Design principles

Michel Beaudouin-Lafon - mbl@lisn.fr
Laboratoire Interdisciplinaire des Sciences du Numérique (LISN)
Ex Situ - http://ex-situ.lri.fr

Outline

“The design of everyday things” - Don Norman

Affordances & Signifiers

Metaphors

Mental model

Conceptual model

The design of everyday things - Norman, 1990

Everyday objects reflect the problems
in user interface design
- Door handles
- Washing machines
- Telephones
- etc.

Introduces the notions of *affordance (/signifier)*, *mapping*, *metaphor*, and *conceptual model*

Provides a set of *design rules*

How to use these doors?

How to use these doors?

How to use these doors?

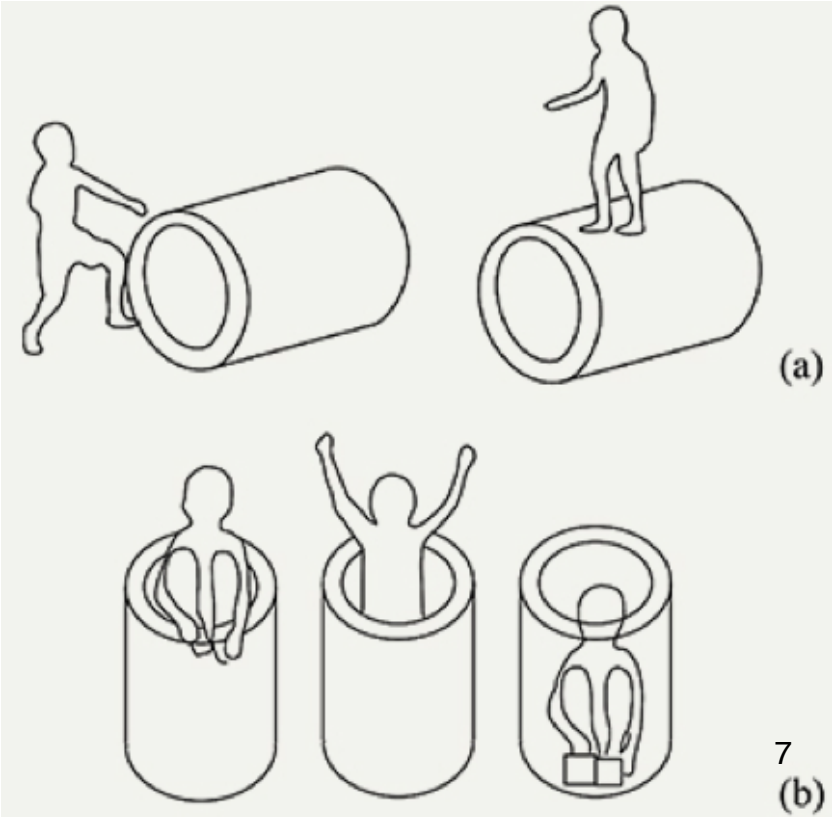
Affordances – James J. Gibson

The capabilities of an object for action

"… the affordances of the environment are what it offers the animal, what it provides or furnishes, either for good or ill…"

James Gibson

The affordance exists
even if it is not perceived

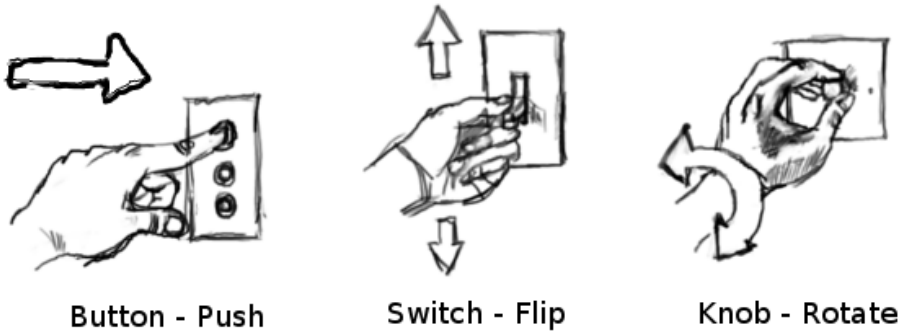


Affordances

The shape, size, aspect of an object suggests what it can be used for

A button is meant to be pushed

A handle is meant to be turned



https://enginess.io/insights/whats-new-design-of-everyday-things

Foundation of our knowledge of the world

«Much of our everyday knowledge resides in the world, not in the head»

Norman, 1988

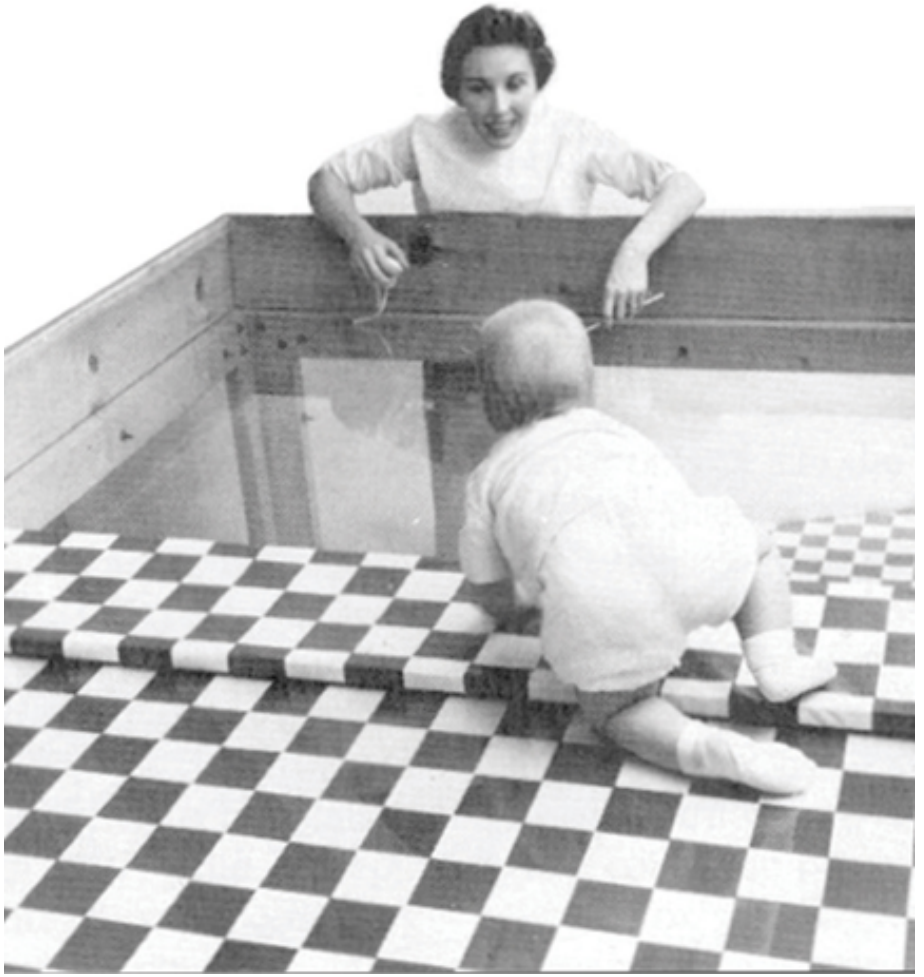
Perceptual learning – Eleanor Gibson

Learning to recognize affordances

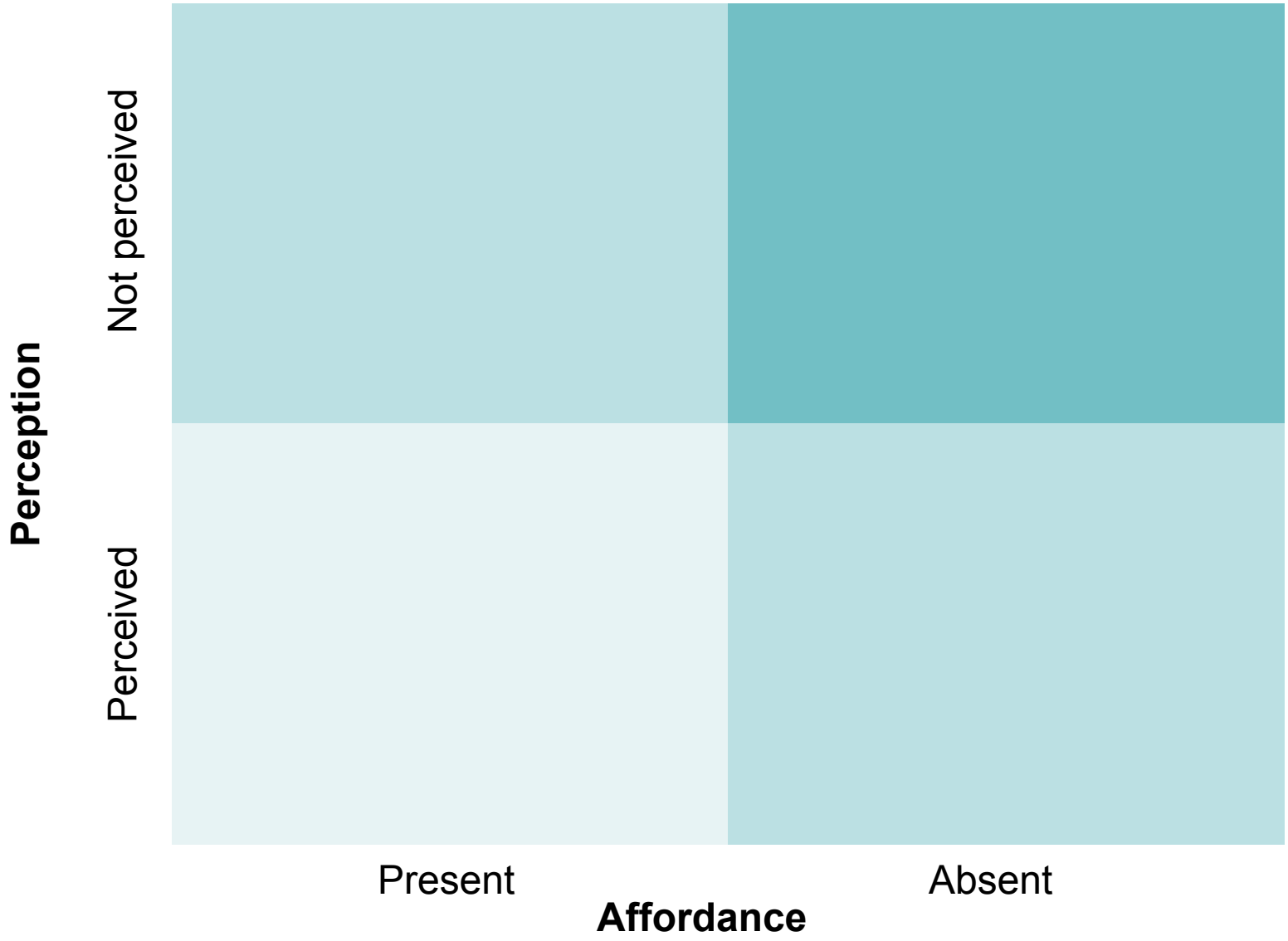
Visual cliff experiment

“We perceive to learn, as well as we learn to perceive”

Eleanor Gibson



Perception of affordances



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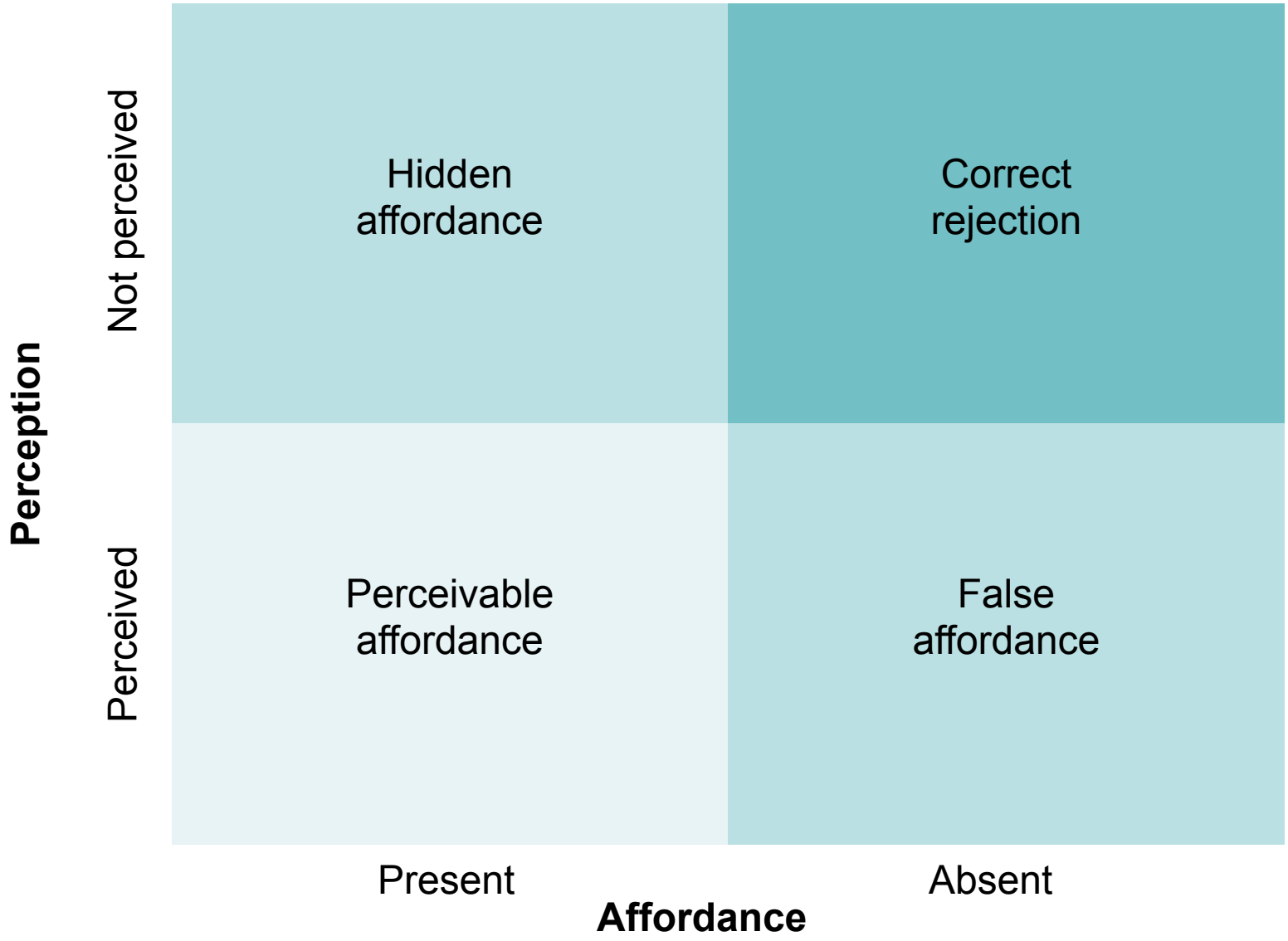


Perception of affordances

Signifiers (not affordances) – Don Norman

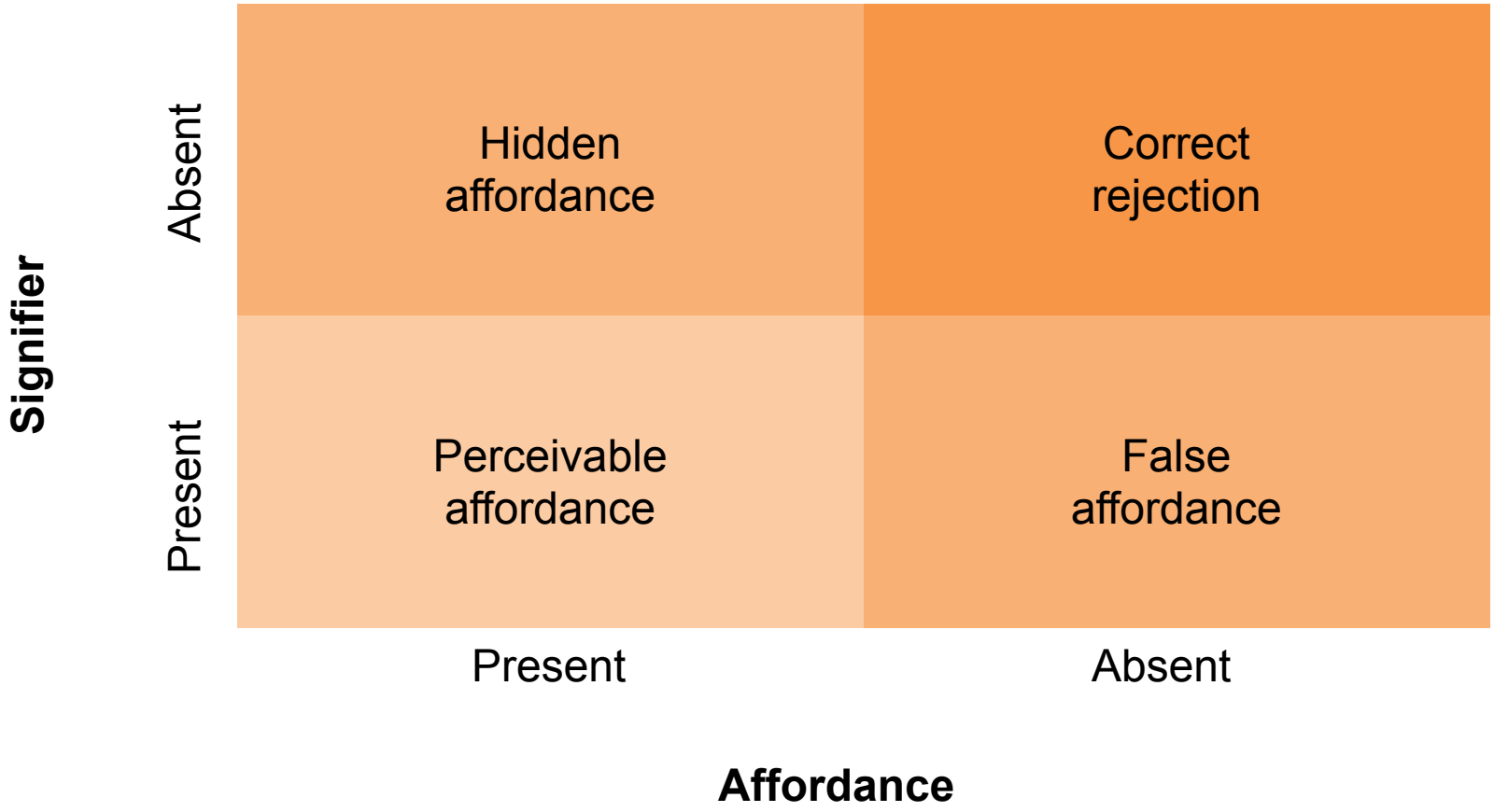
Perceived affordance:
perception of the capabilities of an object for action
based on properties of the object that are **perceived directly**

A handle affords grasping because of its shape
and as we grasp it we perceive
the affordance for turning it

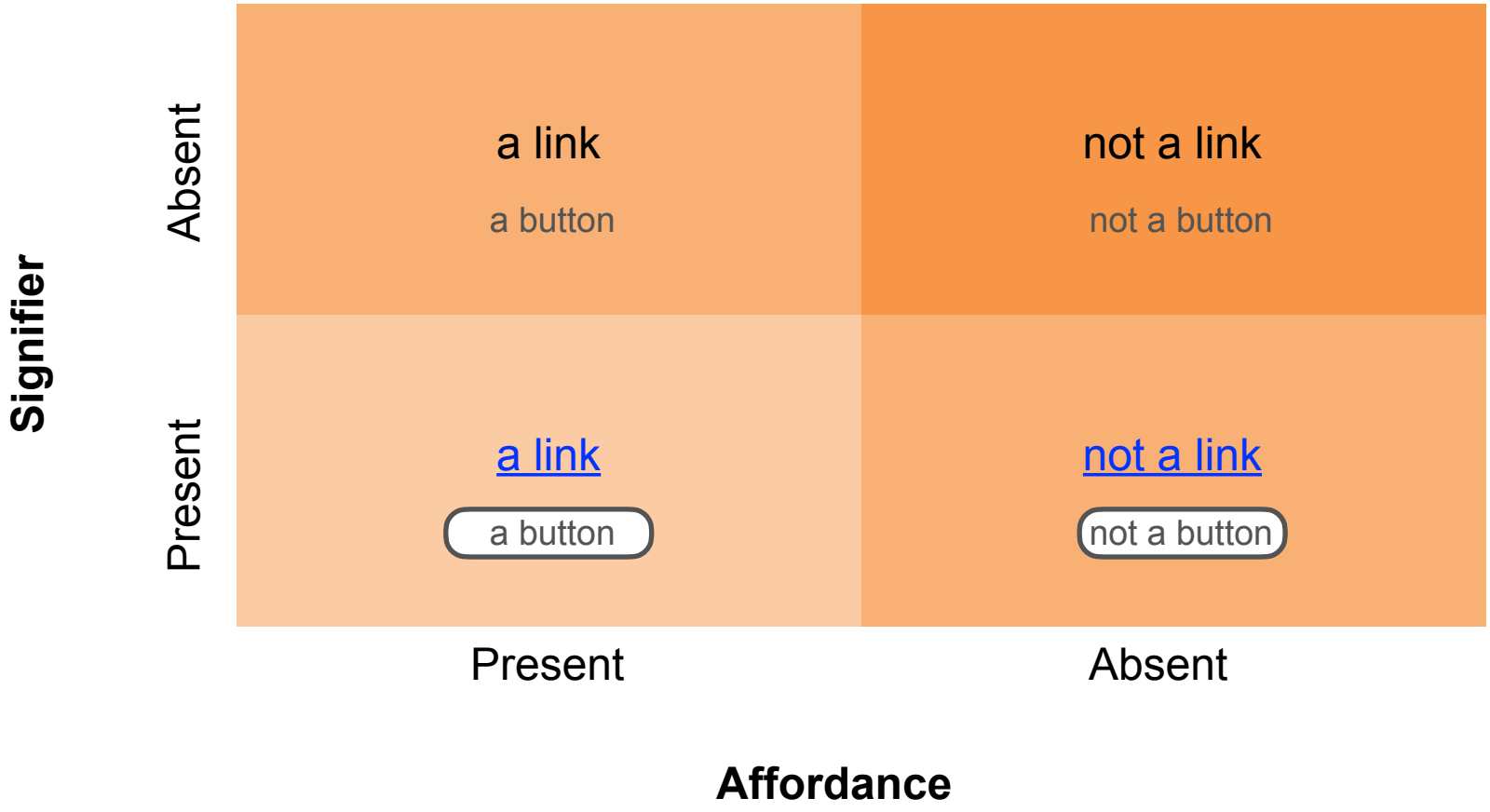
When the affordance is not perceivable,
or is misleading, we can add a **signifier**:
an indication (word, icon, arrow) of the action

Signifiers are often **separate from the object**,
and **not perceived directly**:
a sign needs to be interpreted

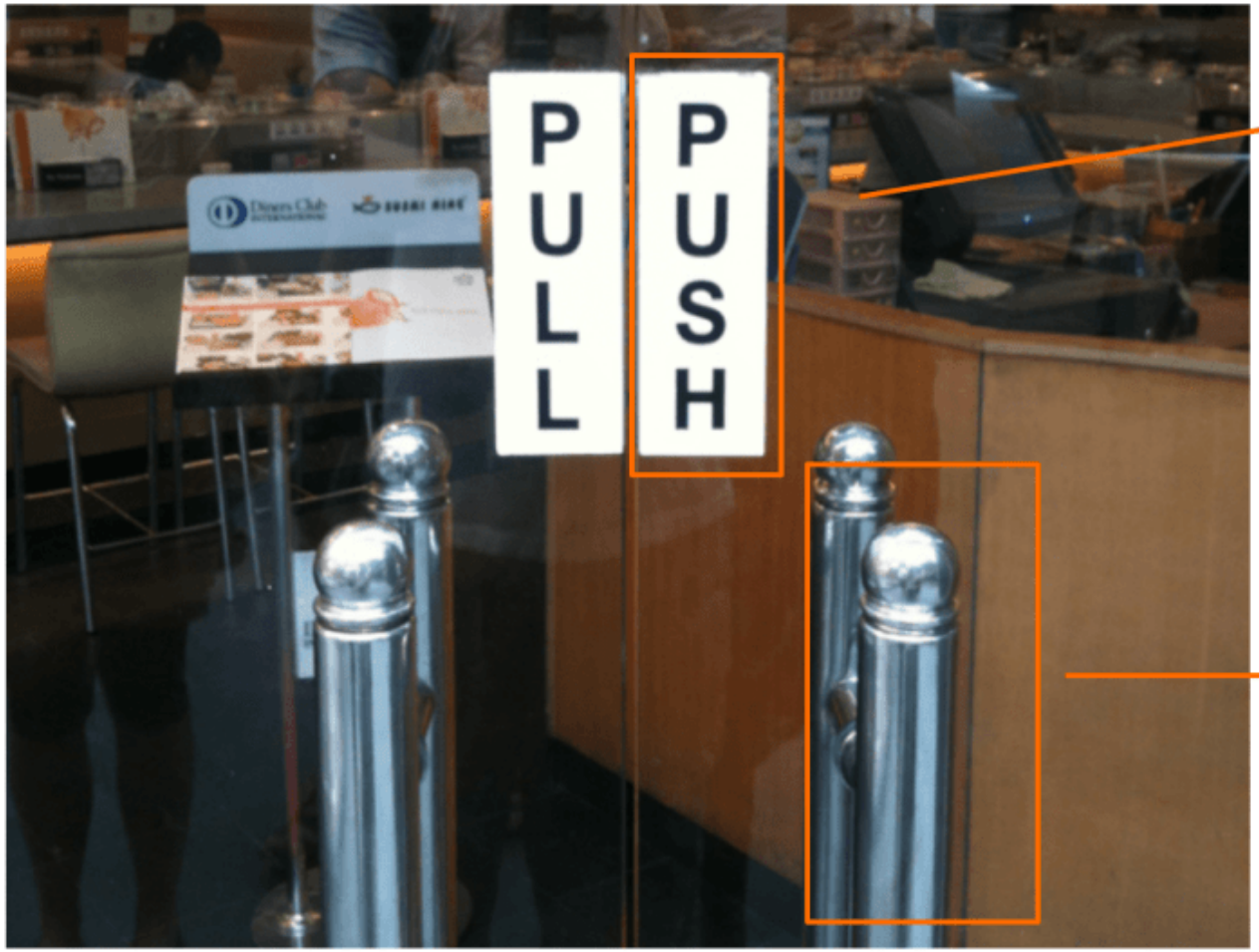
Affordances vs. Signifiers



Affordances vs. Signifiers



Affordance vs. Signifier is often misunderstood

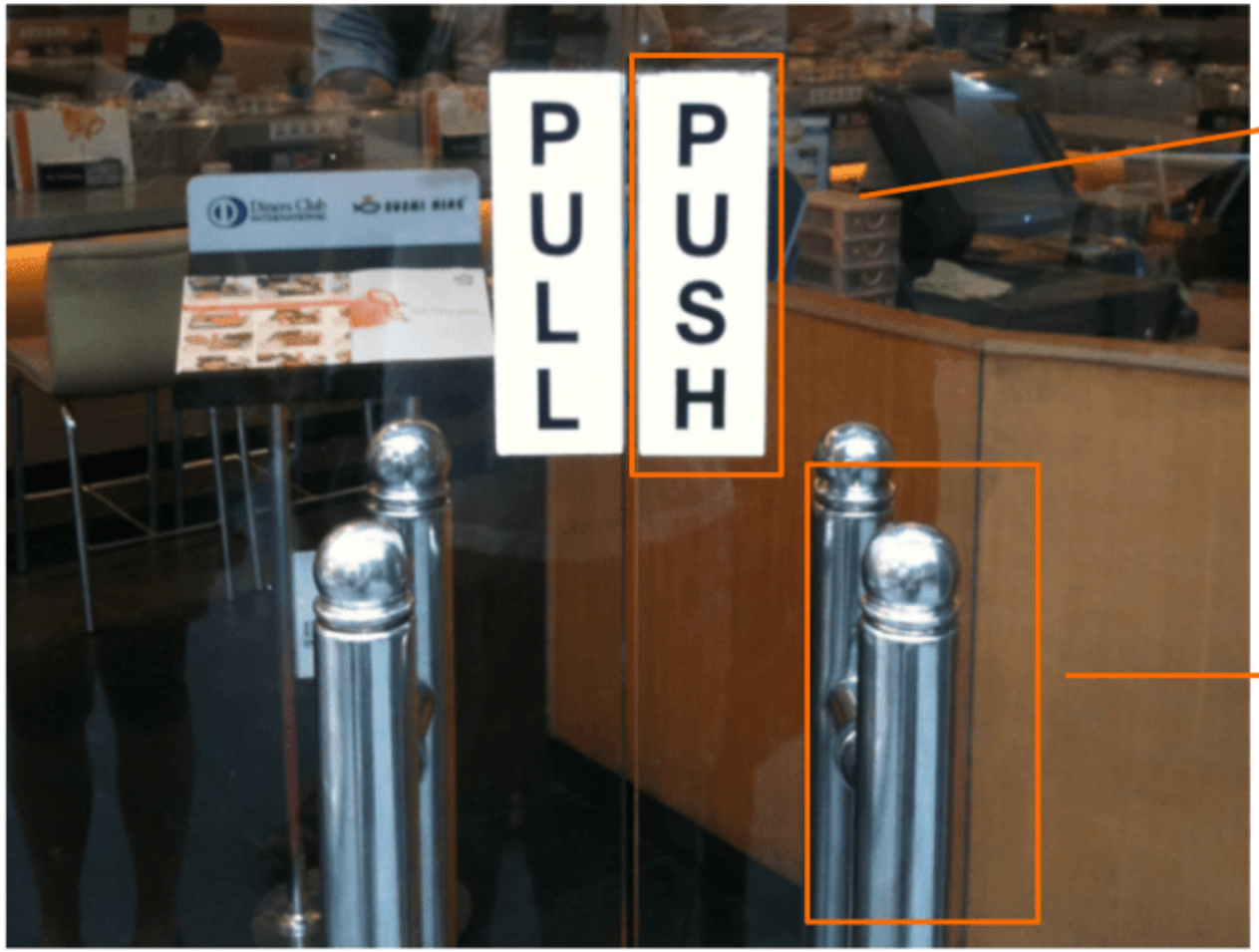


Signifier
- Sign to explain what to do
(because the affordances are confusing)

Affordance
- Handle to ~~physically grasp~~
push (but not pull)

Credit: Patrick Thornton / https://uxdesign.cc/what-is-an-affordance-6b60f2de79f2

Affordance vs. Signifier is often misunderstood



Signifier
- Sign to explain what to do (because the affordances are confusing)

Affordance
for pushing
but
False affordance
for pulling

Credit: Patrick Thornton / https://uxdesign.cc/what-is-an-affordance-6b60f2de79f2

In summary

Affordances are capabilities for action by the subject

- They exist independently of whether or not they are perceived

The perception of affordances is learned

- We recognized object properties (shape, size, color, …)
- that indicate capabilities for action: *direct perception*

But we can be fooled by perception

- hidden affordance: present but not perceived
- false affordance: perceived but not present

Signifiers are added signs to indicate the presence of an affordance

What it means for (graphical) interaction design

In a GUI the main actions are click, drag, and enter text

What is clickable?

What is draggable?

Where can text be entered?

These are signifiers: graphical conventions that we learn to recognize

Skeuomorphic design tries to build on direct perception of affordances

BUT: an image of an object is not the object

What it means for (graphical) interaction design

The advent of “flat” design hides affordances

2007

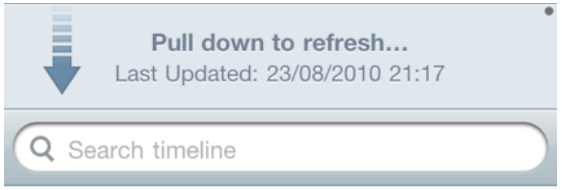
2012

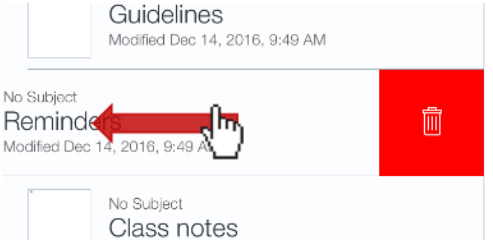
2015

from https://www.nngroup.com/articles/flat-design/

Many interactions don’t even have signifiers

- Pull to refresh
- Swipe to delete
- Gestures
- …





Metaphor

Figure of speech:

establishes a link between two words, without a comparative

(while comparison includes the comparative)

Example: *The moon is a golden sickle*

Direct metaphor *A golden sickle lights the night*

More generally:

Transfers a relationship from one set of objects to another set

To be efficient, the comparative (or the transfer) must be immediately guessed or understood

Example: Desktop metaphor

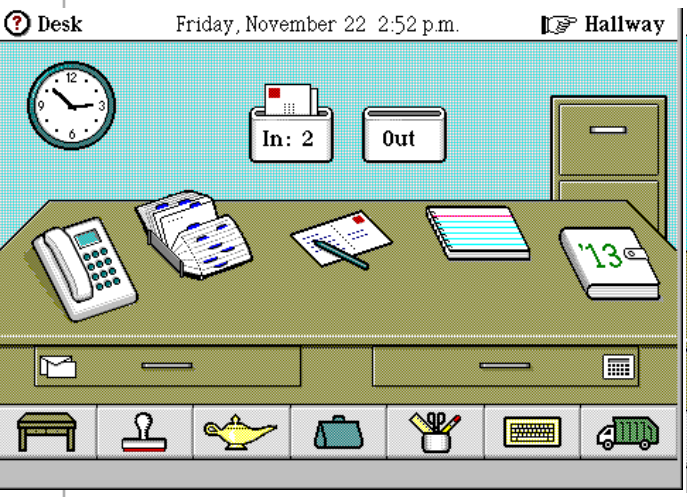
Compares objects of the virtual desk
with objects of a real desk

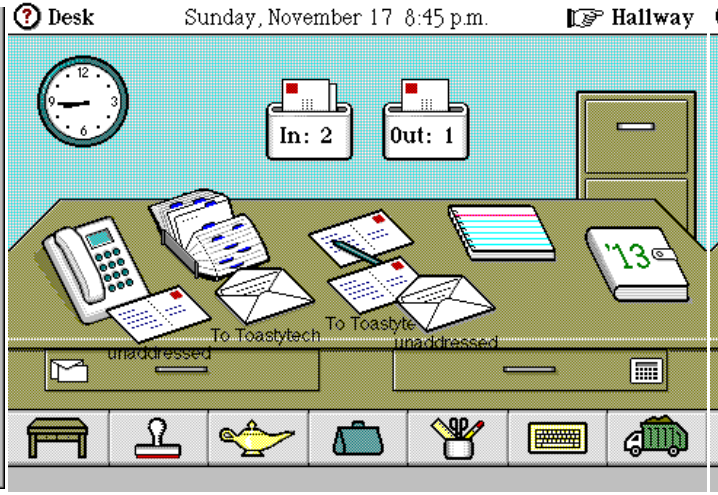
Transfers properties from physical to on-line world:
Move, Open, put in trashcan, …

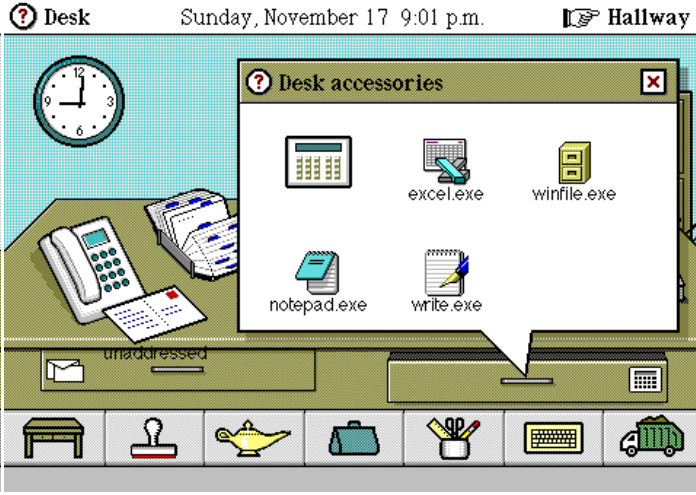
The goal is not to simulate a real desk
but to take advantage of our knowledge of a real desk

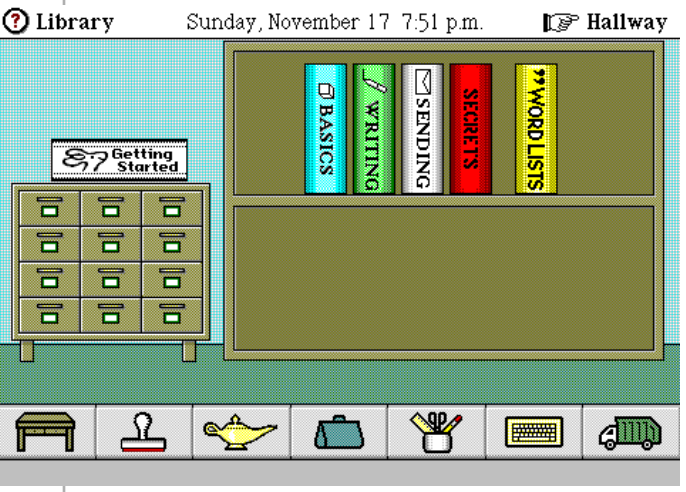
Goal: Save learning
Capitalize on external knowledge
Takes advantages of affordances in the real world

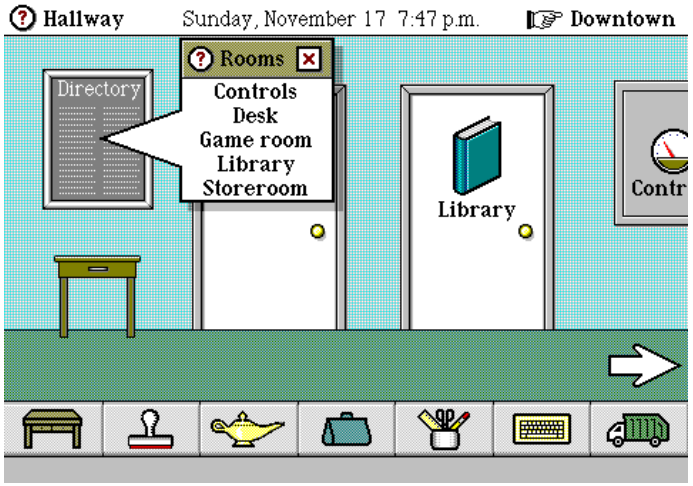
MagicCap: metaphor gone wrong

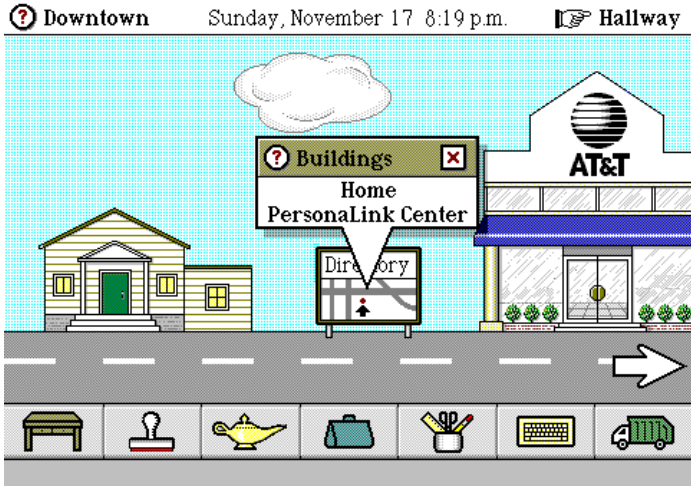












http://toastytech.com/guis/mcap.html

BumpTop: good or bad?

Mental model

Operational representation of the world in one's head

- Example : instructions to get home

Provides a structure to link causes and effects

Supports explanations

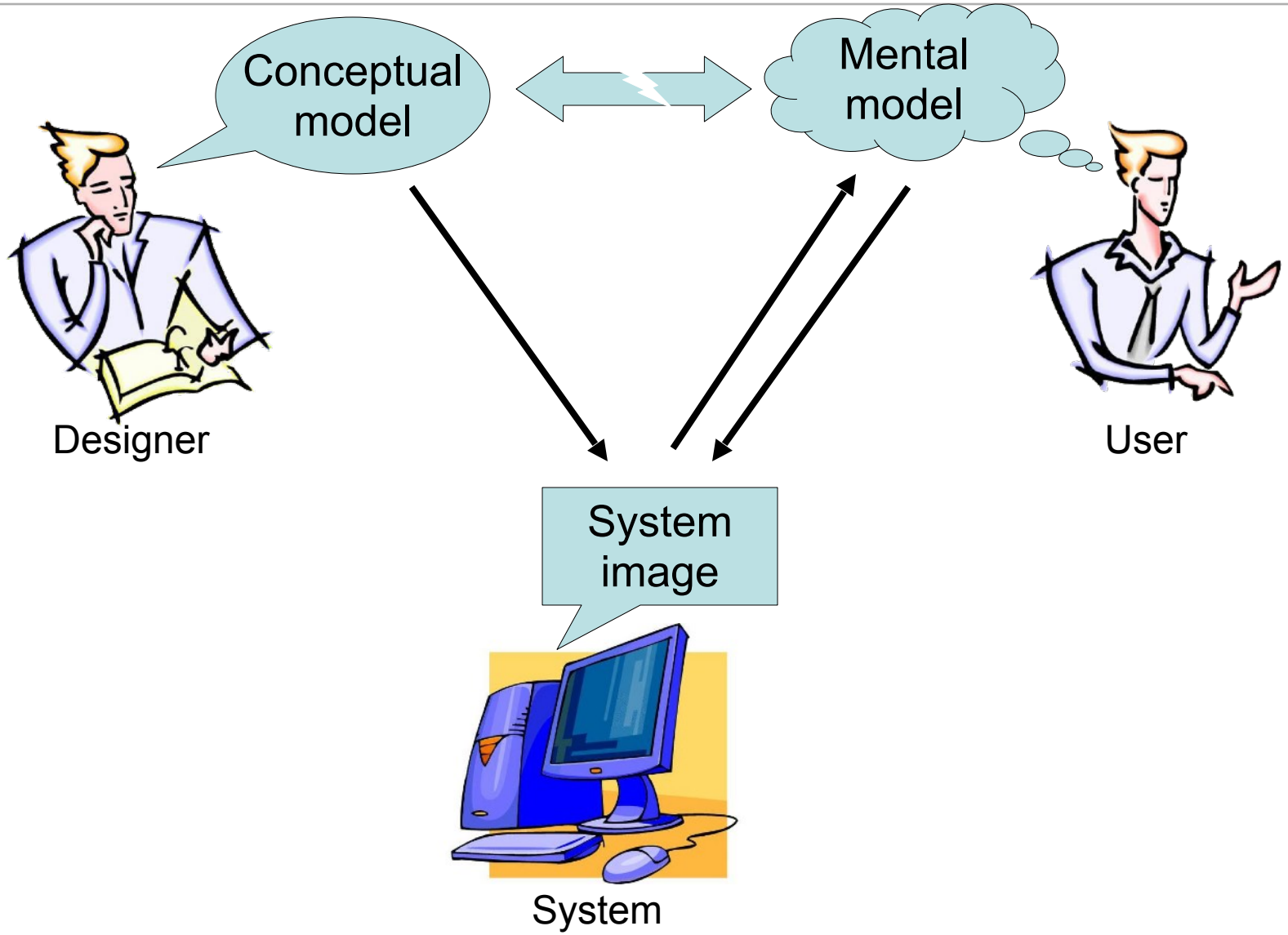
- What do I see? What does it mean?
- What did just happen? Why?
- What did I do that created this situation?

Supports predictions

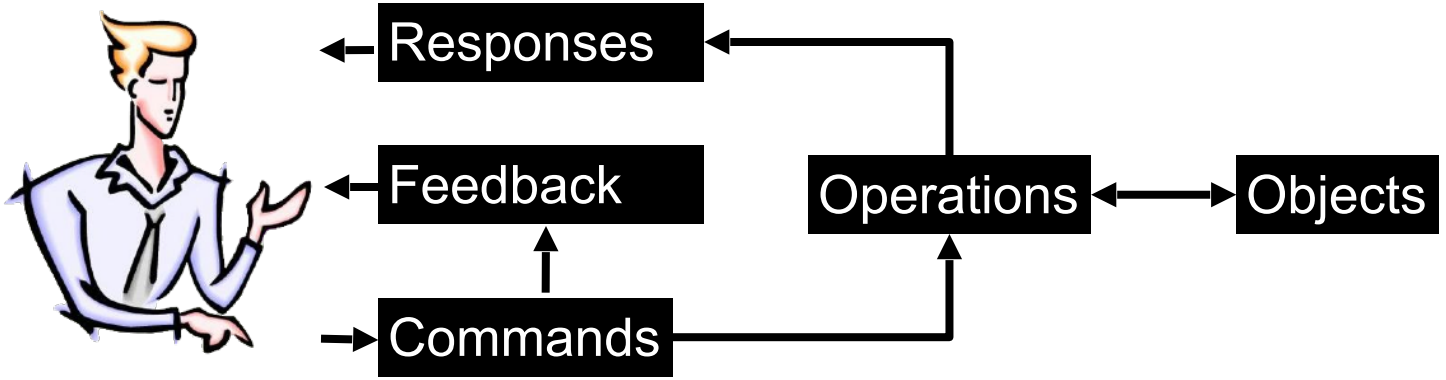
- What can I do now?
- What happens if I do this?

Different types of mental models: objects-actions, state-transitions

Conceptual model



Organizing the conceptual model



Identify the objects:

What the user wants to manipulate

Identify the operations:

What the user wants to do with the objects

Identify the commands:

How the user can activate the operations

Conceptual modeling

Correspondence between conceptual model and mental model:

- improved by a proper use of metaphors
- improved by taking advantage of affordances
- improved by following proper *design guidelines*

In case of poor correspondence:

- Manipulation errors
- Frustration
- Lower productivity

3 principles from Norman (1990)

Recommendations to create « good » conceptual models

1- Make things visible

The user can know the state of the system
by observing the interface

2- Mapping principle

Help understand the correspondence between

- Actions and results
- Controls and their effects
- The state of the system and what is visible

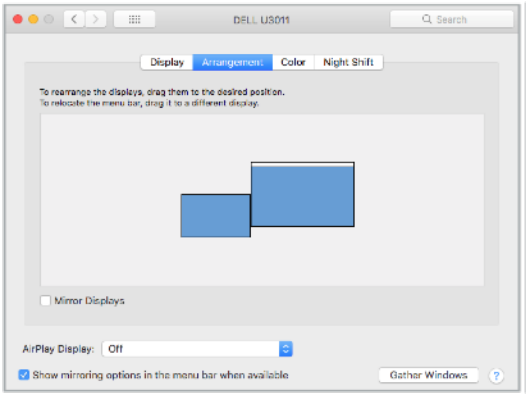
3- Feedback principle

Inform the user

Mapping: which knob controls which burner?

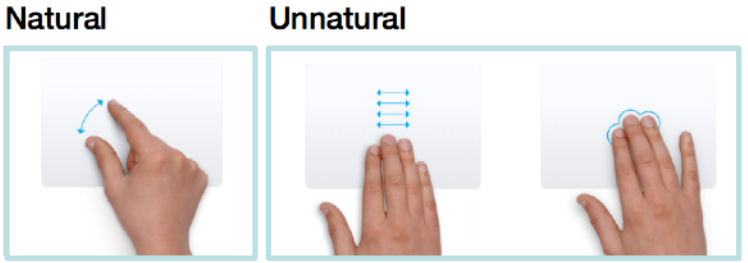
Natural mappings (Norman)

spatial similarity



conceptual similarity

behavioral similarity



8 design rules from Shneiderman (1998)

1. Consistency
2. Short-cuts for expert users
3. Informative feedback
4. Design dialogues with closures
5. Prevent errors and help repair them
6. Provide reversible operations
7. Give control to the user
8. Reduce short-term cognitive load

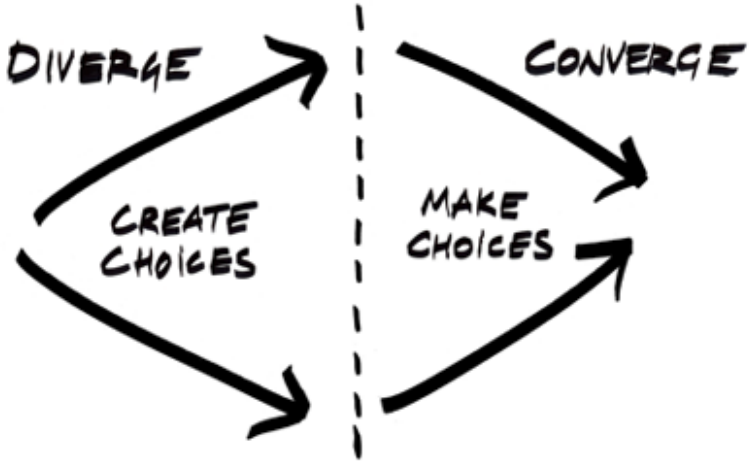
There are dozens of recommendations and hundreds of rules…

For every rule, there are exceptions…

Conclusion

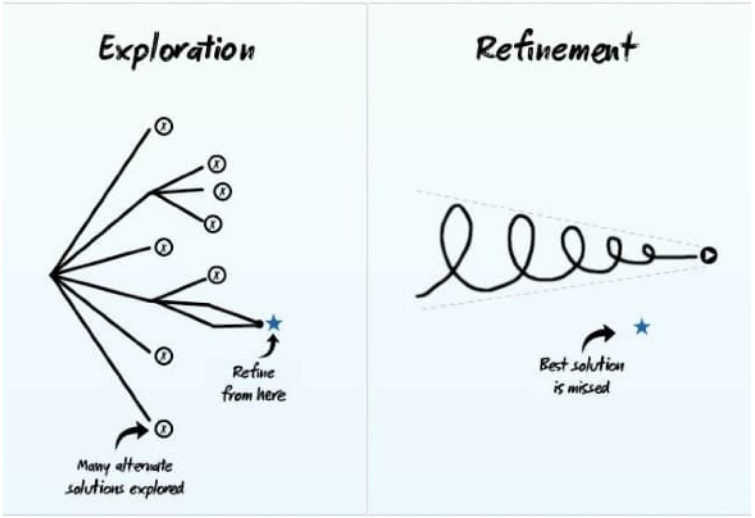
The design funnel

- First generate alternatives
- Then select the best ones
- Then do it again



Explore/Refine

- Breadth-first exploration:
  - explore alternatives
- Depth-first refinement:
  - refine a design



Conclusion

Making things simple is difficult

A good design is better than you think!

Dieter Rams: a good design…

1. Is innovative
2. Makes a product useful
3. Is aesthetic
4. Makes a product understandable
5. Is unobtrusive
6. Is honest
7. Is long-lasting
8. Is thorough down to the last detail
9. Is environmentally friendly
10. Involves as little design as possible