

# Conceptual Models & Interface Metaphors

刘哲明

Prof. James A. Landay  
Computer Science Department  
Stanford University

Autumn 2023  
October 30, 2023



# Hall of Fame or Shame?



## Add/Update Shipping Information

We found an error while verifying your shipping address.  
We've marked the problem in red for you.

### Update the address book of

Required information is marked in GREEN CAPS.

[HELP](#) for questions about shipping.

**NICKNAME:**

Please assign a "nickname" for the person you're shipping to.  
You may change or delete this information at any time.

**FIRST NAME:**

**MIDDLE INITIAL:**

**LAST NAME:**

**ADDRESS:**

(International use only)

**CITY:**

**STATE/PROVINCE:**

Includes APO and FPO. Use "Other" if country is not USA or Canada.

**ZIP/POSTAL CODE:**

**COUNTRY:**

**SHIPPING METHOD:**  **In the U.S.:** [HELP](#)  
 **Standard UPS**

(2 business days plus)

**International:** [HELP](#)  
 **Canada Canada Post**

(4-10 business days)

- Design based on a top retailer's site

# Hall of Shame!



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- Design based on a top retailer's site
- Color deficiency
  - can't distinguish between red & green
- In study, user could not get by this screen!
- How to fix?
  - redundant cues

# A Better Design

800-441-5713 • [Customer Service](#) • [Find a Store](#)

## L.L.Bean

What can we help you find?

CLOTHING FOOTWEAR OUTDOOR EQUIPMENT BAGS & TRAVEL HOME GOODS

Secure Checkout [Edit Shopping Bag](#)

### 1. Shipping Information

**!** Please correct the following items:

- [Please enter your last name.](#)
- [Please select a country for your address.](#)
- [Please select a state for your address.](#)
- [Please enter a phone number.](#)

**Shipping Address for Me** [Ship to someone else](#)

First Name

Middle Name (optional)

Last Name

**!** Please enter your last name.

Gender (optional)  
 Male  Female

Country

**!** Please select a country for your address.

1. Instructions at the top for all errors
2. Redundant exclamation icons
3. Changed color on boxes around input fields with errors
4. Instructions on what to fix near each error

# Conceptual Models & Interface Metaphors

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November 30, 2023

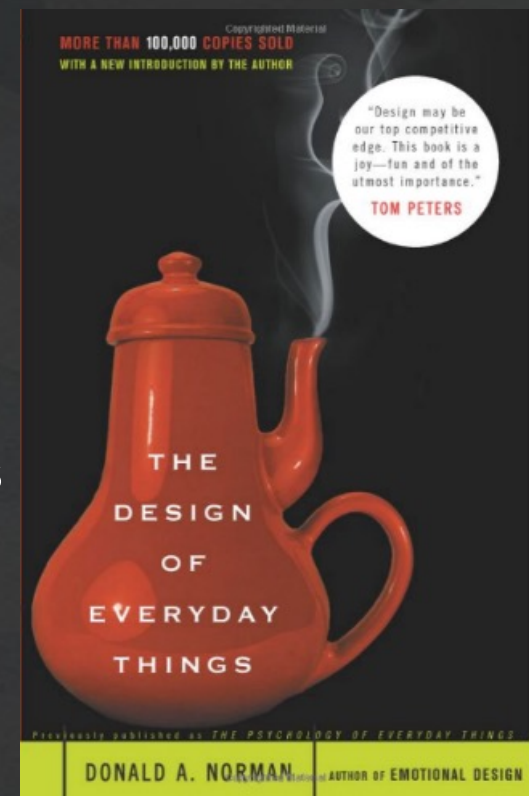


# Outline

- *Design of Everyday Things*
- Conceptual models
- Team break
- Design guides for conceptual models
- Interface metaphors
- UI consistency

# *Design of Everyday Things*

- By Don Norman
    - UCSD, Apple, HP, NN Group, NU, UCSD
  - Design of everyday objects illustrates problems faced by designers of systems
  - Explains conceptual models
    - doors, washing machines, digital watches, phones
  - Resulting design guides
- Highly recommended



# Conceptual Model?

Def. *Mental representation of how an artifact works & how interface controls affect it*

- People may have preconceived models that are hard to change
  - (4 + 5) vs. (4 5 +) on a calculator
  - dragging to trash?
    - deletes file but ejects disk
- Interface must communicate model
  - visually, possibly physically or using sound



David Shillinglaw



# Affordances as Perceptual Clues

Well-designed objects have affordances

- clues to their operation
- often visual, but not always (e.g., speech)



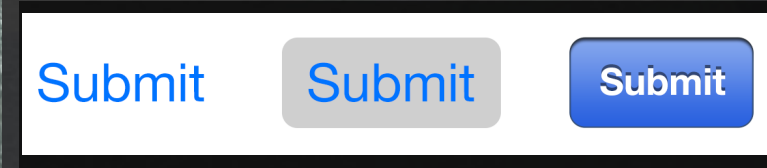
Gibson: “actionable possibilities”



iOS7

iOS7 w/ “button shapes”

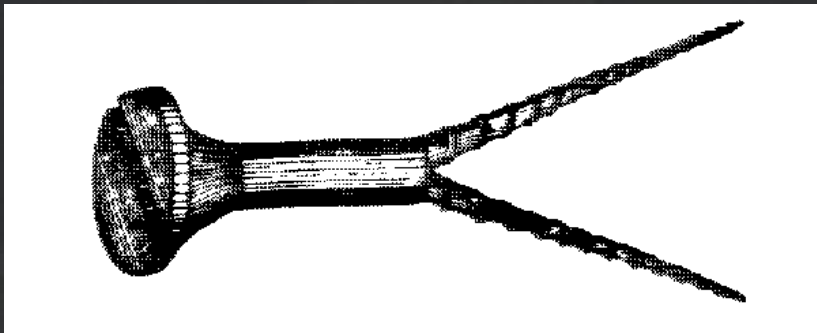
iOS6



# Affordances as Perceptual Clues

Poorly-designed objects

– no clues or misleading clues



Jacques Carelman, *Catalogue d'Objets Introuvables*  
Crazy design for a screw punch!



# Affordances as Perceptual Clues

Poorly-designed objects

– no clues or misleading clues

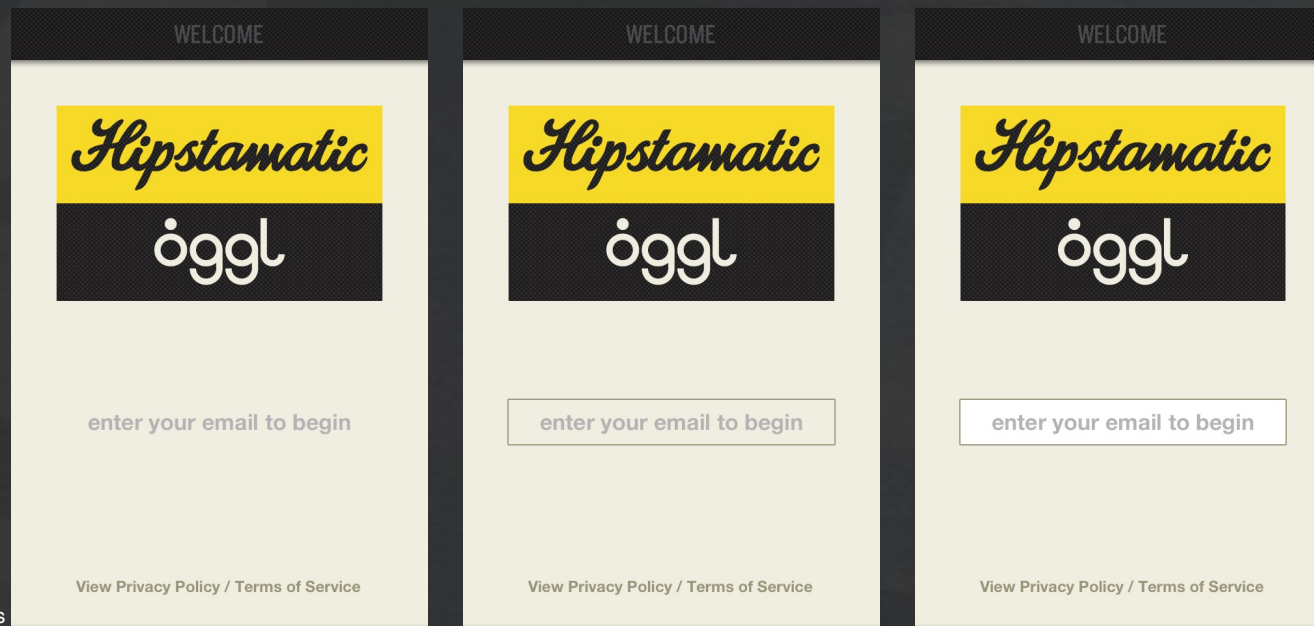


<https://99percentinvisible.org/article/norman-doors-dont-know-whether-push-pull-blame-design/> (5:31)

# Affordances as Perceptual Clues

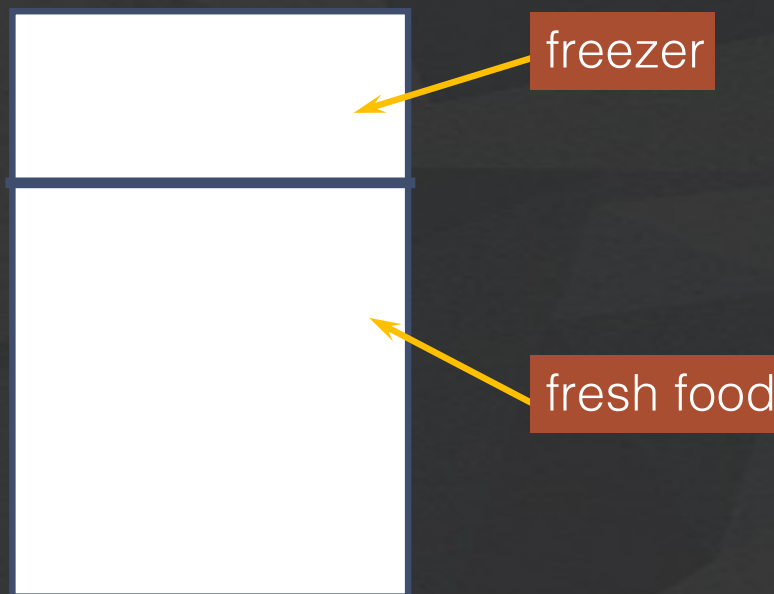
Poorly-designed objects

– no clues or misleading clues



<http://alistapart.com/article/flat-ui-and-forms>

# Refrigerator



Problem: freezer too cold, but fresh food just right

# Refrigerator Controls

|                     |                  |
|---------------------|------------------|
| Normal Settings     | <b>C and 5</b>   |
| Colder Fresh Food   | <b>C and 6-7</b> |
| Coldest Fresh Food  | <b>B and 8-9</b> |
| Colder Freezer      | <b>D and 7-8</b> |
| Warmer Fresh Food   | <b>C and 4-1</b> |
| OFF ( <i>both</i> ) | <b>0</b>         |



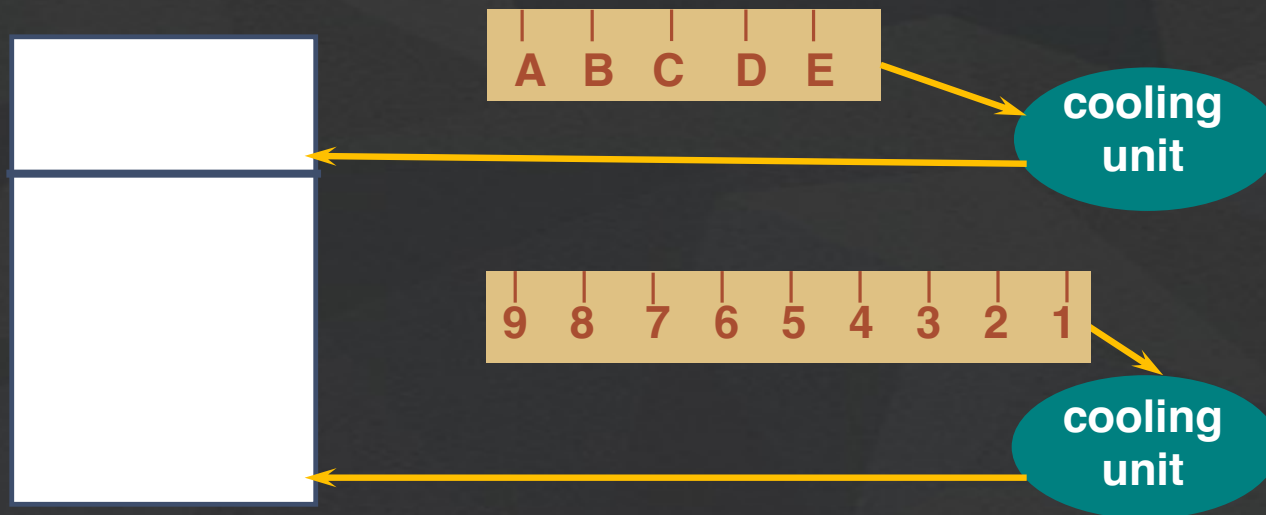
What is your conceptual model?

Spend 60 sec. drawing a diagram showing your model

- where the cooling units are & how they are controlled

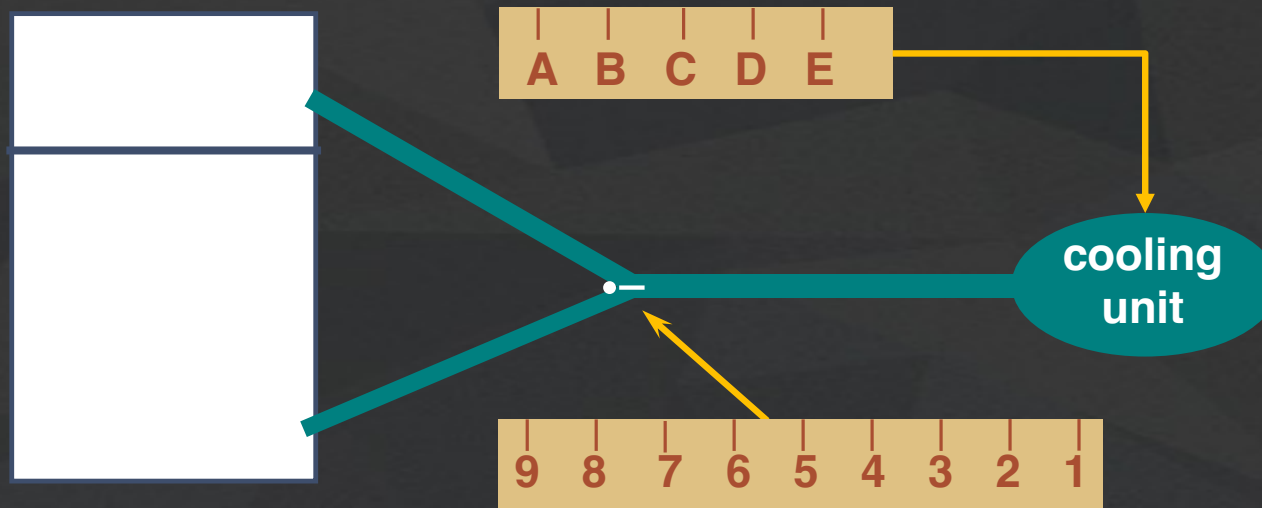
Share with your neighbor & put a picture in the slack channel

# A Common Conceptual Model



*independent* cooling units

# Actual Conceptual Model



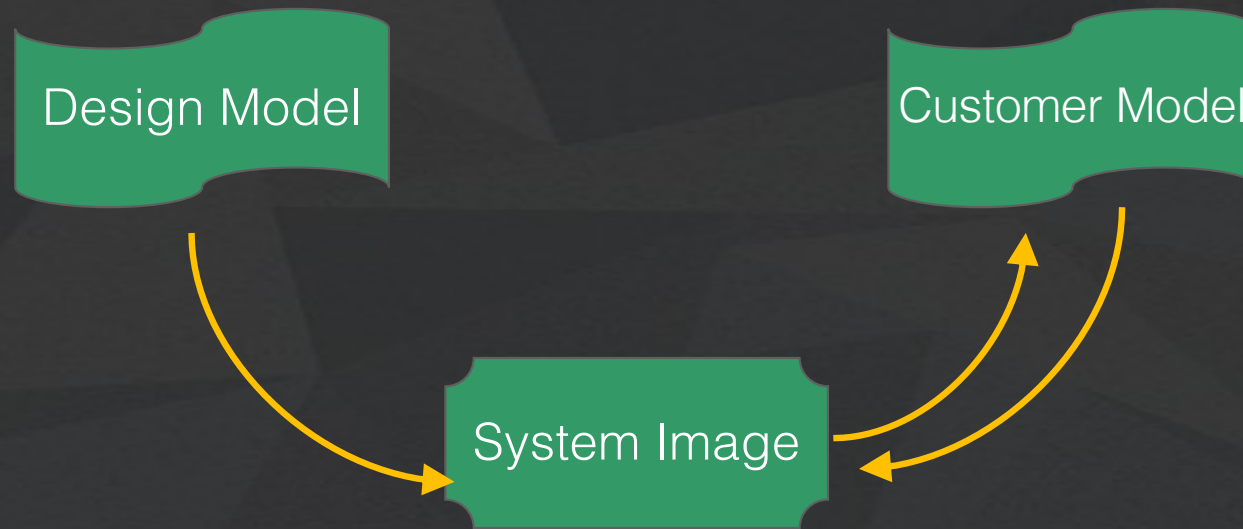
Can you fix the problem?

Possible solutions

- make controls map to customer's model
- make controls map to actual system



# Design Model & Customer Model



- Customers get model from prior experience & usage of new
  - through system image
- What if the two models don't match?

# Conceptual Model Mismatch

- Mismatch between designer's & customer's conceptual models leads to...
  - slow performance
  - errors
  - frustration
  - ...

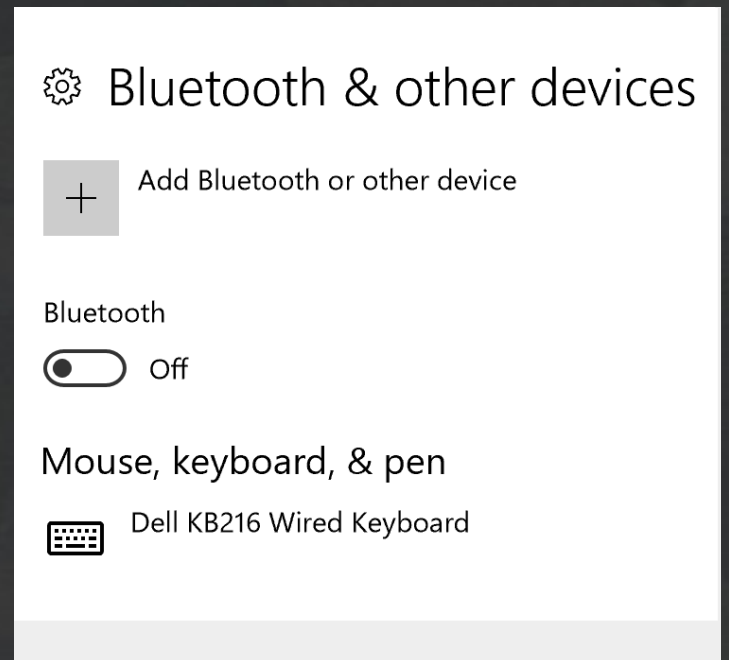


# Model Mismatch: Car Automatic Shifter



# Model Mismatch: Windows 10 Bluetooth

- Is Bluetooth on or off?
- Often switches show the state that sliding towards will execute



Example and images from <https://www.nngroup.com/articles/two-ux-gulfs-evaluation-execution/>

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# Model Mismatch: Windows 10 Bluetooth

- Is Bluetooth on or off?
- Often switches show the state that sliding towards will execute
- We see how it works when we see several switches

## Notifications

Get notifications from apps and other senders



Show notifications on the lock screen



Show reminders and incoming VoIP calls on the lock screen



Hide notifications when I'm duplicating my screen



Show me the Windows welcome experience after updates and occasionally when I sign in to highlight what's new and suggested



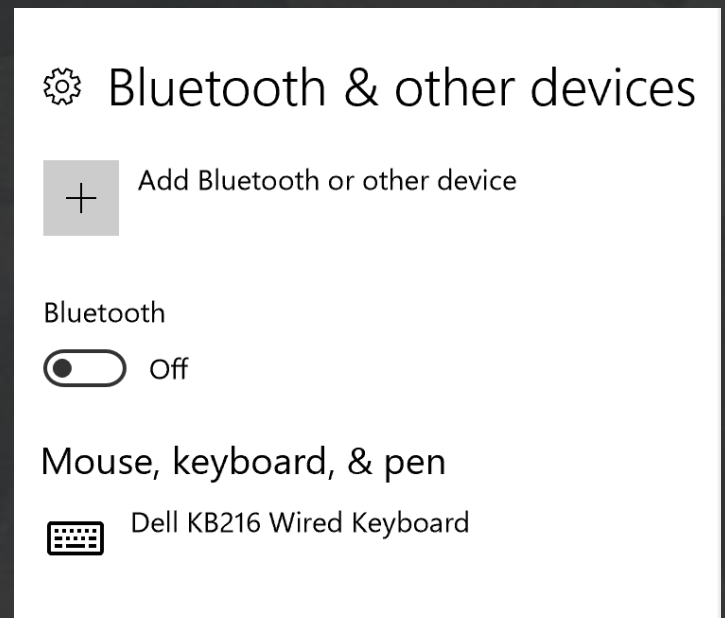
Get tips, tricks, and suggestions as you use Windows



Example and images from <https://www.nngroup.com/articles/two-ux-gulfs-evaluation-execution/>

# Model Mismatch: Windows 10 Bluetooth

- Is Bluetooth on or off?
- Often switches show the state that sliding towards will execute
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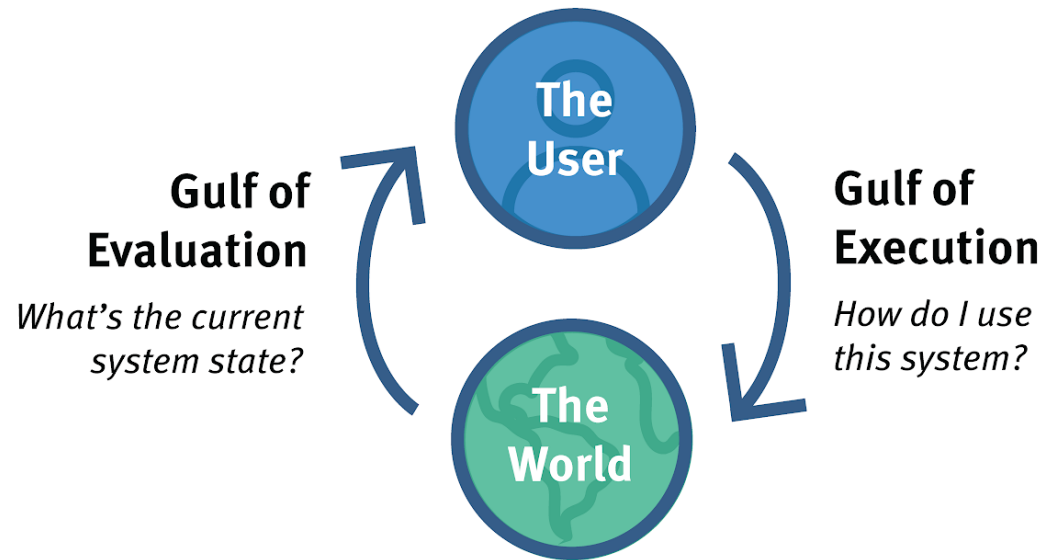


The system state is *visible*, but we fail to *evaluate* the state correctly

Example and images from <https://www.nngroup.com/articles/two-ux-gulfs-evaluation-execution/>

# Gulf of Evaluation & Gulf of Execution

*reduce the gulf* through design



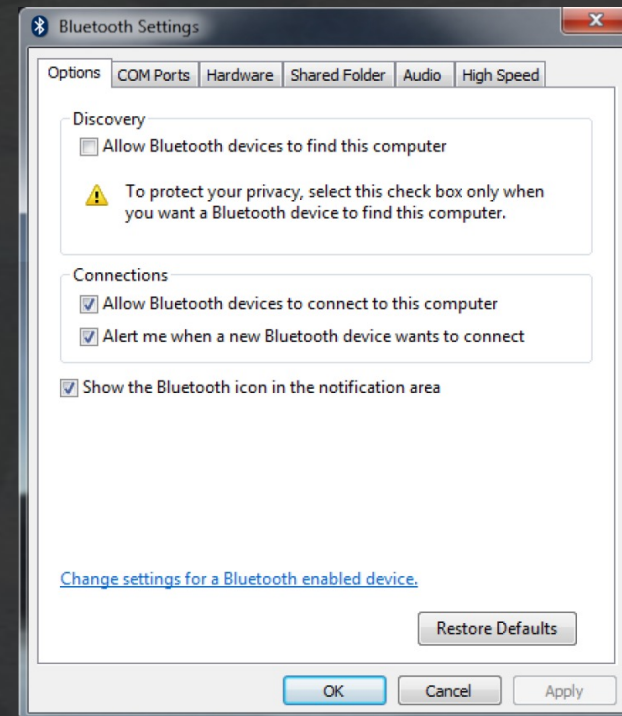
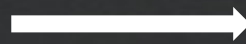
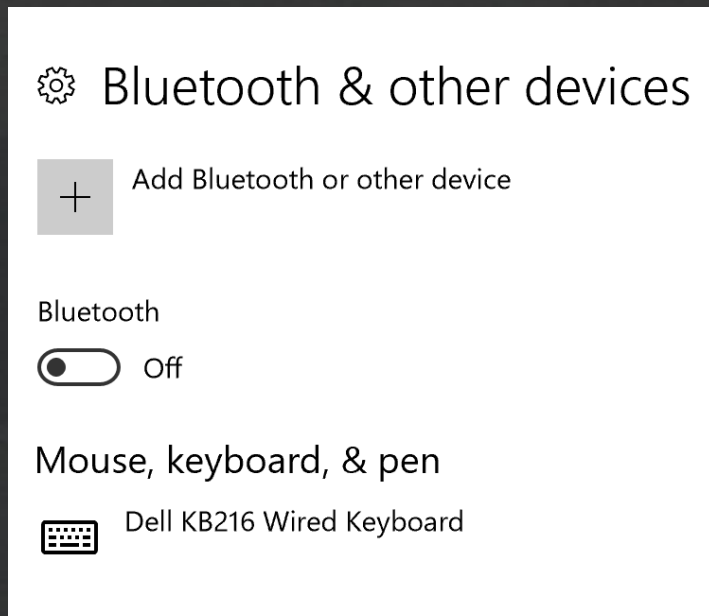
nngroup.com **NN/g**

Example and images from <https://www.nngroup.com/articles/two-ux-gulfs-evaluation-execution/>



# Gulf of Evaluation & Gulf of Execution

*reduce the gulf* through design



Example and images from <https://www.nngroup.com/articles/two-ux-gulfs-evaluation-execution/>

# Administrivia

- Grading on Assignment #4: Concept Video

|                 |       |         |         |         |          |           |
|-----------------|-------|---------|---------|---------|----------|-----------|
| A4 Video Only:  | -: 0% | ✓ -: 0% | ✓ -: 0% | ✓ : 23% | ✓ +: 55% | ✓ ++: 23% |
| A4 Slides Only: | -: 0% | ✓ -: 0% | ✓ -: 3% | ✓ : 28% | ✓ +: 58% | ✓ ++: 13% |

- Questions about Medium-fi Prototype assignment?

- both the Figma Basics & Design Systems workshops are now online. Check them out now for this & following assignments!

- Final workshop – Accessibility – will link to recording online
  - we will give a few bonus points for projects that do a good job of addressing accessibility

# Administrivia

- If you aren't in CS147L & want to learn React Native
  - see CS147 home page for links to CS147L assignments 1-4 & Lectures 1A-6B
- Keep up w/ readings/HW on class website
  - <http://cs147.stanford.edu/>
  - midterm coming up in week 8 (weeks 7-8 have lighter work)

# Midterm

*Scope:* Everything through Usability Testing (Week 8 - Lecture 14) including Reading/Videos/Podcasts, Lectures, Assignments.

*Format:* Will primarily be a multi-part design problem (but know and be able to demonstrate *all* aspects of the design process & use facts for reasoning for your answers), with some multiple choice/short answer on knowledge of HCI as well.

*Place:* Hybrid exam – part I in class & part II (design problem) at home (Gradescope)

*Time:* This midterm will take place during a 24-hour window starting in class Wed., Nov. 15, at 1:30 pm Pacific time. You will have ~1:30 for part I in class and ~2 hour for part II at home.

# TEAM BREAK

Talk about how to build your medium-fi  
prototype

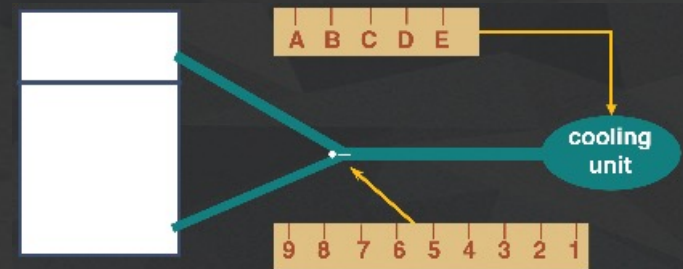
# Design Guides



- Provide good conceptual model
  - customer wants to understand how controls affect object
- Make things visible
  - if object has function, interface should show it
- Map interface controls to customer's model
  - infix vs. postfix calculator – whose model is that?
- Provide feedback
  - what you see is what you get! (WYSIWYG)

# Make Things Visible

- Refrigerator?
  - make the 1..9 dial something about percentage of cooling between the two compartments?
- Functions available on watch w/ 4 buttons? Is there an issue?
  - too many & they are not visible!



# Make Things Visible



- Compare to controls on old & new car radios
  - #controls = #functions
  - controls are labeled (mostly) and grouped together



# Make Things Visible



- Compare to controls on old & new car radios
  - #controls = #functions
  - controls are labeled (?) and grouped together

# Make Things Visible



- Compare to controls on old & new
  - #controls = #functions
  - controls are labeled (?) and grouped
  - tradeoffs of the “glass UI” (e.g., Tesla)



# Map Interface Controls to Customer's Model

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



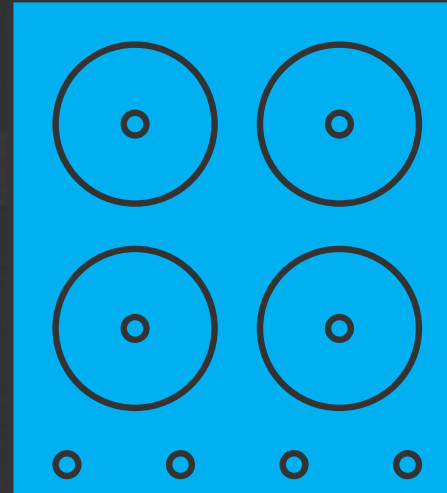
# Map Interface Controls to Customer's Model

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



Mercedes Benz Seat Control maps to real world

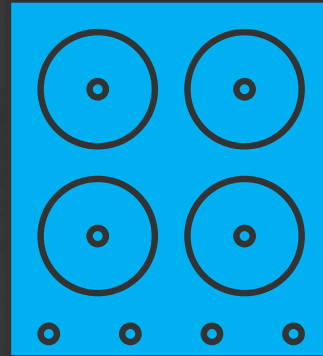
# Map Interface Controls to Customer's Model



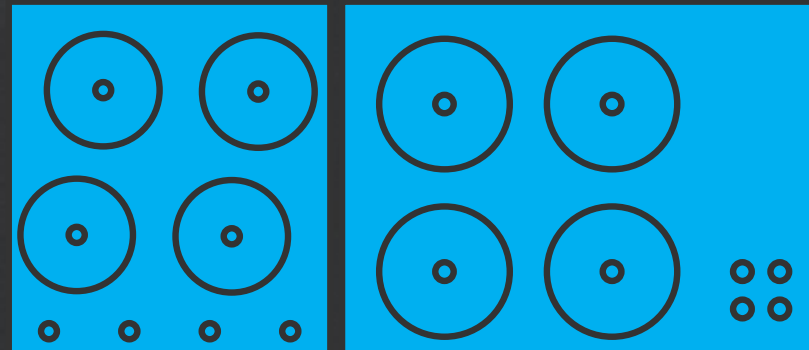
Problem?

Which knob controls which burner?

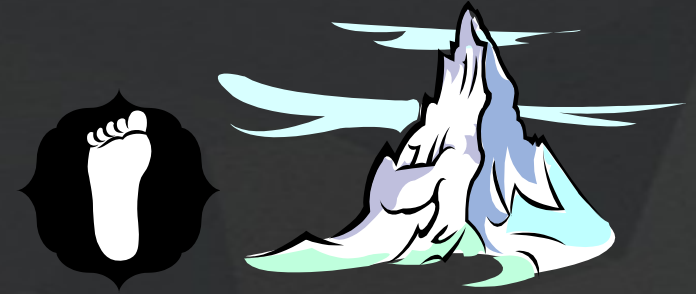
# Map Interface Controls to Customer's Model



Possible fixes?



# Metaphor

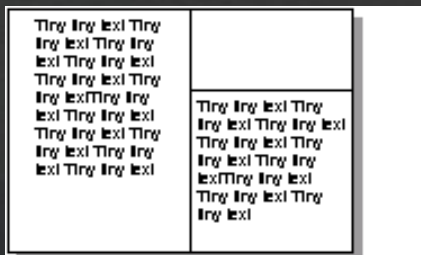


- Definition ?  
“The transference of the relation between one set of objects to another set for the purpose of brief explanation.”
- Lakoff & Johnson, *Metaphors We Live By*
  - “...the way we think, what we experience, and what we do everyday is very much a matter of metaphor.”
  - in our language & thinking – “argument is war”
    - ... he attacked every weak point
    - ... criticisms right on target
    - ... if you use that strategy
- We use metaphor in UI design to *leverage existing conceptual models*

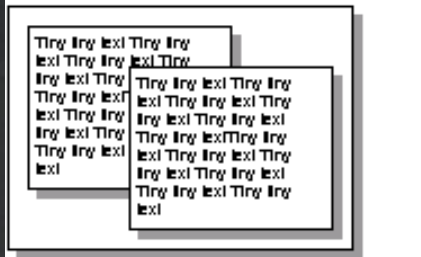




# Desktop Metaphor



⇓ Leap!



Xerox PARC's overlapping windows

Suggests a conceptual model

- not really an attempt to simulate a real desktop
- a way to explain why some windows overlapped
- leverages knowledge about files, folders & trash

# Example Metaphors

- Global metaphors
  - personal assistant, wallet, clothing, cards
- Data & function
  - to-do list, calendar, documents, find, assist
- Collections
  - drawers, files, books, newspapers, photo albums



# How to Use Metaphor

- Develop interface metaphor tied to conceptual model
- Communicate that metaphor to the user
- Provide high-level task-oriented operations, not low-level implementation commands

# Avoid Metaphor for Metaphor's Sake

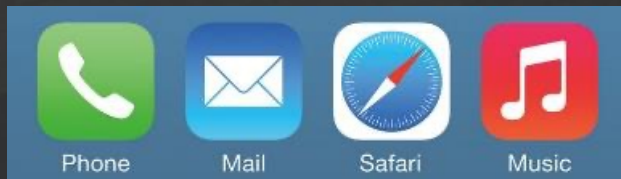
- Skeuomorphism
  - “making items resemble their real-world counterparts”  
or  
“a physical ornament or design on an object made to resemble another material or technique”
- Argument against: takes up space & leads to inconsistent look
- Argument for: helps people learn



Apple iBooks2

# Avoid Metaphor for Metaphor's Sake

- Metaphors can become dated



iPhone metaphors dated?



iPad Podcast app – ever seen a reel-to-reel tape deck?

# Ways of Being Consistent

- Interfaces should be consistent in a *meaningful* way
  - e.g., ubiquitous use of same keys for cut/copy/paste
  - H4: Consistency & Standards
- Types of consistency
  - consistent internally
    - e.g., same terminology & layout throughout app
  - consistent with other apps
    - e.g., works like MS Word, uses same keyboard conventions
    - design patterns (across many apps)
  - consistent with physical world

# Is Consistent Always Better? NO

- Palm PDA example: should “new appointment” & “delete appointment” be in the same place?
- New (add) is common, but delete is not



# Is Consistent Always Better?

NO

**Event Details** ⓘ

**Time:** 12:00 pm - 1:00 pm

**Date:** Thu 6/24/99

**Alarm:**

**Repeat:**

None Day **Week** Month Year

**Every:** ...1 week(s)

**End on:** ▼ No End Date

**Repeat on:** S M T W T F S

**Private:**

OK Cancel Delete... Note

Early Palm design  
(like desktop version)

**Event Details** ⓘ

**Time:** 12:00 pm - 1:00 pm

**Date:** Thu 6/24/99

**Alarm:**

**Repeat:** None

**Private:**

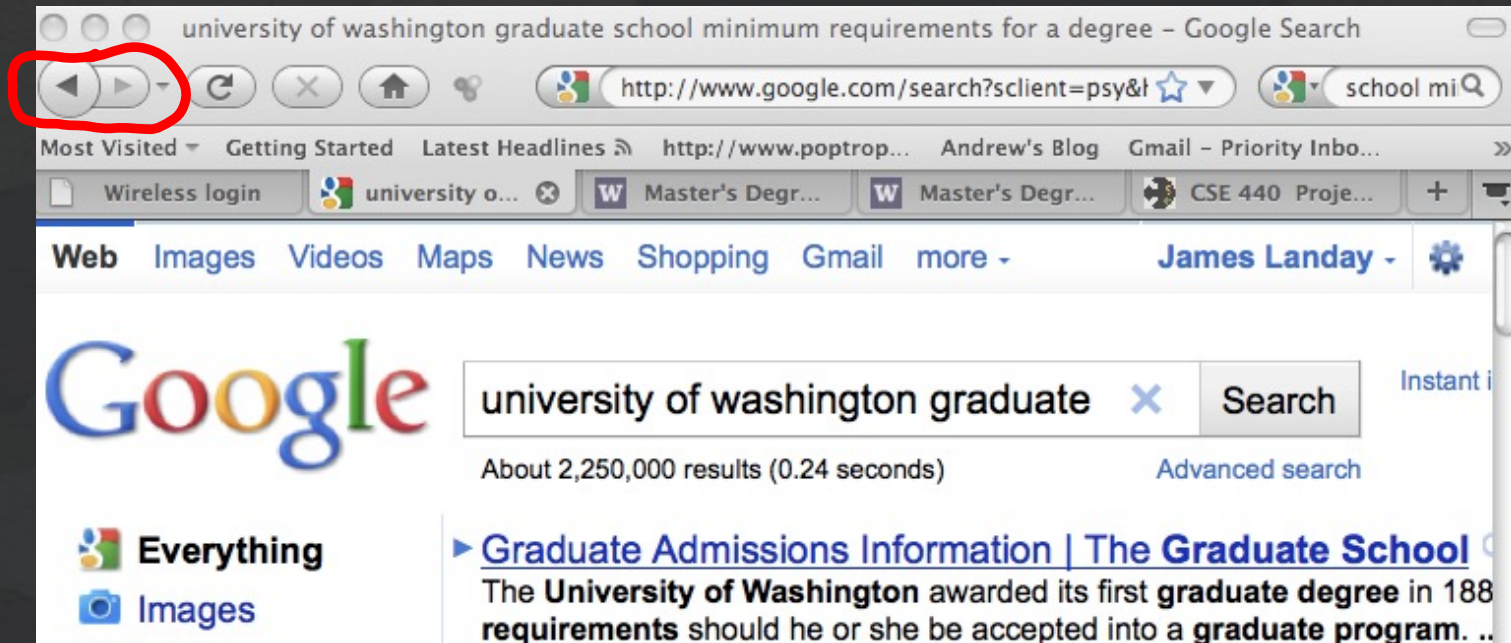
OK Cancel Delete... Note

Streamlined design



# Is Consistent Always Better?

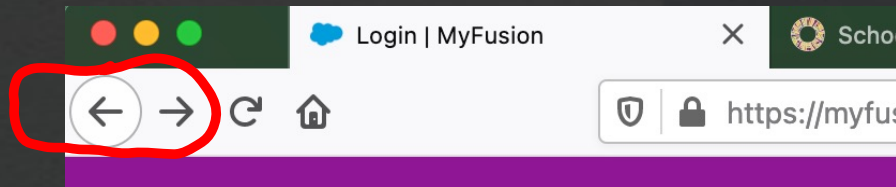
NO



Firefox 3 Back/Forward Buttons

# Is Consistent Always Better?

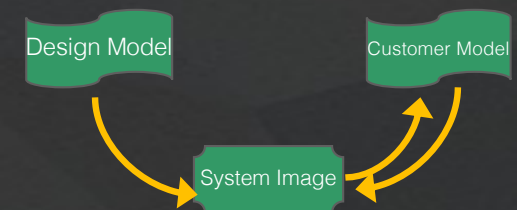
# NO



More Recent Firefox Back/Forward Buttons

# Summary

- Conceptual model?
  - mental representation of how the object works & how interface controls effect it
- Design model should equal customer's model?
  - mismatches lead to errors
  - use customer's likely conceptual model to design
- Design guides?
  - provide good conceptual model
  - make things visible
  - map interface controls to customer's model
  - provide feedback



# Further Reading

- *Design of Everyday Things*, Donald Norman
- Design as Practiced, Donald Norman
  - Talks about failure to make changes to Macintosh
  - [http://www.jnd.org/dn.mss/Design\\_as\\_Practiced.html](http://www.jnd.org/dn.mss/Design_as_Practiced.html)
- Computing the Case Against User Interface Consistency, Jonathan Grudin
  - Talks about why interfaces should not always be consistent
  - <https://www.semanticscholar.org/paper/The-Case-Against-User-Interface-Consistency-for-can-Jonathan-Grudin/71cc342910a4add7ee522c5510769a1c51df2ebd>

# Next Time

- Lecture
  - Heuristic Evaluation (w/ in-class exercise)
- Read
  - How to Conduct a Heuristic Evaluation by Jakob Nielsen
- Studio
  - This week: Half-way review w/ outside experts