CSE 593

Usability Principles

Farnaz Jahanbakhsh

Lecture content adapted with modifications from:

- MIT 6.813 materials authored with contributions from: Elena Glassman, Philip Guo, Daniel Jackson, David Karger, Juho Kim, Rob Miller, Stefanie Mueller, Clayton Sims, and Haoqi Zhang
- MIT 6.S063 by David Karger & Lea Verou
- UMich EECS 593 by Nikola Banovic

EECS ELECTRICAL ENGINEERING AND COMPUTER SCIENCE
UNIVERSITY OF MICHIGAN

Logistics

- Assignment 1 (Individual) graded. Assignment 1 (Group) being graded.
- Assignment 2 (Individual) due next week (Oct 9 at 5PM).
- Assignment 2 (Group) due in two weeks (Oct 16 at 5PM).
- Required reading due before next lecture!
- Quiz 4 assigned after next lecture and due on Friday.

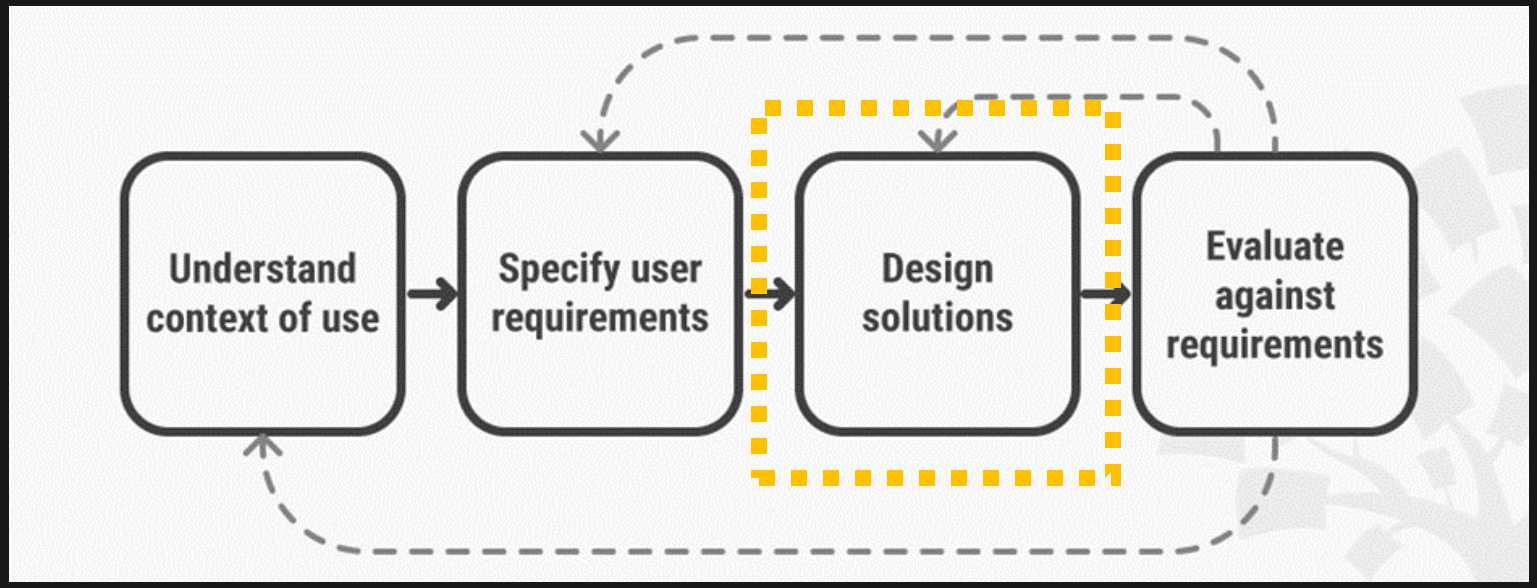
Goals

Discuss how to improve usability along its 3 dimensions

Define Usability Principles

Learn how the principles of usability help in design of interactive computer technology

User-Centered Design Process



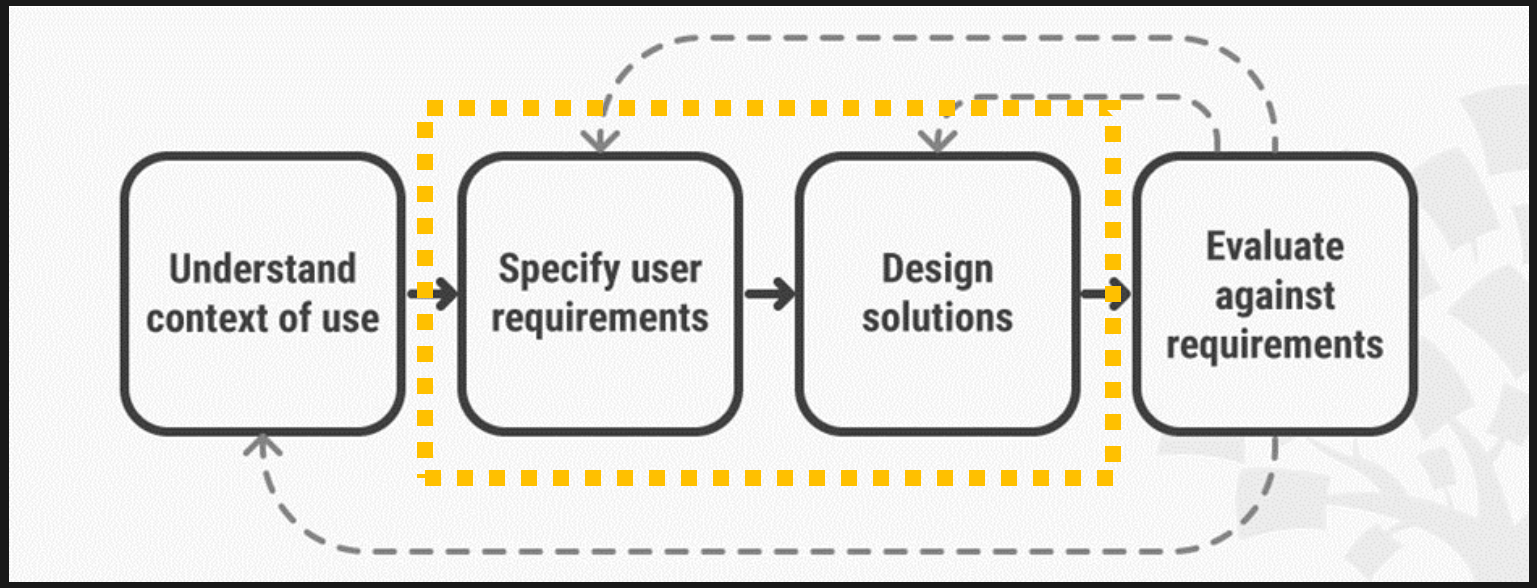
Interaction Design Foundation (https://www.interaction-design.org/literature/topics/user-centered-design)

What is usability?

What is usability?

"The extent to which an artifact enables the human to effectively and efficiently complete a task or accomplish a goal with satisfaction."

User-Centered Design Process



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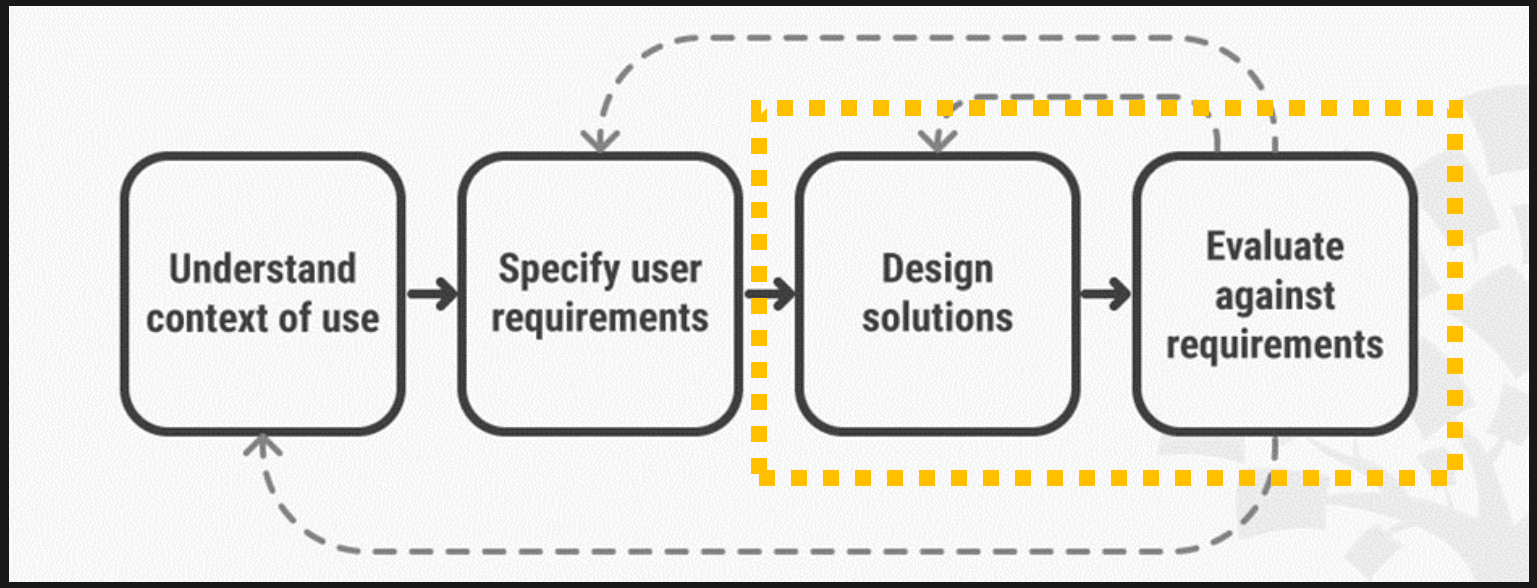
User-Centered Design Process



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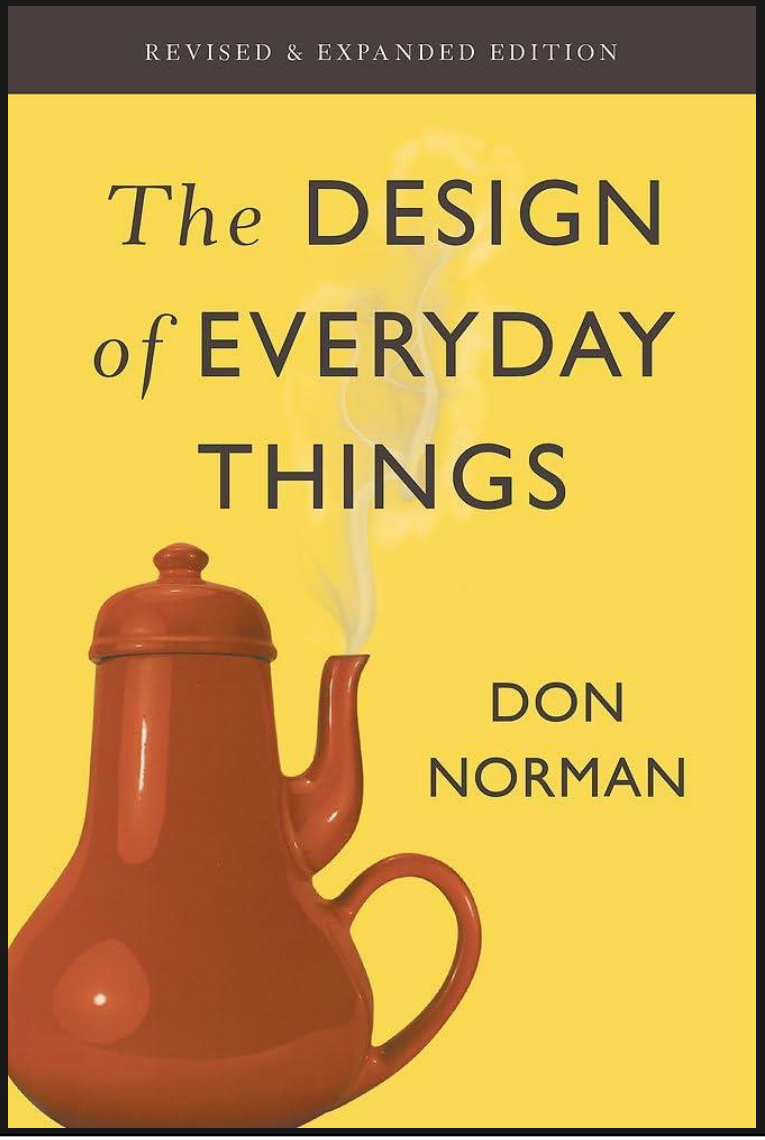
Usability Principles



Don Norman on “The Design of Everyday Things” (https://youtu.be/_Kc57XAE_V4)

3 aspects of usability

- Learnability
- Efficiency
- Safety

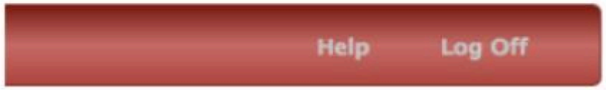
3 aspects of usability

- Learnability
- Efficiency
- Safety

How we don’t learn

Not by reading a manual*

Not by taking a class*

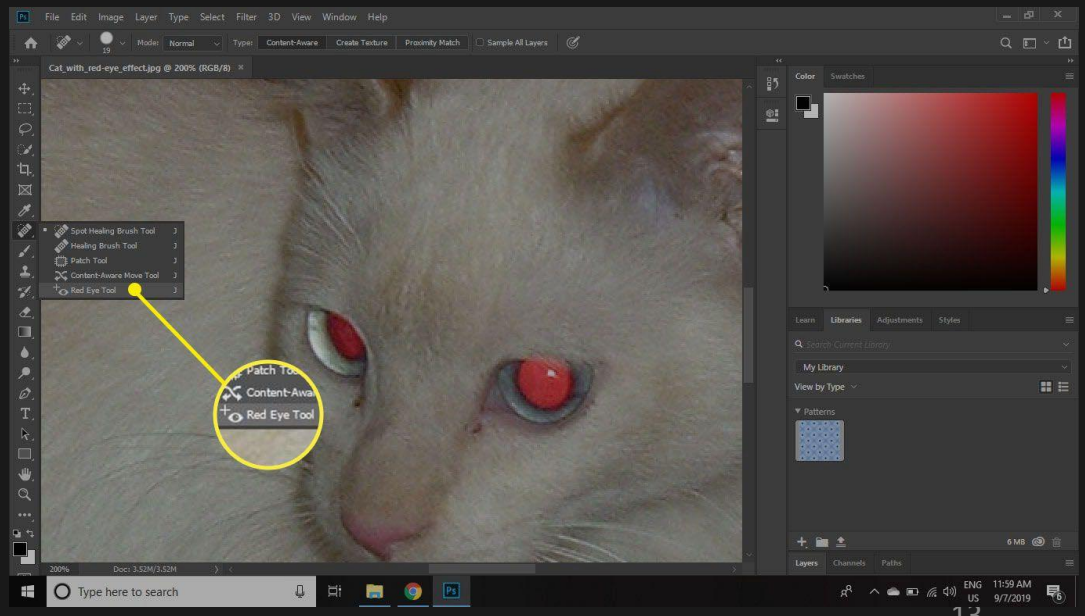


Not by reading the help first*

* Standard caveat: “it depends”

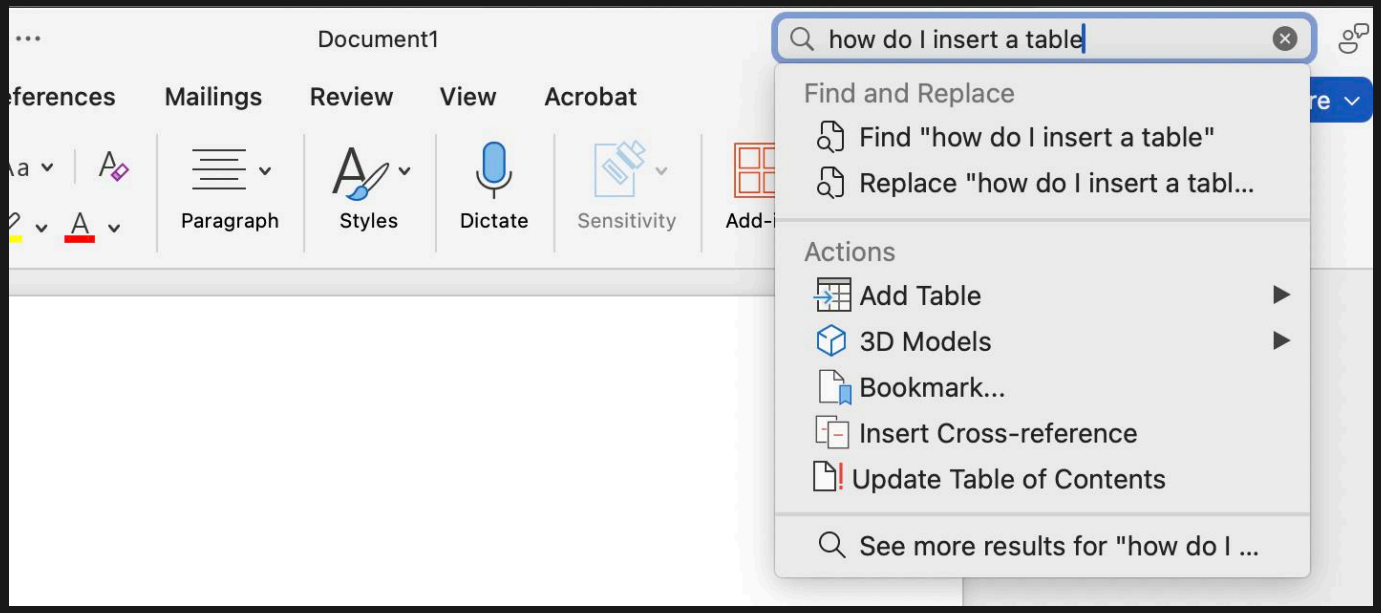
Learning by doing

- User arrives with a goal
- Explores the interface for a way to satisfy the goal
- Next steps should be discoverable
- With feedback

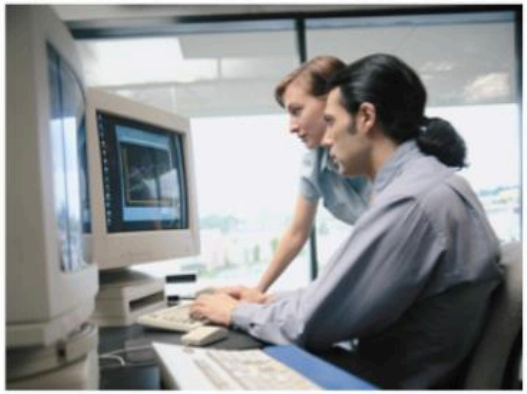


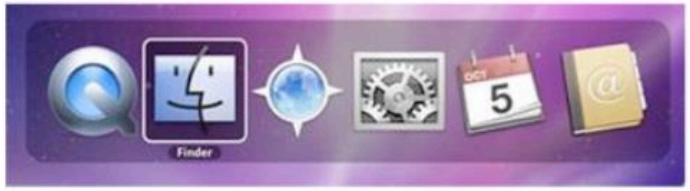
Seeking help

- User resorts to seeking help when they get stuck
- User already has a problem when they arrive, and they're usually looking for concrete solutions to it



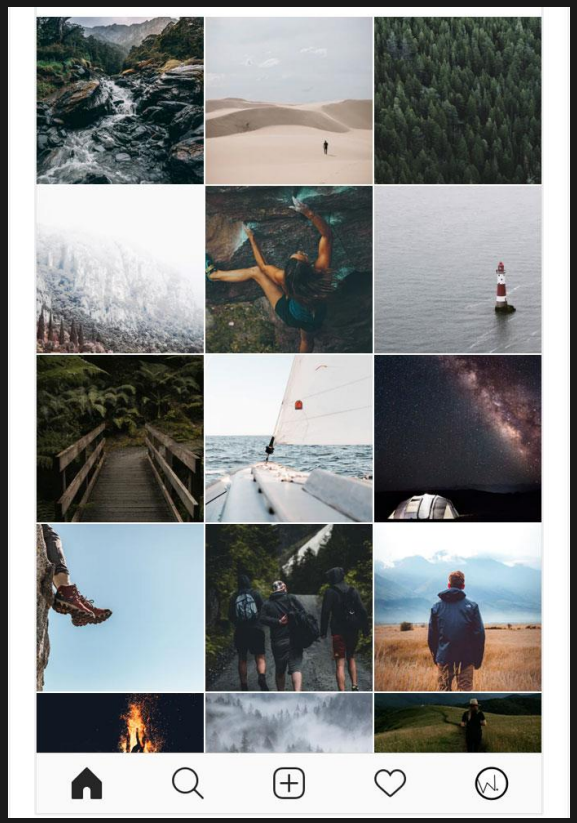
Learning by watching





How did you learn Alt-Tab?

```
\newcommand{\out}[1]{{#1}}
\newcommand{\wsl}[1]{\out{{\small\textcolor{red}{\bf [* WSL: #1]}}}}
\newcommand{\farnaz}[1]{\out{{\small\textcolor{blue}{\bf [* FJ: #1]}}}}
\newcommand{\scott}[1]{\out{{\small\textcolor{magenta}{\bf [* SC: #1]}}}}
\newcommand{\justin}[1]{\out{{\small\textcolor{purple}{\bf [* JC: #1]}}}}
\newcommand{\kori}[1]{\out{{\small\textcolor{green}{\bf [* KI: #1]}}}}
```



Support learning by watching

- The founders launched in a small private beta with 500 enthusiastic community members for three months before opening to everyone
- By the time the site launched publicly, it was full of positive examples of technical questions answered helpfully and succinctly, which set the expectation

From Stanford CS278 by Michael Bernstein

Gulfs of execution and evaluation

- Gulf of execution: how does the user know what to do?
- Gulf of evaluation: how does the user know what happened?

Gulf of execution and gulf of evaluation (https://youtu.be/bg4UwyPPZ6U?t=30)

Please answer this question in Canvas

Consider the following scenario.

Please answer this question in Canvas

Consider the following scenario.

The user approaches a vending machine intending to purchase a cola beverage.

Which of the gulfs is the user in? Select the best answer.

- ❑ The gulf of evaluation.
- ❑ The gulf of execution.
- ❑ Both the gulf of execution and the gulf of evaluation.
- ❑ Neither the gulf of execution nor the gulf of evaluation.

You have 120 seconds…

DONE!

Please answer this question in Canvas

Consider the following scenario.

The user approaches a vending machine intending to purchase a cola beverage. The user presses on a large physical button under a picture of a cola bottle on it.

Which of the gulfs is the user in? Select the best answer.

- ❑ The gulf of evaluation.
- ❑ The gulf of execution.
- ❑ Both the gulf of execution and the gulf of evaluation.
- ❑ Neither the gulf of execution nor the gulf of evaluation.

You have 120 seconds…

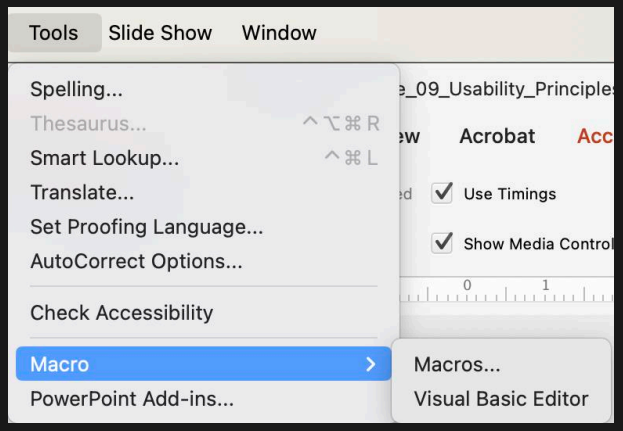
DONE!

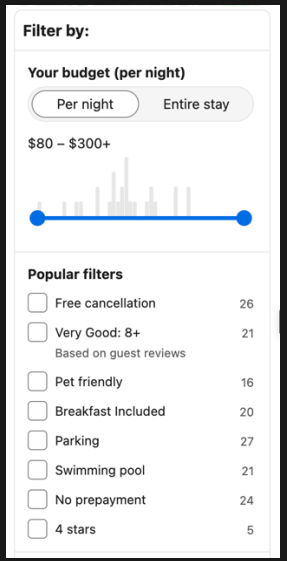
To help user bridge the gulf of execution faster:

Improve learnability

Information architecture

- Defining a structure for a website or app
- Helps users understand where they are and where to go
- Using organization mechanisms such as hierarchies, categories, tags, and filtering





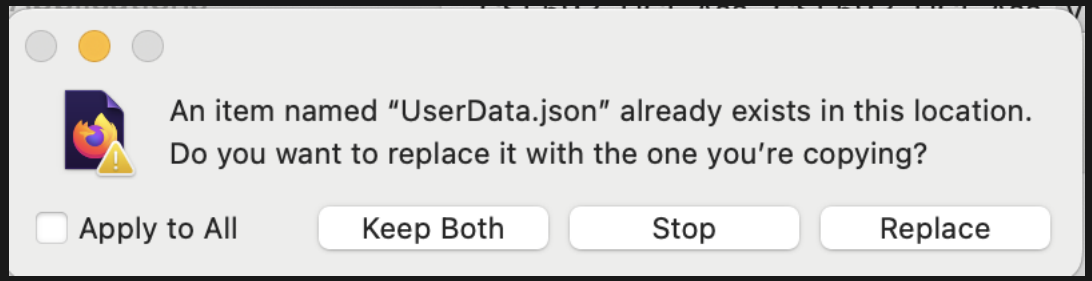
3 aspects of usability

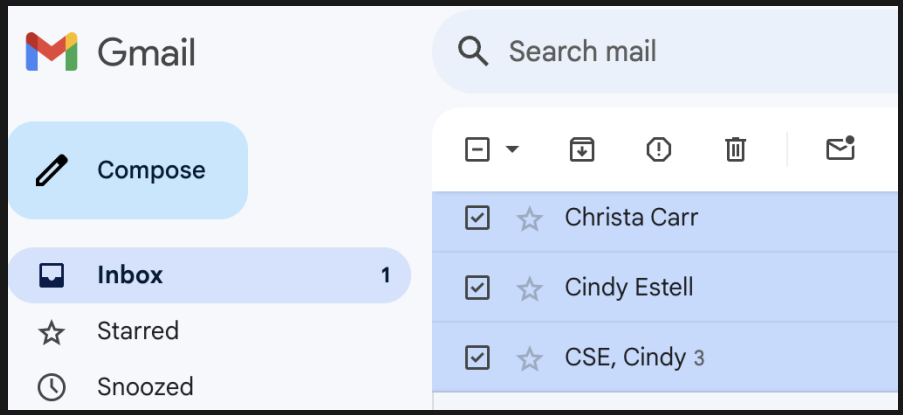
- Learnability
- Efficiency
- Safety

Efficiency

- of task
  - limit high level steps needed to accomplish goal
- of thought
  - don't make the user think or remember
- of movement
  - limit mechanical steps needed

Efficiency of task: Aggregation

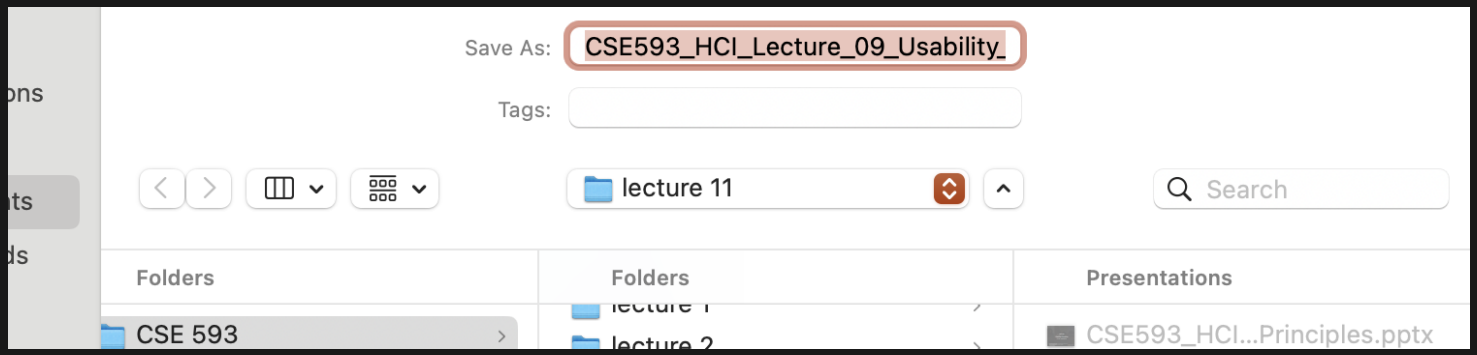




Efficiency of task: Anticipation

Defaults:

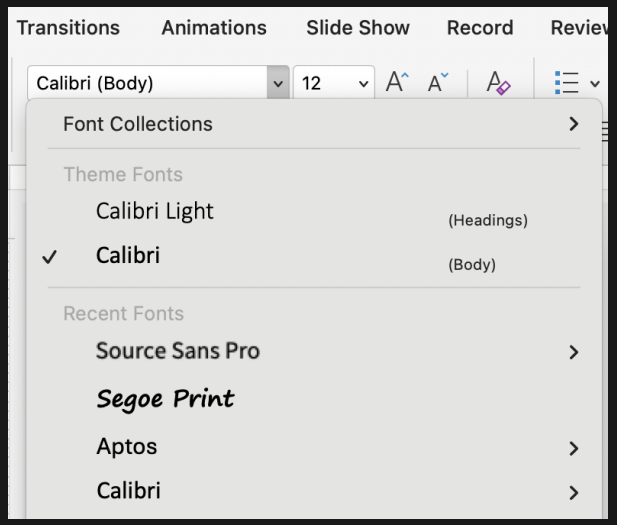
- Fill in a form with defaults
  - from history, by prediction
- Make the defaults fragile

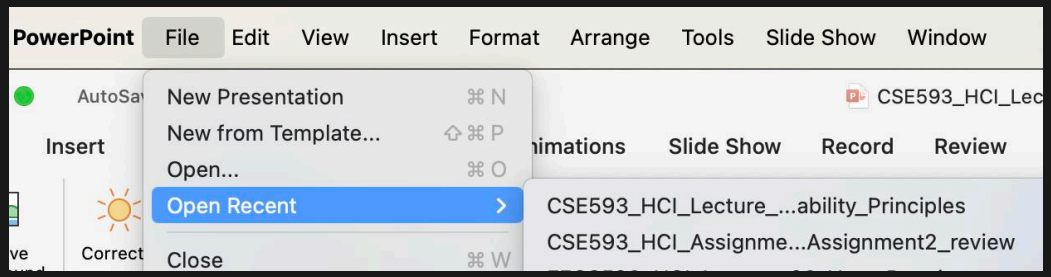


Efficiency of task: Anticipation

Support temporal locality:

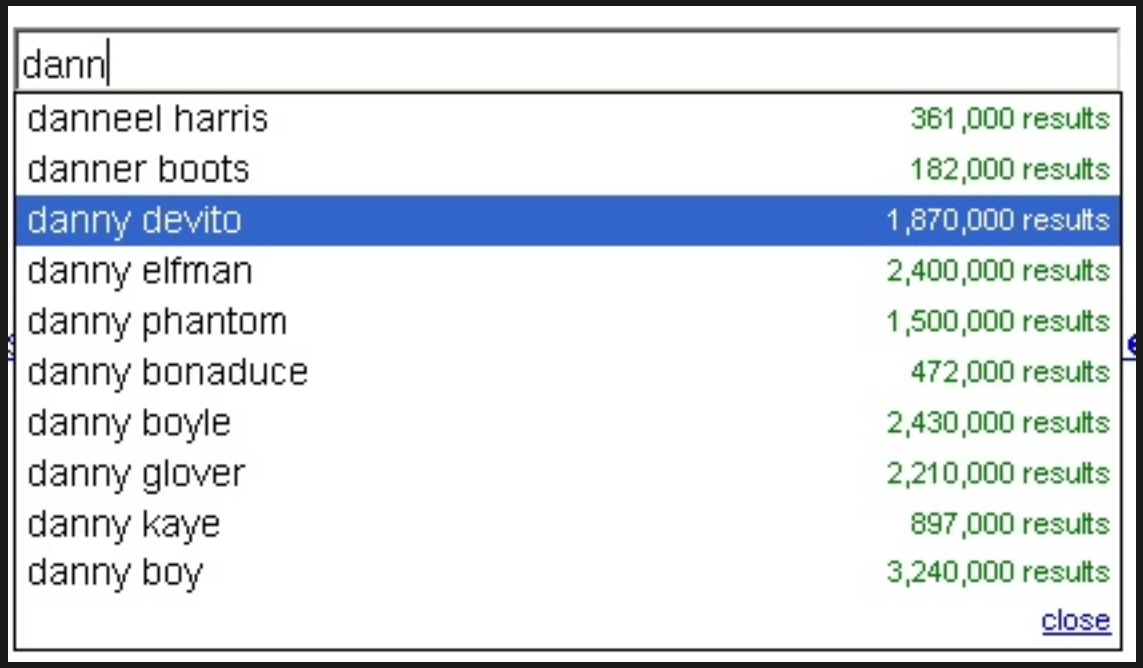
- Offer recently-used or frequently-used choices





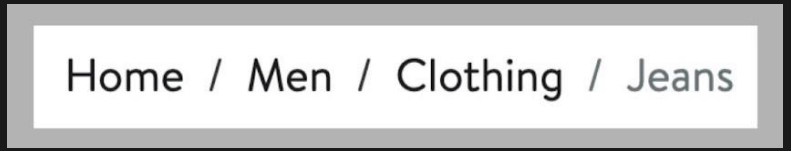
Efficiency of task: Anticipation

Autocomplete



Efficiency of thought

Recognition over recall

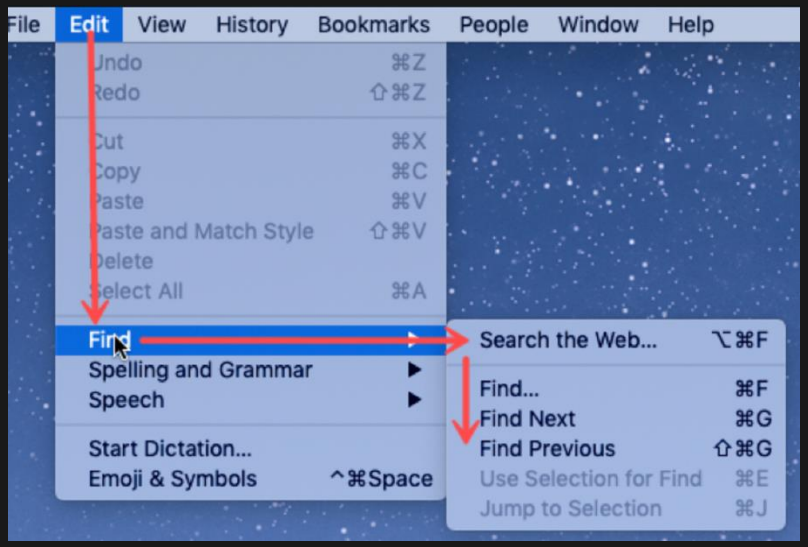


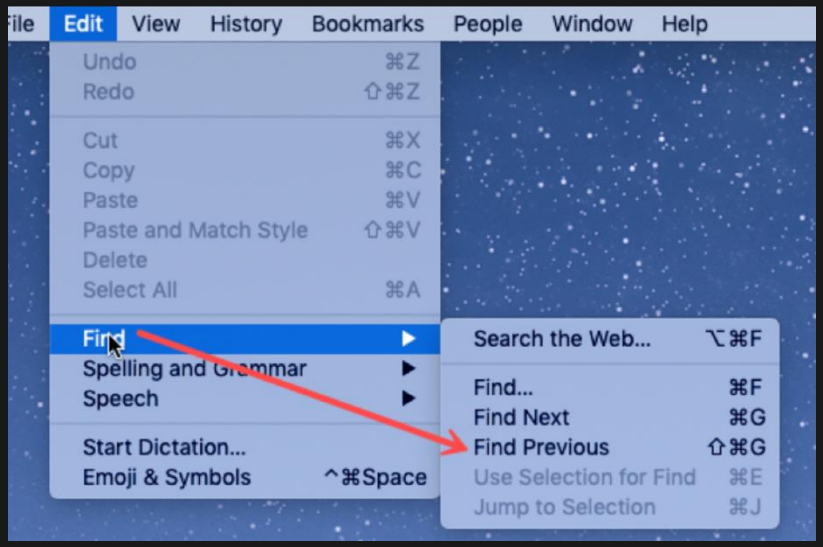
- Recognition:
  - remembering with the help of a visual cue
  - uses knowledge in the world

- Recall:
  - remembering with no help
  - requires knowledge in the head

Efficiency of movement

- Make use of Fitts's law
- Make steering easy





3 aspects of usability

- Learnability
- Efficiency
- Safety

User errors and error prevention

- Slips
- Mistakes

Slips vs. Mistakes (https://youtu.be/s0hStSMc_Rs)

Please answer this question in Canvas

Consider the following scenario.

Please answer this question in Canvas

Consider the following scenario.

The user approaches a vending machine intending to purchase a cola beverage. The user inserts the right amount of money into the machine. The user then presses on a picture of a cola on it (instead of the physical button below it), thinking it will dispense a bottle. It does not dispense anything.

Which type of error did the user make? Select the best answer.

- ❑ Mistake
- ❑ Slip
- ❑ Both a mistake and a slip
- ❑ Nether a mistake nor a slip

You have 120 seconds…

DONE!

Please answer this question in Canvas

Consider the following scenario.

The user approaches a vending machine intending to purchase a cola beverage. The user inserts the right amount of money into the machine. The user then accidentally presses on a picture of a cola on it (instead of the physical button below it), knowing it will not dispense a bottle and that they should have pressed on the physical button below it. It does not dispense anything.

Which type of error did the user make? Select the best answer.

- ❑ Mistake
- ❑ Slip
- ❑ Both a mistake and a slip
- ❑ Nether a mistake nor a slip

You have 120 seconds…

DONE!

Usability Principles (according to Norman at least)

- Visibility
- Feedback
- Constraints
- Mapping
- Consistency
- Affordance

Visibility

- Allows users to identify what can be interacted with
  (not necessarily how)

- The user cannot interact with the unknown

Visibility

- Allows users to identify what can be interacted with
(not necessarily how)

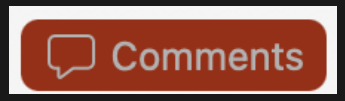
- The user cannot interact with the unknown

- Related to two important concepts: findability and discoverability

Findability & Discoverability (https://youtu.be/AKobvjBRLbY)

Feedback

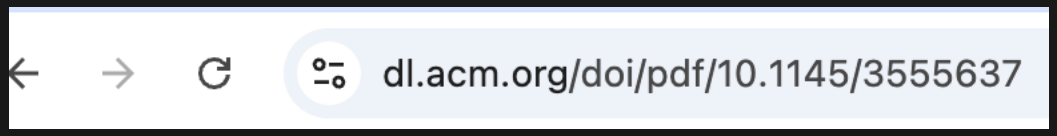
- Information about reaction in response to user action
  - Low level feedback

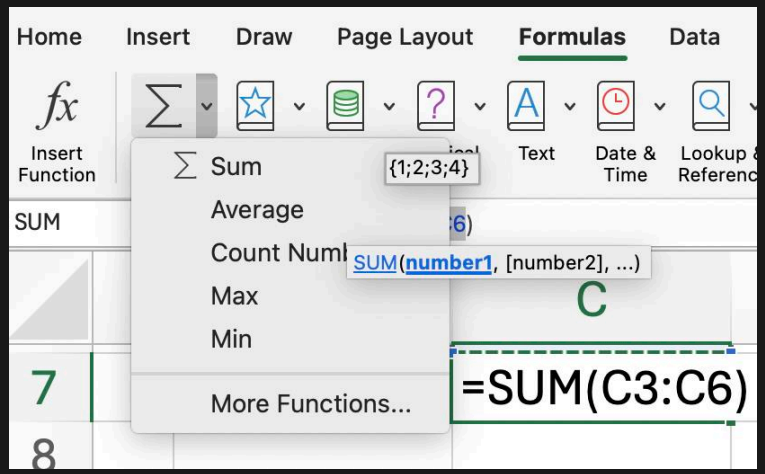


  - High level feedback

Feedback: self-disclosure

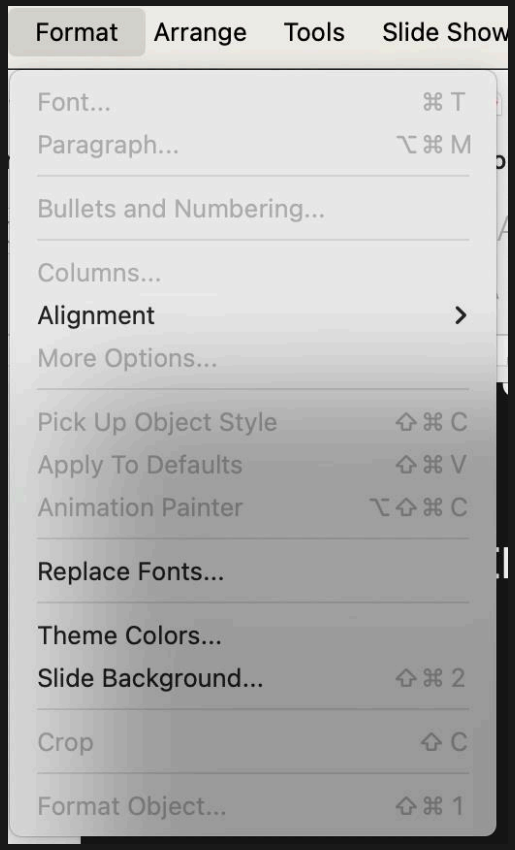
- Teaching through feedback
- Interfaces with both a GUI and a command language





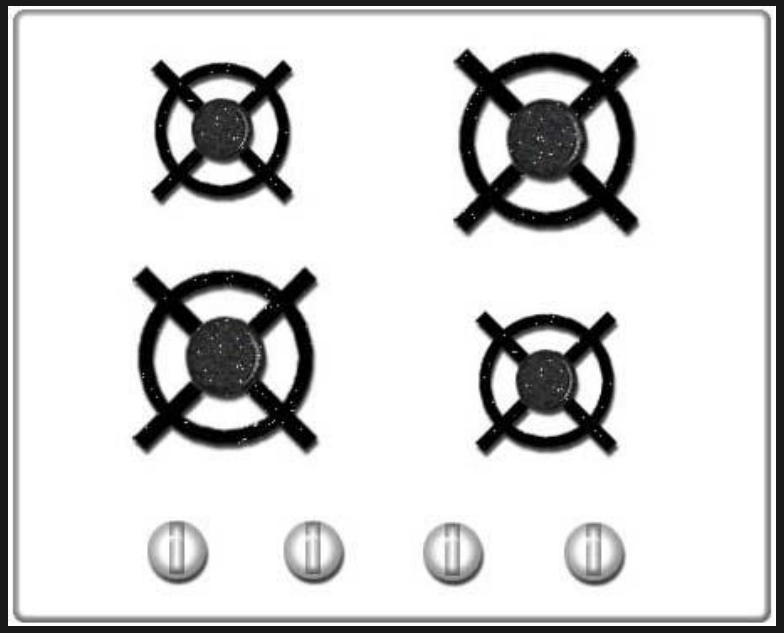
Constraints

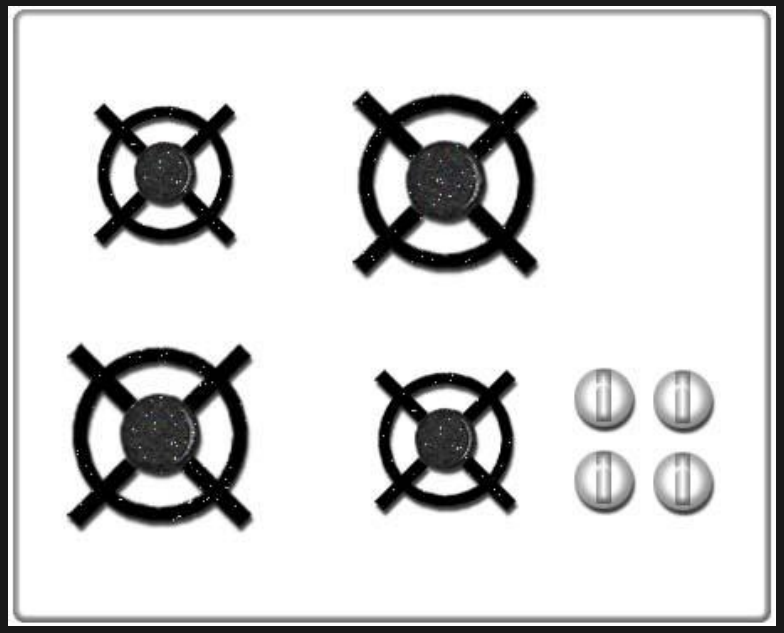
- Making restrictions on what can be done known



Mapping

- Relationship between controls and effects



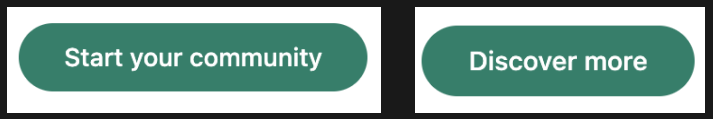


Consistency

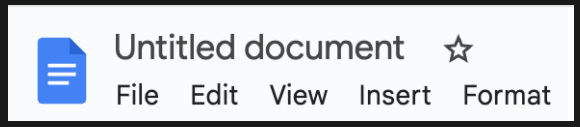
- Leverage known standards and conventions to improve familiarity
  - Similar things should look and act, in similar ways.
  - Different things should be visibly different.
- aka, the principle of “least surprise”

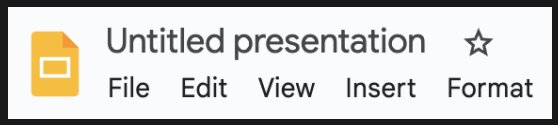
Consistency

- Internal consistency

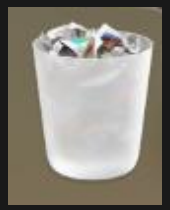


- External consistency





- Metaphorical consistency



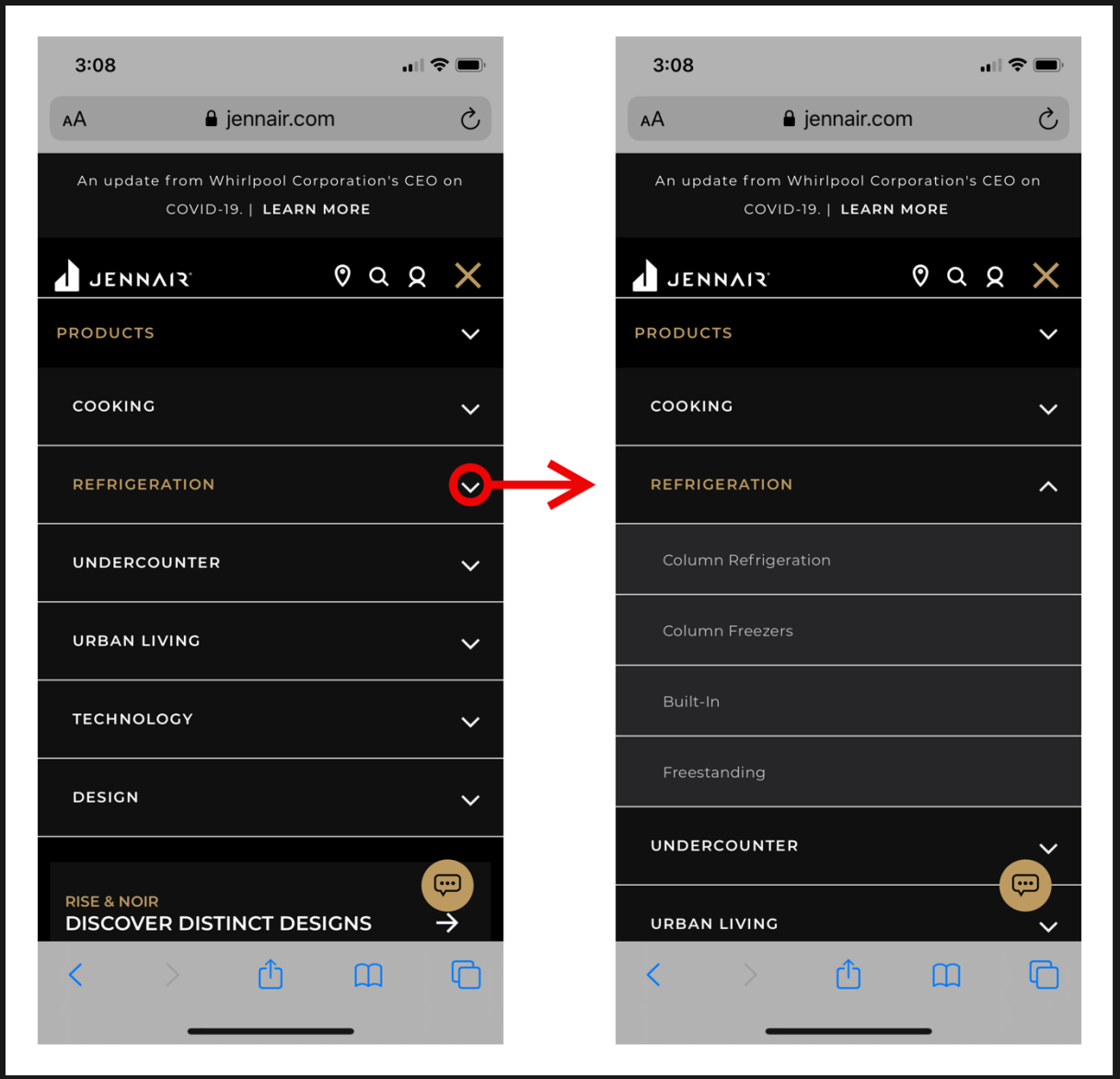
MacOS’s natural scrolling

- Broke the familiar pattern for scrolling
- Breaking external consistency?
- With other applications, yes. With apple devices no.
- But perhaps more metaphorically consistent!

Affordances and Signifiers

- Clues that allow users to identify how to interact
- Affordances: Inherent properties of an object that show how it can be used
- Signifiers: visual cues that communicate where and how an action should take place


No dogs
except guide dogs
PULL
Signifies
pulling
PULL



Example from https://www.nngroup.com/articles/accordion-icons/


No dogs
except guide dogs
PULL
PULL
Signifies pulling
Affords pushing

Affordances and Signifiers

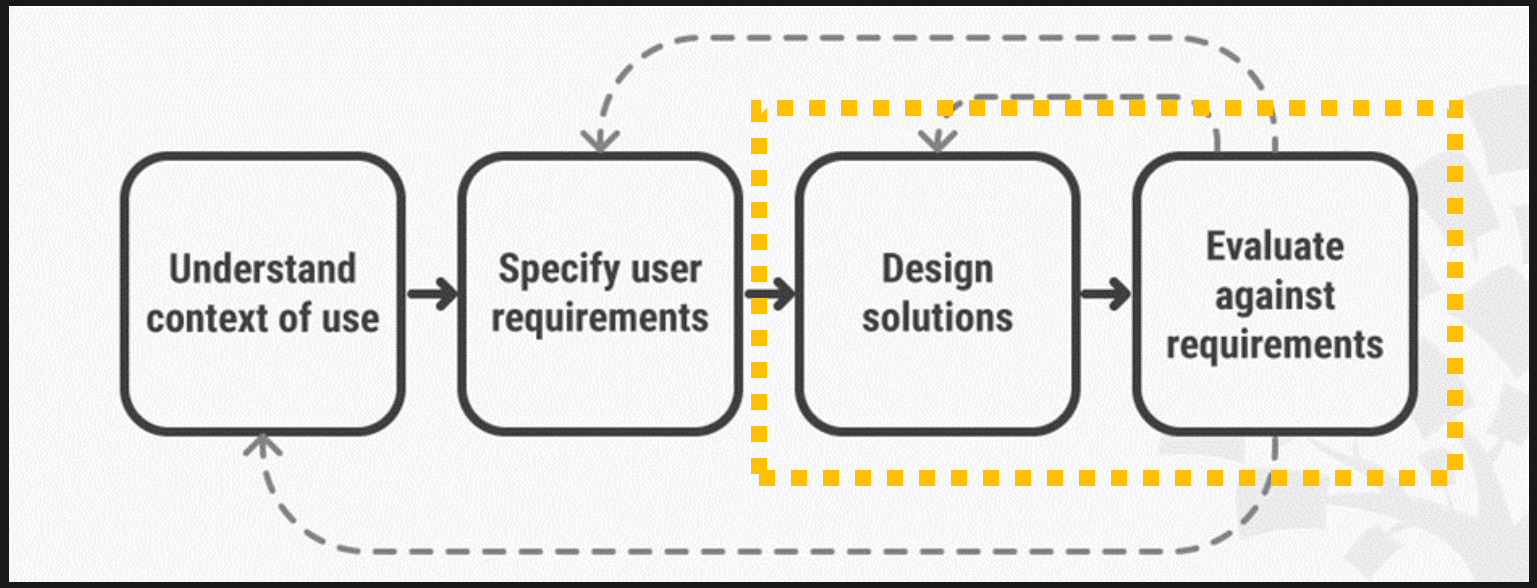
Virtual objects

Usability Heuristics

#1 Visibility of system status
#2: Match between system and the real world
#3: User control and freedom
#4: Consistency and standards
#5: Error prevention
#6: Recognition rather than recall
#7: Flexibility and efficiency of use
#8: Aesthetic and minimalist design
#9: Help users recognize, diagnose, and recover from errors
#10: Help and documentation

https://www.nngroup.com/articles/ten-usability-heuristics/
https://www.youtube.com/playlist?list=PLJOFJ3Ok_idtb2YeifXIG1-TYoMBLoG6I

User-Centered Design Process



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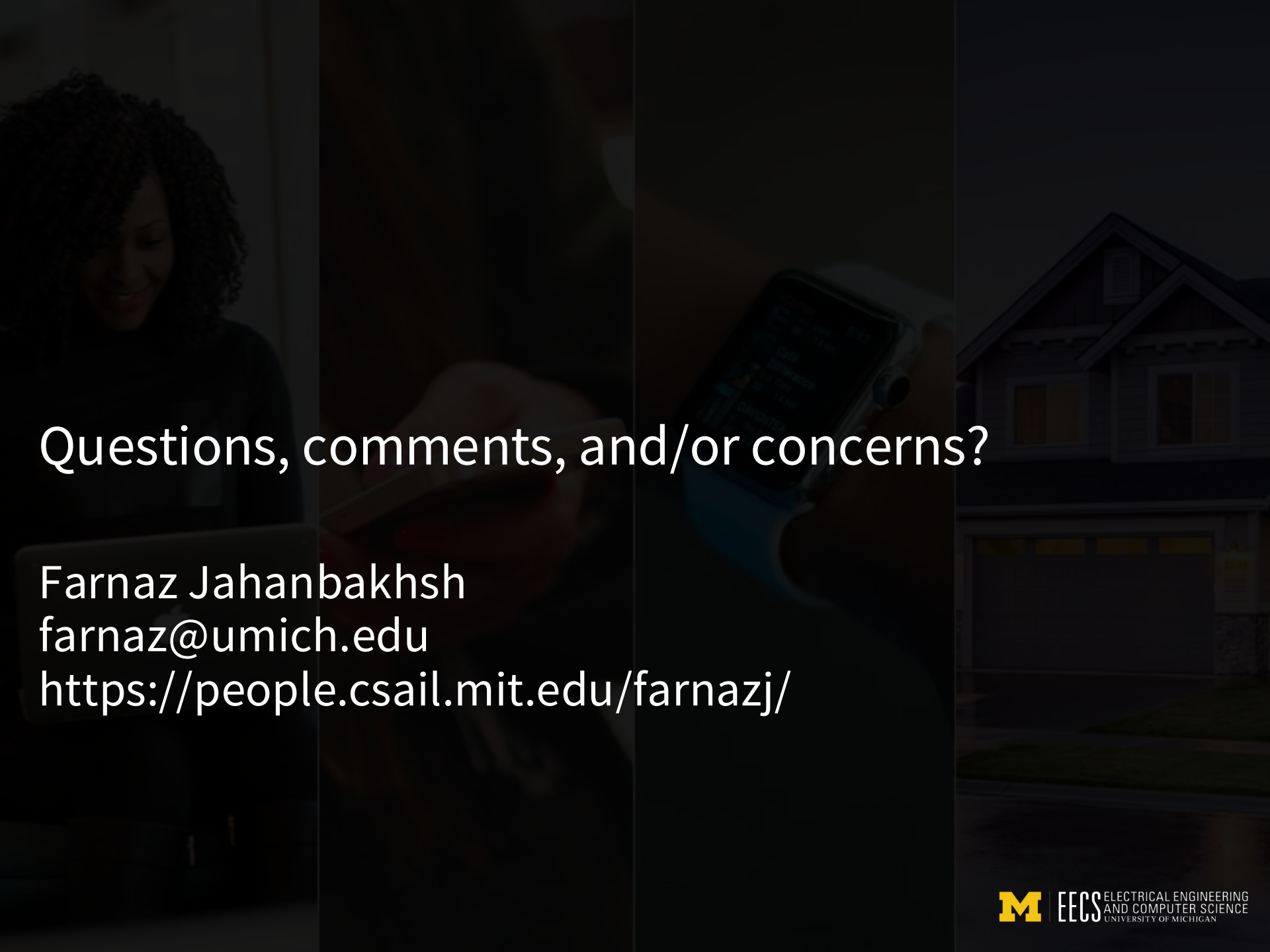

Questions, comments, and/or concerns?

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