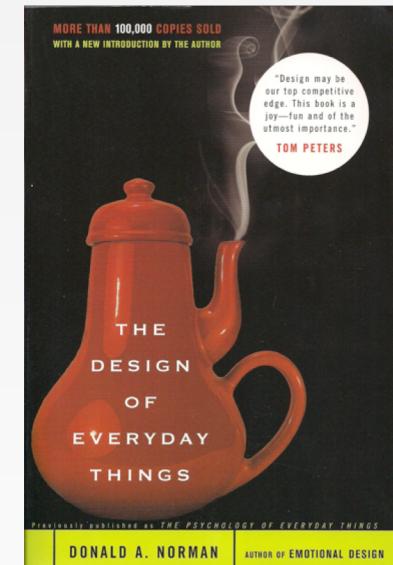


User-Centered Design

Usability and Usefulness

Norman's Model of Interaction

UI Design Principles



Don Norman,
The Design of Everyday Things



What innovation made watching television easier?

YOU HAVE TO SEE IT TO BELIEVE IT!

FLASH-MATIC TUNING

BY
ZENITH

ONLY ZENITH HAS IT!

A flash of magic light from across the room (no wires, no cords) turns set on, off, or changes channels...and you remain in your easy chair!

YOU CAN ALSO SHUT OFF LONG, ANNOYING COMMERCIALS WHILE PICTURE REMAINS ON SCREEN!

Here is a truly amazing new television development—and only Zenith has it! Just think! Without budging from your easy chair you can turn your new Zenith Flash-Matic set on, off, or change channels. You can even shut off annoying commercials while the picture remains

on the screen. Just a flash of light does it. There are no wires or cords. This is not an accessory. It is a built-in part of several new 1956 Zenith television receivers. Stop at your Zenith dealer's soon. Zenith-quality television begins as low as \$149.95.*

If it's new...it's from Zenith!

YOU HAVE TO SEE IT TO BELIEVE IT

*Manufacturer's suggested retail price. Slightly higher in Far West and South.

With a beam of magic light

this Zenith "flash tuner"
works TV miracles!
Absolutely harmless to humans!

The Bismarck (Model X2264EQ). 21", Flash-Matic Tuning, Cinébeam®, Ciné-Lens. Blond grained finish cabinet on casters. Also in mahogany color (X2264RQ). As low as \$399.95.*



The royalty of TELEVISION and radio

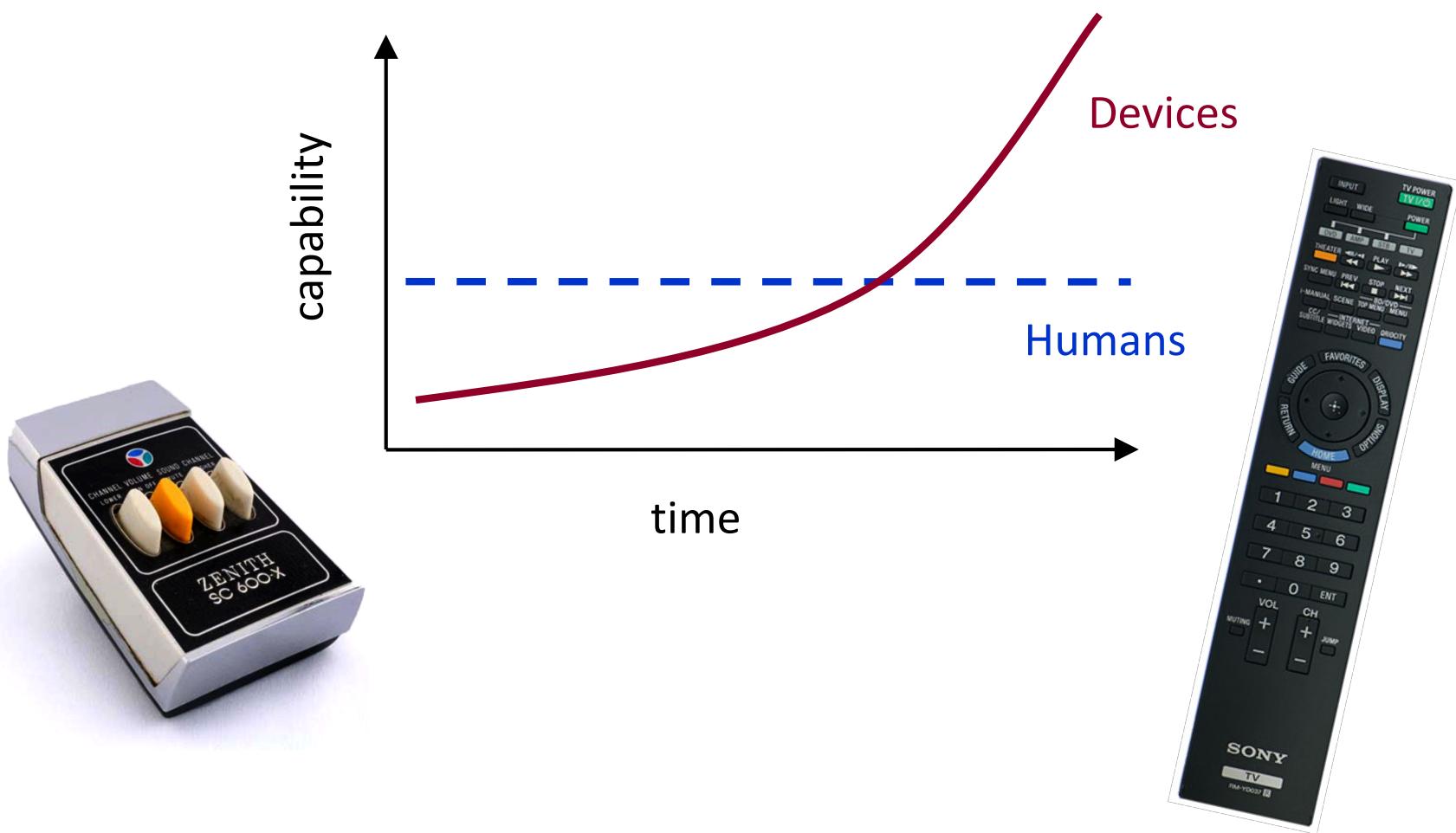
Backed by 36 years of leadership
in radionics exclusively

ALSO MAKERS OF FINE HEARING AIDS
Zenith Radio Corporation, Chicago 39, Ill.





[Jakob Nielsen](#)'s Alertbox, June 7, 2004



Buxton, W. (2001). Less is More (More or Less), in P. Denning (Ed.), *The Invisible Future: The seamless integration of technology in everyday life*. New York: McGraw Hill, 145 – 179.

Solution?

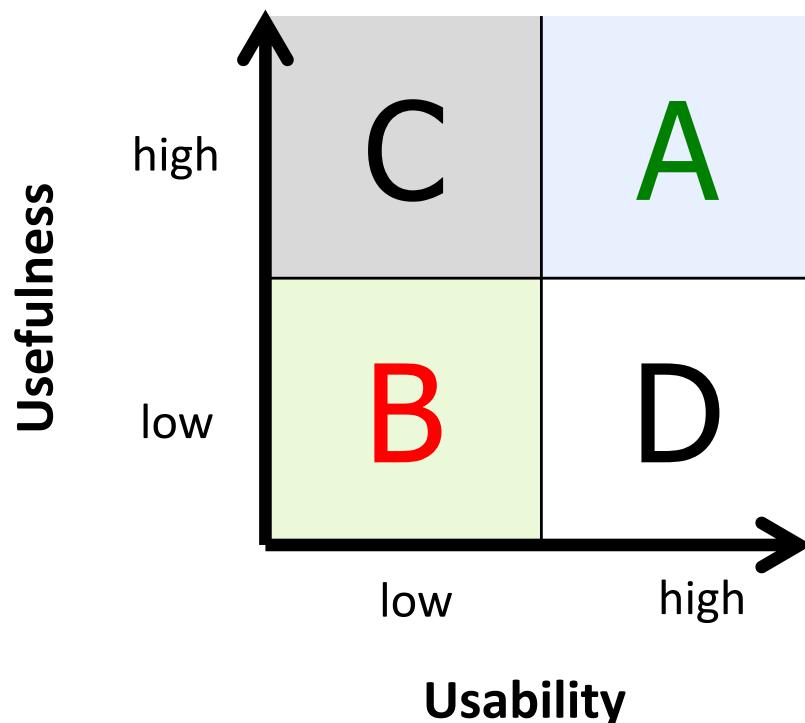


Solution?



Usability and Usefulness

- **Usability:** The effectiveness, efficiency, and satisfaction with which users can achieve tasks in a particular environment with a product.
- **Usefulness:** Meeting specific needs and supporting real tasks, the quality of being of practical use.



Good Door Usability



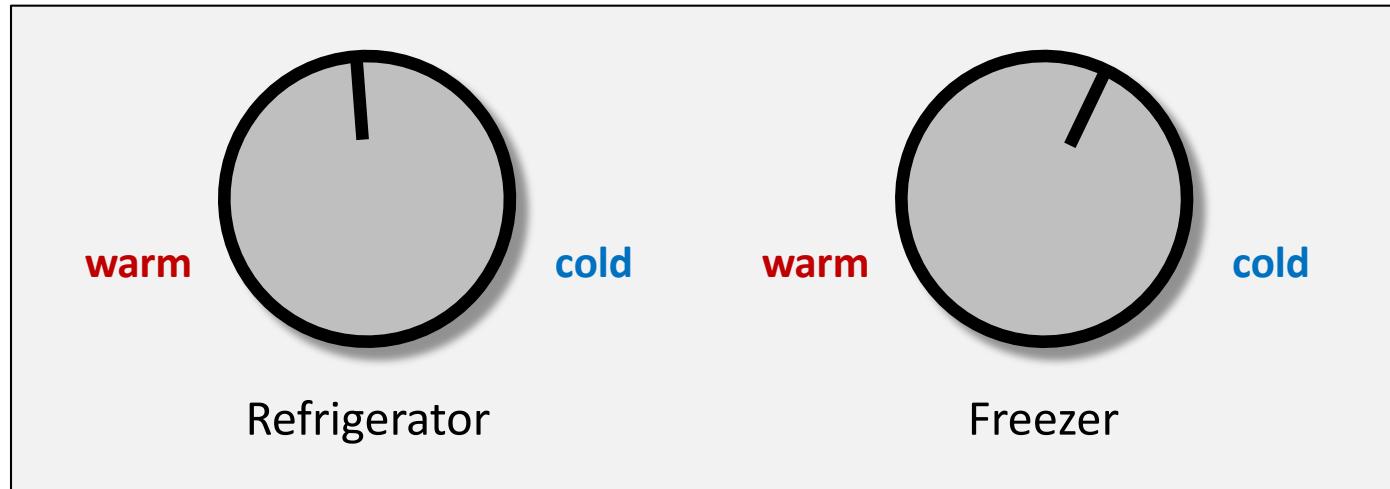
Poor Door Usability



?!?!?



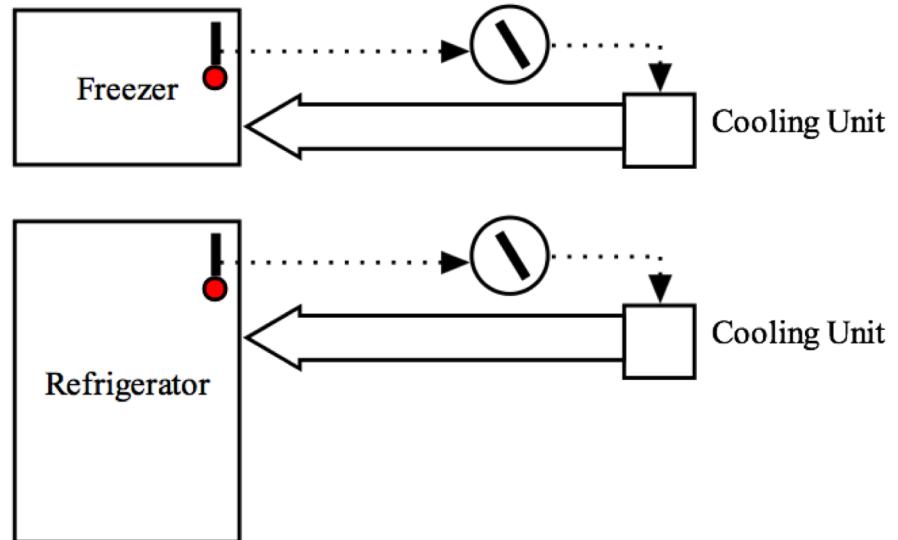
Example: Refrigerator Control



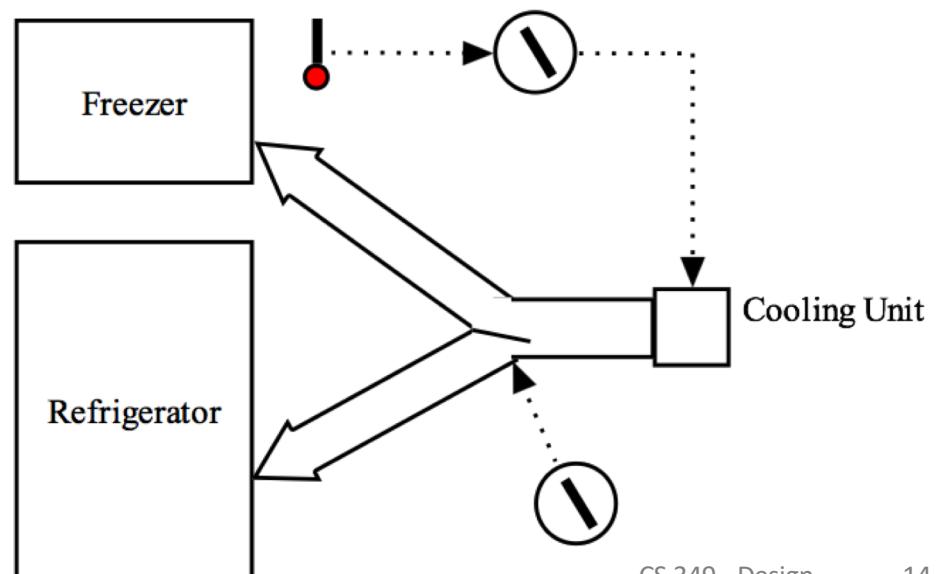
- Suppose the refrigerator is at the correct temperature. The freezer is too cold. What do you do?
- You can't really check your work for 24 hours...

Example: Refrigerator Function

- It looks like two independent temperature controls

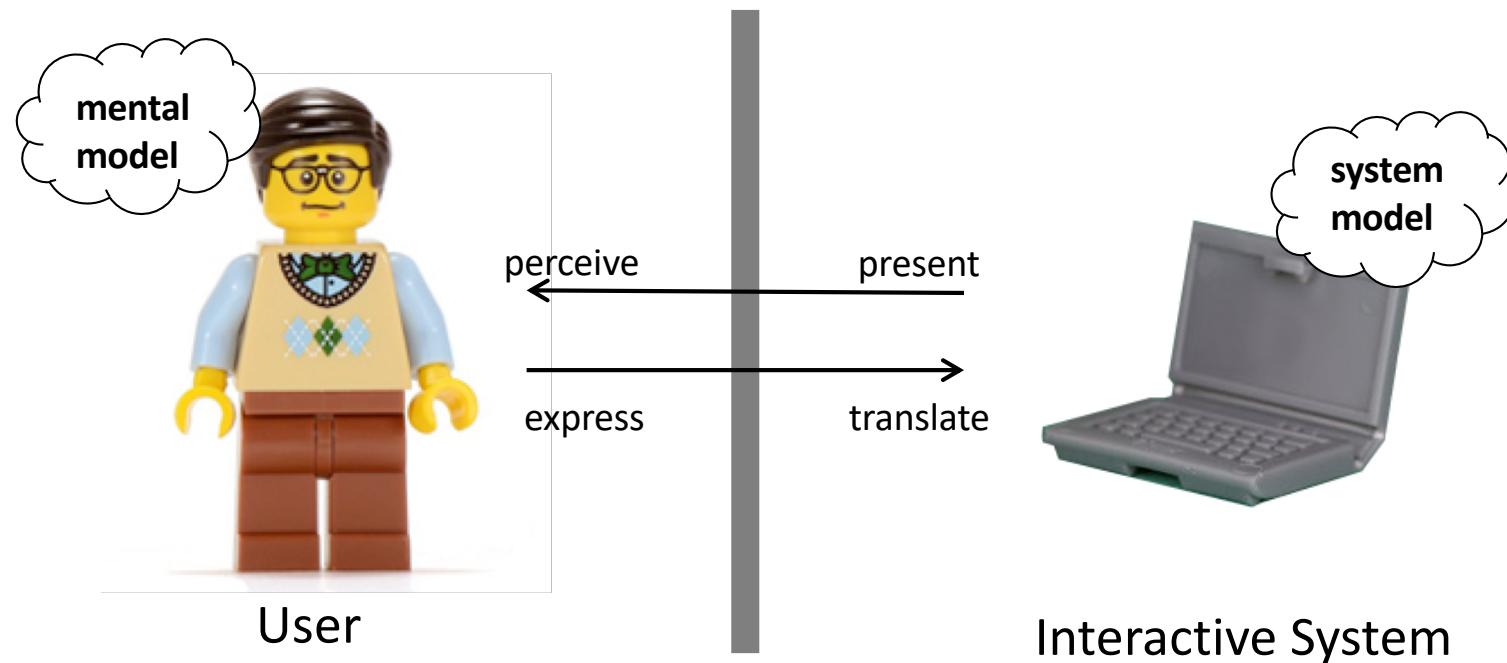


-
- It's actually one temperature control and a cold air valve

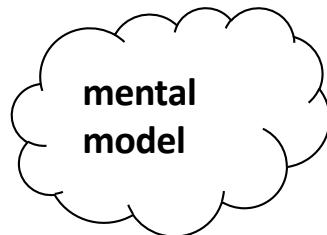


User Mental Model

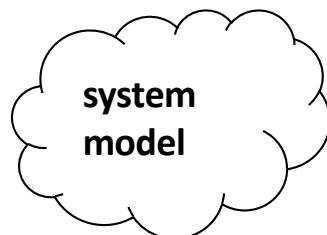
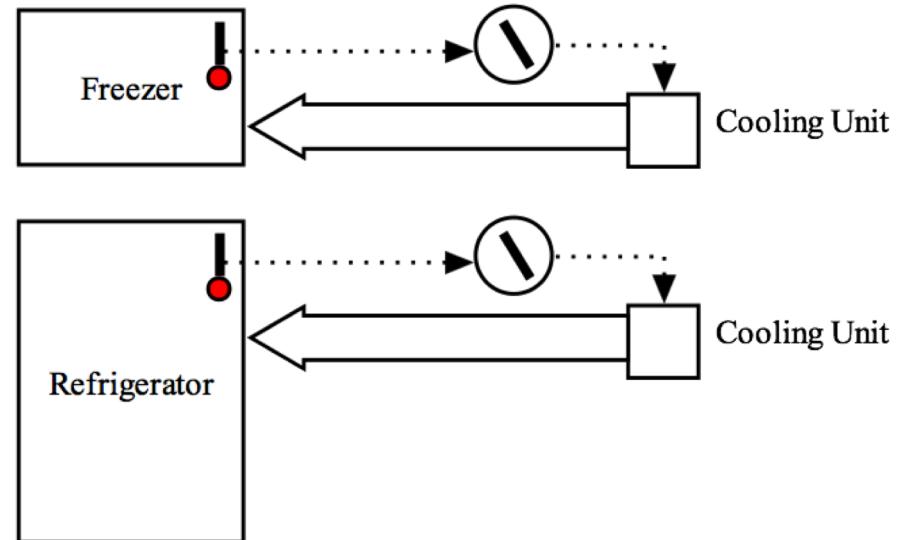
- What the user believes about the system
(how system works, what state system is in)
 - “if I do _____, the system will do _____”
 - “the system is _____”
- Frequently, a mental model is inaccurate or incomplete compared to system model



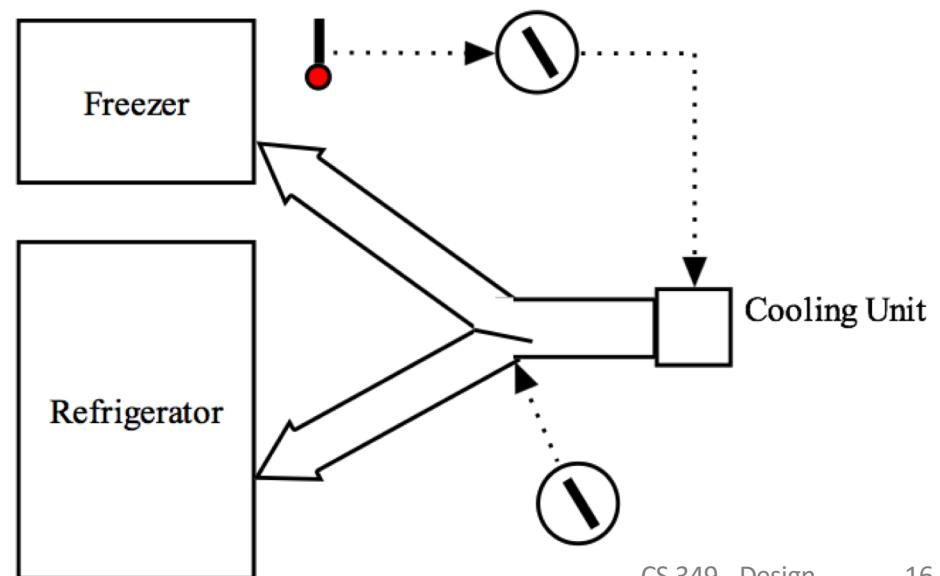
Refrigerator User Model vs. System Model



- The **user's mental model** is two independent temperature controls

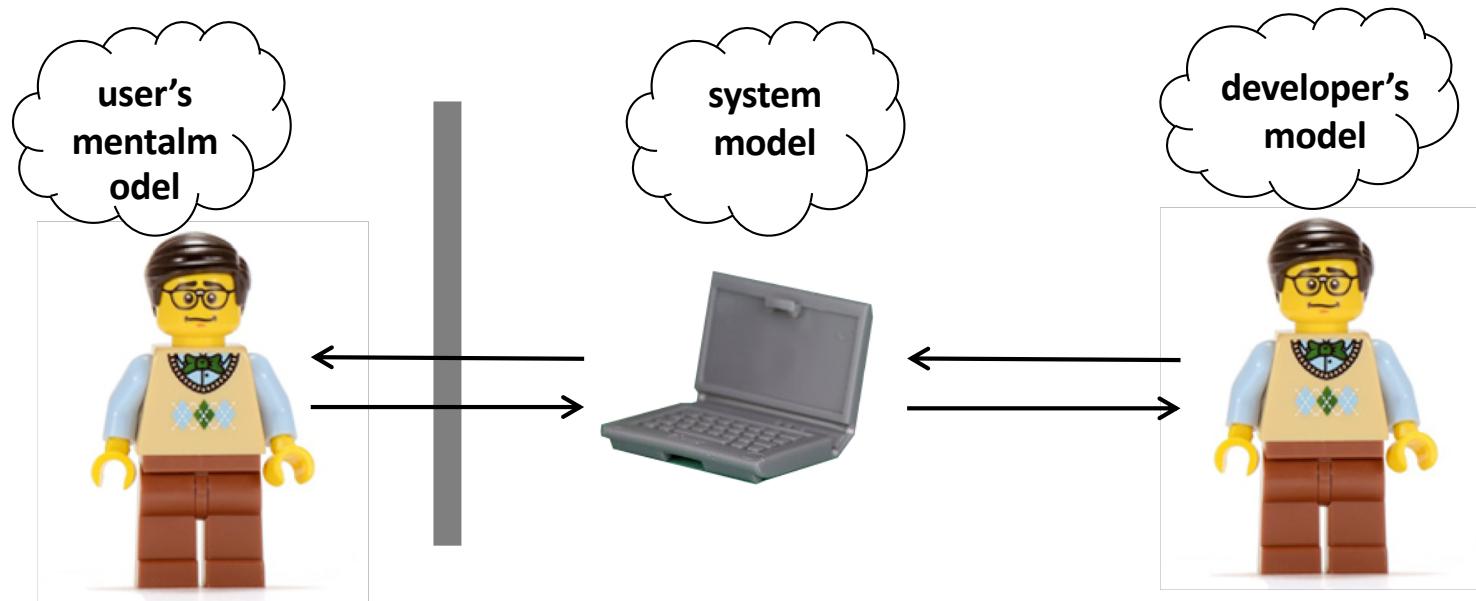


- The **system model** is one temperature control and a cold air valve



Three Models of a System

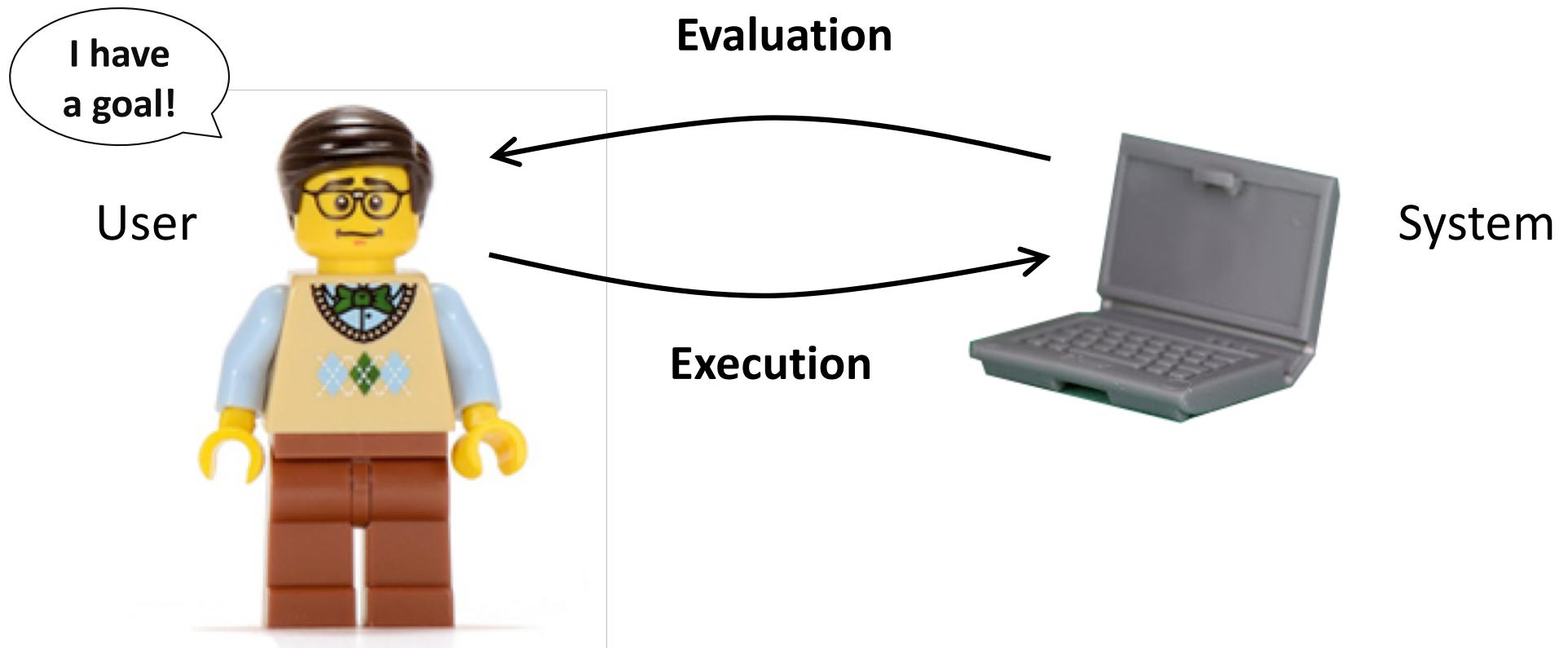
- **Developer's model:** how the developer believes system is used
- **System model:** how the system actually works
- **User's model:** how the user believes system should be used



- Developer and User **communicate via the system**
 - Goal is to have both images align as closely as possible

Don Norman's Model of Interaction

- **Execution:** What we do to the system to achieve a goal
- **Evaluation:** Comparing what happened with our intended goal

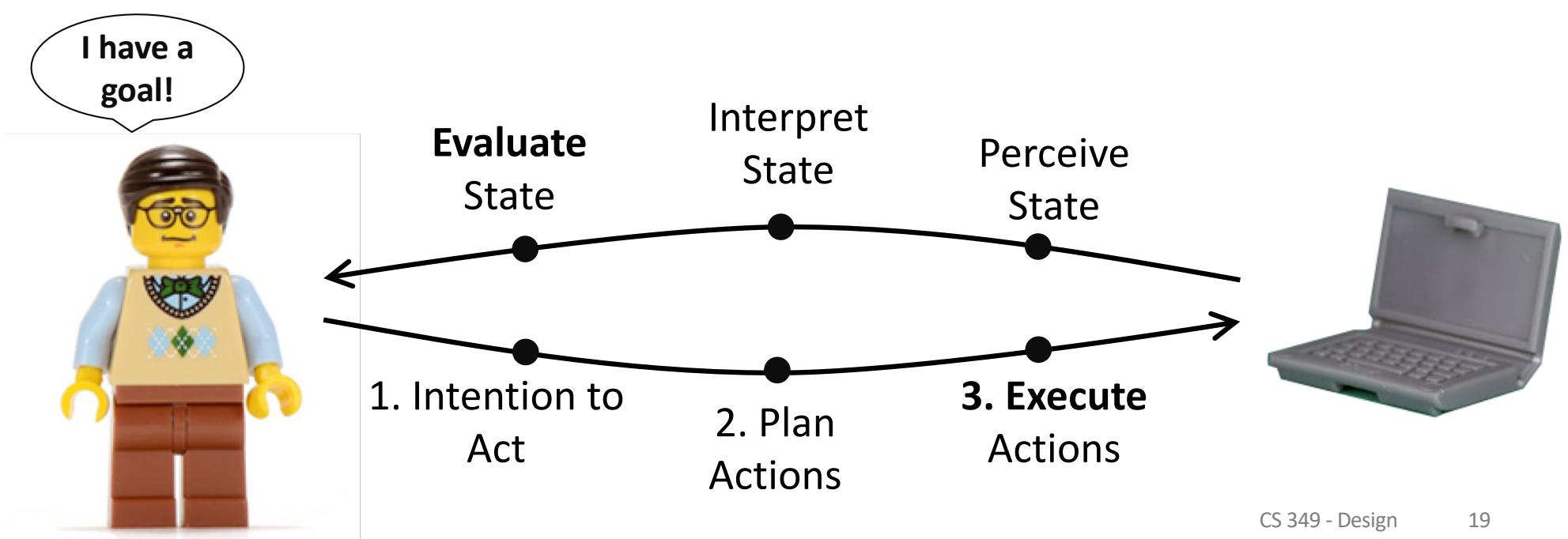


Execution Stages

1. Form an intention to act to achieve a goal
2. Plan an sequence of actions to fulfill that intention
3. **Execute** planned actions with physical movements

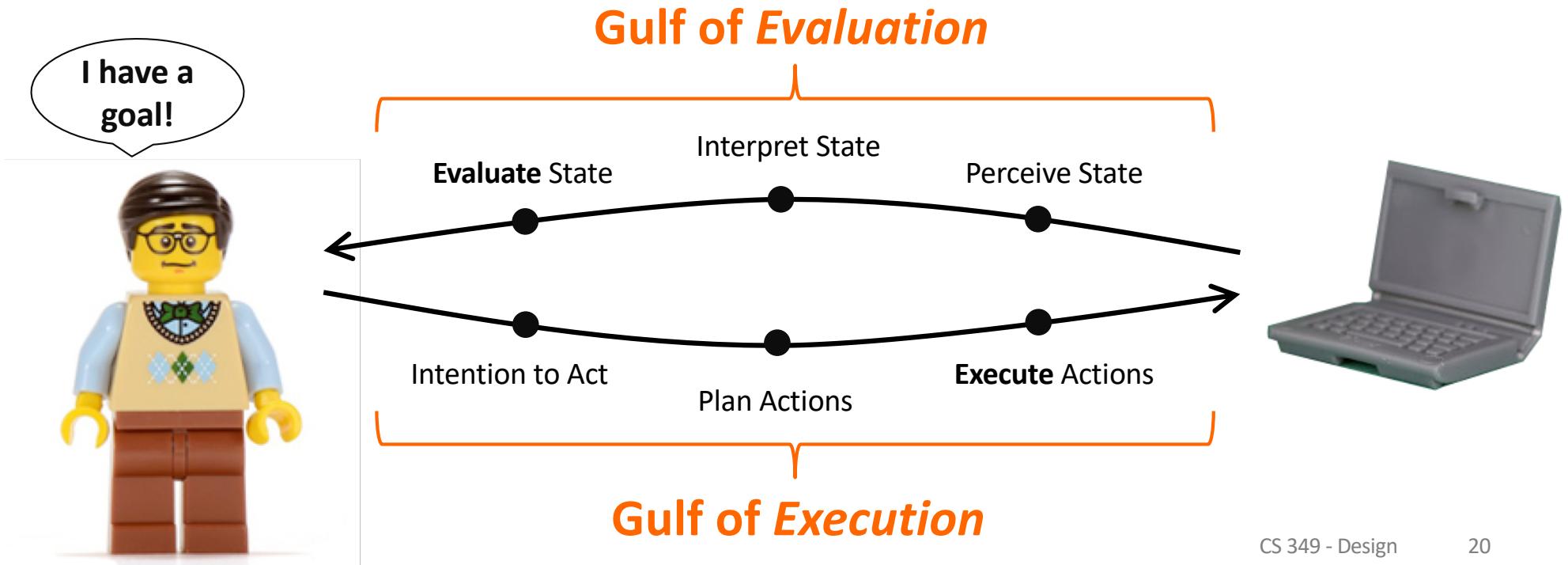
Evaluation Stages

1. Physically perceive the current state of the system
2. Interpret that perception according to experience
3. **Evaluate** the interpreted state compared to our goal



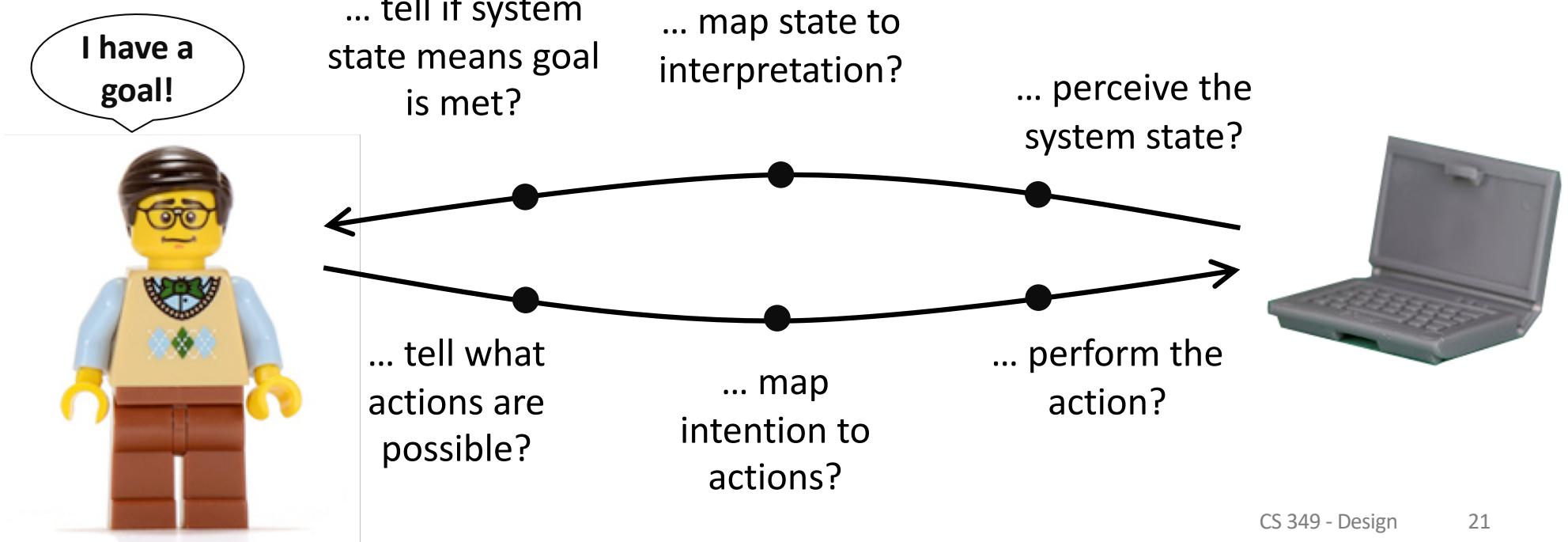
Gulf of Execution and Gulf of Evaluation

- **Gulf of Execution:** Difficulty translating user's intentions into actions allowed by system. Can user carry out their intentions?
- **Gulf of Evaluation:** Difficulty in interpreting the state of the system to determine whether our goal has been met.



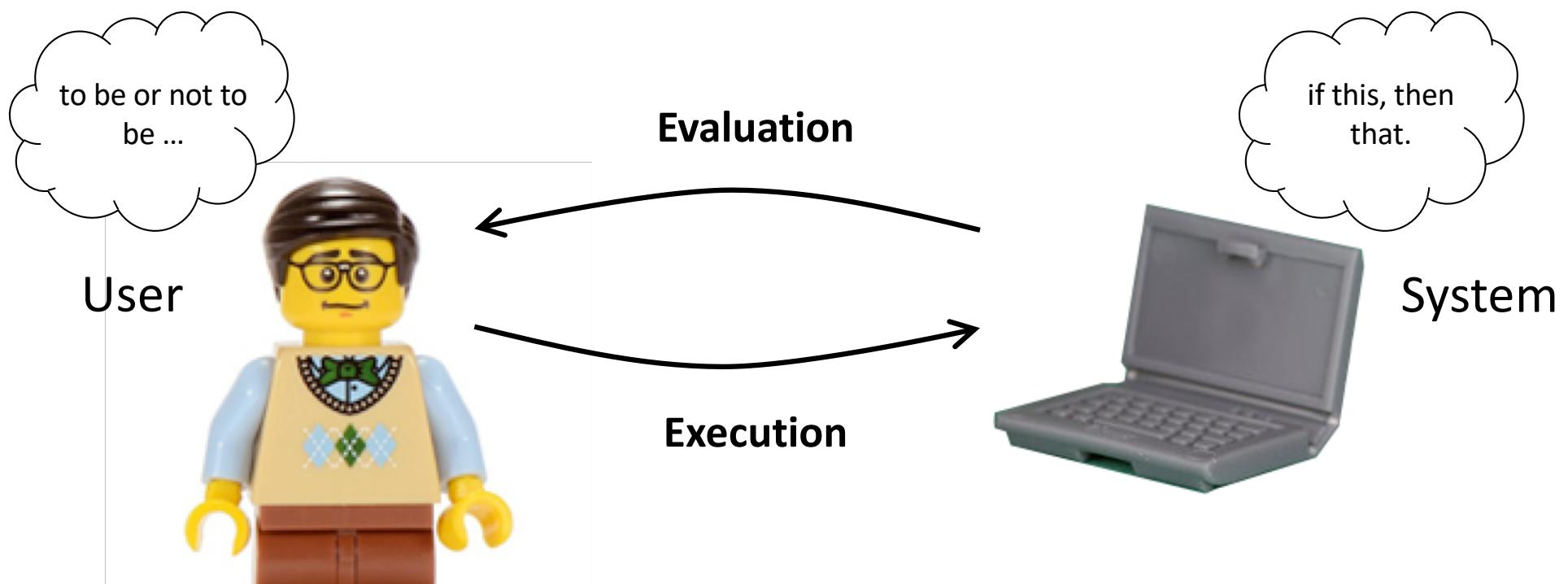
The Value of the Model

- Design goal is to minimize gulf of execution and gulf of evaluation



Central Tension

- **User:** rich and varied experiences; makes intuitive leaps; learns; uses metaphors; creative
- **System:** follows a rigid program; not creative; only primitive learning (at best)
- **User Interface:** needs to mediate between these two radically different systems



UI Design Principles

- Don Norman’s “fundamental” design principles
- Basic principles which reduce *gulf of execution* and *evaluation* and create a more correct mental model for user
 - Perceived Affordance
 - Mapping
 - Constraints
 - Visibility/Feedback
 - Metaphor

Perceived Affordance

- What you think you can do with an object, based on perceived properties.



“pull”



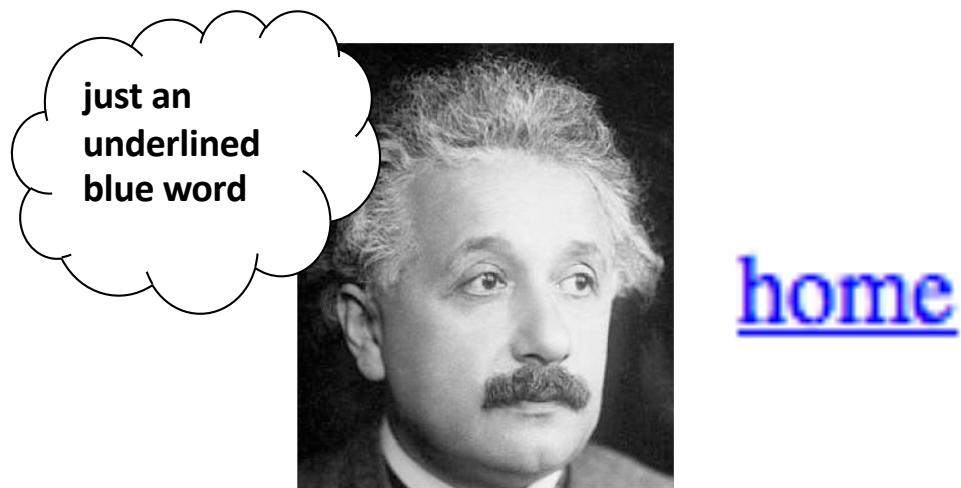
“push”



“drag”

Perceived Affordance and Mental Models

- What influences our perception of affordances and the manner in which we develop mental models?
 - Individual histories (e.g. have you seen this before?)
 - Cultural background (e.g. how things are described in your culture)
- Examples where you have developed an incorrect model or misunderstood affordance?

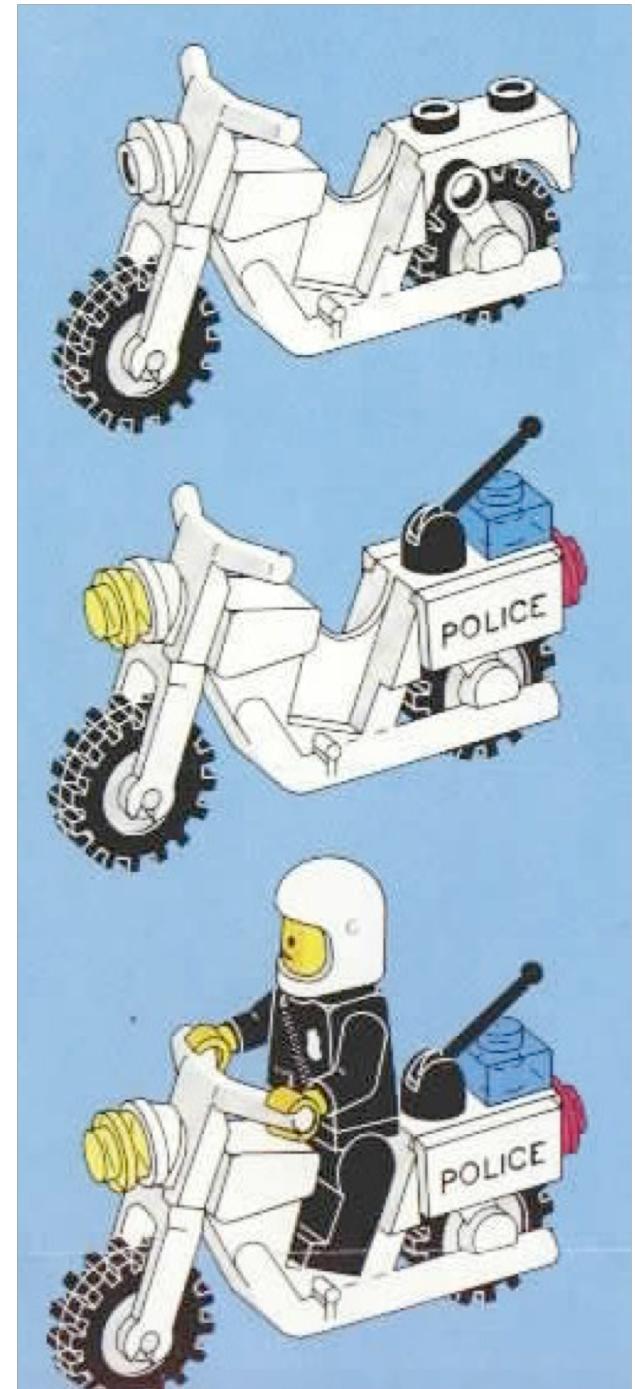


Constraints

Guide by preventing certain actions while enabling/encouraging others

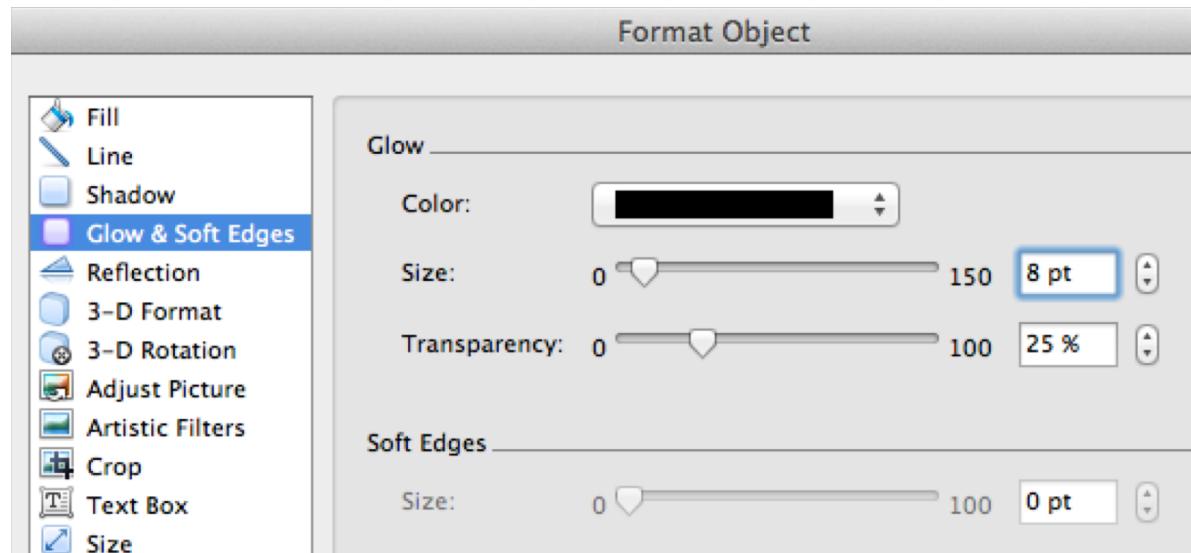
Norman's Lego Motorcycle Experiment

- **Physical** Constraints
 - Bricks can only fit certain ways
- **Semantic** Constraints
 - Riders face forwards, wheels touch the ground
- **Cultural** Constraints
 - Red means brake light
- **Logical** Constraints
 - No leftovers!



Constraints in User-Interfaces

- Physical, Logical, Semantic, Cultural?



Desktop



Documents



Downloads



Dropbox



Code



Movies



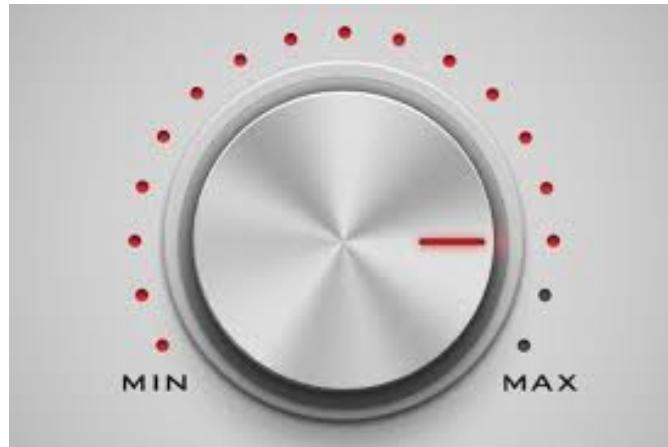
Music



Pictures

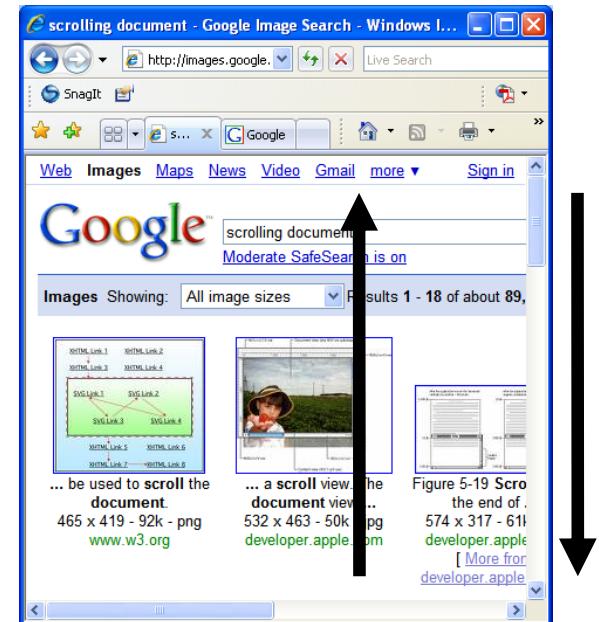
Mappings

- The relationship between two things, in this case between the control movement and the results in the world.
 - Doors: bars/plates for pushing, handles for pulling
 - Conventions: up/clockwise for “more”
- GUIs: Components often mimic physical controls and follow same conventions and mappings.



Mappings in User Interfaces

- Physical actions of input device mapped to UI instrument
- Instruments actions mapped to object of interest
- Recall **instrumental interaction**
 - Degree of integration, degree of compatibility



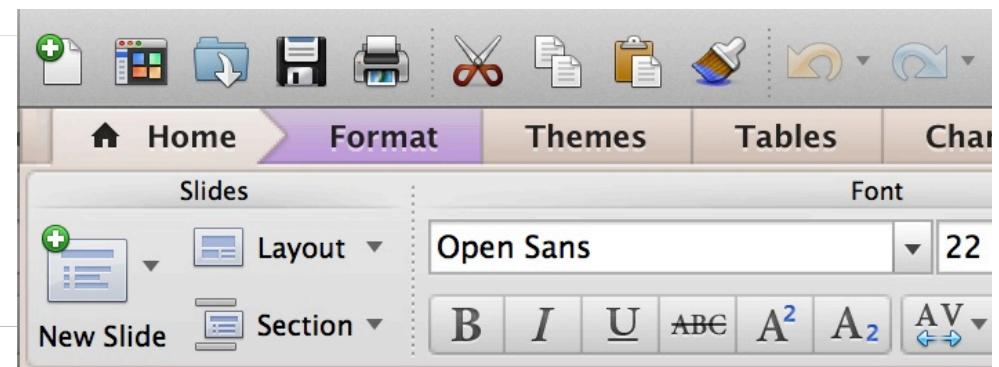
Literal Mapping

- Some things work well in physical world, but not in virtual (see *metaphor*)



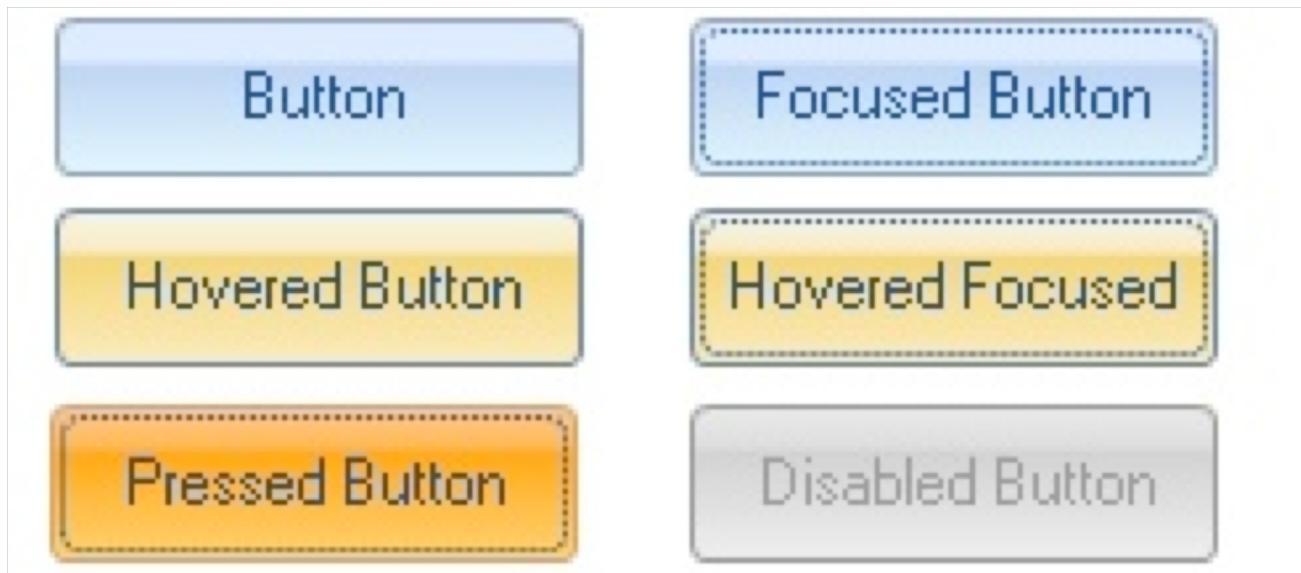
Visibility

- Make relevant parts visible and convey the correct message
 - Doors: Parts often gave the wrong message (pull vs. push), but hinges made visible the swing direction (though poorly)
 - GUIs: Make controls visible, either on-screen or in menus. List keyboard short-cuts in menus.
- Communicating what action has actually been done; what result has been accomplished.
 - Refrigerator: Feedback loop is terribly slow.
 - GUIs: Every action should give feedback. If can't be completed immediately, give some sort of progress indicator.



Widget Feedback

- Does widget effectively communicate:
 - That it is enabled/disabled?
 - That it has focus?
 - Its current state?
- Does feedback communicate affordances?



Metaphor

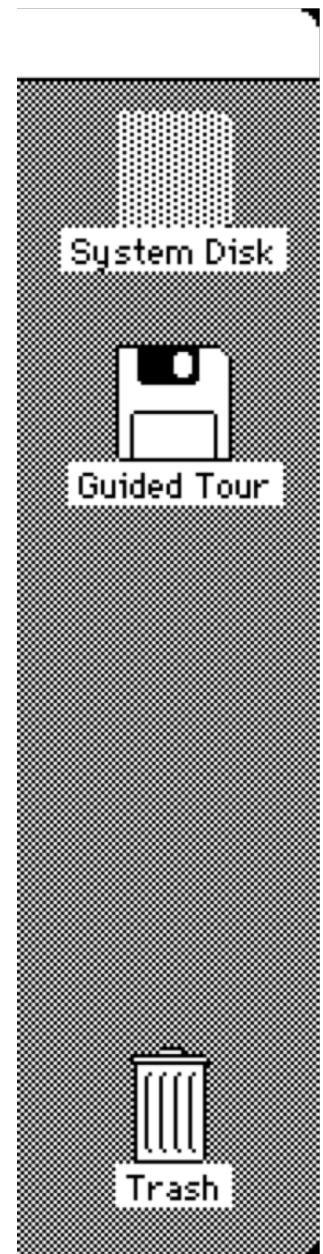
- Set of unifying concepts in a GUI used to simplify interaction with a computer system
- Done by borrowing concepts from one domain (the source or vehicle) and applying them to another (the target or tenor)
- Scale can vary from system to application to UI feature
- Examples:
 - The desktop metaphor in windowing systems
 - Assembly-line metaphor for a new car configurator
 - ...

Benefits of Metaphors

- Common language for objects
 - Window, Recycle Bin/Trash, Folders, Files
- Guide for cognitive semantics of system
 - Windows allow you to look into a house, or into a document
 - Recycling allows you to reclaim storage
- Analogy to explore similarities and differences
 - Computer window has scrollbars, more similar to a repositionable viewport
 - Differences arise because characteristics of the target cause inconsistencies in the metaphor

Inconsistencies in Metaphors

- Original Mac trash
 - Delete files on computer
 - Eject disk from drive
- File system metaphor
 - Original Mac had all file systems on desktop
 - BeOS had external drives on the desktop and internal drives in a “Computer” icon
 - Windows had all file systems in a “Computer” icon



Metaphor Gone Too Far



Microsoft Bob (1995)