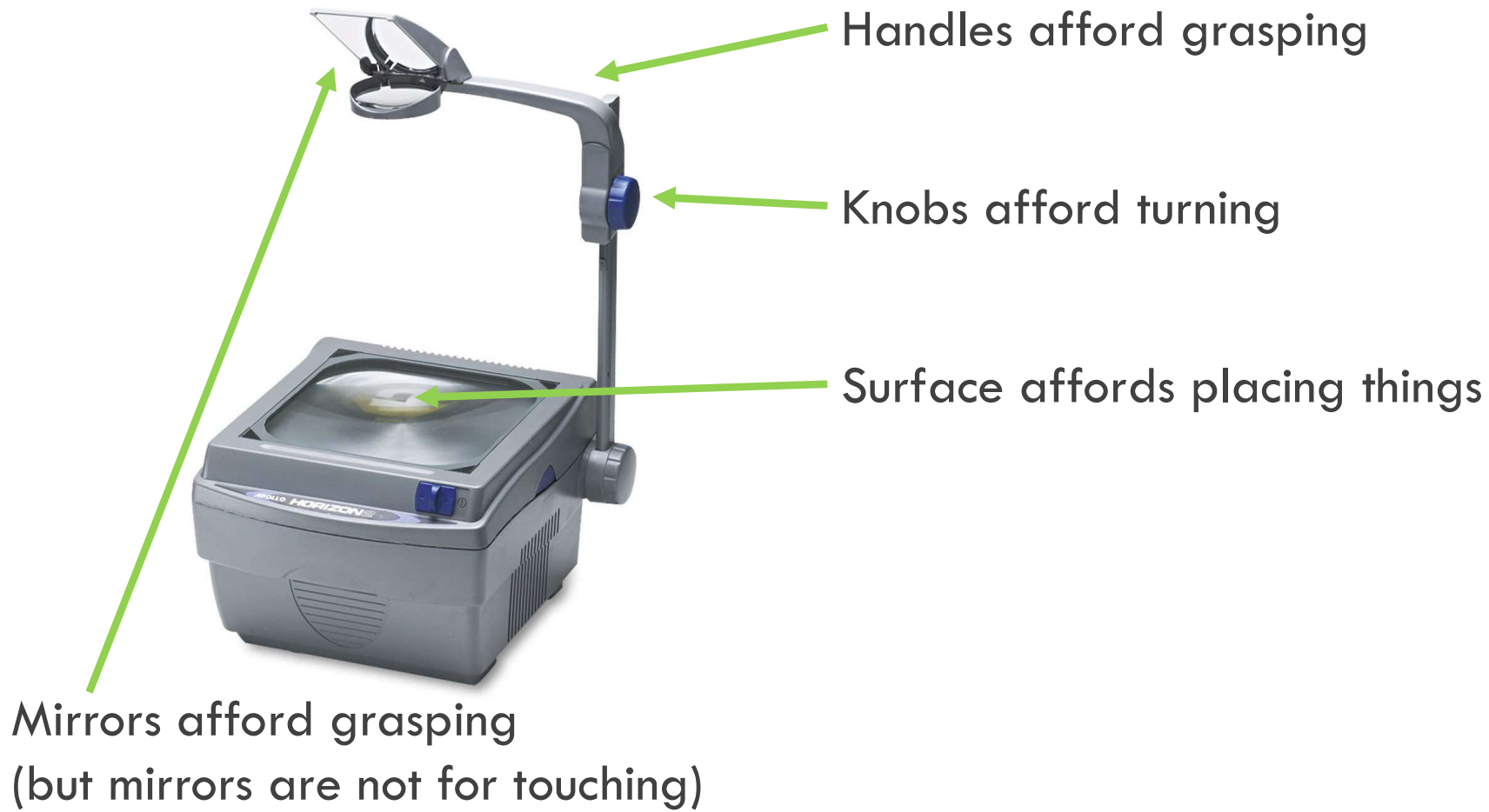
Affordances



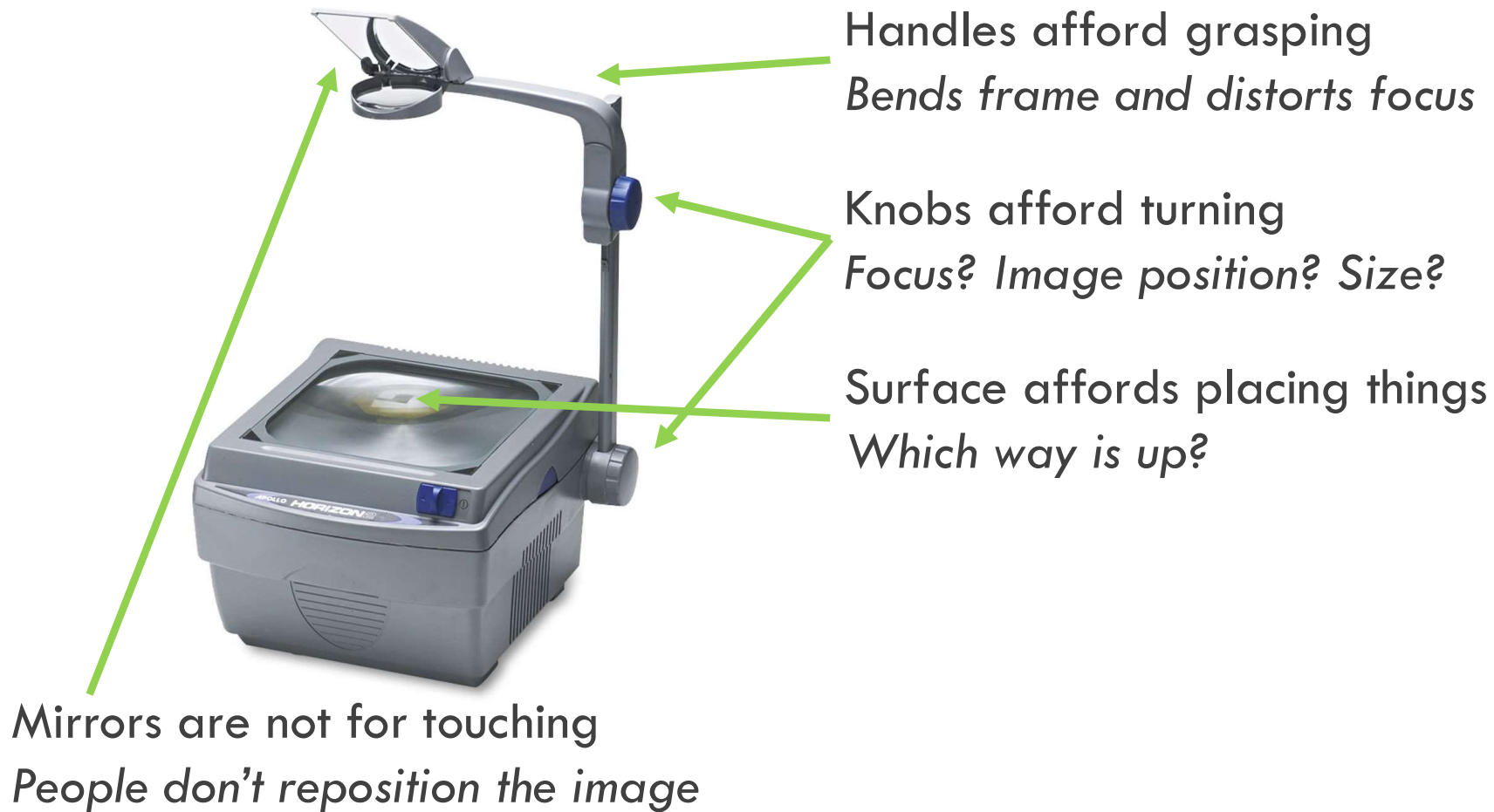
Affordances – hidden affordance



Affordances – design analysis



Affordances – design analysis

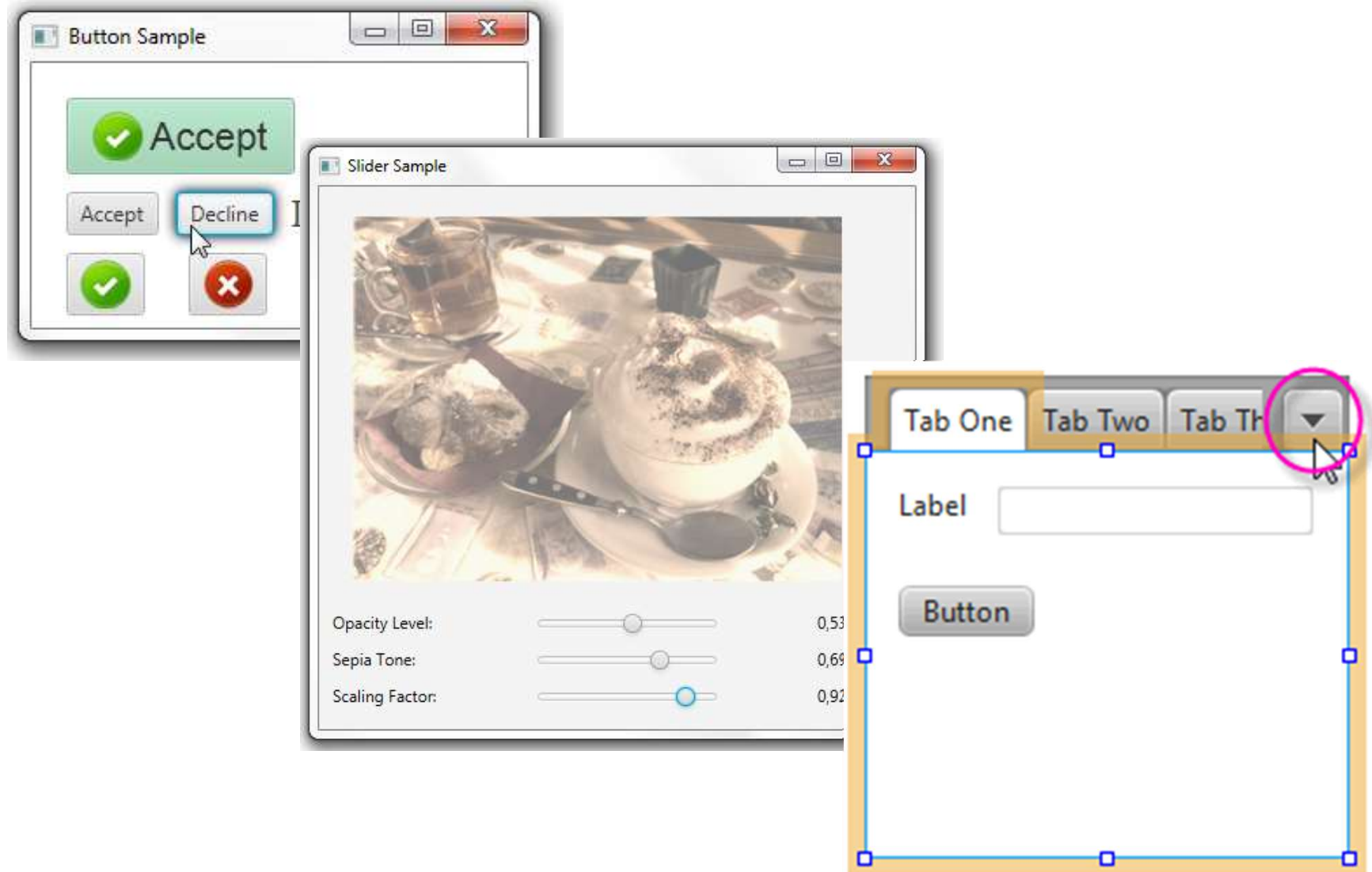


Affordances in GUIs

- In GUIs, perception only through visuals
- Designer creates appropriate visual affordances via
 - familiar idioms
 - metaphors



Affordances in GUIs



Affordances

Handles afford grabbing / pulling,
but these are for scrolling!



Affordances – false affordance

Handles afford grabbing / pulling,
but these are for scrolling!



Affordances – false affordance



Signifiers

Signifiers

- *Advertising* about the affordance
- Implicit signifiers
 - Visual appearance of the object
 - “It looks like I can grasp it”
 - Prior knowledge or assumptions about properties
 - “I think it’s light enough to pick up and throw”
- Explicit signifiers
 - Deliberate instructions
 - “Pick up the rock to open the door”
- Learn to read the signifiers

How do these doors work?



How do these doors work?



How do these doors work?



How do these doors work?



How do these doors work?



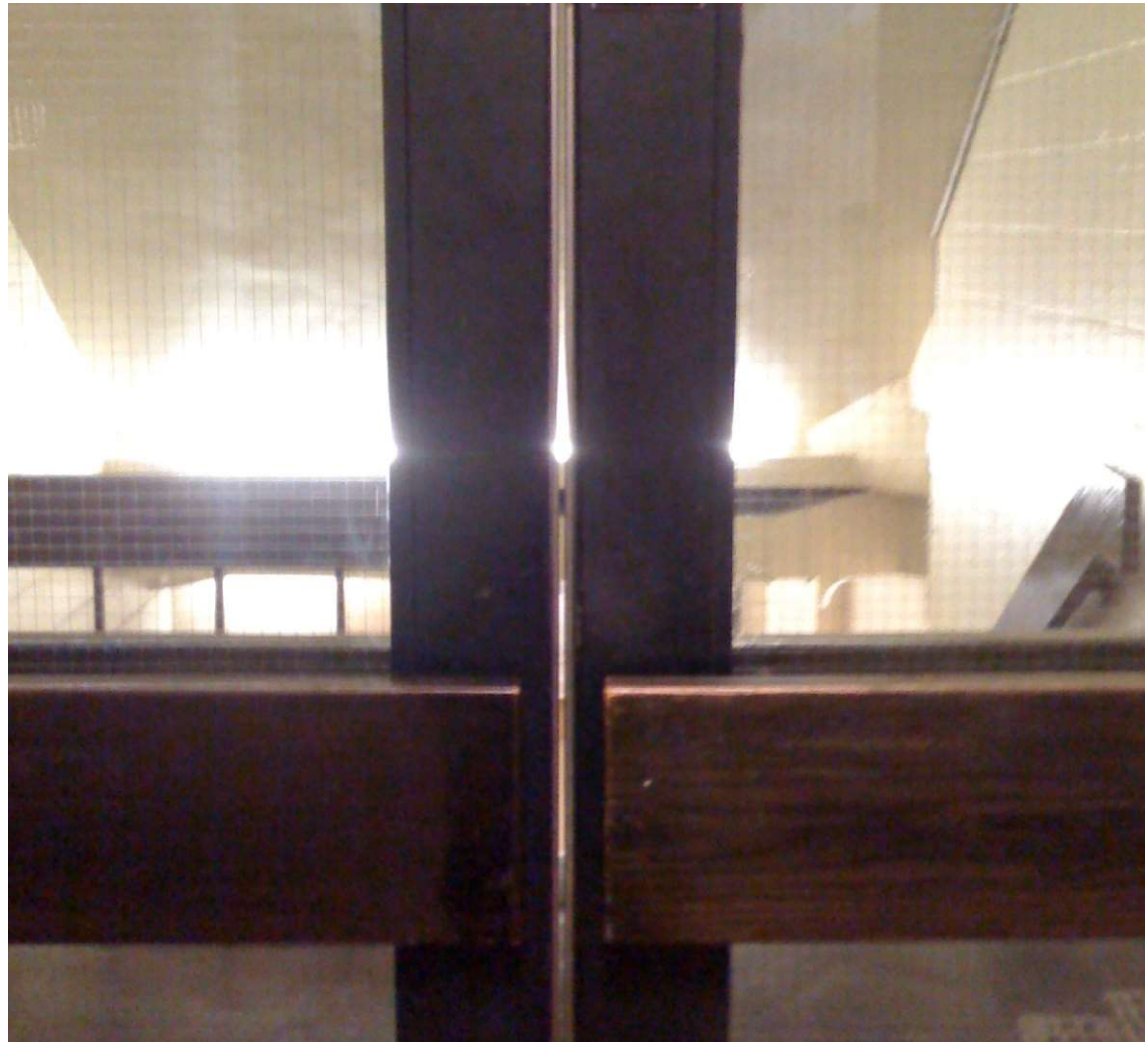
How do these doors work?

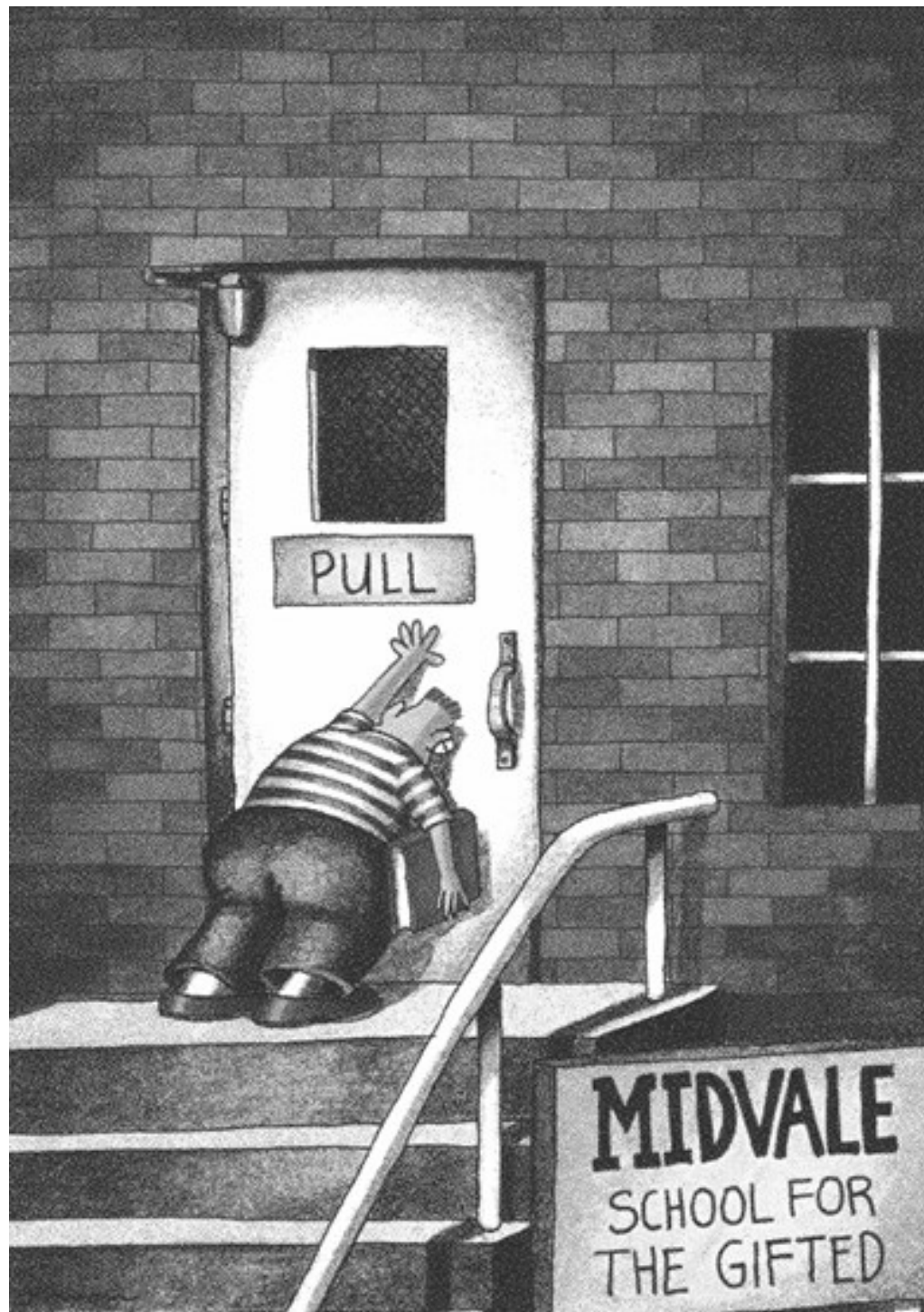


How do these doors work?



How do these doors work?





Affordances and Signifiers

- Use these concepts to explain:

- Hidden affordance



- False affordance



Outline

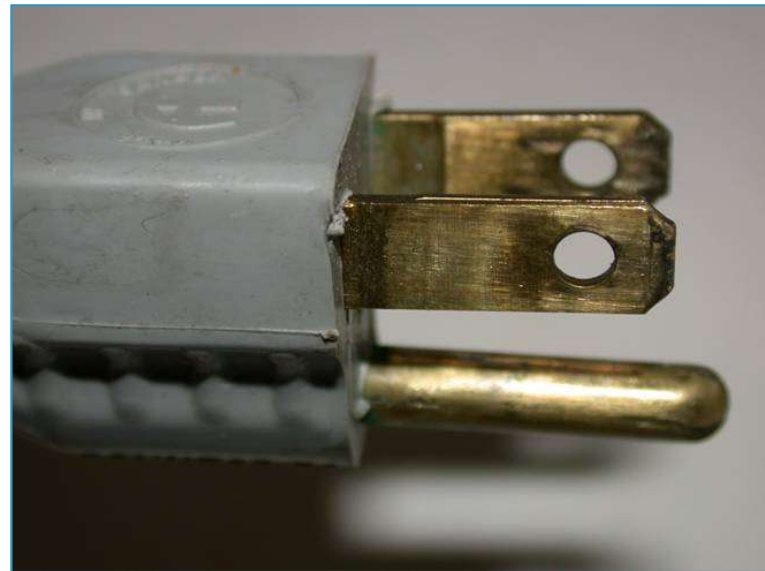
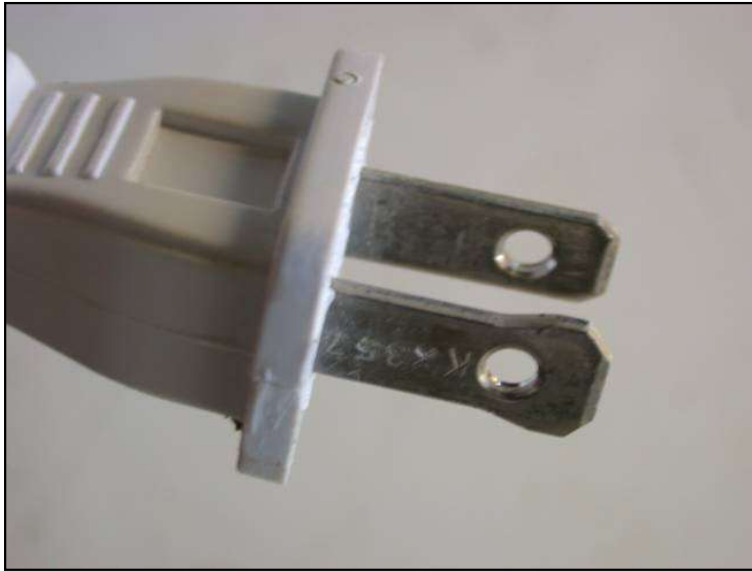
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Visible Constraints

Visible Constraints

- Limitations of the actions possible, that can be perceived from object's appearance
 - provides people with a range of usage possibilities

Visible Constraints



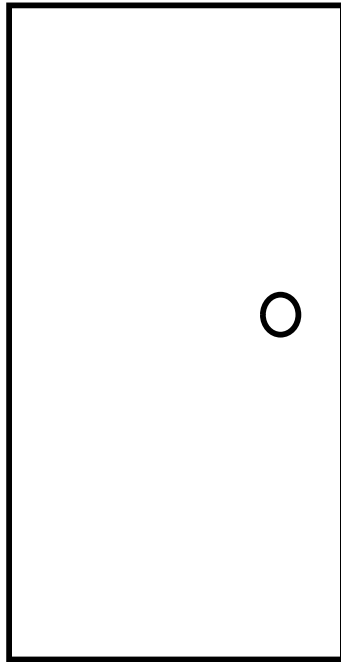
(Invisible) Constraints



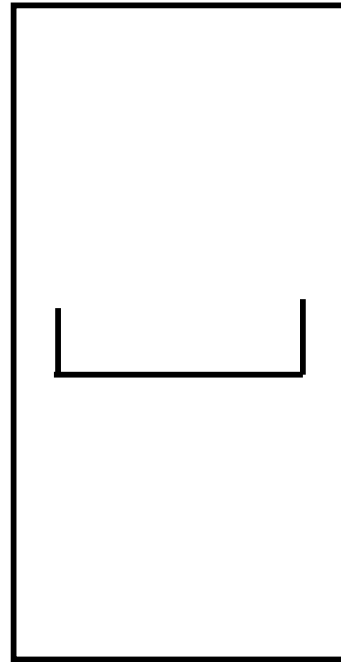
Visible Constraints?



Visible Constraints

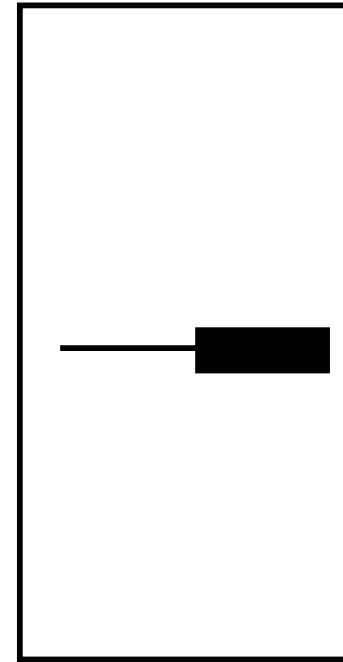


Push or pull?



Push or pull?

Which side?



Can only push,
side clearly visible

Visible constraints: entering a date

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- More constraints = fewer opportunities for error
 - particularly important for managing user input

Form1

Date:

Month Day Year

May 22 1997
Month Day Year

May ▼ 22 ▼ 1997 ▼

Appointment

General Attendees Notes Planner

When

Start: 8 : 30 AM Wed 5 /14 /97

End: 4 : 30 PM Wed 5 /14 /97

☐ All day

Description:

Smart Technology Ser

Where:

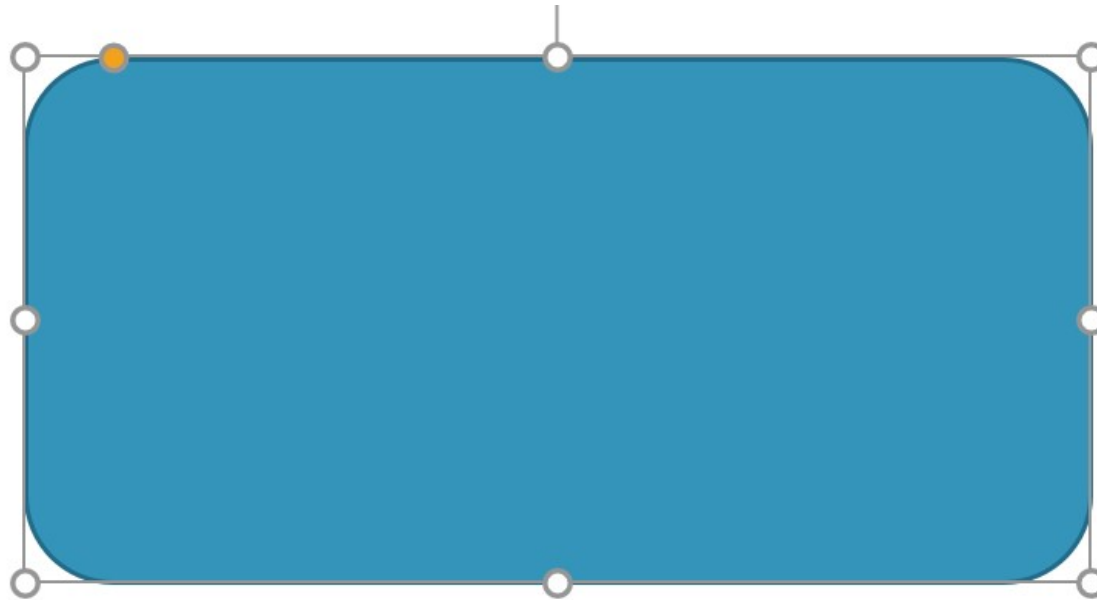
May 1997

S	M	T	W	T	F	S
27	28	29	30	1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31
1	2	3	4	5	6	7

Visible constraints: resize handles

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- More constraints = fewer opportunities for error
 - particularly important for managing user input



Mappings



Control panel of a Centenary oven with six rotary knobs and a light indicator.

Light Indicator: A small light bulb icon with "OFF" and "ON" labels.

Knobs and Settings:

- Knob 1 (Leftmost):** Labeled "OFF" and "ON". Scale: 150, 200, 250.
- Knob 2:** Labeled "OFF". Scale: 100, 150. Markers: "LO", "HI".
- Knob 3:** Labeled "OFF". Markers: "LO", "HI".
- Knob 4:** Labeled "OFF". Markers: "LO", "HI".
- Knob 5:** Labeled "OFF". Markers: "LO", "HI".
- Knob 6 (Rightmost):** Labeled "OFF". Marker: "LO".

Temperature Scale: 200 230 260 (top row), 400 450 500 (bottom row).

Function Indicators:

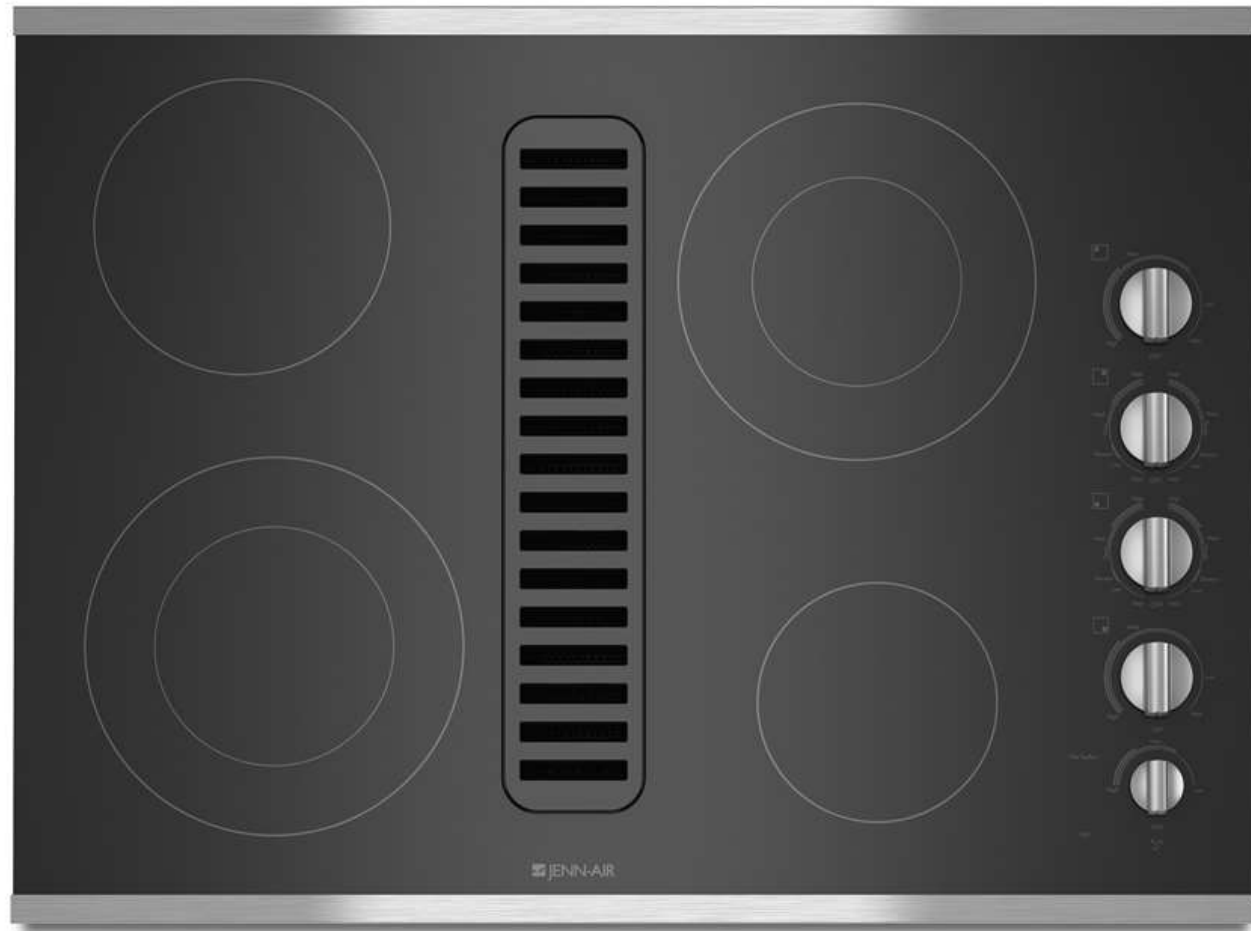
- OVEN:** Indicated by a 2x2 grid of blue squares.
- HOTPLATES:** Indicated by a 2x2 grid of blue squares.
- GRILL:** Indicated by a 2x2 grid of blue squares.

Centenary

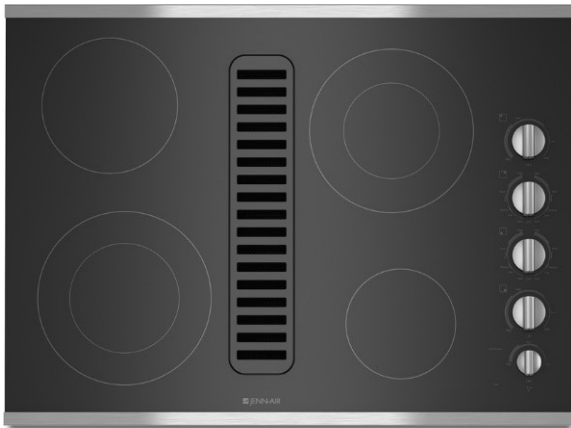
Stove vs. 1-week-old laptop



Mappings



Mappings



Arbitrary
24 possibilities



Partial
8 possibilities



Full
1 possibility



OFF

OFF

250

200

150

ON

200 230 260

400 450 500

OVEN

OFF

HI

LO

OFF

HI

LO

OFF

HI

LO

OFF

HI

LO

OFF

HI

LO

GRILL

Centenary

Natural Mapping?



Natural Mapping?



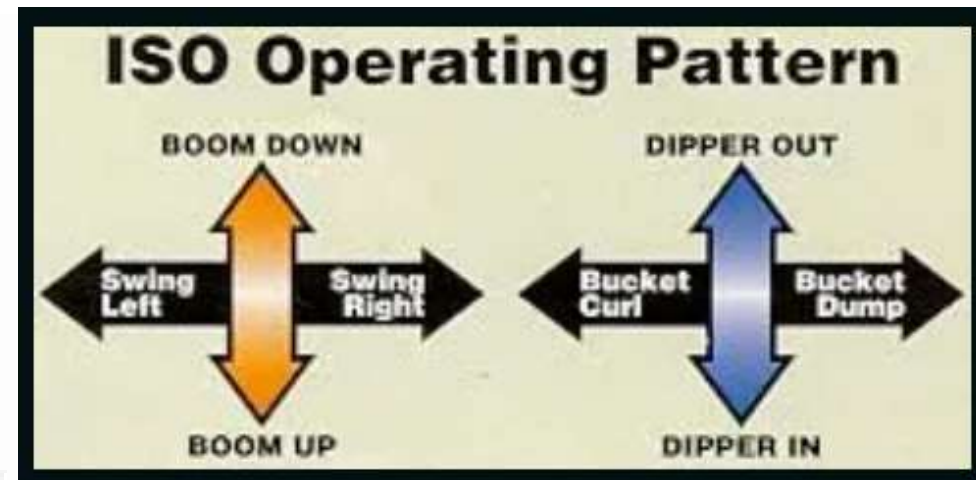
Natural Mapping?



Natural Mapping?

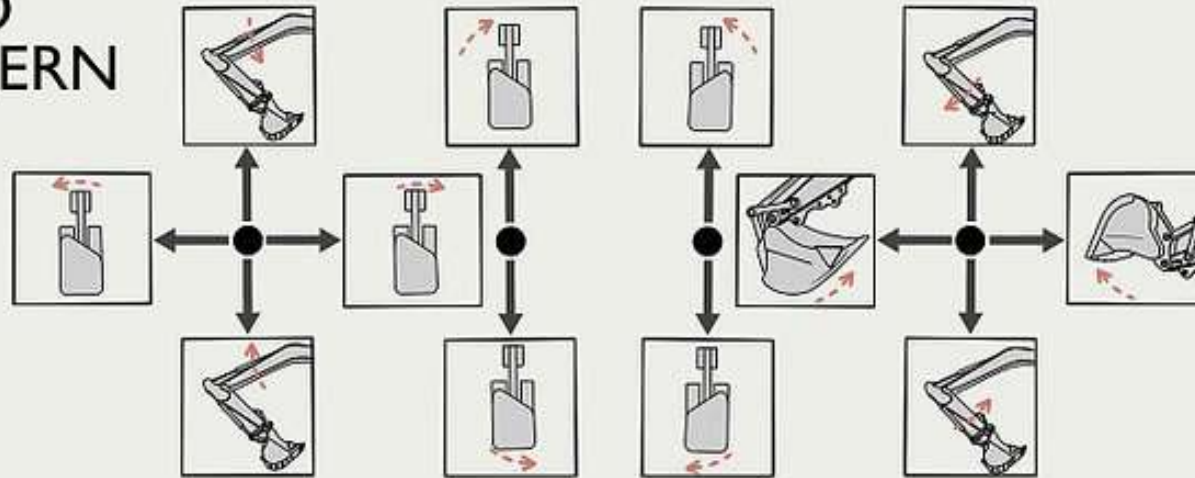


Natural Mapping?

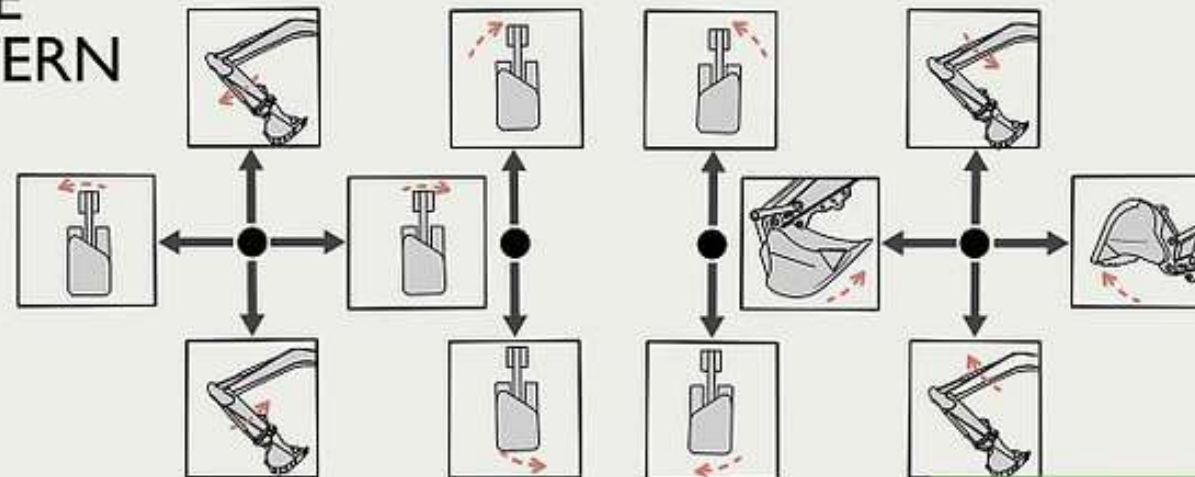


Natural Mapping?

ISO
PATTERN



SAE
PATTERN



Natural Mapping?



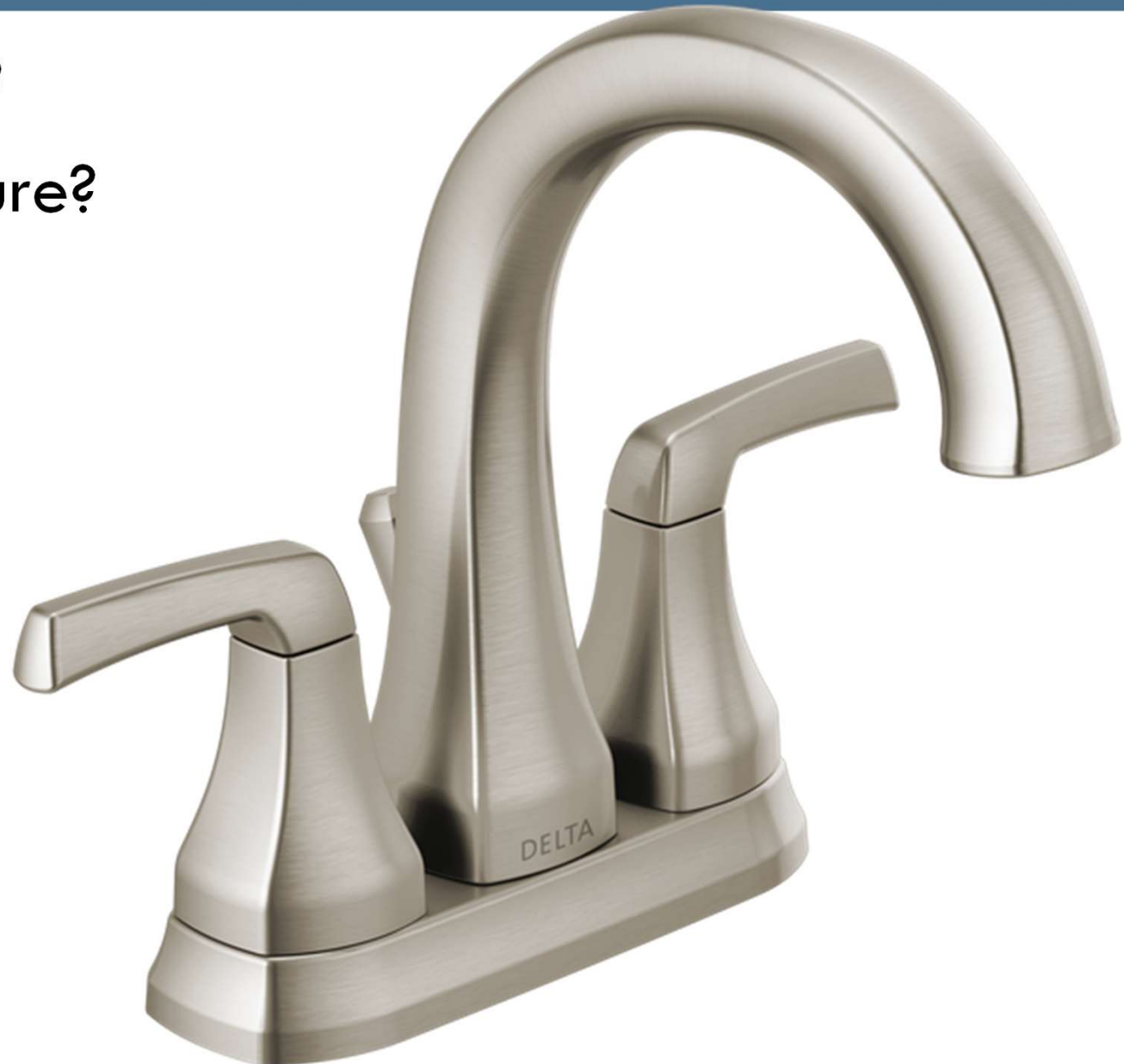
Mapping Problems

- Where do you plug in the mouse?
- Mapping ambiguous



Mapping Problems

- Flow rate?
- Temperature?



Mapping Problems

- Flow rate?
- Temperature?



Mapping Problems

- Flow rate?
- Temperature?



Mapping Problems

- Which space is the correct one to fill in?

Confusion at Palm Beach County polls

Some Al Gore supporters may have mistakenly voted for Pat Buchanan because of the ballot's design.

Although the Democrats are listed second in the column on the left, they are the third hole on the ballot.

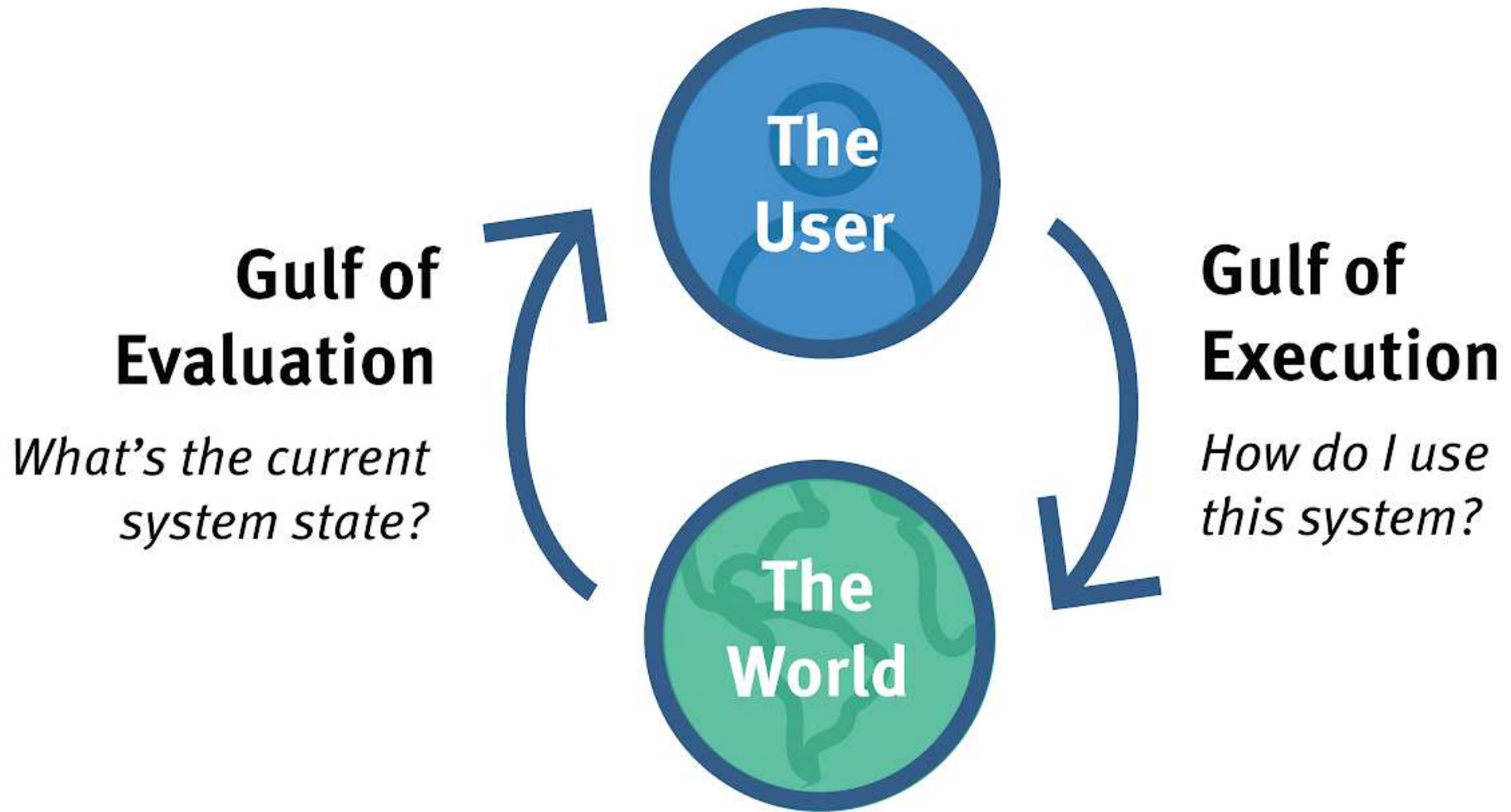
Punching the second hole casts a vote for the Reform party.

ELECTORS FOR PRESIDENT AND VICE PRESIDENT (A vote for the candidates will actually be a vote for their electors.) (Vote for Group)	
(REPUBLICAN) GEORGE W. BUSH - PRESIDENT DICK CHENEY - VICE PRESIDENT	3 ➔
(DEMOCRATIC) AL GORE - PRESIDENT JOE LIEBERMAN - VICE PRESIDENT	5 ➔
(LIBERTARIAN) HARRY BROWNE - PRESIDENT ART OLIVIER - VICE PRESIDENT	7 ➔
(GREEN) RALPH NADER - PRESIDENT WINONA LA DUKE - VICE PRESIDENT	9 ➔
(SOCIALIST WORKERS) JAMES HARRIS - PRESIDENT MARGARET TROWE - VICE PRESIDENT	11 ➔
(NATURAL LAW) JOHN HAGELIN - PRESIDENT NAT GOLDHABER - VICE PRESIDENT	13 ➔

← 4	(REFORM) PAT BUCHANAN - PRESIDENT EZOLA FOSTER - VICE PRESIDENT
← 6	(SOCIALIST) DAVID McREYNOLDS - PRESIDENT MARY CAL HOLLIS - VICE PRESIDENT
← 8	(CONSTITUTION) HOWARD PHILLIPS - PRESIDENT J. CURTIS FRAZIER - VICE PRESIDENT
← 10	(WORKERS WORLD) MONICA MOOREHEAD - PRESIDENT GLORIA LA RIVA - VICE PRESIDENT
WRITE-IN CANDIDATE To vote for a write-in candidate, follow the directions on the long stub of your ballot card.	

Feedback

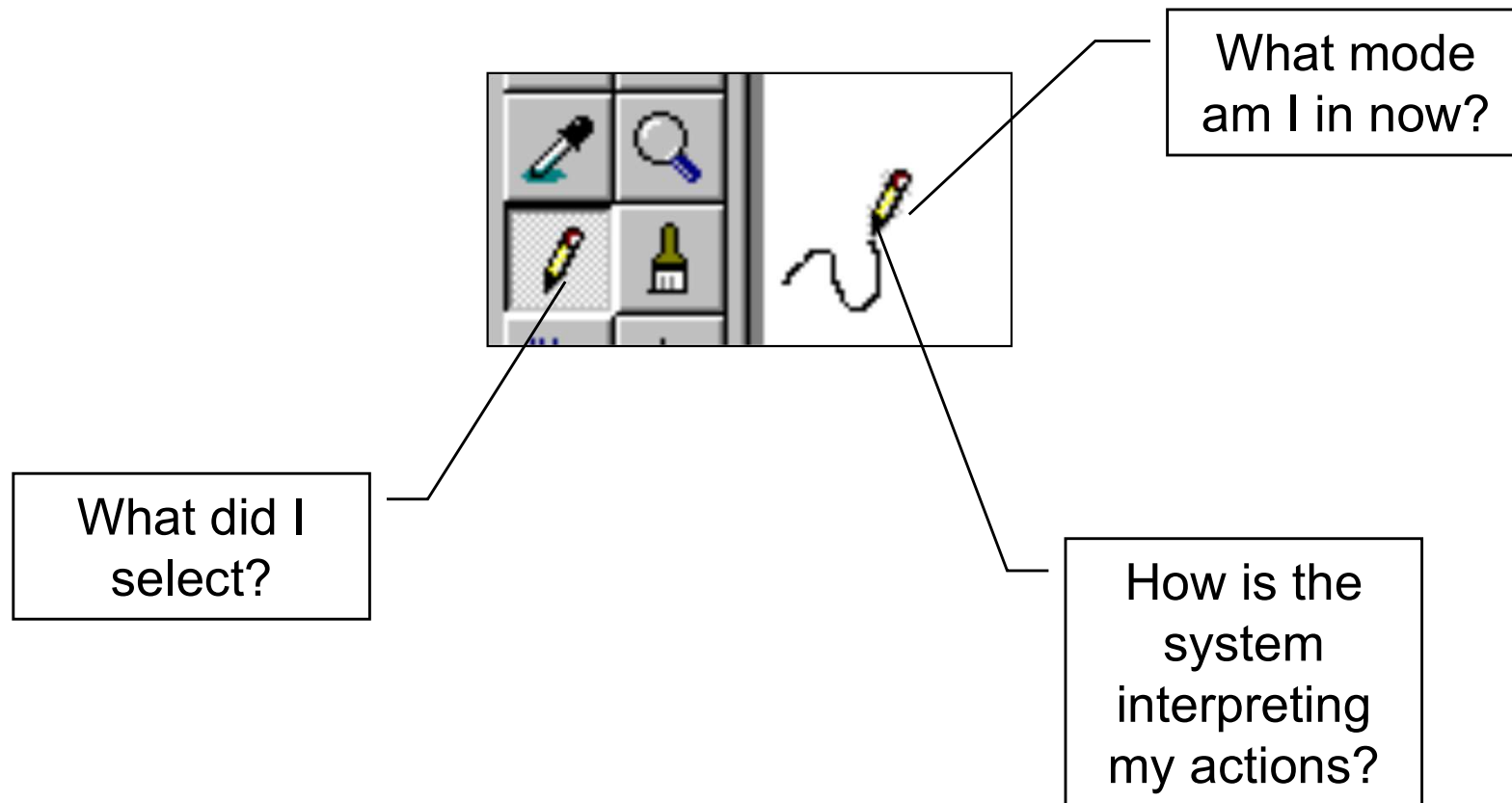
Gulfs of execution and evaluation



Feedback

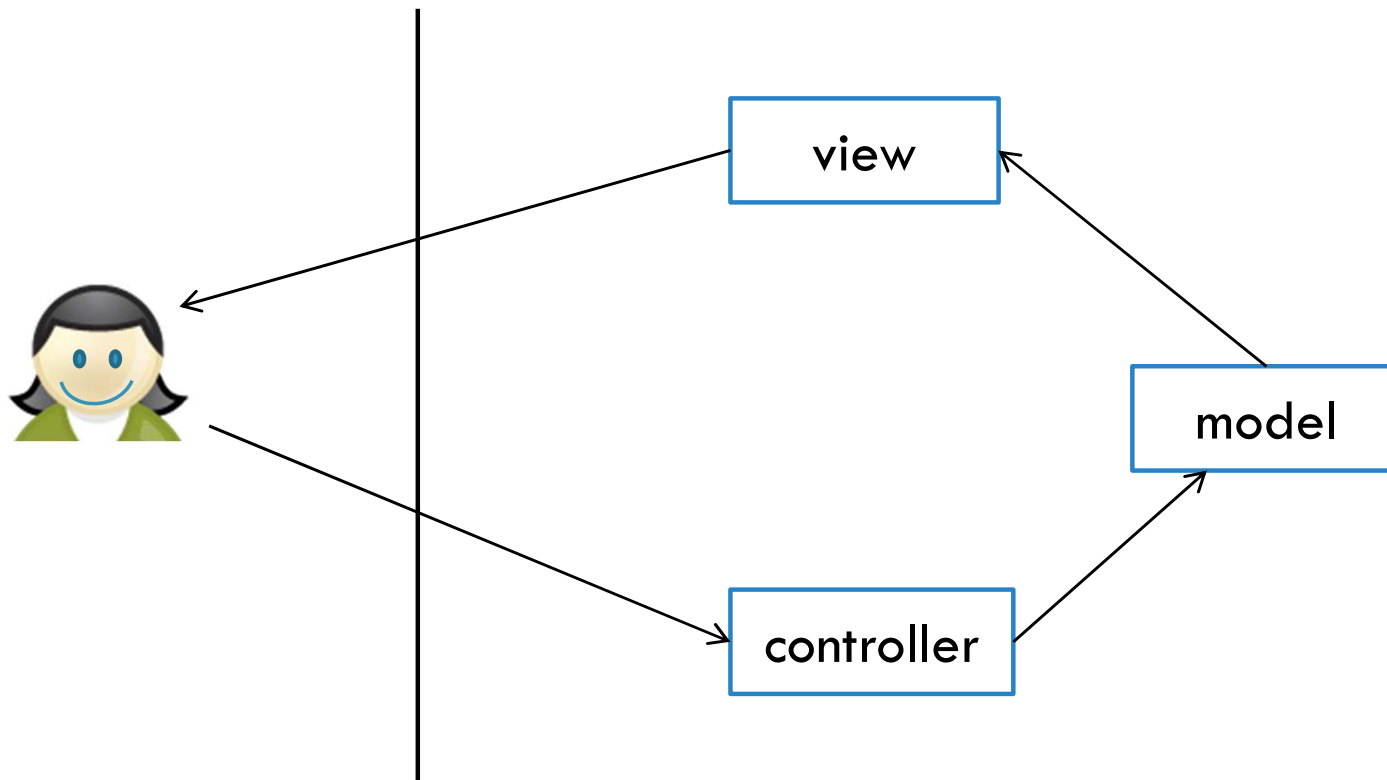
- Well-designed feedback lets the user know the state of the system, that the system has understood or responded to their actions, and what the results of their actions are.

Feedback



Feedback

- Response time:
 - Cursor lag when moving mouse across the screen
 - Setting Don Norman's refrigerator



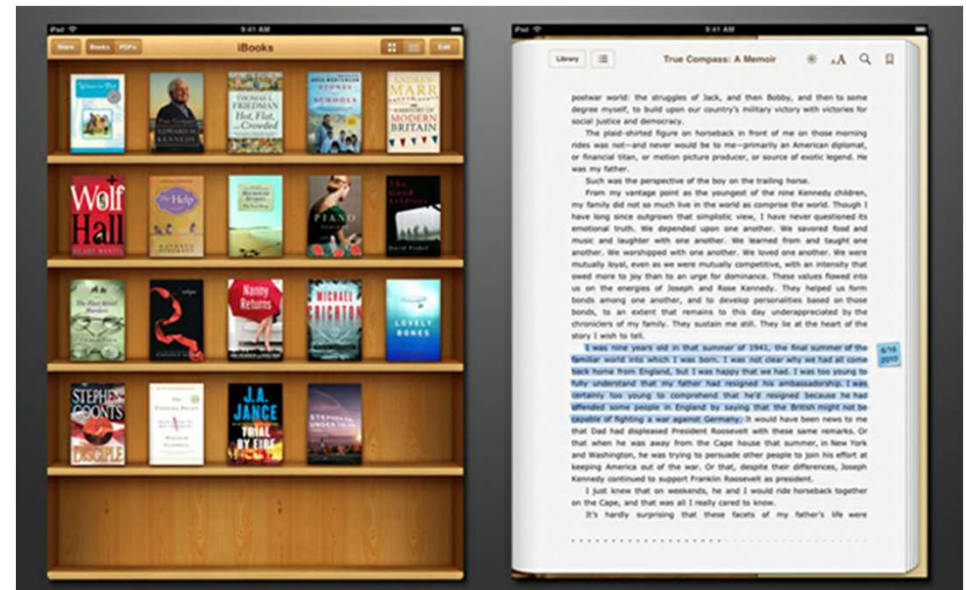
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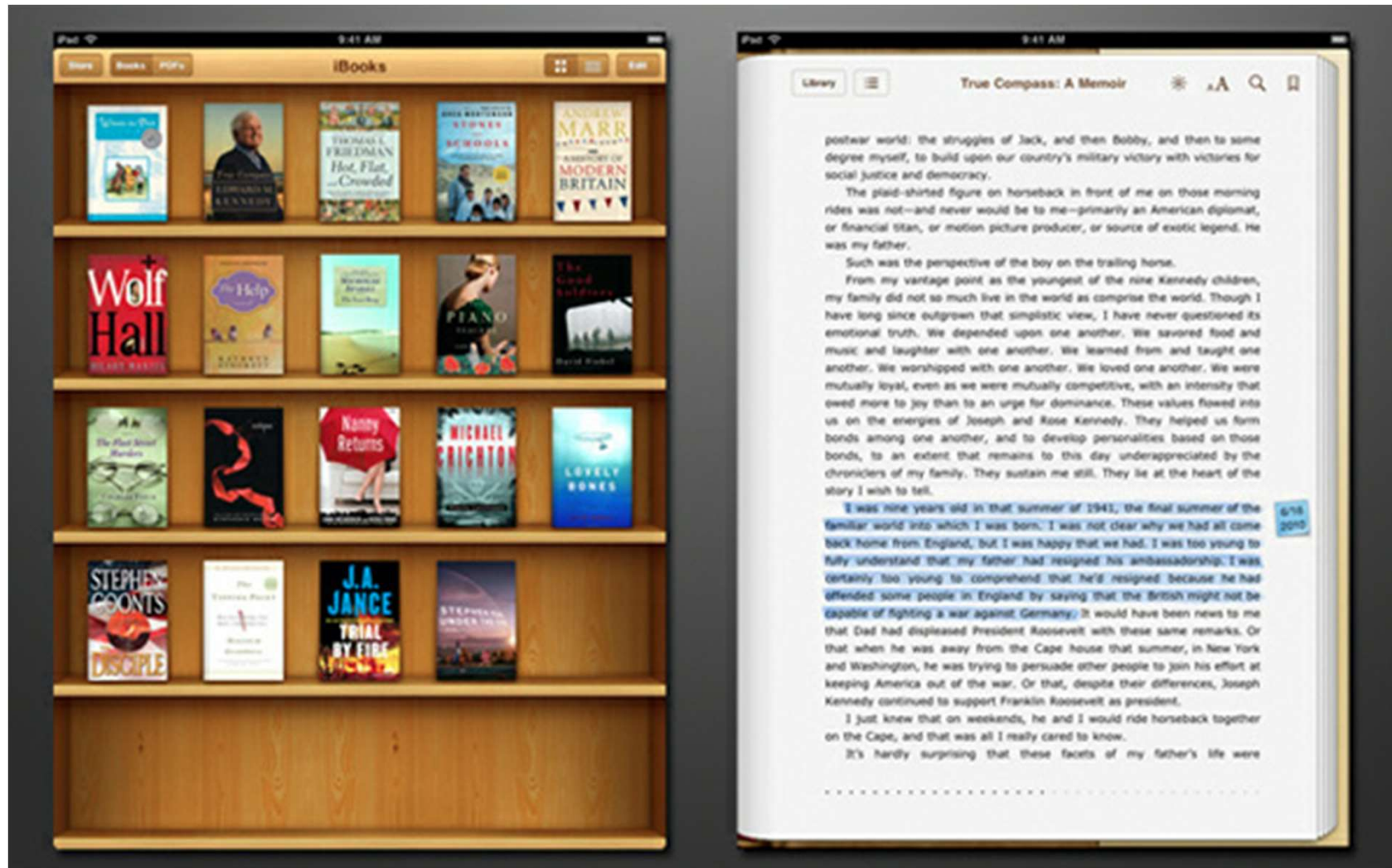
Transfer Effects

Transfer Effects

- People transfer their learning/expectations of similar objects to the current objects
 - positive transfer: previous learning also applies to new situation
 - negative transfer: previous learning conflicts with the new situation



Transfer Effects

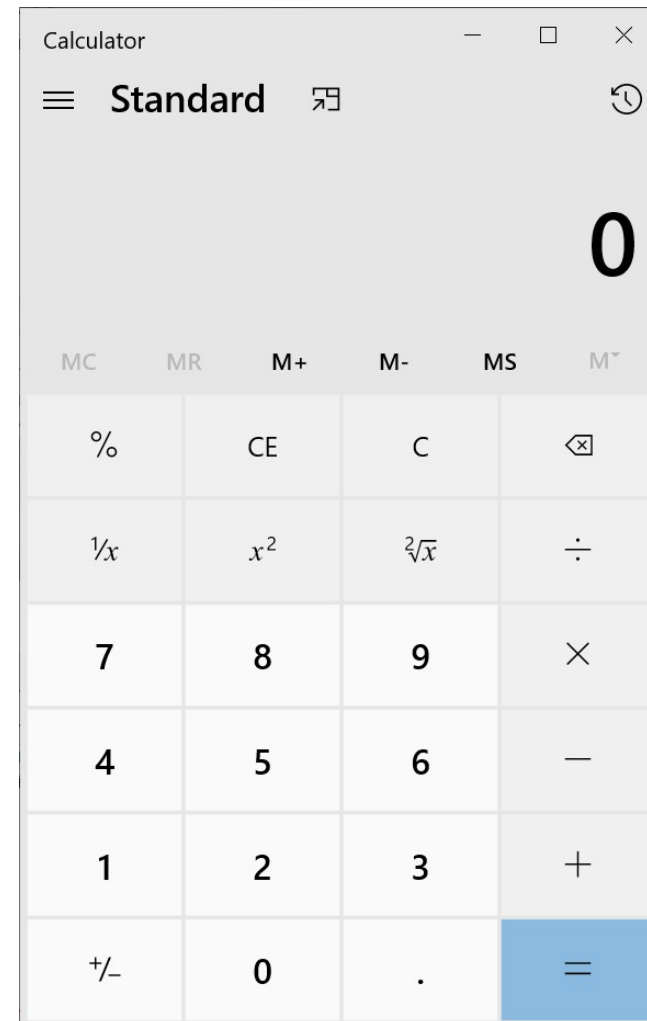
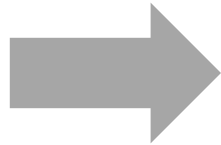


Transfer Effects

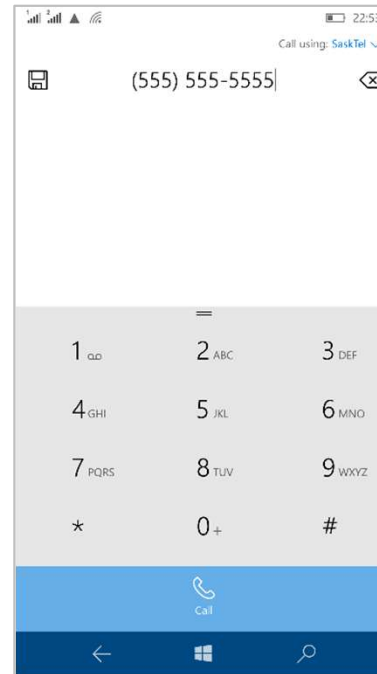
- Idioms and generic commands
 - Control X/C/V: cut, copy, paste
 - Pulldown menus
 - Scrollbars
 - Double-clicking

Transfer Effect Problems

- “Windows calculator is just like a real calculator”

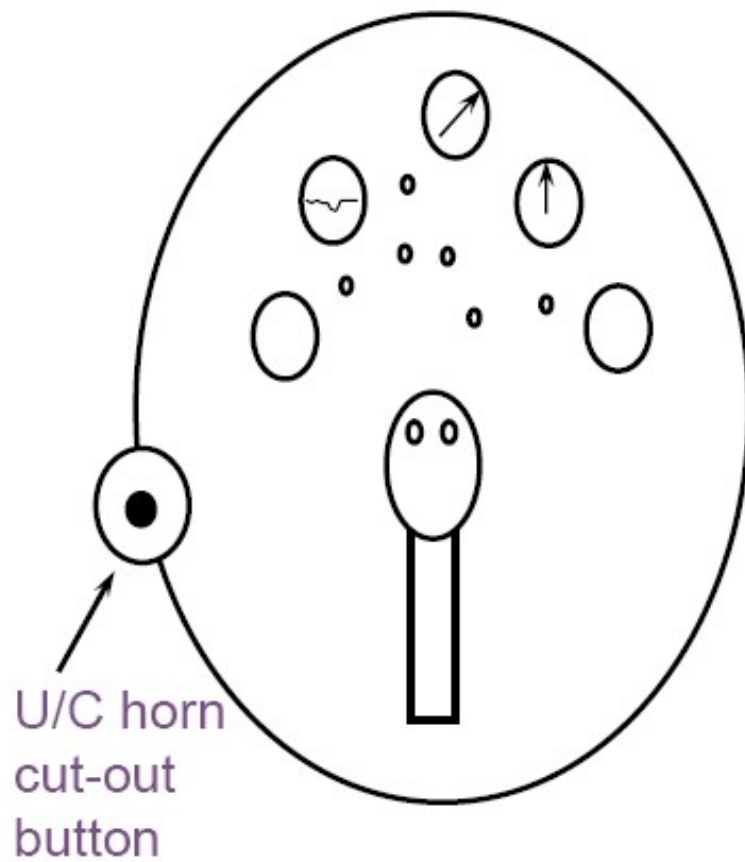


Transfer Effect Problems

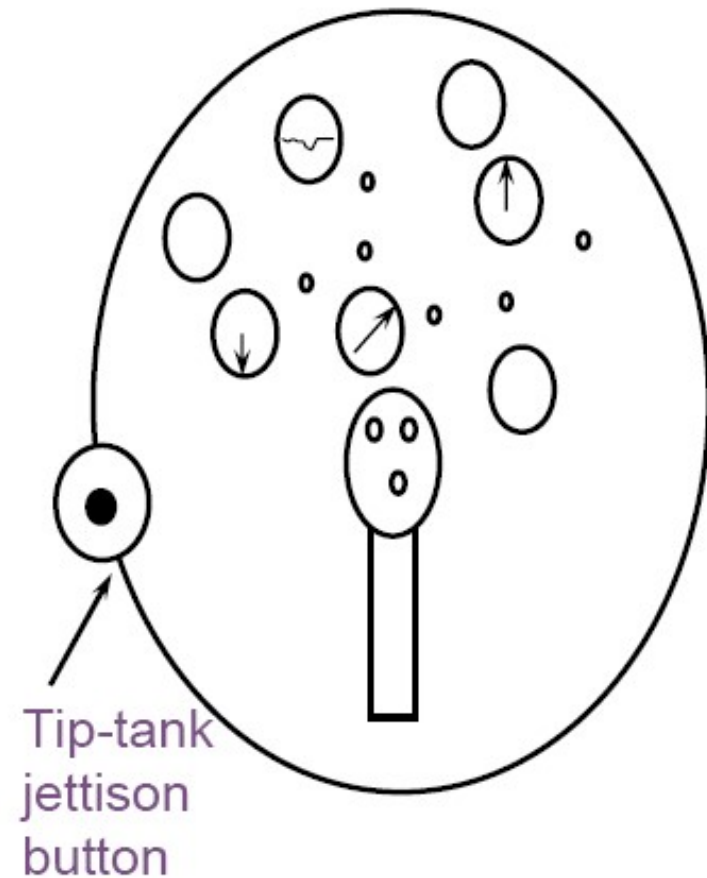


Transfer Effect Problems

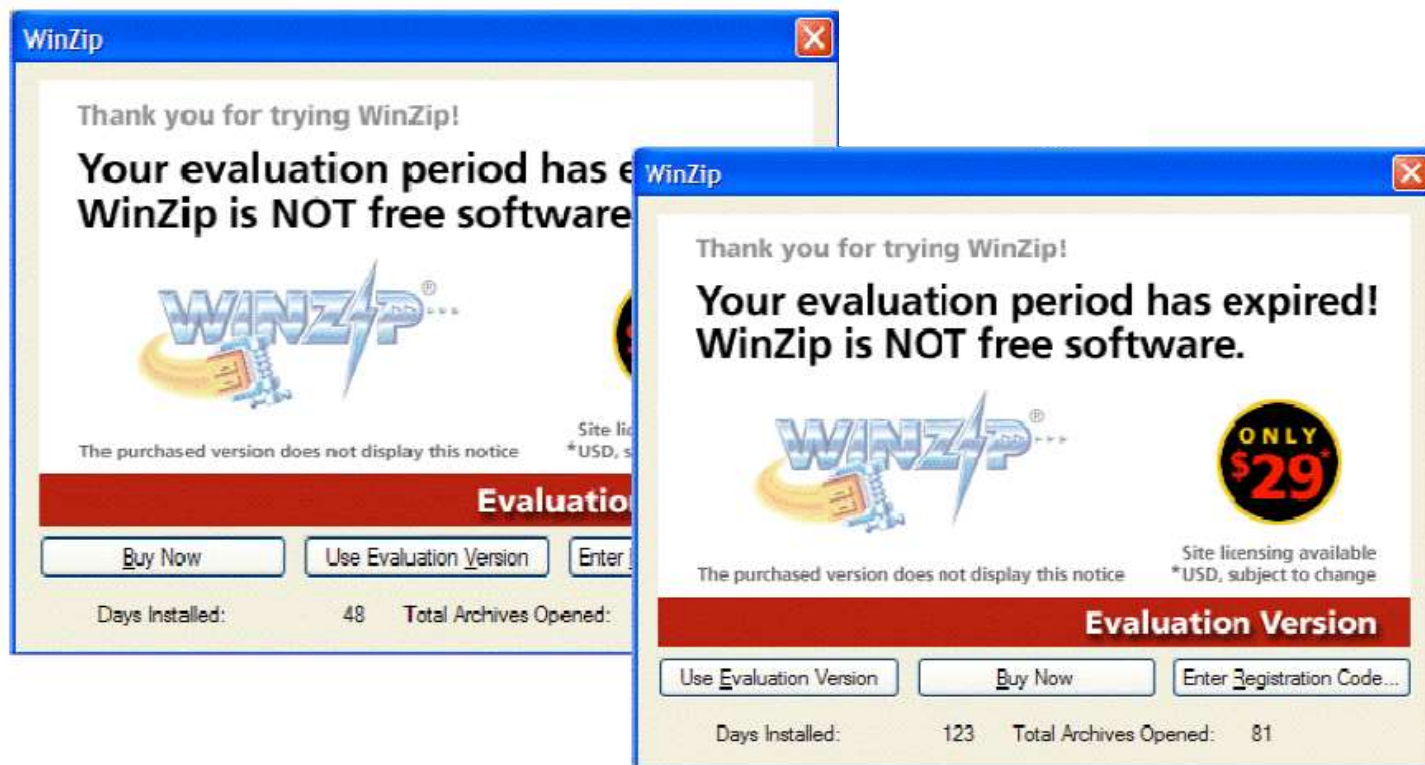
The Harvard Control Panel



The T-33 Control Panel



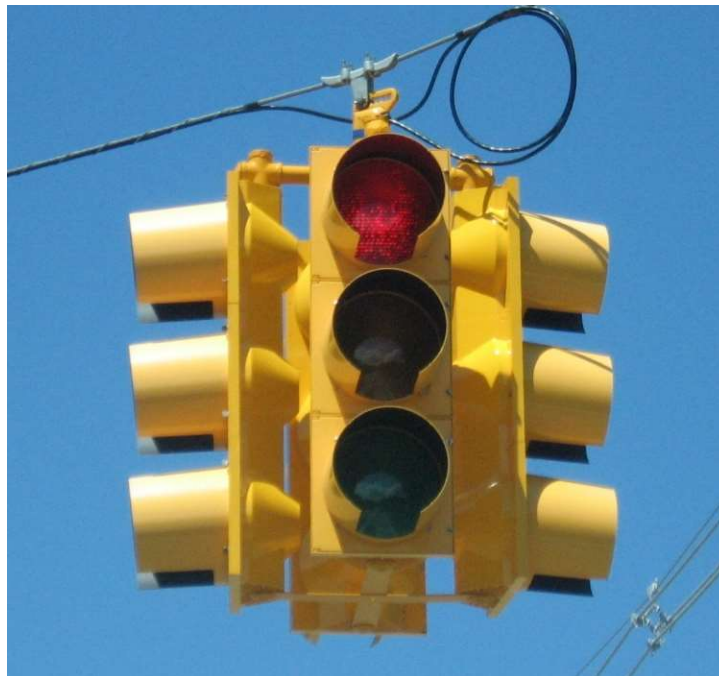
Intentional Inconsistencies



Idioms & Population Stereotypes

Idioms and Population Stereotypes

- Interface idioms are ‘standard’ interface features we learn, use, and remember
- Idioms may define arbitrary behaviours



Idioms and Population Stereotypes

- Idioms vary in different cultures or locations
 - Light switches
 - North America: down is off
 - Britain: down is on
 - Faucets
 - North America: clockwise is on
 - Britain: clockwise is off



Idioms and Population Stereotypes

- Because a trashcan in some places looks like this:
- A user might be confused by this image popular in early Apple interfaces:
- Sun found their email icon problematic for some American urban dwellers who are unfamiliar with rural mailboxes.



Conceptual Models

Conceptual Model

- People have “mental models” of how things work, built from:
 - affordances
 - constraints
 - mapping
 - positive transfer
 - population stereotypes/cultural standards
 - instructions
 - interactions

Conceptual Model

- Models allow people to mentally simulate operation of device
- Models may be wrong, particularly if the attributes they are built from are misleading

Good Example: Scissors

- Affordances:
 - holes for something to be inserted
- Constraints:
 - big hole for fingers, small hole for thumb
- Mapping:
 - between holes and fingers
 - between user action and device action
- Positive transfer and cultural idioms:
 - learnt when young
- Feedback
 - no latency, visible effects
- Conceptual model:
 - implications of operation clear



Bad Example: Watch

- Affordances:
 - four push buttons to push, but not clear what they will do
- Constraints:
 - physical constraints on buttons, but no indication of function
- Mapping:
 - No indication of button → function
- Positive transfer and cultural idioms:
 - somewhat standardized core controls and functions, but still highly variable
- Conceptual model:
 - must be learnt



Conceptual Model

- communicate model through visual image
 - visible affordances, mappings, and constraints
 - feedback
 - cultural idioms, transfer
 - instructions augment visuals
- all work together to remind a person of what can be done and how to do it