Direct Manipulation

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How might this measuring cup be improved?


OXO

- How do people learn interactive systems?
- What makes an interface easy or hard?
- Why do people make errors?
- What makes an interface “natural”

Fundamental principles of interaction design

- **Visibility** (also called perceived affordances or signifiers)
- **Feedback**
- **Consistency** (also known as standards)
- **Non-destructive operations** (hence the importance of undo)
- **Discoverability:** All operations can be discovered by systematic exploration of menus
- **Reliability.** Operations should work. Period. And events should not happen randomly.

Donald A. Norman and Jakob Nielsen, ACM Interactions, 2010

The Gulf of **Execution**:

How Do I do?

The Gulf of **Evaluation**:
What Happened?

Direct manipulation

- Immediate feedback on actions
- Continuous representations of objects
- Leverage metaphor

Good design reduces the gulfs

How easily can one:

- Determine the function of the device?
- Tell what actions are possible?
- Determine mappng from intention to physical movement?
- Perform the action?
- Tell if system is in desired state?
- Determine mapping from system state to interpretation
- Tell what state the system is in?

Handles

Learning Mental Models

- “A text processor is a typewriter”
- “Indeed, the models that learners spontaneously form are incomplete, inconsistent, unstable in time, and often rife with superstition”
- Olson and Carroll

What kinds of mental models?

- My own behavior
- Someone else's behavior
- A software application
- ...or any information process that's mediated

Users / designers communicate through their mental models

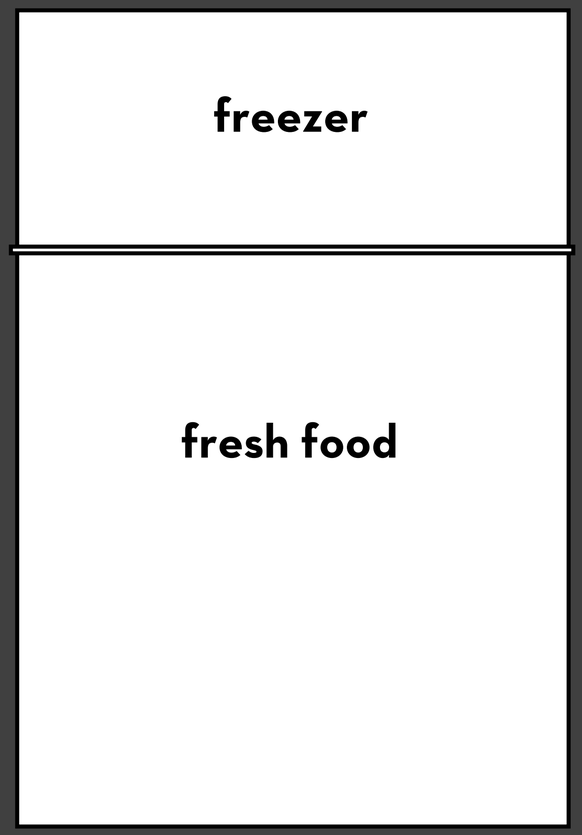
- Designer's model = mental/conceptual model of the system
- User's model = mental model developed through interaction with the system
- Designer expects user's model to be the same as the designer's model
- But often it isn't!

Conceptual Model Mismatch

- Mismatch between designer's & user's conceptual models leads to...
  - Slow performance
  - Errors
  - Frustration
  - ...

Consider this refrigerator...

PROBLEM: freezer too cold, but fresh food just right



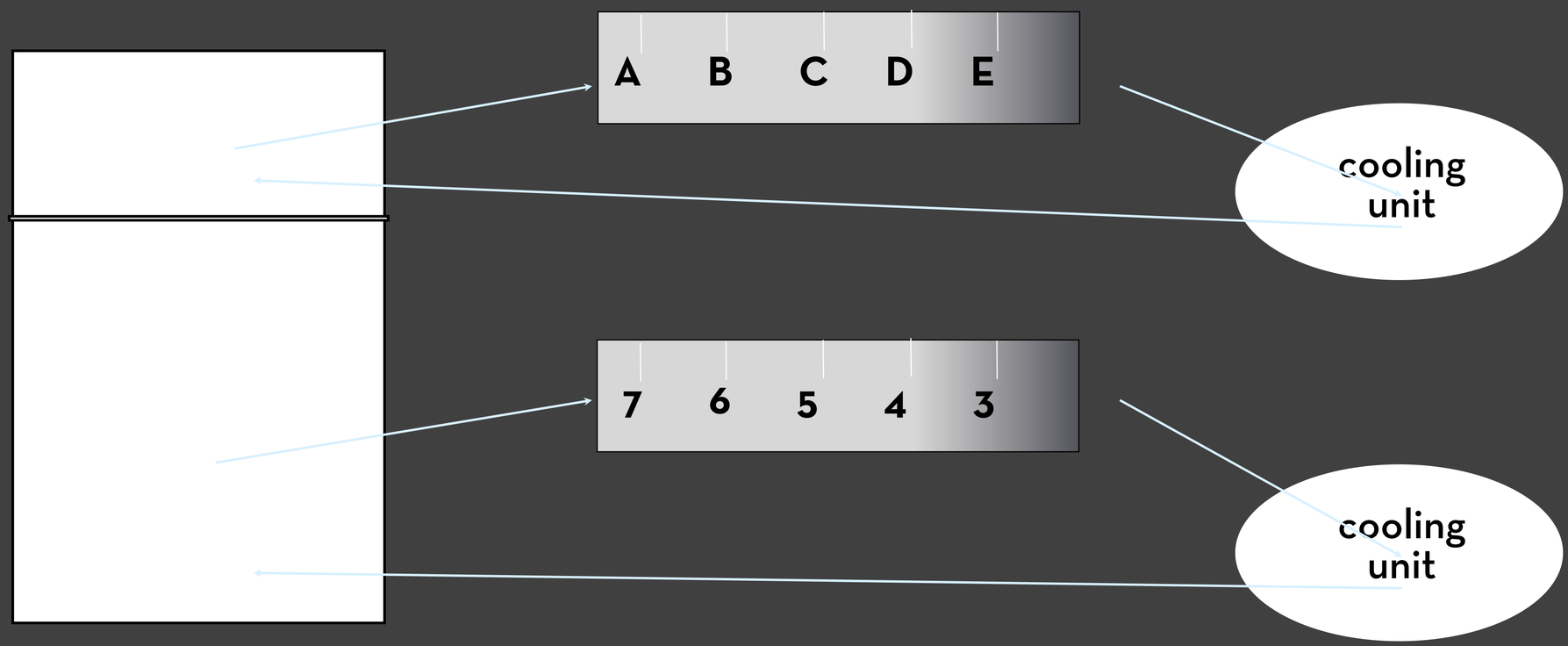
Source: Don Norman, The Design of Everyday Things

This frig has two dials...

Normal Setting	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)	OFF (both) 0

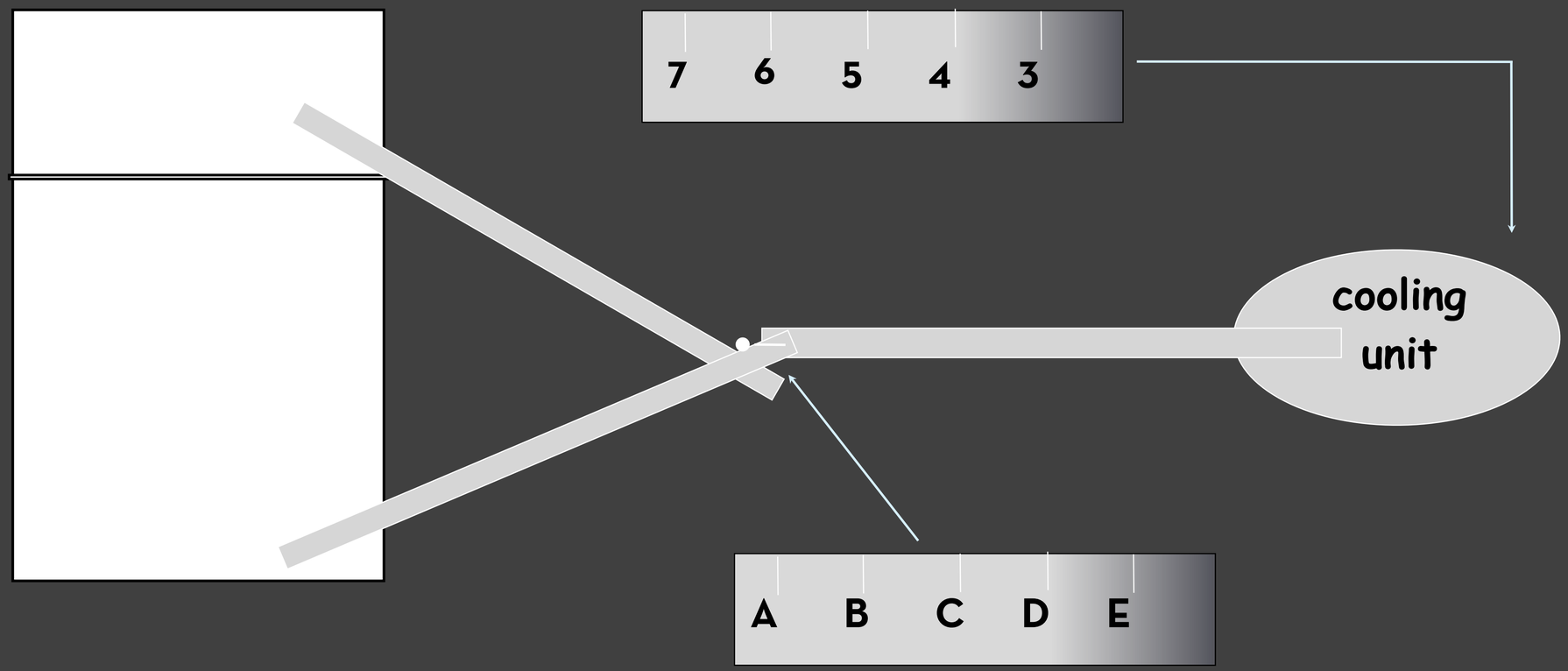
Source: Don Norman, The Design of Everyday Things

A likely model...



Source: Norman, Don. The Design of Everyday Things. Currency, 1990. James Landay, CS160 UC Berkeley, Mental Models Lecture.

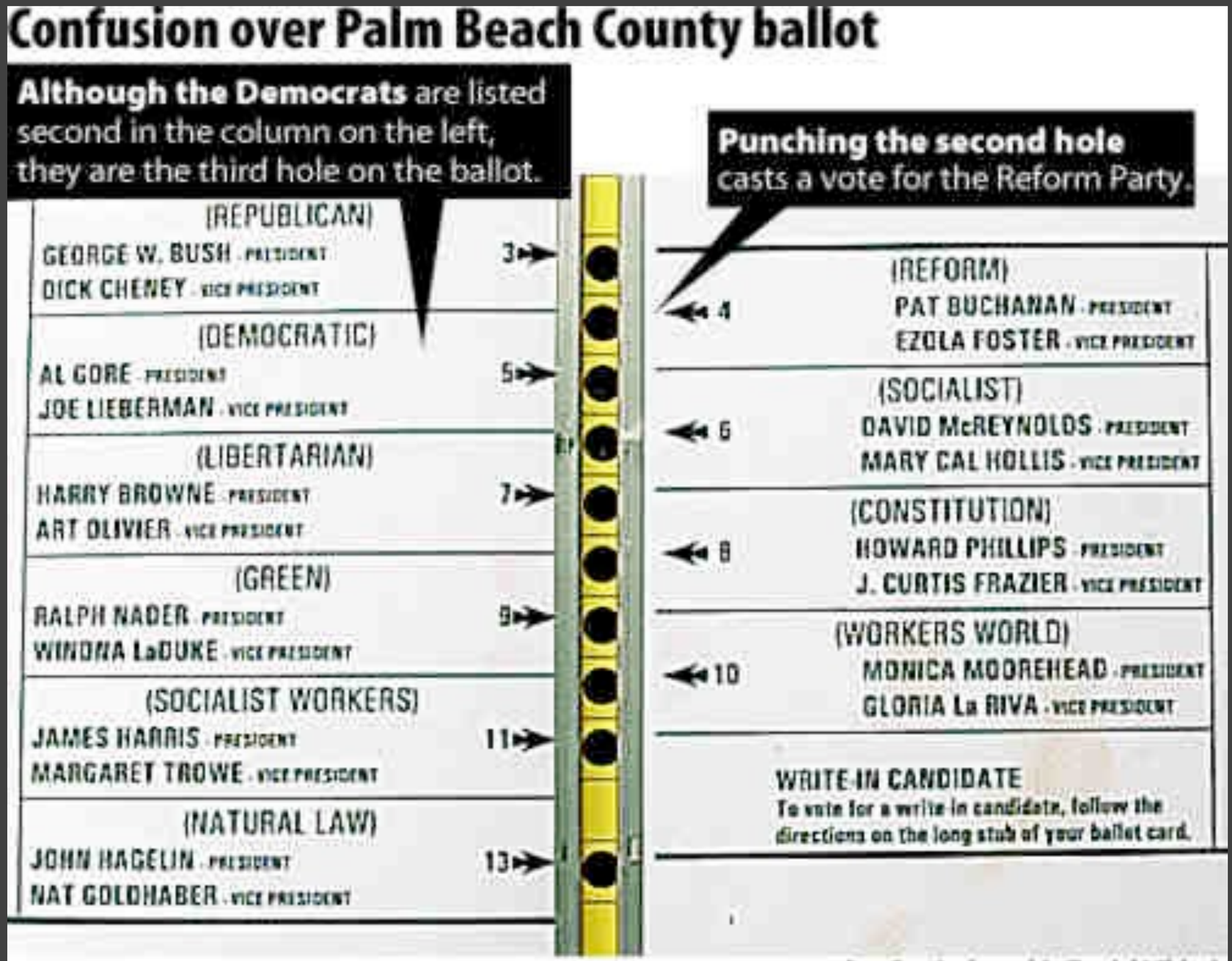
Actual Model



Source: Norman, Don. The Design of Everyday Things. Currency, 1990. James Landay, CS160 UC Berkeley, Mental Models Lecture.

Slips v. Mistakes

Butterfly Ballot



Sun-Sentinel graphic/Daniel Niblock

VISIBILITY


** TEST COUNTING MODE **
Election
Nov-05-2002
Georgia Demonstration
Vote Center
10
Demonstration Precinct
Unit 0 Version 39 Copy 0 Count 9
Insert card to start
Please Insert Your Card
System Information
SN 114995 System Total 366 Power High

Example (good)

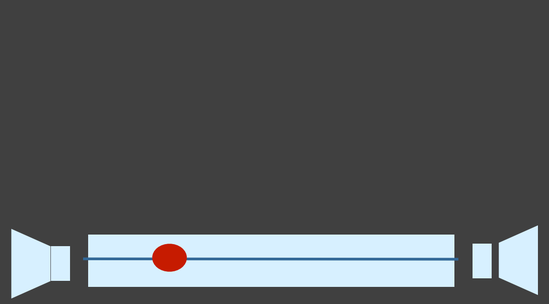
Mercedes S500 Car Seat Controller

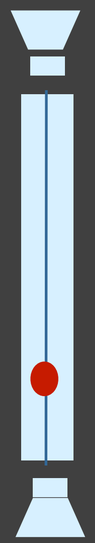
Source: http://www.lilviv.com/motoring/cars/s500/seatcont.jpg

Map Interface Controls

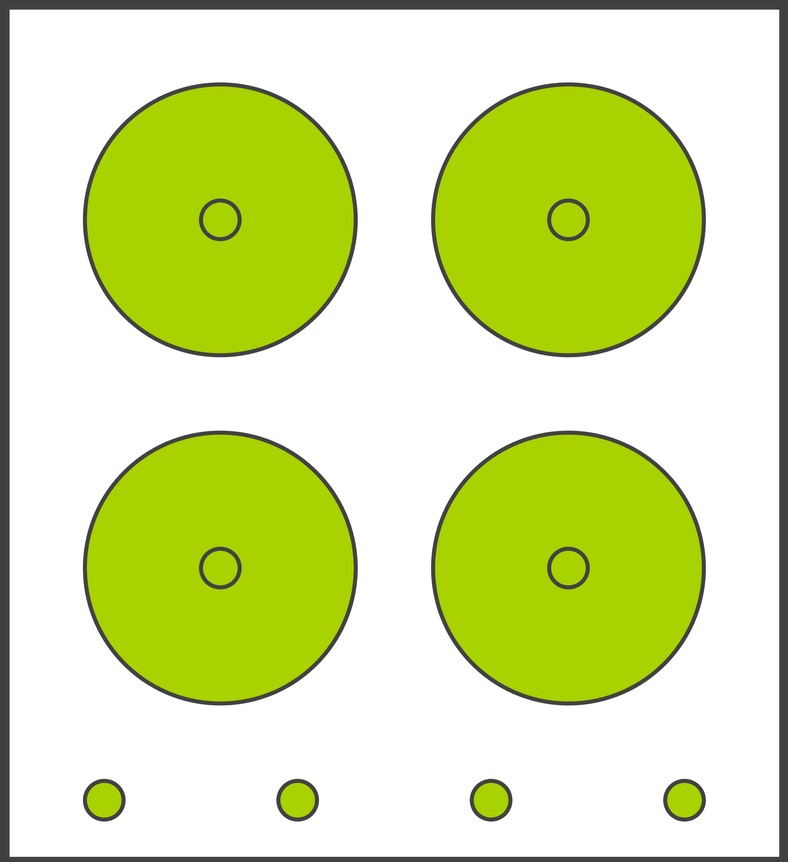
- Control should mirror real-world
- Which is better for dashboard speaker front / back control?

Dashboard

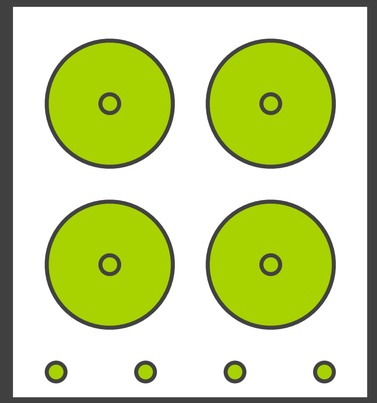


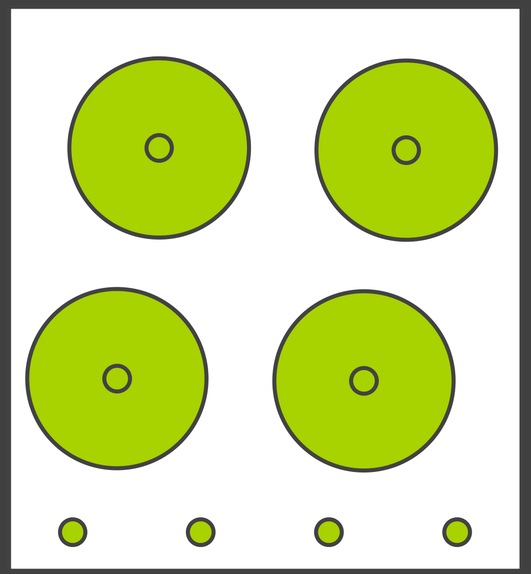


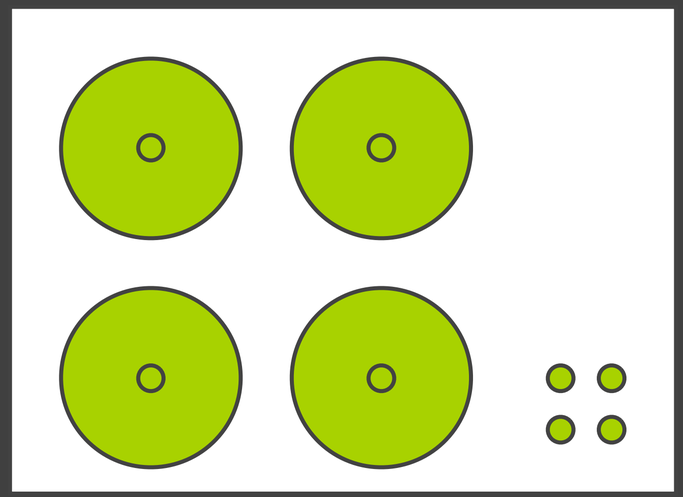
Map Interface Controls



Map Interface Controls







Direct Manipulation Provides

- Good idea of how each object works and how to control it
- Interface itself discloses how it is used
- The art in design is to translate users cognitive capabilities and existing mental models into interfaces that work!

“If technology is to provide an advantage, the correspondence to the real world must break down at some point.”

- Jonathan Grudin

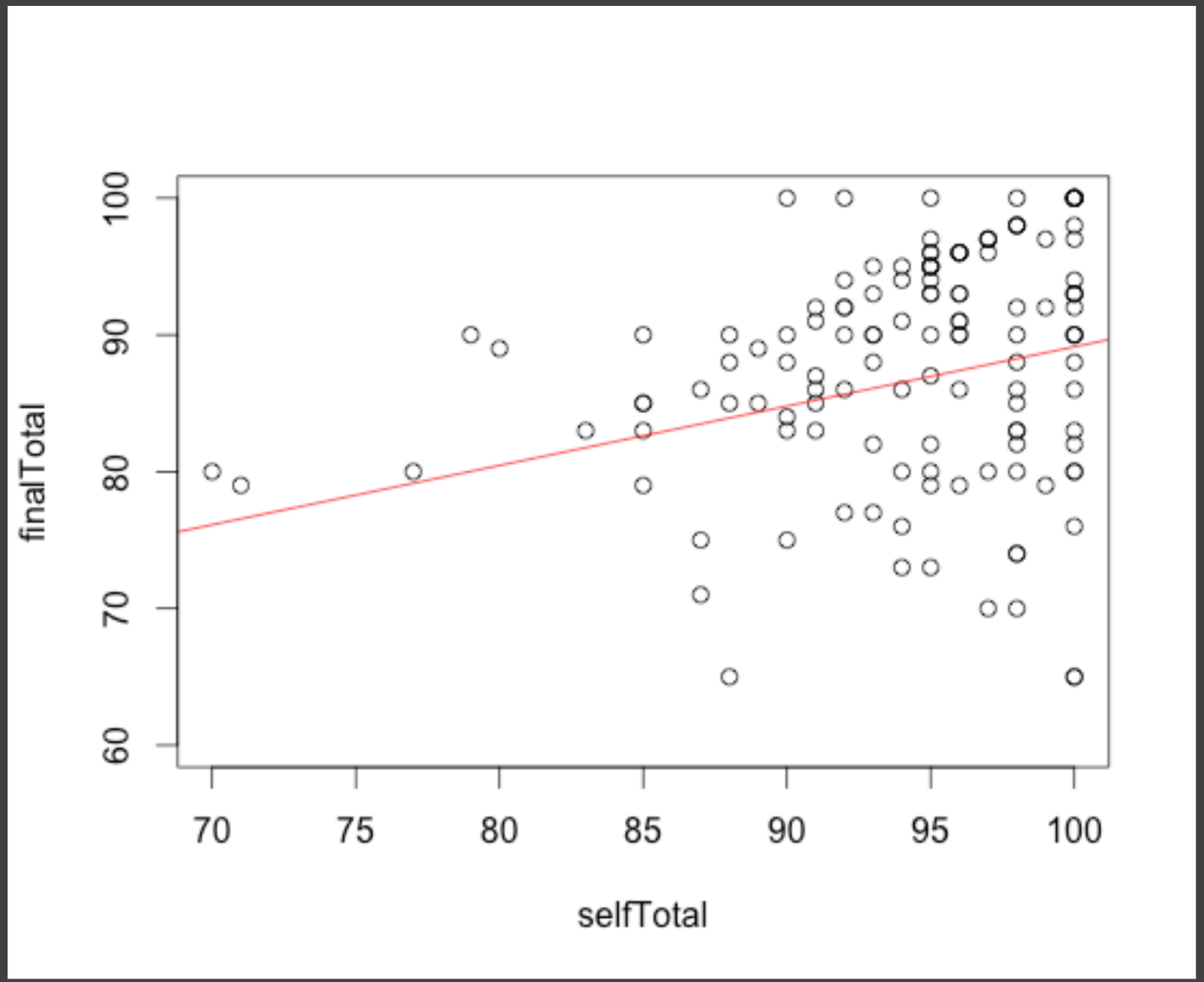
CURRENT
PRACTICE

NEW
TECHNOLOGY

minimize
this distance

Final Scratch

Self Assessment



- Can the user do what they would like?
  (are the semantics sufficiently expressive)
- What representations are used for communication?