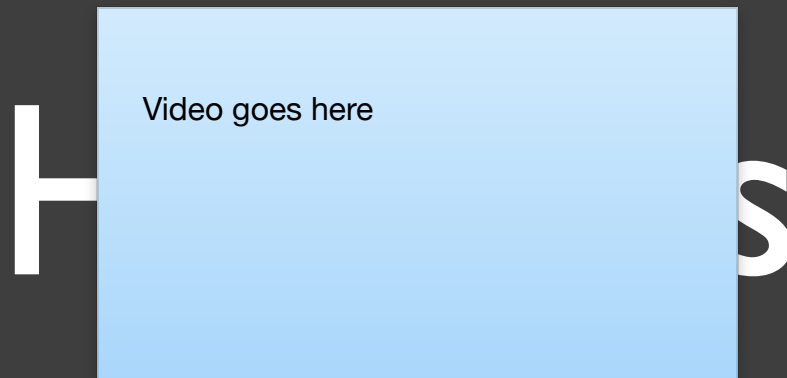


# Mental Models



# Key to good design:

- What makes an interface learnable?
- What leads to errors?



# Consider this refrigerator...

problem: freezer too cold, but fresh food just right



# This frig has two dials...



Normal Setting

Colder Fresh Food

Coldest Fresh Food

Colder Freezer

Warmer Fresh Food

OFF (both)

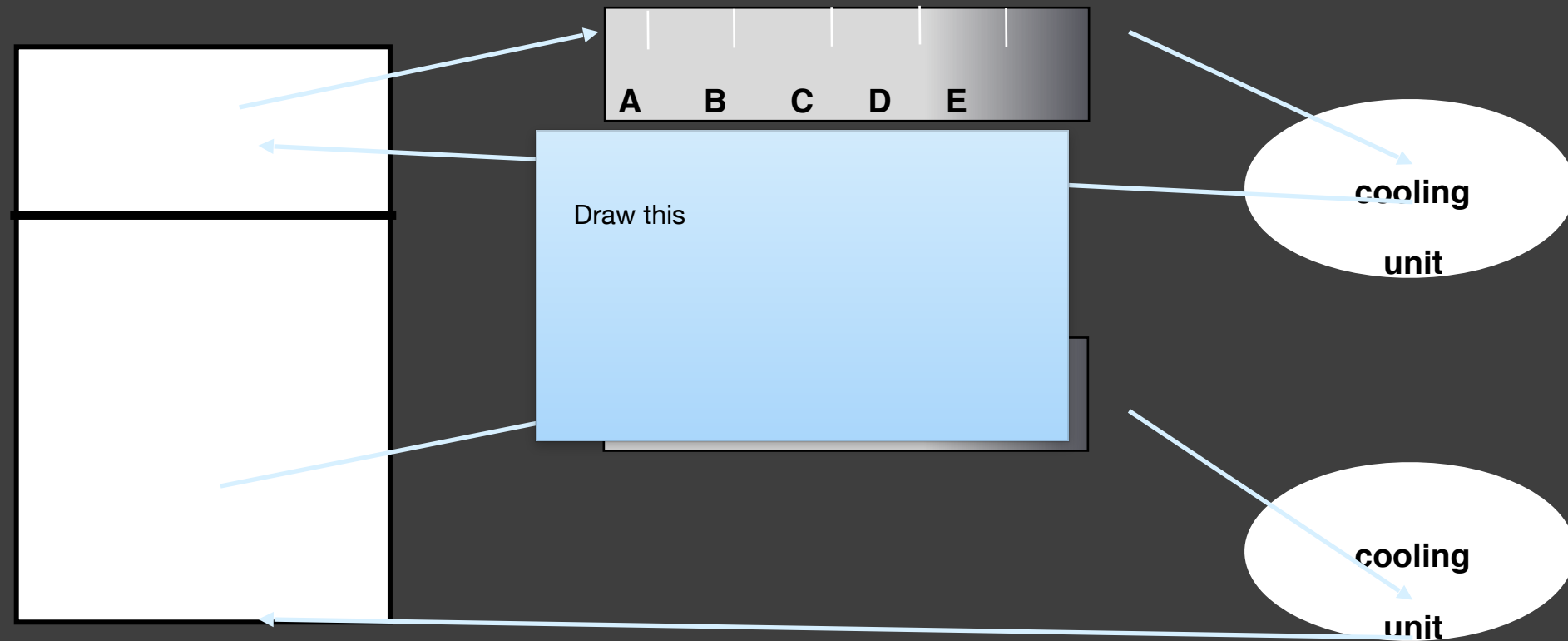
Draw this

D and 6-7

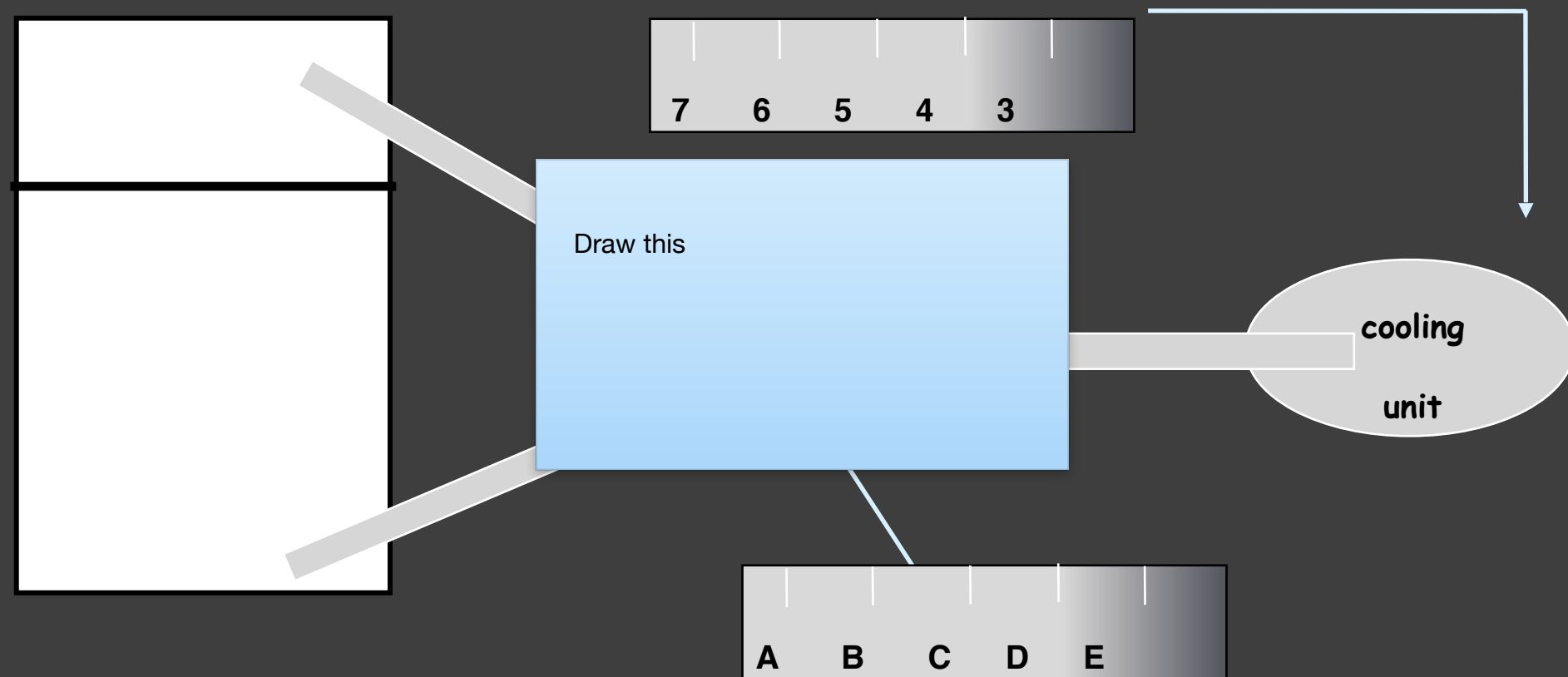
C and 3-1

OFF (both) 0

# A likely model...



# Actual Model



# The goal: design beacons the right model

- User's model develops through interaction with the system
- Designers often expects user's model to be the same as theirs
- But often it isn't!



# Conceptual Model Mismatch

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

Mental models arise from experience, metaphor, and analogical reasoning

- “A text processor is a typewriter”
- We have models (beliefs) about our own behavior, of others, of objects, software...
- Our models are incomplete, inconsistent, unstable in time, and often rife with superstition

# Slips v. Mistakes

# Butterfly Ballot

1

OFFICIAL BALLOT, GENERAL ELECTION  
PALM BEACH COUNTY, FLORIDA  
NOVEMBER 7, 2000

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

OFFICIAL BALLOT, GENERAL ELECTION  
PALM BEACH COUNTY, FLORIDA  
NOVEMBER 7, 2000

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



visibility



# Example (good)

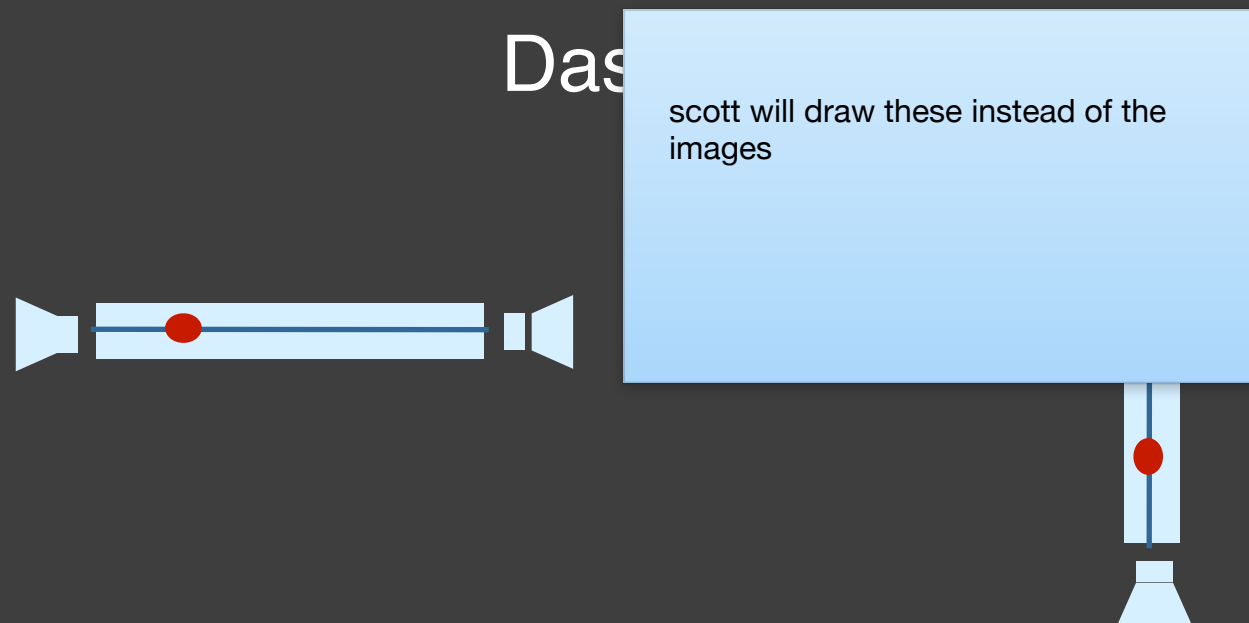


Mercedes S500 Car Seat Controller

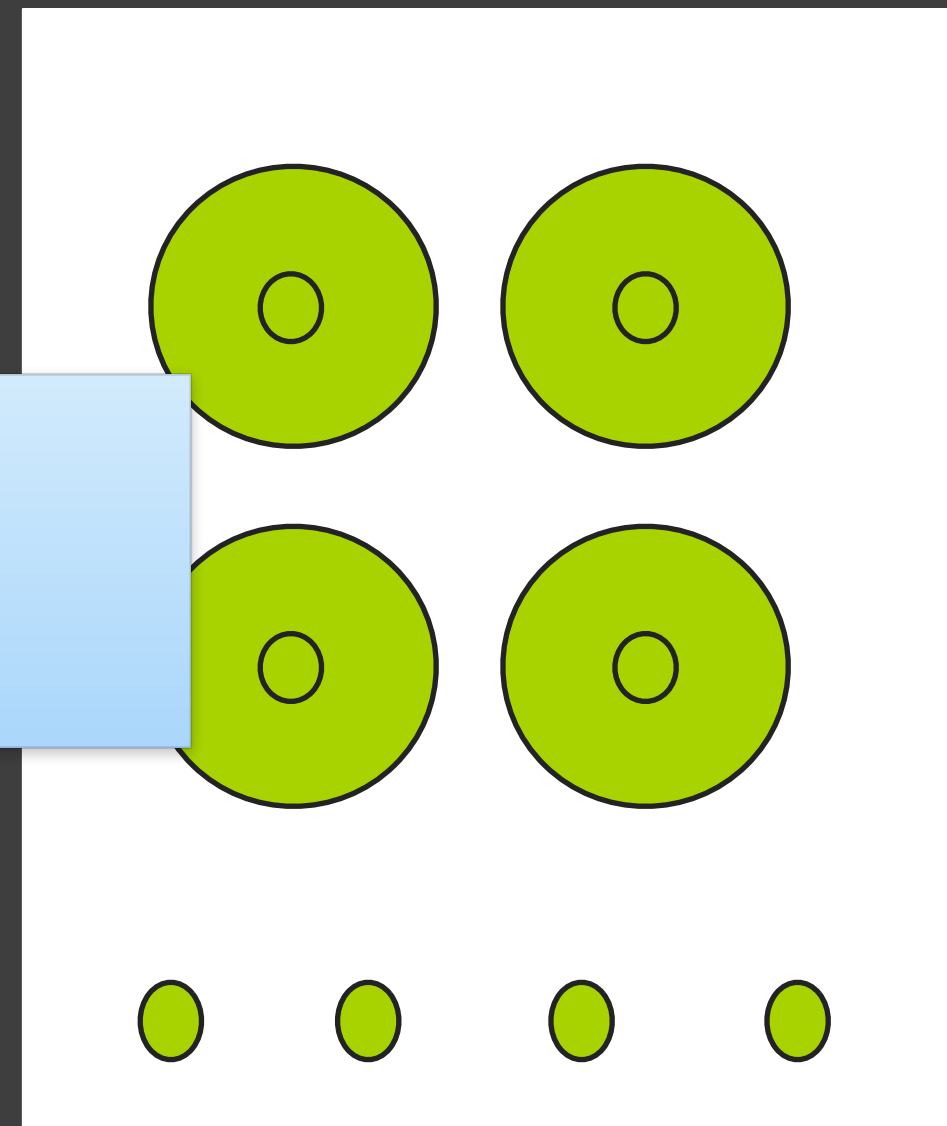
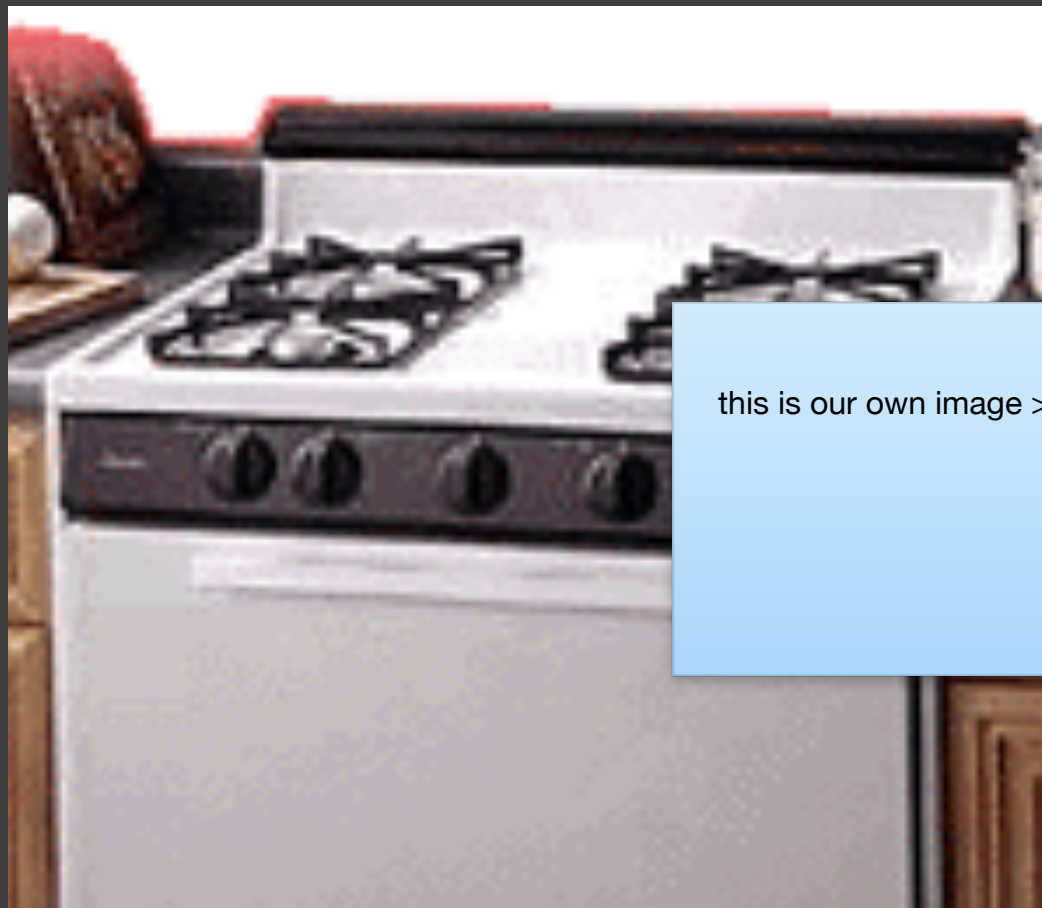


# Map Interface Controls

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

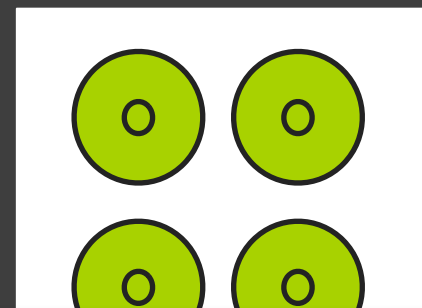


# Map Interface Controls

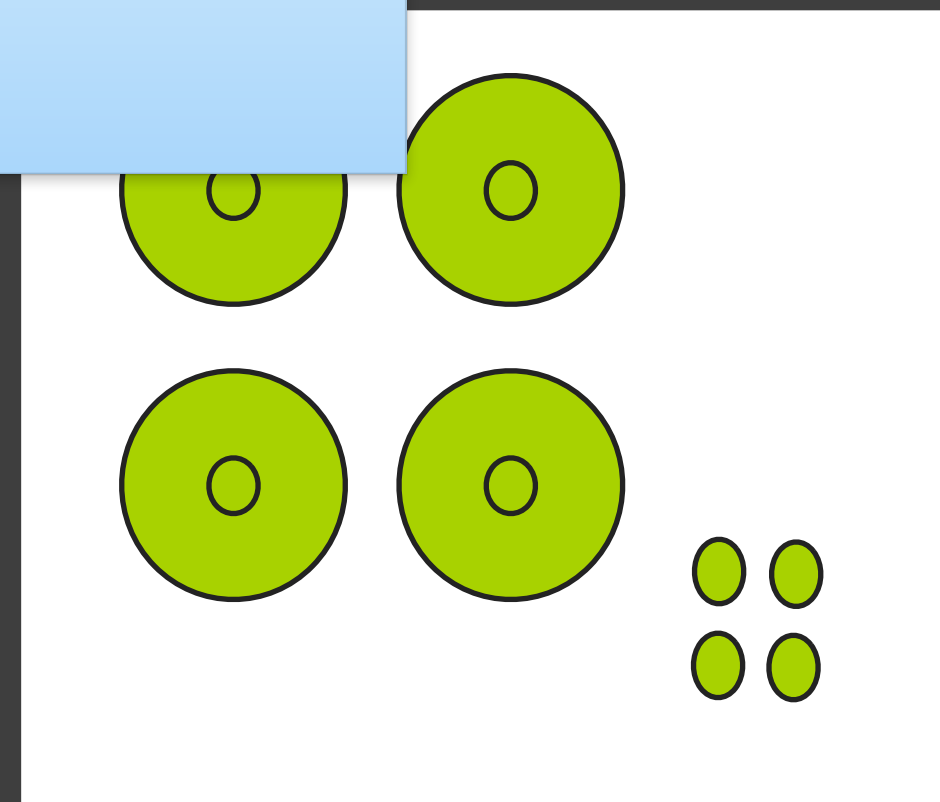
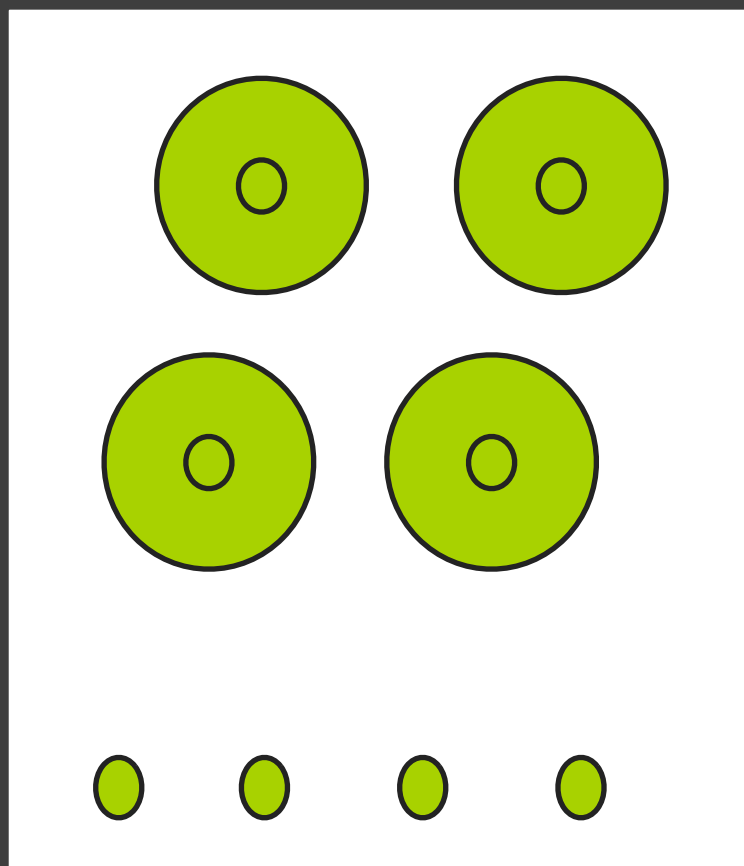




# Map Interface Controls



the green burner images are our own



# 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



# To learn more...

- Mental Models
  - Olson and Carroll 1984
  - Gentner and Stevens, Mental Models
- Errors
  - Norman, Design of Everyday Things
  - Norman, Things that Make Us Smart (chapter 5)
  - Norman, Design Rules based on analyses of human error
  - James Reason, Human Error
- Direct Manipulation
  - Shneiderman
  - Hutchins, Hollan, Norman

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