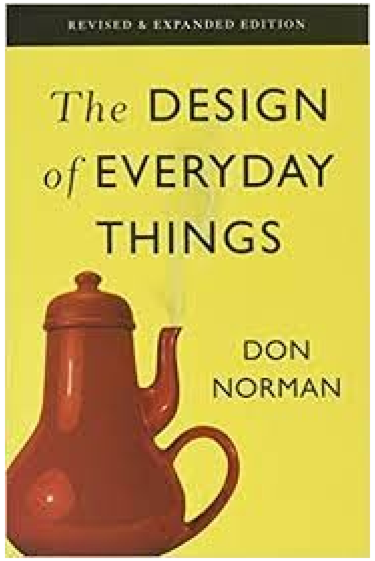
Fundamentals of Interaction

With lots of credit to Khai Truong and Gillian Hayes
for contributions to this lecture

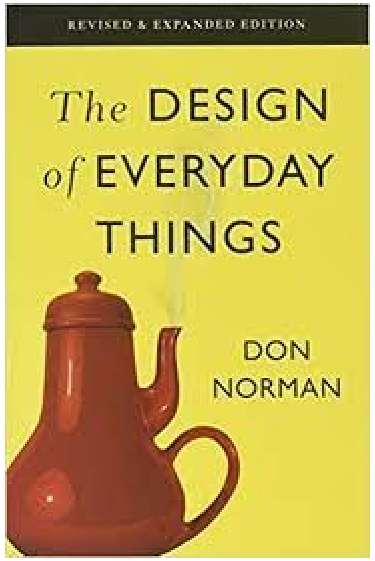
The Design of Everyday Things

- Written by Don Norman
  - UCSD
  - Nielsen Norman Group (nngroup.com)
- The hidden frustrations with everyday things
- Principles for design

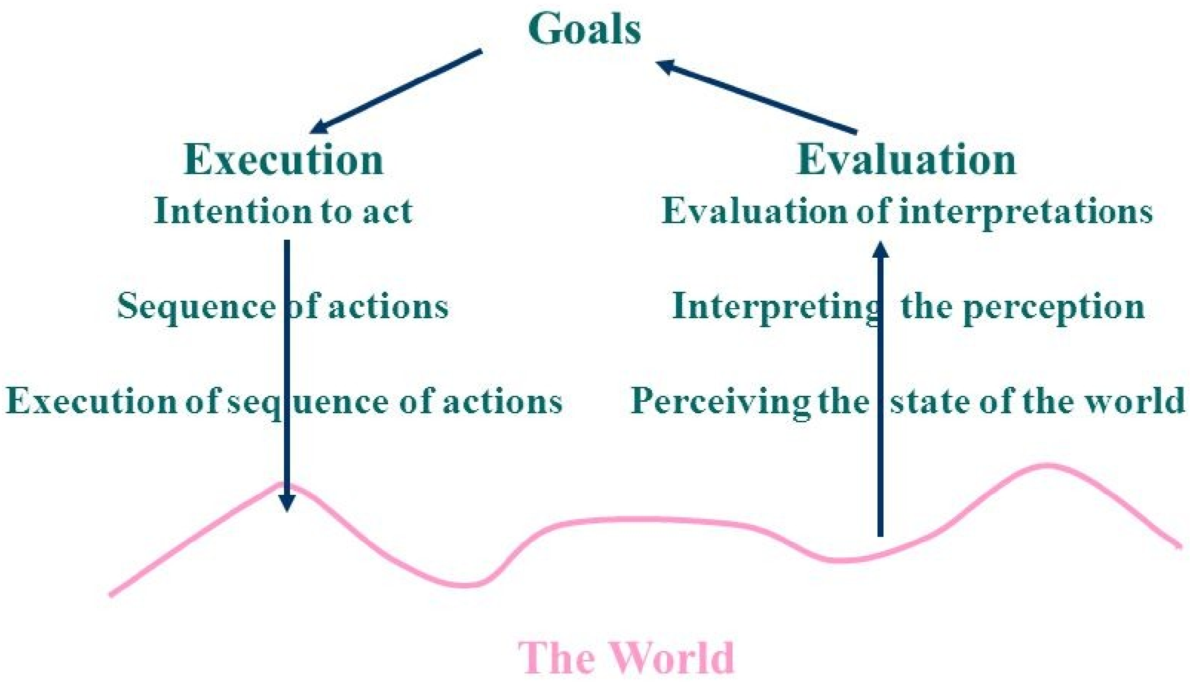


The Design of Everyday Things

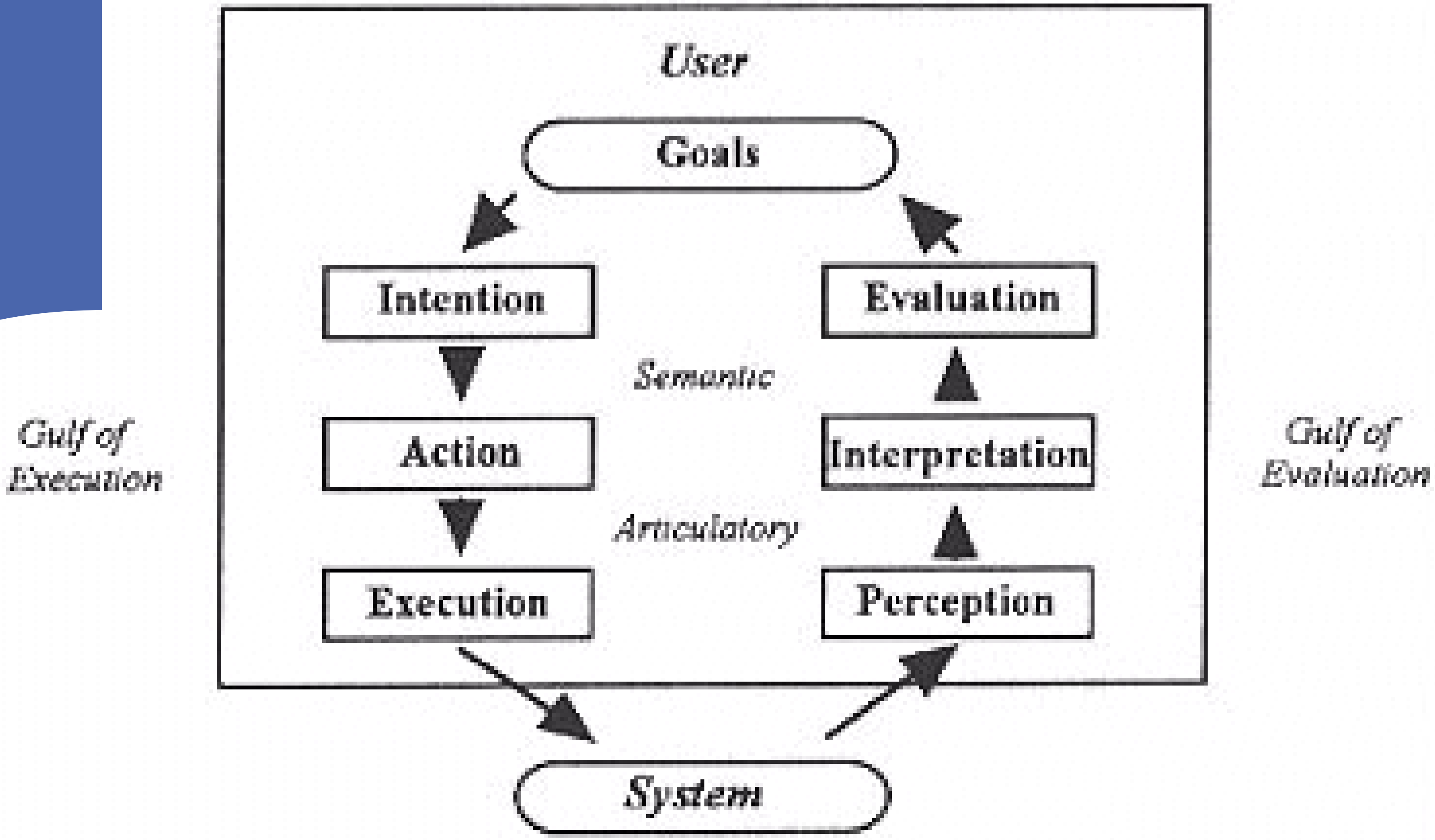
"The basic idea is simple. To get something done, you have to start with some notion of what is wanted—the goal that is to be achieved. Then, you have to do something to the world, that is, take action to move yourself or manipulate someone or something. Finally, you check to see that your goal was made. So there are four different things to consider: the goal, what is done to the world, the world itself, and the check of the world. The action itself has two major aspects: doing something and checking. Call these *execution* and *evaluation.*" [Norman, p. 46.]



Goals, Execution, & Evaluation


Goals
Execution
Intention to act
Sequence of actions
Execution of sequence of actions
Evaluation
Evaluation of interpretations
Interpreting the perception
Perceiving the state of the world
The World

Seven Stages of Action

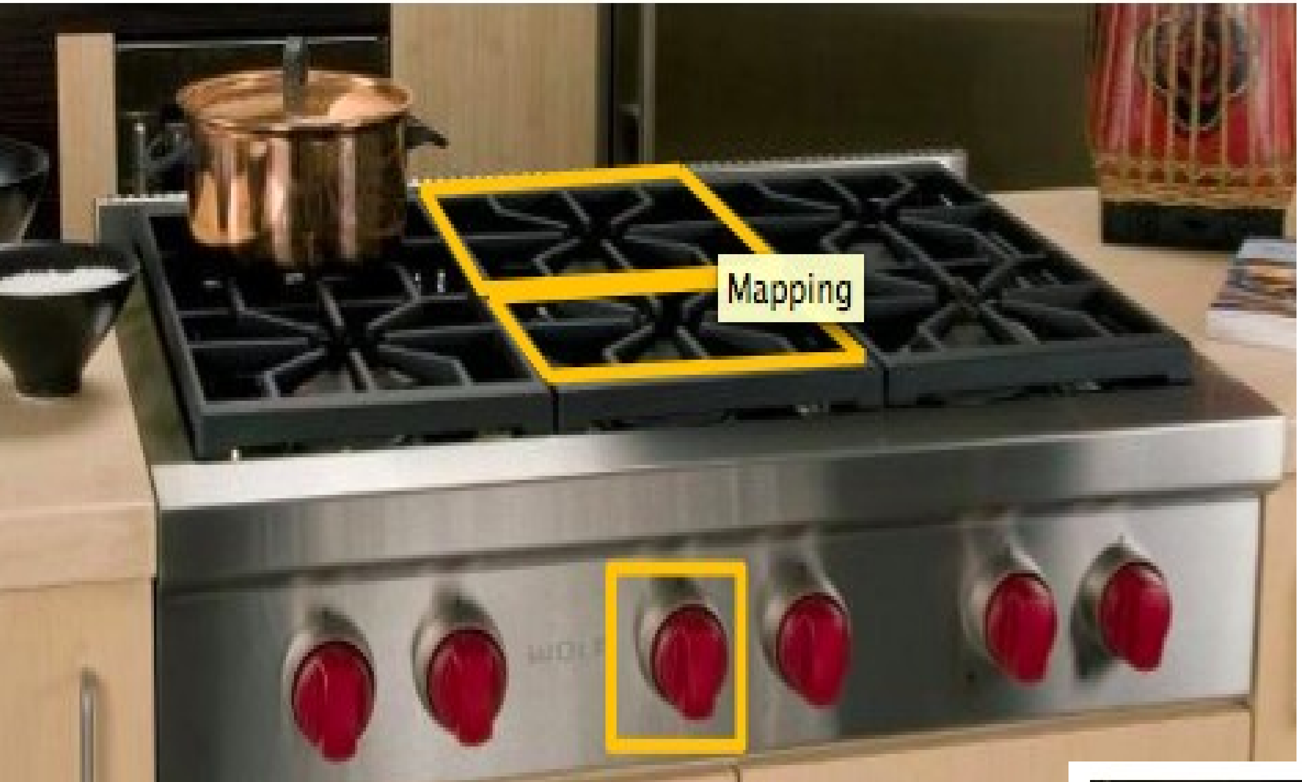


Important Design Principles

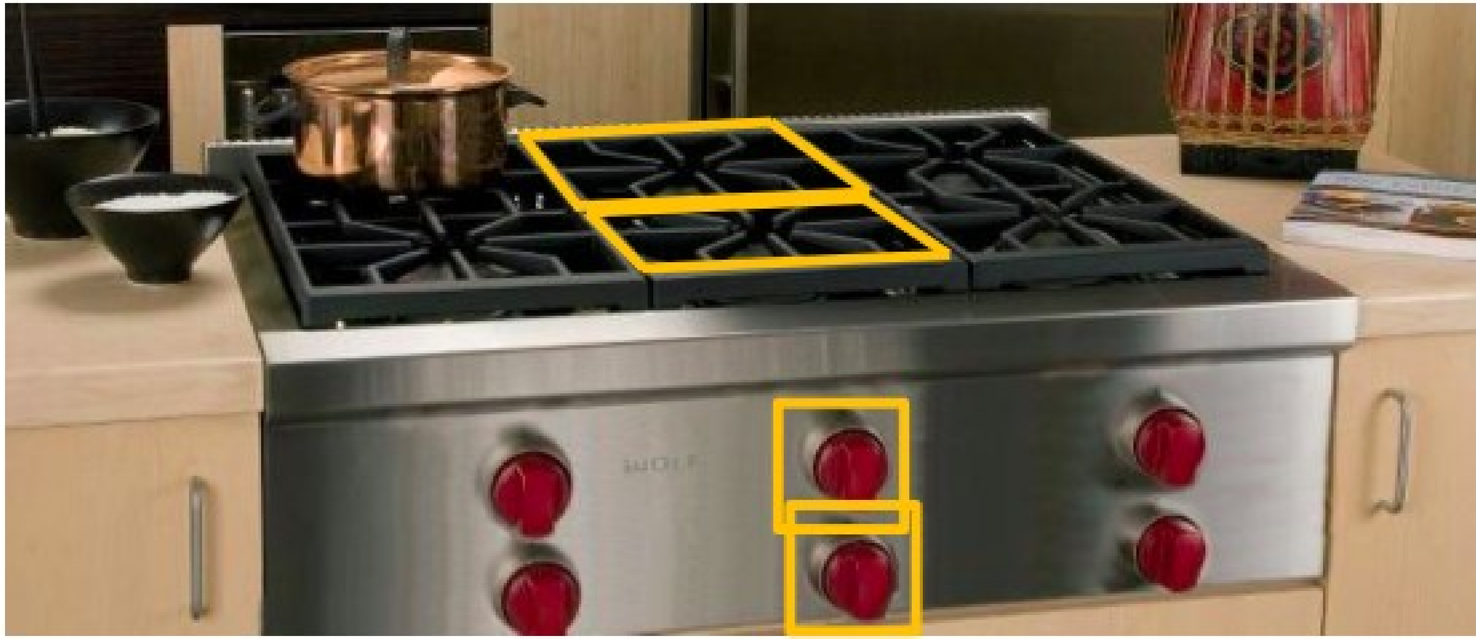
- Natural mapping
- Visibility
- Perceived affordance
- Constraints
- Feedback
- Mental / conceptual models

Mapping

- The relationship between two things
- Relationship between controls & their manipulations and the results in the world



Or



Visibility

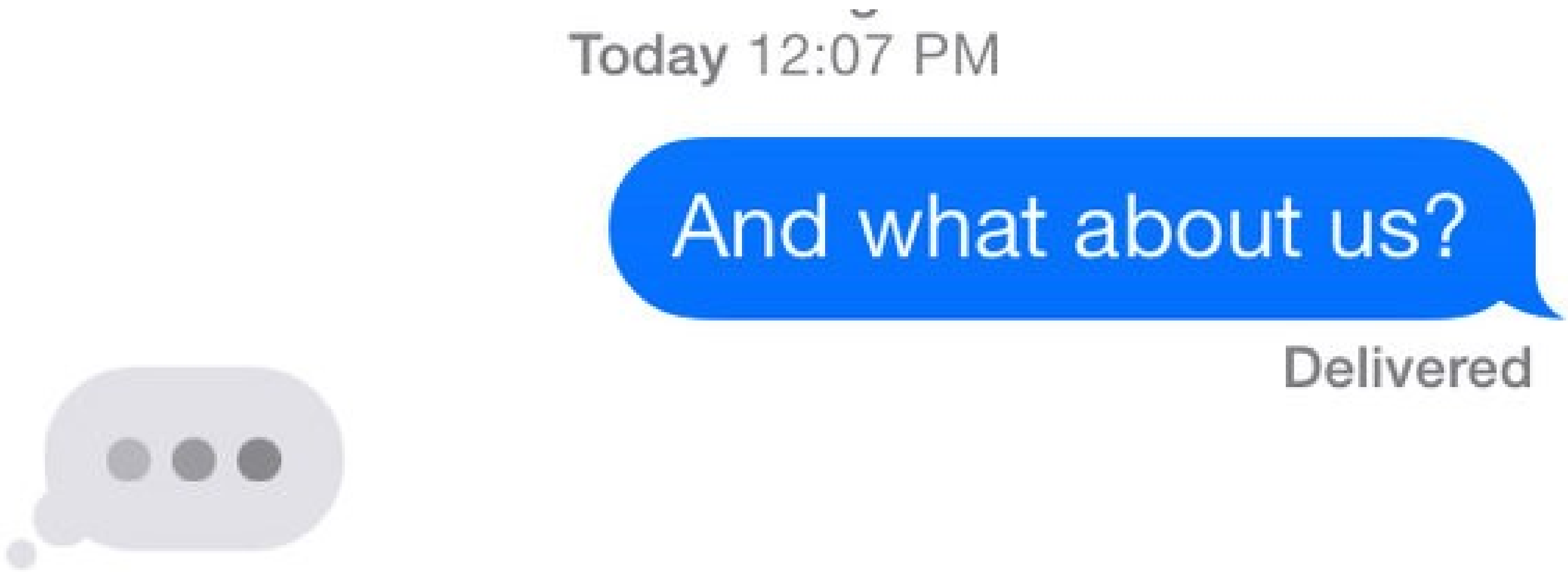
- Make capabilities perceivable and interpretable
- Counteracting factors
  - Features
  - Aesthetics
  - Abstractions

Visibility

- When number of functions is greater than number of controls, functionality is often hidden
- When capabilities are visible, it does not require memory of how to use
- Leverage recognition over recall
  - Knowledge“in the world” vs.“in the head”

Feedback

- Sending back to the user information about what action has actually been done, what result has been accomplished
- I.e., let someone know what just occurred
    - Can be sound that’s made
    - Can be change in physical state



Today 12:07 PM

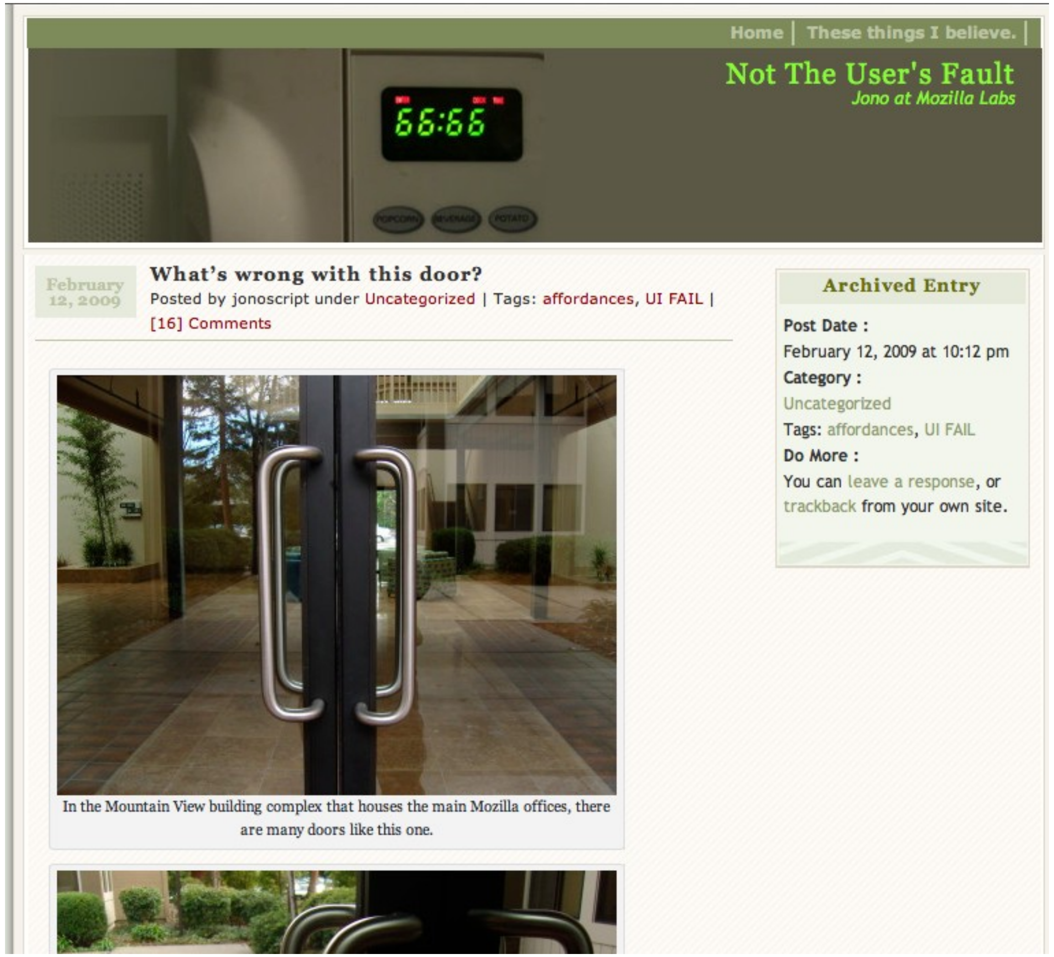
And what about us?

Delivered

Affordance

- Perceived and actual clues about something
  - …that determine just how a thing could possibly be used
  - These are NOT features!
- How does this apply to design?
- Complex things may need explanation, but simple things should not
- If a simple thing requires instructions, it is likely a failed design

Norman’s pet peeve: door handles



Not The User's Fault

Jono at Mozilla Labs

February 12, 2009

What’s wrong with this door?

Posted by jonoscript under Uncategorized | Tags: affordances, UI FAIL | [16] Comments

In the Mountain View building complex that houses the main Mozilla offices, there are many doors like this one.

Archived Entry

Post Date :
February 12, 2009 at 10:12 pm

Category :
Uncategorized

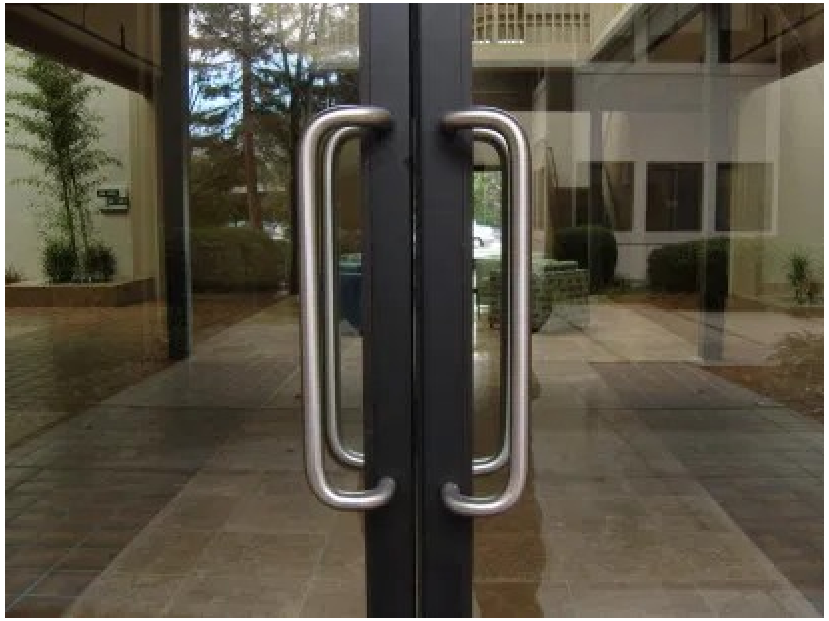
Tags: affordances, UI FAIL

Do More :
You can leave a response, or trackback from your own site.

An example from the Mozilla offices in Mountain View

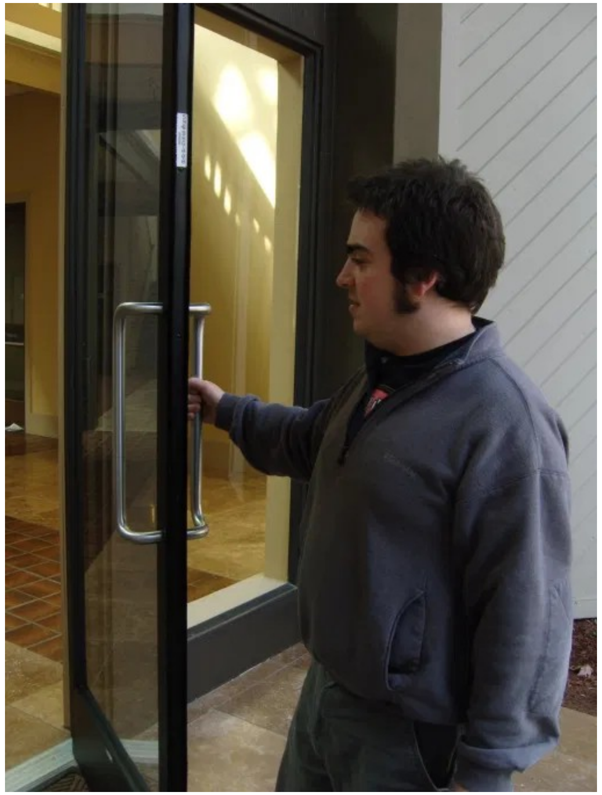
From
http://jonoscript.wordpress.com/2009/02/12
/whats-wrong-with-this-door/

Norman’s pet peeve: door handles



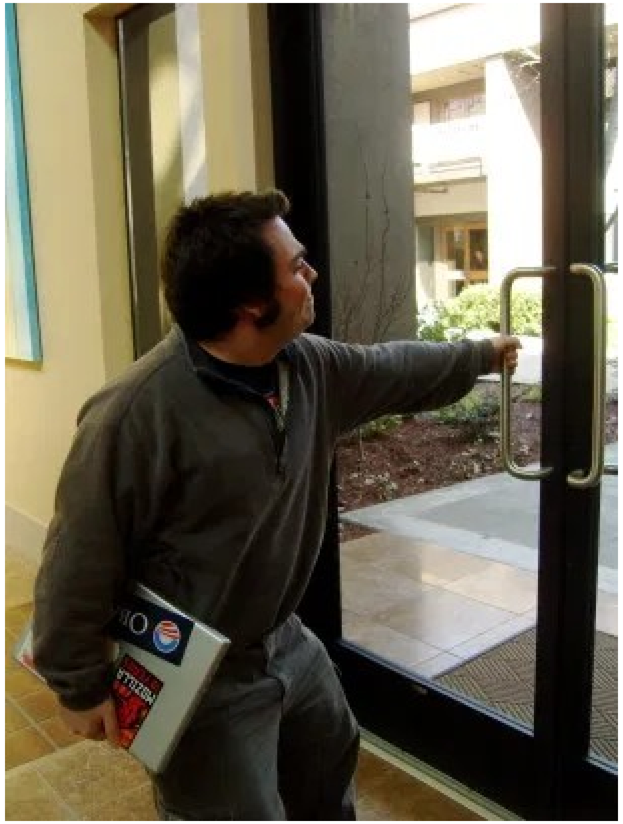
What is your natural reaction to opening a door with this type of handle for the first time?

Norman’s pet peeve: door handles



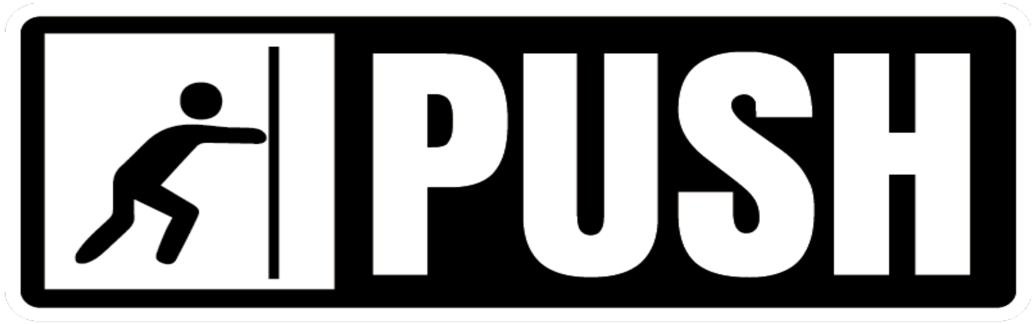
A vertical handle like this one *affords* pulling.

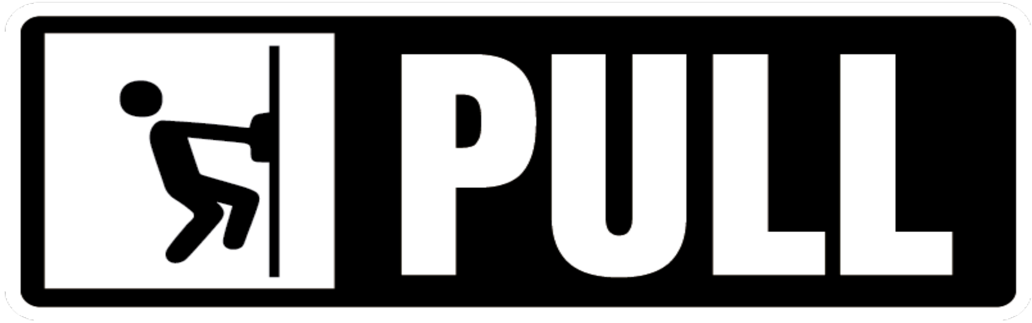
Norman’s pet peeve: door handles



But when you are on the other side…the interaction changes. The design breaks down.

Norman’s pet peeve: door handles

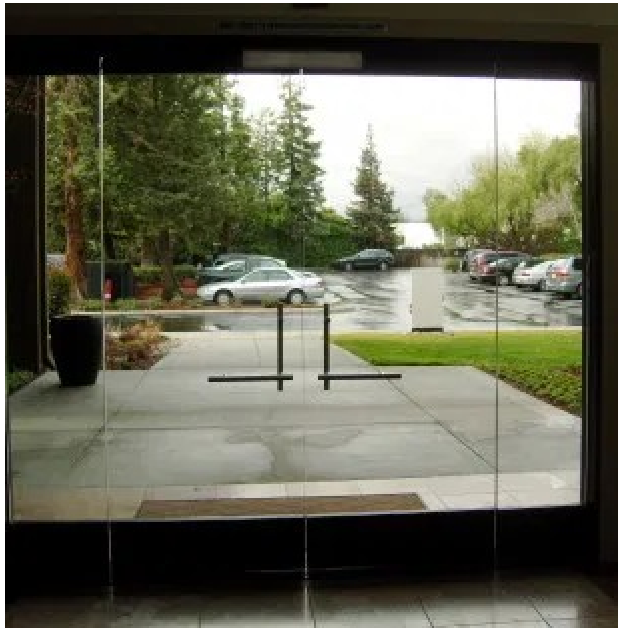


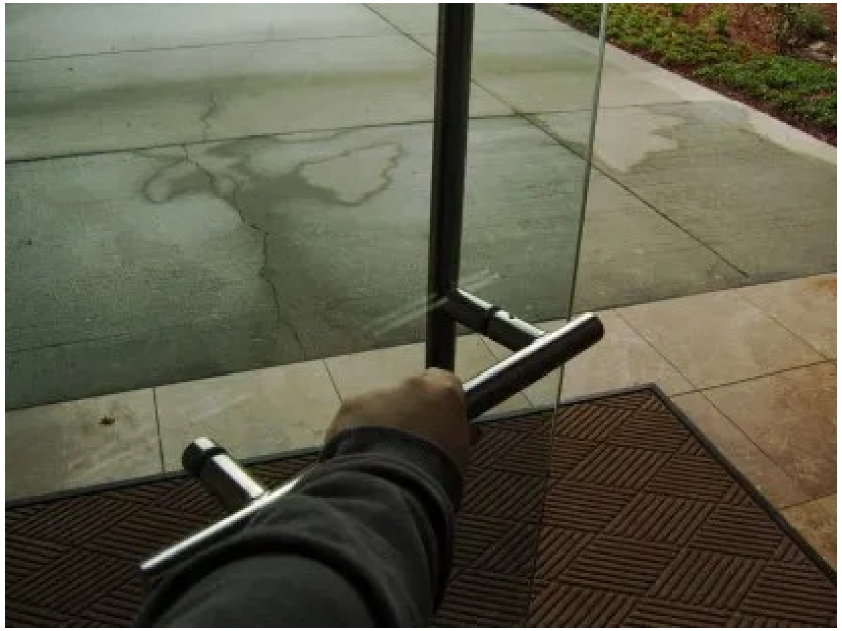


One way to solve poor affordance.

But does improve the design?

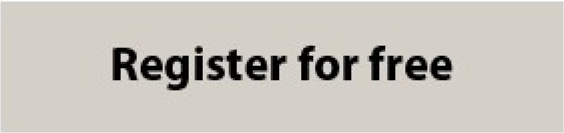
Norman’s pet peeve: door handles

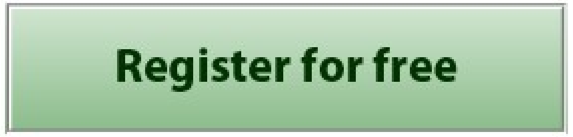




A better approach…

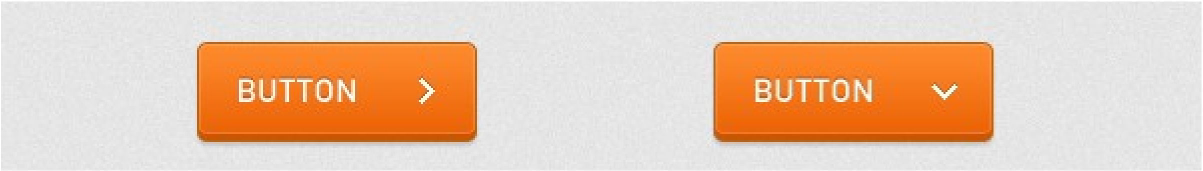
Different doors in the same building!?





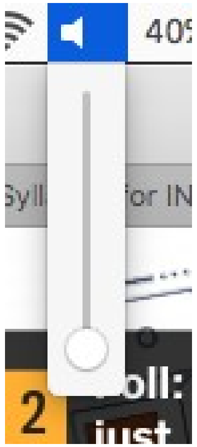
Which affords clicking?

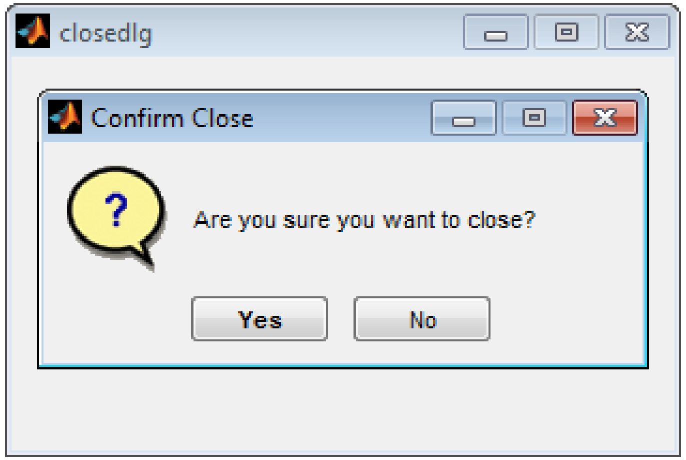
What do these two buttons afford?



Constraints

“Physical" or psychological limitations that constrain possible actions





Are you sure you want to close?

Conceptual Models

- People build their own understanding of how things work
- But how? What factors contribute to a user’s conceptual model of a system?
  - Visibility
  - Affordances
  - Constraints
  - Mappings

Conceptual Model Examples

Elevator Door Close Buttons and Walk Signals

- How do you think they work?
- Mental models are not always right

People are explanatory (usually)

- ✓ Sometimes they get it right
- ✕ Sometimes they blame the wrong cause
- ☹ Sometimes they blame themselves

Learned helplessness

Designers should work to foster the appropriate conceptual model

1. How does something actually work?

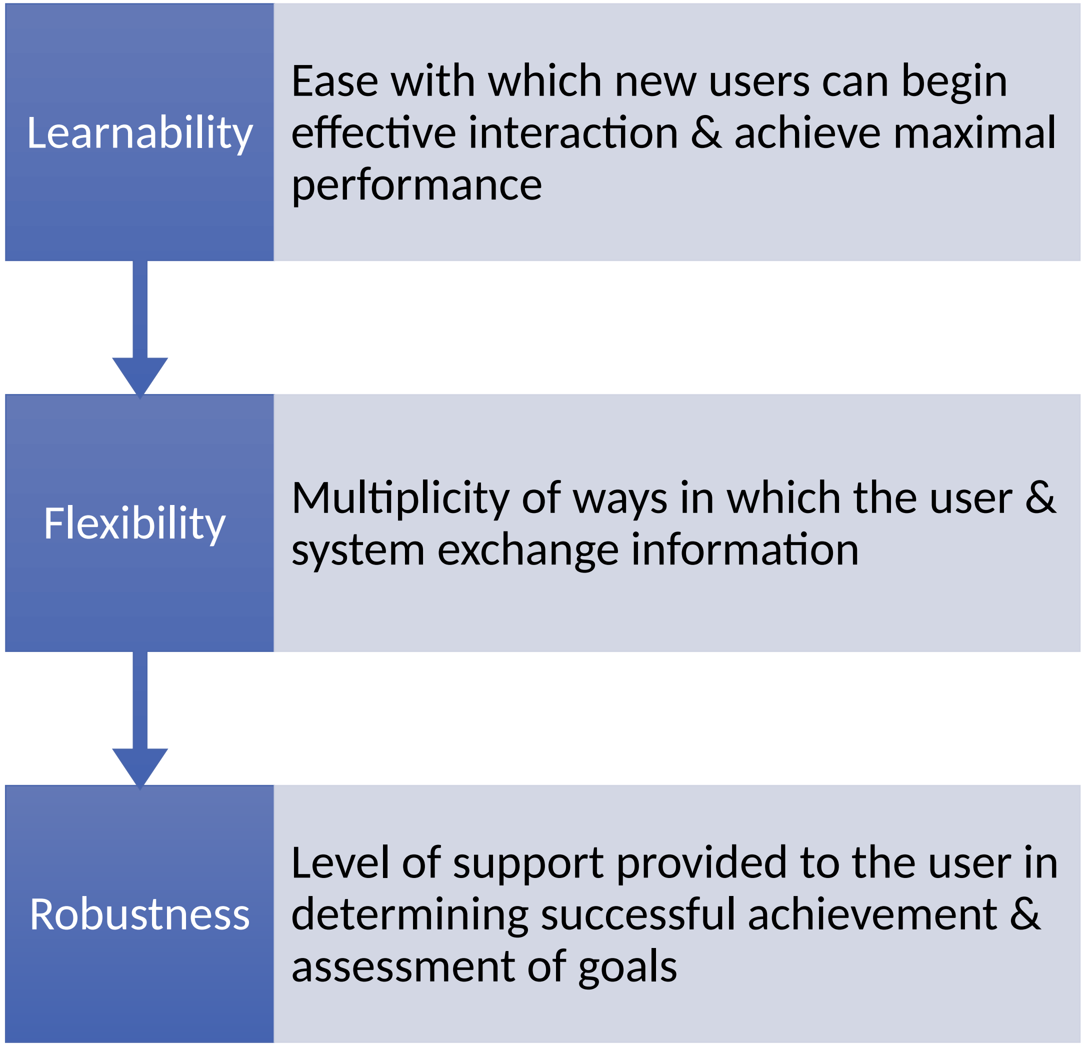
2. How does the user think the thing works?

3. How should the user conceptualize about (1) ?

Designing for people

- Designers are not users & vice versa
  - The user is not like me!!!
- Provide clear mappings between controls and behaviors
  - Make states & possible actions/behaviors visible
  - Afford & constrain the intended use
  - Provide feedback of actions/behaviors
  - Foster appropriate mental models

Principles of Usability



Learnability

Ease with which new users can begin effective interaction & achieve maximal performance

Flexibility

Multiplicity of ways in which the user & system exchange information

Robustness

Level of support provided to the user in determining successful achievement & assessment of goals

Learnability: Predictability

- Based on the user’s interaction with the system thus far, can the user determine the result of a future interaction with the system?

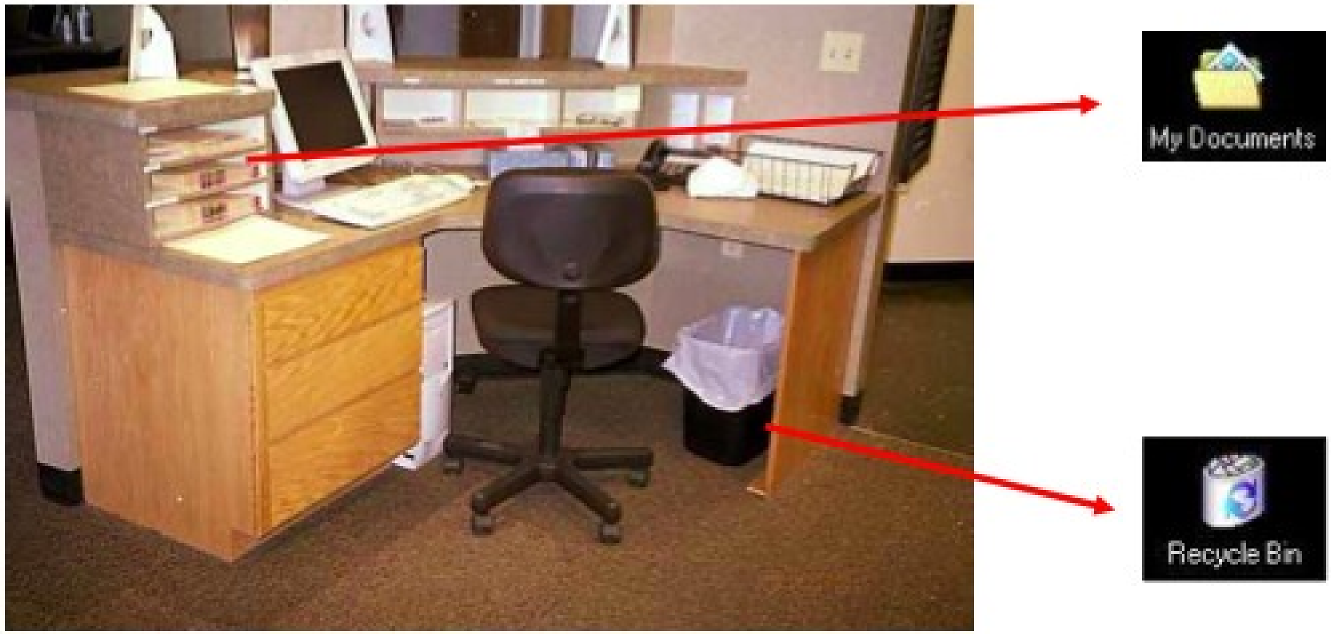
- I think that this action will do…

Learnability: Synthesizability

Based on the current state, can the user accurately assess the effect of past operations?

Learnability: Familiarity

Does the user’s existing knowledge correspond to the knowledge necessary to effectively interact with the system?

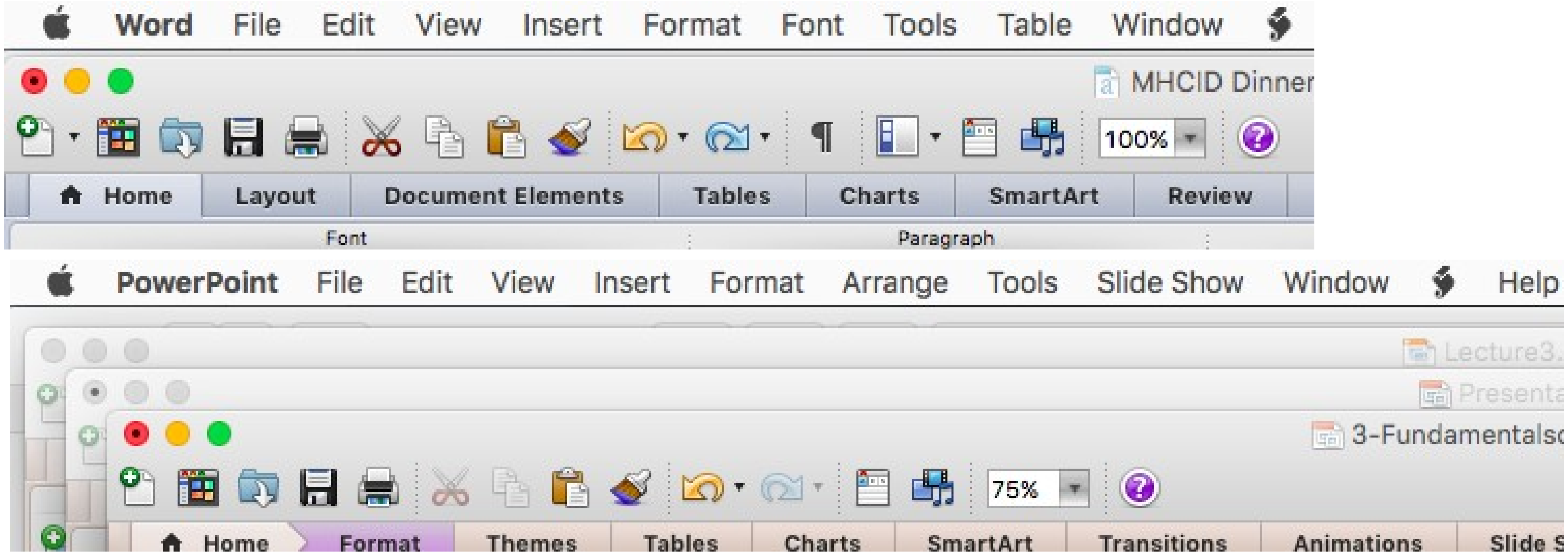


Learnability: Generalizability

Can the user's knowledge from a specific interaction with the system be extended to apply to similar, novel interactions?

Learnability: Consistency

Do similar situations or similar task objectives result in similar system behaviors?


Word File Edit View Insert Format Font Tools Table Window
MHCID Dinner
100%
Home Layout Document Elements Tables Charts SmartArt Review
Font
Paragraph
PowerPoint File Edit View Insert Format Arrange Tools Slide Show Window Help
Lecture3.
Presenta
3-Fundamentals
75%
Home Format Themes Tables Charts SmartArt Transitions Animations Slide S

Flexibility

- Dialog initiative
- Multi-threading
- Task migratability
- Substitutivity
- Customizability

Flexibility: Dialog Initiative

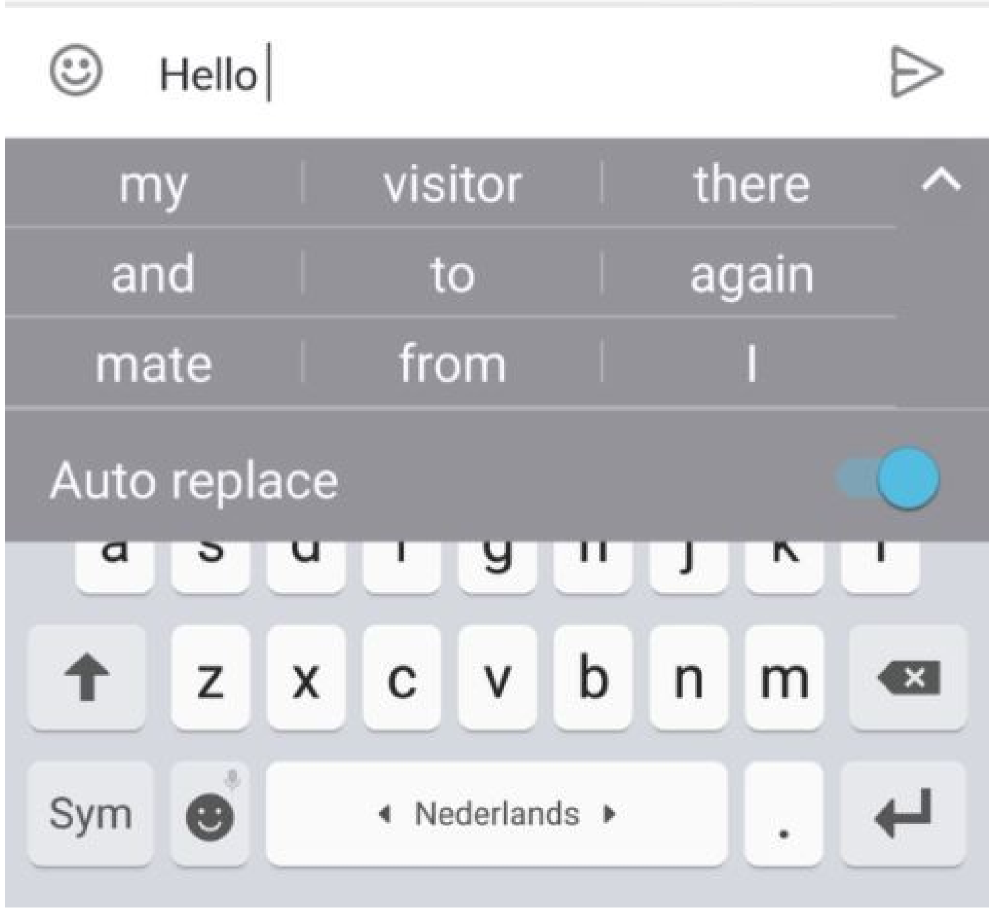
- Does the user have the control and freedom to initiate system requests, or does the system constrain the user’s actions?
  - User pre-emptive
  - System pre-emptive

Flexibility: Multi-Threading

- Does the user-system interaction allow for multiple separate threads of interaction?
- Two types
  - Concurrent: multiple tasks simultaneously
  - Interleaved: many tasks, but input to one at a time

Flexibility: Task Migratability

Can control over a task be passed between the user and the system as necessary?



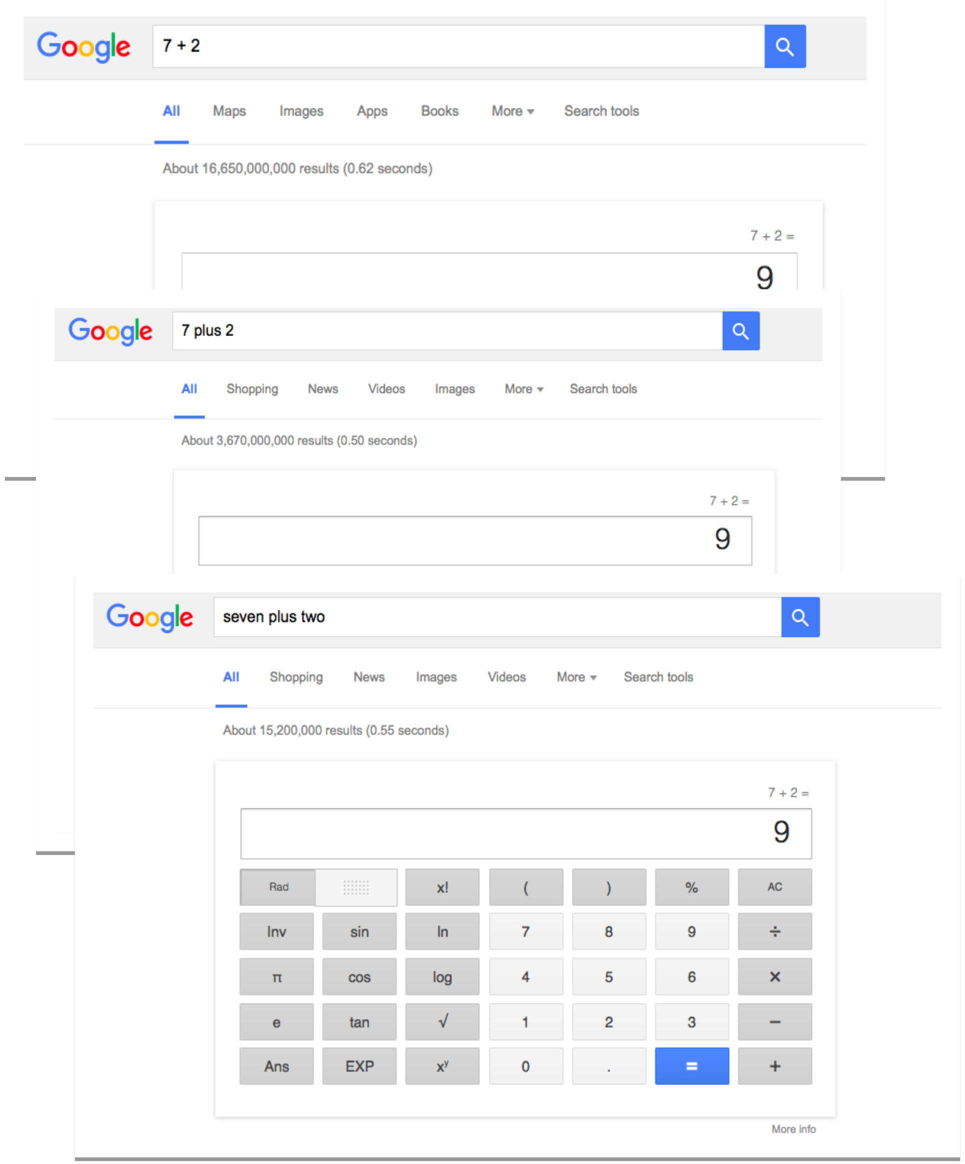
Hello

my	visitor	there
and	to	again
mate	from	I

Auto replace

Flexibility: Substitutivity

Can equivalent values be substituted and recognized as the same?



7 + 2

About 16,650,000,000 results (0.62 seconds)

7 + 2 =

9

7 plus 2

About 3,670,000,000 results (0.50 seconds)

7 + 2 =

9

seven plus two

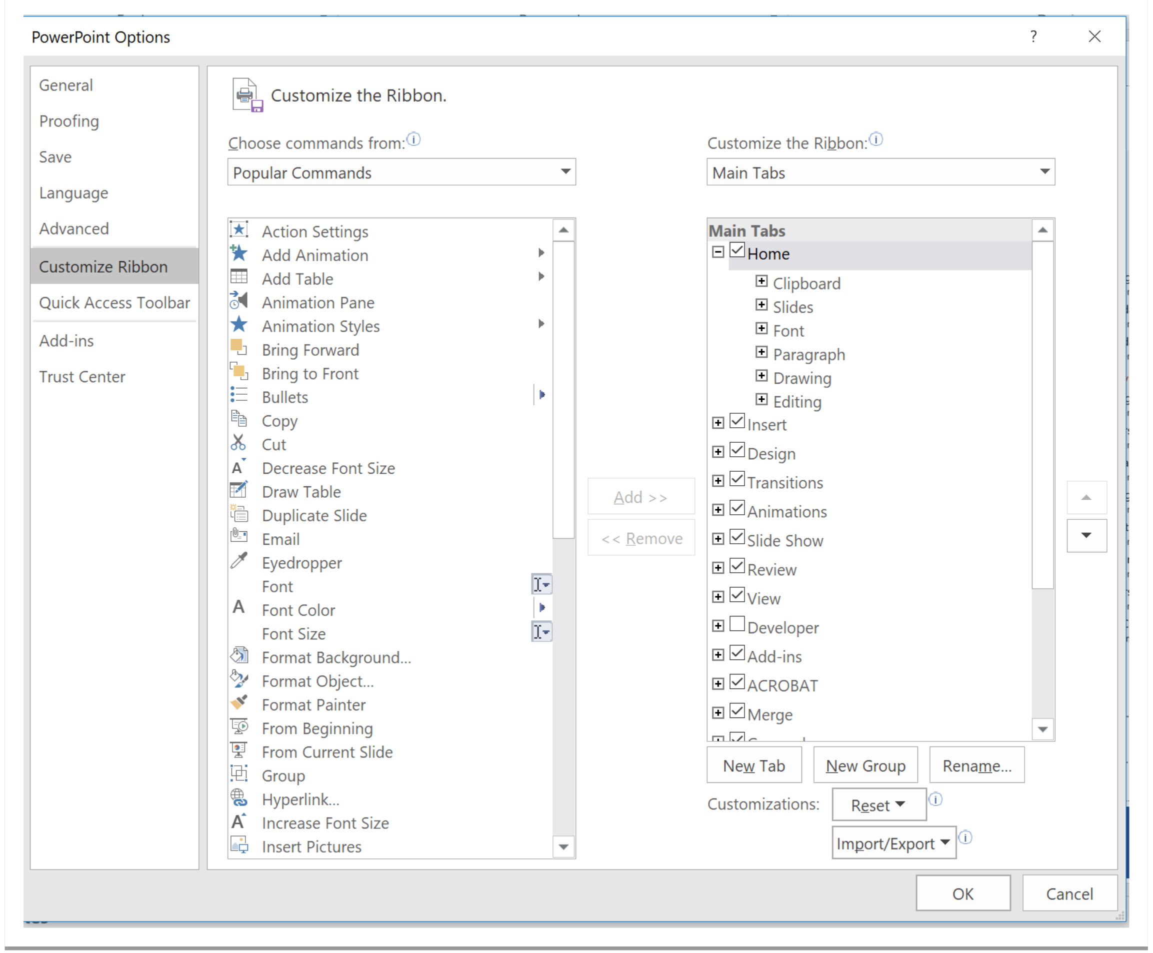
About 15,200,000 results (0.55 seconds)

7 + 2 =

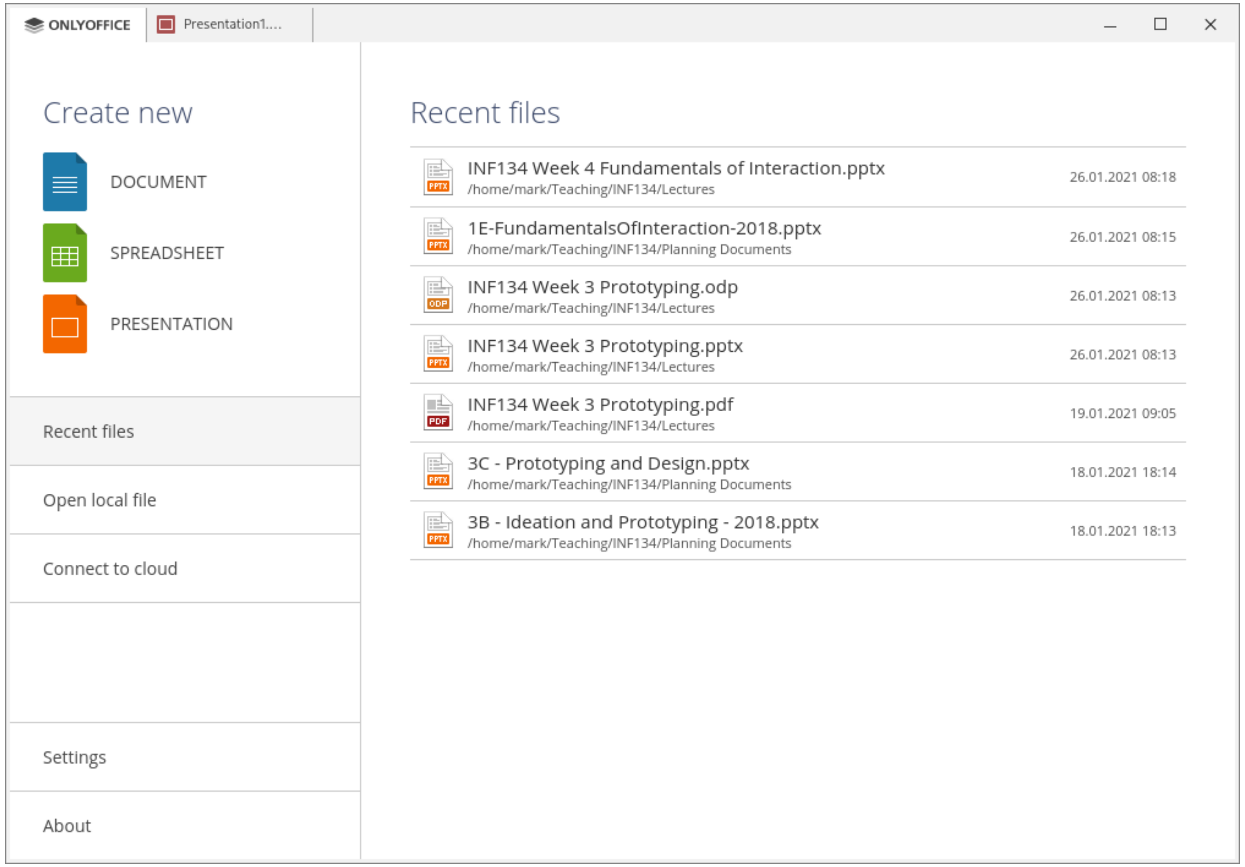
9

Flexibility: Customizability

- Is the interface modifiable by the user and/or the system?
  - Adaptability: The user’s ability to adjust the forms of input and output
  - Adaptivity: The automatic customization of the interface by the system



Adaptable



INF134 Week 4 Fundamentals of Interaction.pptx /home/mark/Teaching/INF134/Lectures	26.01.2021 08:18
1E-FundamentalsOfInteraction-2018.pptx /home/mark/Teaching/INF134/Planning Documents	26.01.2021 08:15
INF134 Week 3 Prototyping.odp /home/mark/Teaching/INF134/Lectures	26.01.2021 08:13
INF134 Week 3 Prototyping.pptx /home/mark/Teaching/INF134/Lectures	26.01.2021 08:13
INF134 Week 3 Prototyping.pdf /home/mark/Teaching/INF134/Lectures	19.01.2021 09:05
3C - Prototyping and Design.pptx /home/mark/Teaching/INF134/Planning Documents	18.01.2021 18:14
3B - Ideation and Prototyping - 2018.pptx /home/mark/Teaching/INF134/Planning Documents	18.01.2021 18:13

Adaptive

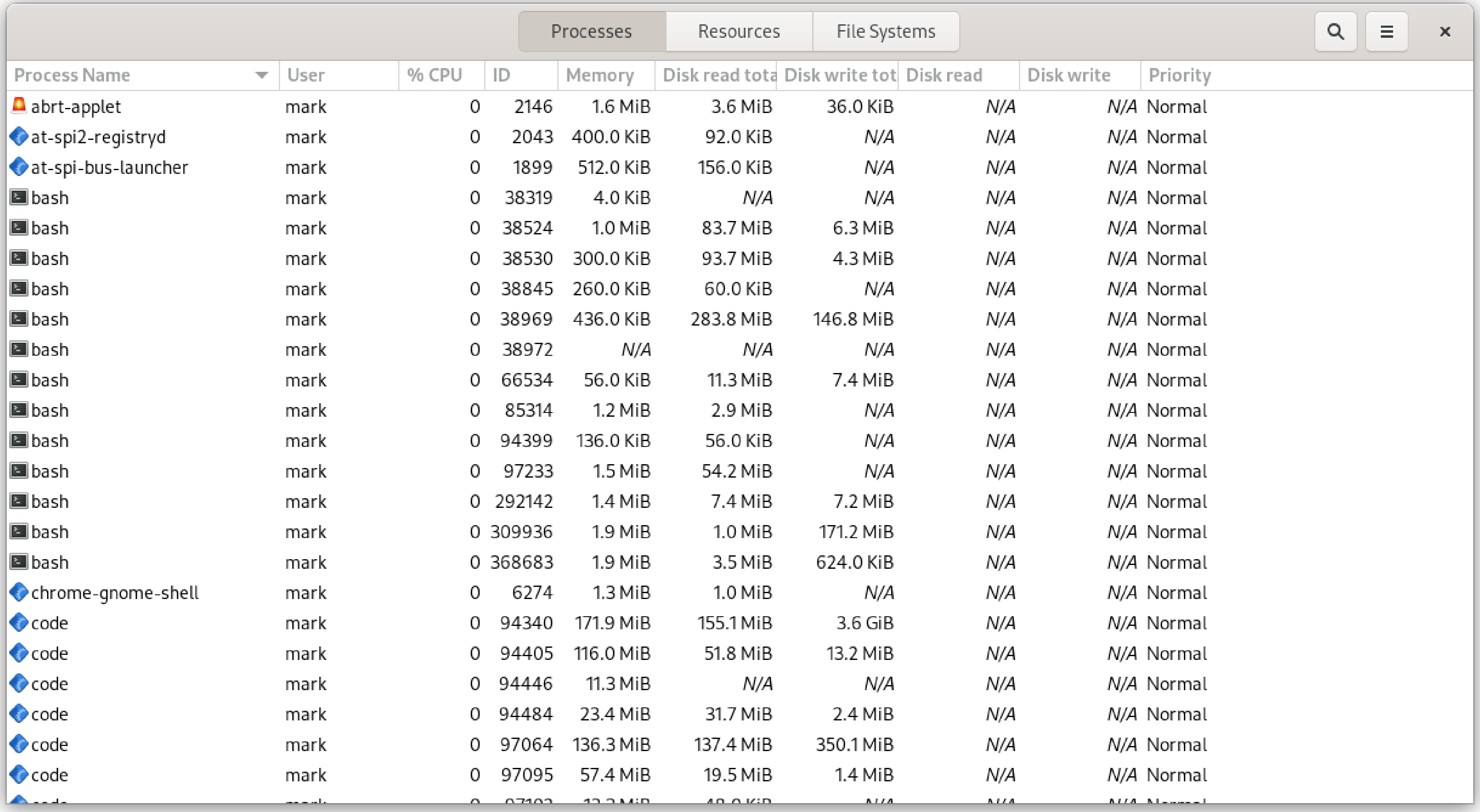
Robustness

- Observability
- Recoverability
- Responsiveness
- Task conformance

Observability

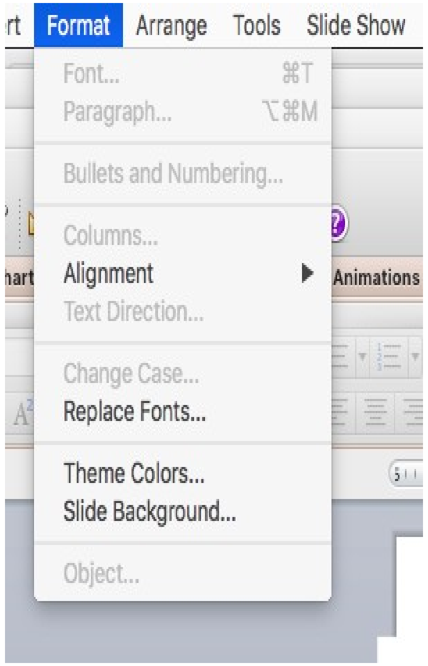
- Can the user evaluate the internal state of the system based on its external and perceivable representation?
  - Browsability – allows user to explore more about system
  - Reachability – understand possible interactions/states of a system
  - Persistence – allow user to understand and act on effect of a system (after some duration)

Browsability

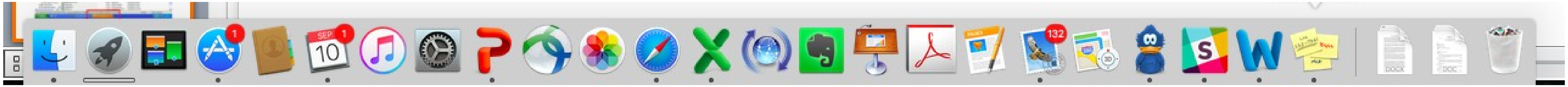


Process Name	User	% CPU	ID	Memory	Disk read tota	Disk write tot	Disk read	Disk write	Priority
abrt-applet	mark	0	2146	1.6 MiB	3.6 MiB	36.0 KiB	N/A	N/A	Normal
at-spi2-registryd	mark	0	2043	400.0 KiB	92.0 KiB	N/A	N/A	N/A	Normal
at-spi-bus-launcher	mark	0	1899	512.0 KiB	156.0 KiB	N/A	N/A	N/A	Normal
bash	mark	0	38319	4.0 KiB	N/A	N/A	N/A	N/A	Normal
bash	mark	0	38524	1.0 MiB	83.7 MiB	6.3 MiB	N/A	N/A	Normal
bash	mark	0	38530	300.0 KiB	93.7 MiB	4.3 MiB	N/A	N/A	Normal
bash	mark	0	38845	260.0 KiB	60.0 KiB	N/A	N/A	N/A	Normal
bash	mark	0	38969	436.0 KiB	283.8 MiB	146.8 MiB	N/A	N/A	Normal
bash	mark	0	38972	N/A	N/A	N/A	N/A	N/A	Normal
bash	mark	0	66534	56.0 KiB	11.3 MiB	7.4 MiB	N/A	N/A	Normal
bash	mark	0	85314	1.2 MiB	2.9 MiB	N/A	N/A	N/A	Normal
bash	mark	0	94399	136.0 KiB	56.0 KiB	N/A	N/A	N/A	Normal
bash	mark	0	97233	1.5 MiB	54.2 MiB	N/A	N/A	N/A	Normal
bash	mark	0	292142	1.4 MiB	7.4 MiB	7.2 MiB	N/A	N/A	Normal
bash	mark	0	309936	1.9 MiB	1.0 MiB	171.2 MiB	N/A	N/A	Normal
bash	mark	0	368683	1.9 MiB	3.5 MiB	624.0 KiB	N/A	N/A	Normal
chrome-gnome-shell	mark	0	6274	1.3 MiB	1.0 MiB	N/A	N/A	N/A	Normal
code	mark	0	94340	171.9 MiB	155.1 MiB	3.6 GiB	N/A	N/A	Normal
code	mark	0	94405	116.0 MiB	51.8 MiB	13.2 MiB	N/A	N/A	Normal
code	mark	0	94446	11.3 MiB	N/A	N/A	N/A	N/A	Normal
code	mark	0	94484	23.4 MiB	31.7 MiB	2.4 MiB	N/A	N/A	Normal
code	mark	0	97064	136.3 MiB	137.4 MiB	350.1 MiB	N/A	N/A	Normal
code	mark	0	97095	57.4 MiB	19.5 MiB	1.4 MiB	N/A	N/A	Normal
code	mark	0	97103	12.3 MiB	48.0 KiB	N/A	N/A	N/A	Normal

Reachability



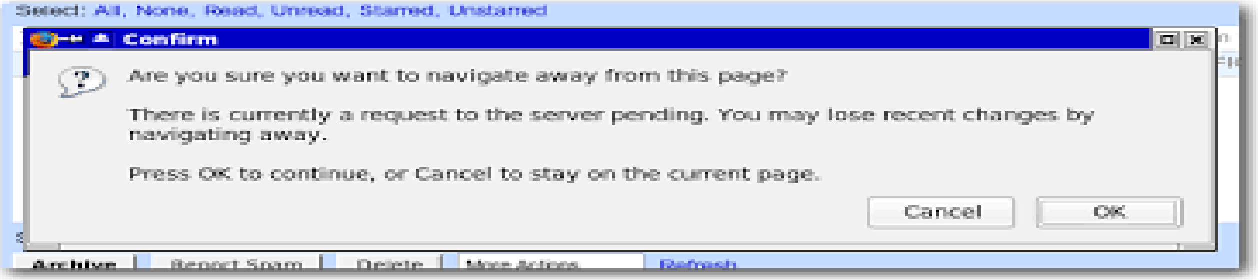
Persistence



Robustness: Recoverability

- Can the user reach the desired goal or accomplish the task after recognizing that they have made an error in a previous interaction?
- Backward recovery: undo previous error(s)
- Forward recovery: ability to fix when user can not undo

Error Prevention



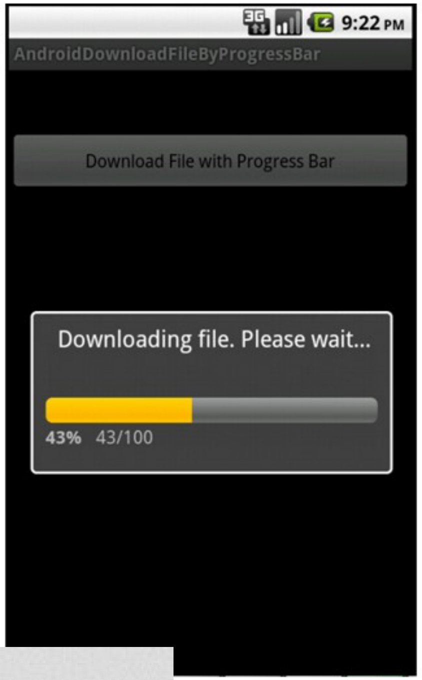
Are you sure you want to navigate away from this page?

There is currently a request to the server pending. You may lose recent changes by navigating away.

Press OK to continue, or Cancel to stay on the current page.

Robustness: Responsiveness

- Is the rate of communication between the system and the user fast enough/appropriate for the interaction?
- Response time: time for system to respond in some way to user action(s)
- Response should match user expectations



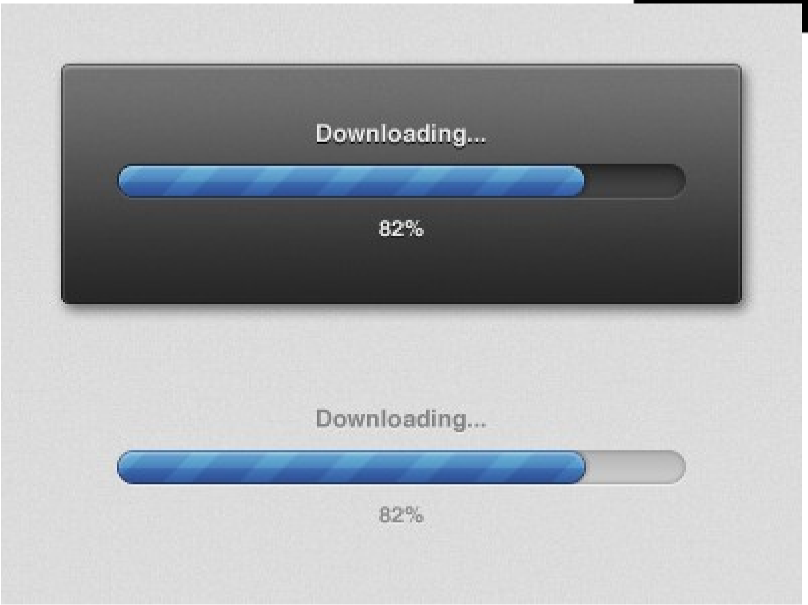
9:22 PM

AndroidDownloadFileByProgressBar

Download File with Progress Bar

Downloading file. Please wait...

43% 43/100



Downloading...

82%

Downloading...

82%

Robustness: Task Conformance

- Does the system support the tasks that the user wants to accomplish, and does the system support these tasks in the way that the user wants it to?
- I.e., mapping between system services and all the user tasks
- Task completeness: can system do all tasks of interest?
- Task adequacy: can user understand how to do tasks?

What are your questions?