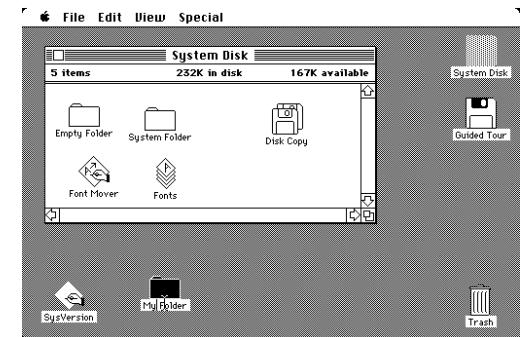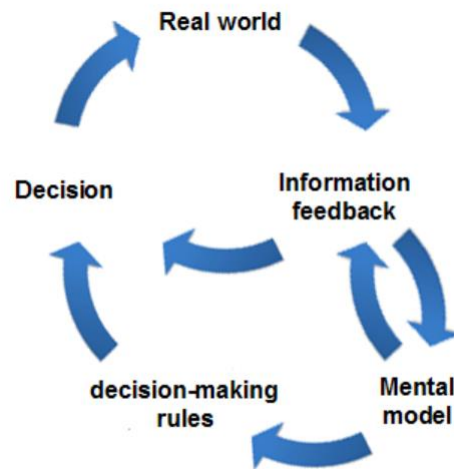# Mental and conceptual models

Relevant issues:

- What are mental models?

- How do we construct them?

- What is known about them?

- What are they used for?

- What are conceptual models?

- Guidelines to obtain good conceptual models (promoting good mental models)

What are Mental Models? | IxDF (interaction-design.org)

Mental models and Conceptual models

- The **conceptual model is the UI highest level**

- The conceptual model is the conceptual framework in which the functionality is provided to the user

- **To understand how to design a good conceptual model it is necessary to understand mental models**

- A **mental model** (in a simple way) is the **user's internal representation** of the current conceptualization and understanding of the system

- **A conceptual model is the designer's attempt to foster good mental models through UI aspects**
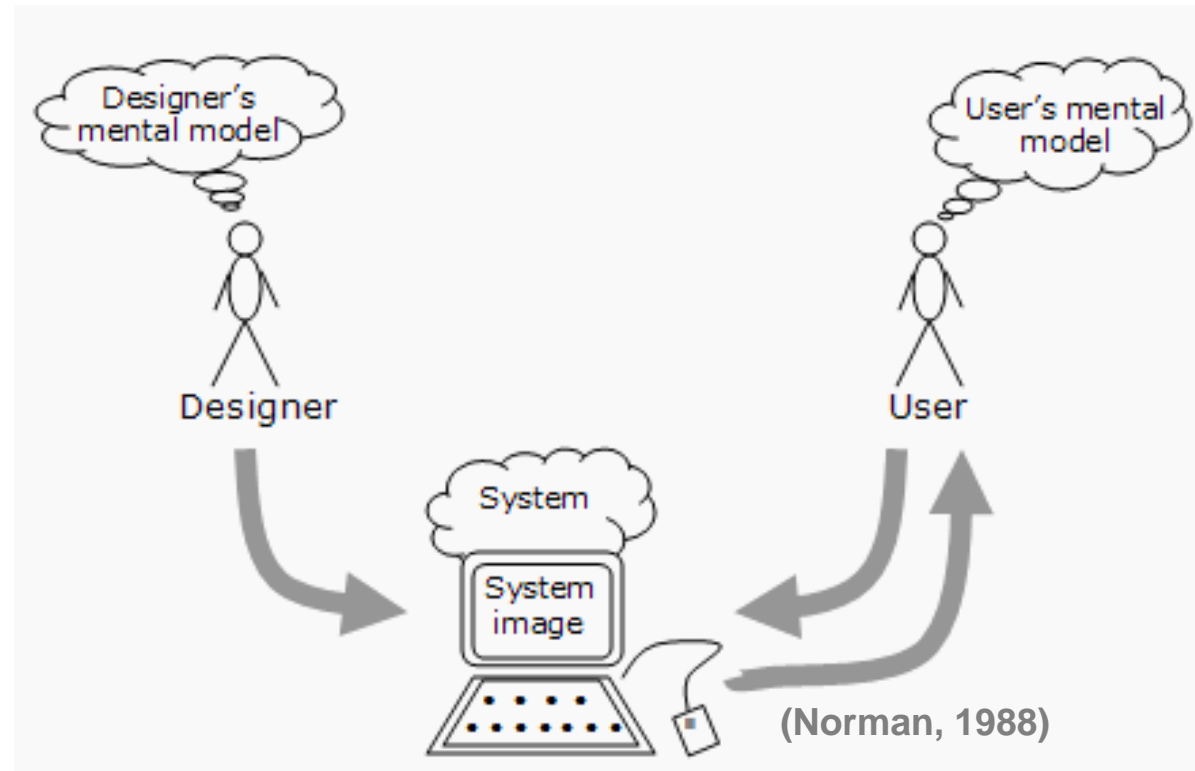
Mental models

Mental models are representations of the world that help us understand complex concepts and make better decisions

- based on past experiences, beliefs, and assumptions to understand how the world works

- essential for decision-making, problem-solving, and learning, as well as effective communication and collaboration in group settings

- The user develops a **mental model** of how he/she thinks the system works

- And uses it to:
  - reason about the system
  - anticipate system behavior
  - explain why the system reacts as it does

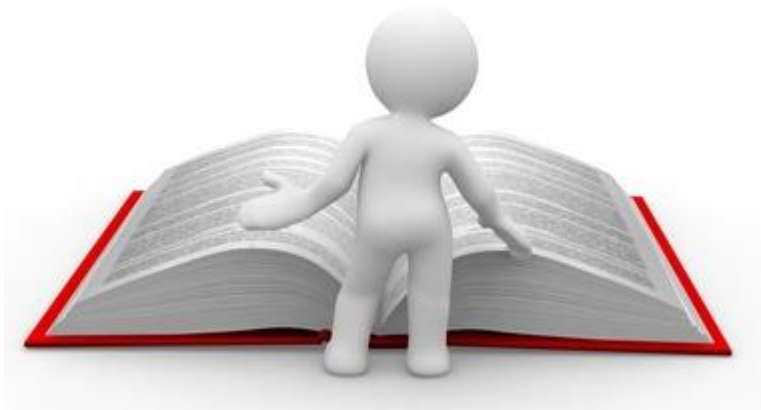https://www.interaction-design.org/literature/book/the-glossary-of-human-computer-interaction/mental-models

(Norman, 1988)

How do we create a mental model?

- Using the system

- Observing others using the system

- Reading documentation

- …

and thus **all these are important ways to train the user to use a system**

Mental models allow:

- Make predictions

- Determine causes of observed events

- Determine adequate actions to produce the wanted changes

- Understand analogous devices

- …

"What users believe they know about a UI strongly impacts how they use it. Mismatched mental models are common, especially with designs that try something new."

https://www.nngroup.com/articles/mental-models/

Example: remote controller of some projectors @ DETI

- This device has a different UI from the others I am used to
  (not complying with the consistency and standards heuristic)

- I will try to infer how to use it based on the mental models I have

- But it is ambiguous and it does not give prompt feedback
  (not complying with the visibility of the system status heuristic)

- Determining adequate actions to produce the wanted changes fails!

I press one button, nothing happens, I press the other ...

… low efficiency, low efficacy, low satisfaction

poor usability and UX

Mental models:

- Are **incomplete**

- Are **unstable**   (people easily forget the details)

- Are **not scientific**   (mantain "supersticious" behaviours)

- **Don´t have specific limits** (mistake similar devices and operations)

- ...

Often people do a lot of extra actions instead of planning,
which would avoid those actions!

"We must give up finding elegant mental models, and instead learn how to understand the incomplete and confuse structures people have"

Donald Norman

Main guidelines to obtain a good conceptual model
(that fosters a good mental model)

- Make visible invisible parts and processes
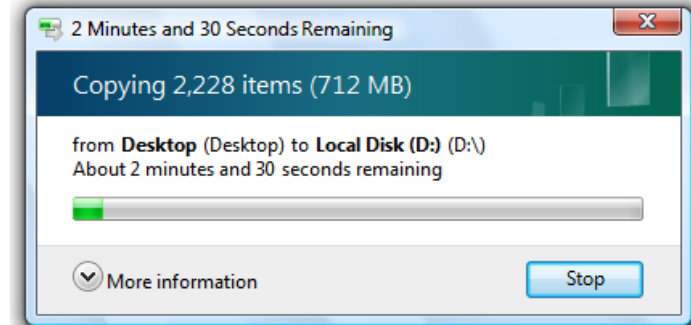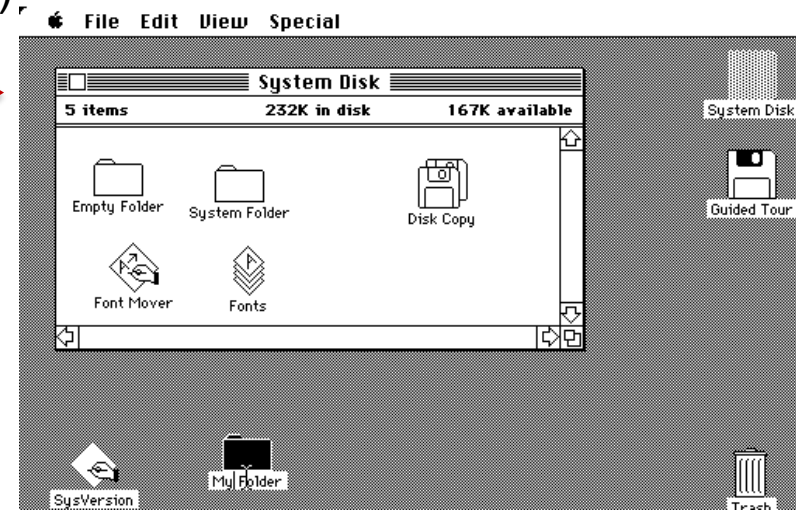
- Give *feedback*

- Use coherence (colors names, command syntax, dialog styles, information location on the screen, etc., etc.)

Desktop metaphor →

- Use a metaphor (optional)

All this may help the user to understand

better how the system works

Metaphors

- Exploit existing mental models of the real world

Metaphors **can be misleading** since the "the essence of metaphor is understanding and experiencing one kind of thing in terms of another" (Lakoff and Johnson, 1983)
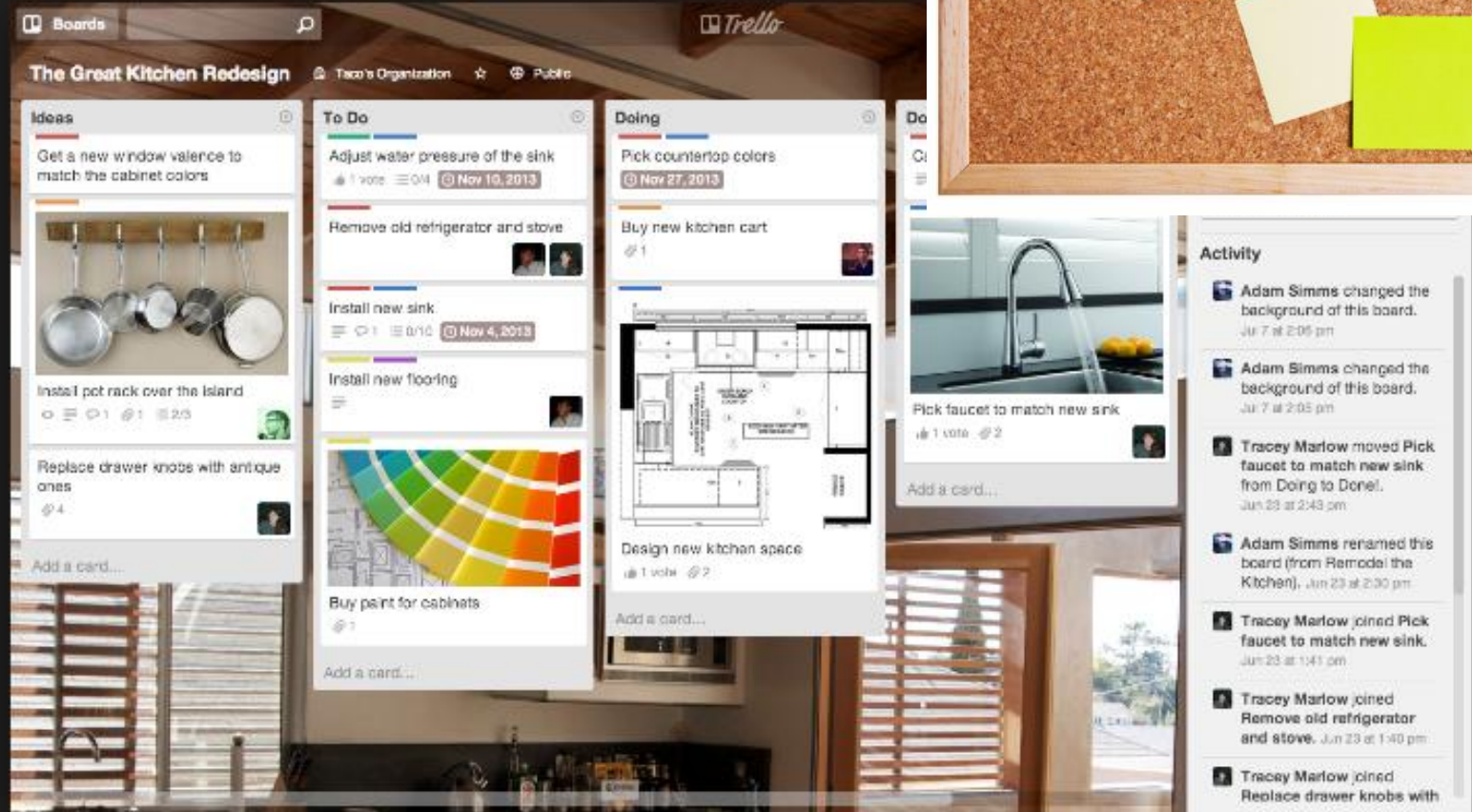
- Which, by definition, makes a metaphor different from what it represents or points to

https://www.interaction-design.org/literature/book/the-encyclopedia-of-human-computer-interaction-2nd-ed/human-computer-interaction-brief-intro

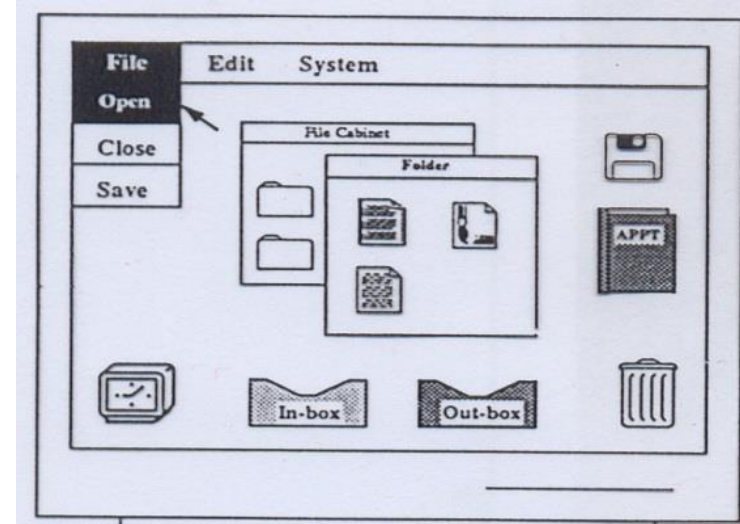Example: The Desktop metaphor:

Another example:
the bulletin board (Trello)

<https://trello.com/tour>

Potential problems in using metaphors

- Incomplete metaphors may **confound** the user

- Risk of **under-utilization** of the system's capacities

- Less experienced users (e.g. children) seem to expect more **"literal" metaphors**

- Sophisticated users seem to expect more **"magical" metaphors**

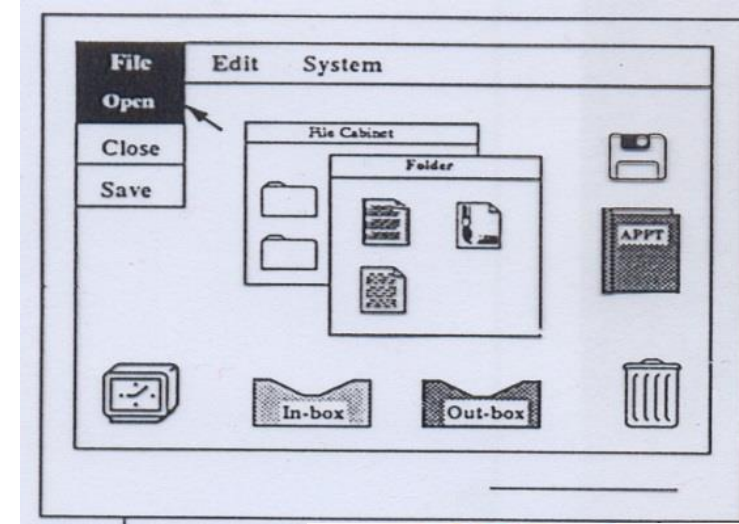**Thus, the use of a metaphor should be carefully pondered …**

Examples of using metaphors

• In Apple's original desktop metaphor:

     remove the diskette from the system ->

     -> drag it to the recycling bin !! (unlike the real world…)

• Navigation/locomotion in VR systems:

     Magical metaphor -> "teleportation"

     Less magical (more literal) -> "physically" walking

Conceptual models - summary

- A conceptual model is a **high-level description** of a product in terms of:
  - what users can do with it
  - the concepts they need to understand how to interact with it

- Developing a conceptual model involves:
    - Understanding the problem space
    - Specifying how the proposed design will support users

- Conceptual models **must foster good mental models**

- Paradigms, visions, theories, models, and frameworks
  - Provide ways of framing design and research

Main bibliography

- Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, *Human-Computer Interaction*, 3rd edition, Prentice Hall, 2004

- Jenny Preece and Helen Sharp, *Interaction Design – Beyond Human-Computer Interaction*, 5th edition, John Wiley, 2019 (http://www.id-book.com/chapter3_teaching.php)

- John Carroll, Human Computer Interaction - brief intro, *The Encyclopedia of Human-Computer Interaction,* 2nd edition https://www.interaction-design.org/literature/book/the-encyclopedia-of-human-computer-interaction-2nd-ed/affective-computing

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https://www.interaction-design.org/literature/book/the-glossary-of-human-computer-interaction/mental-models