Direct Manipulation

Human-Computer Interaction   **Beatriz Sousa Santos, 2024**

Interaction/ Dialog styles
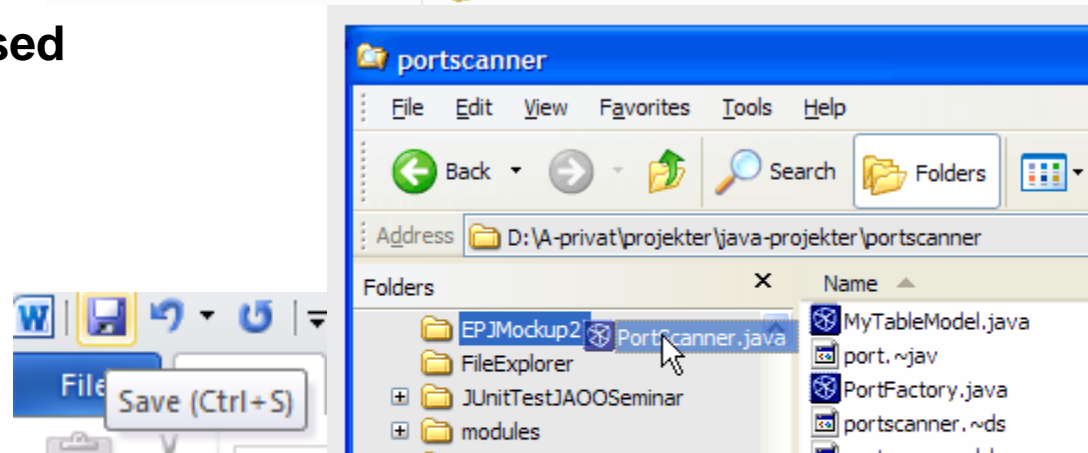
A possible classification:

- Menus
- Fill-in-forms
- Direct manipulation
- Function keys
- Question and answer
- Command languages
- Natural languages
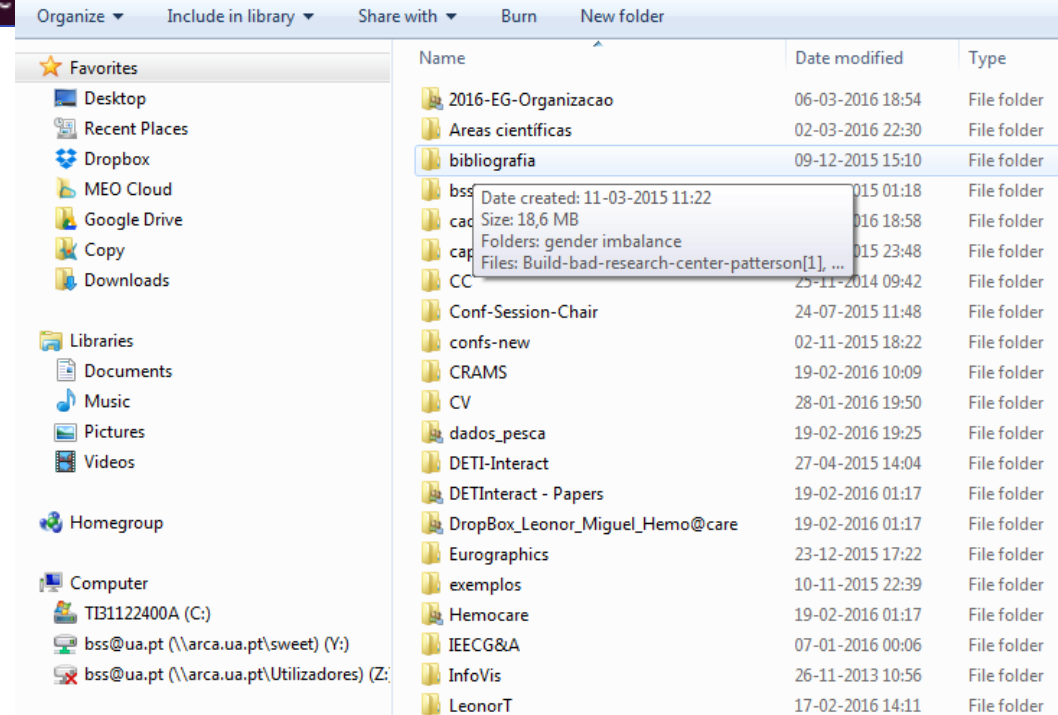
Often two or more styles are used simultaneously

Direct manipulation
(name coined by Shneiderman, 1982)

- Can be traced down to Sketchpad
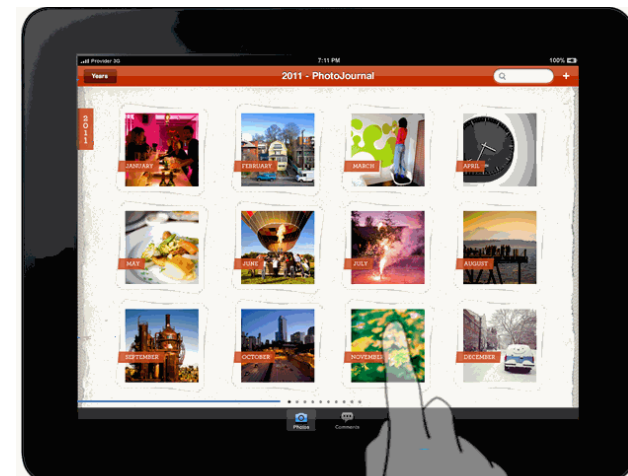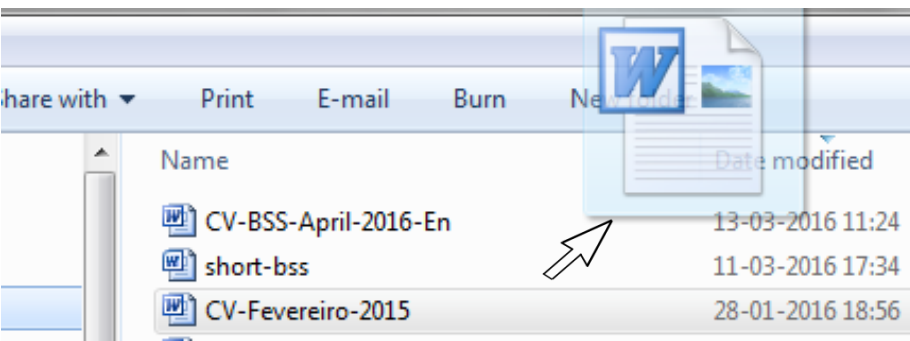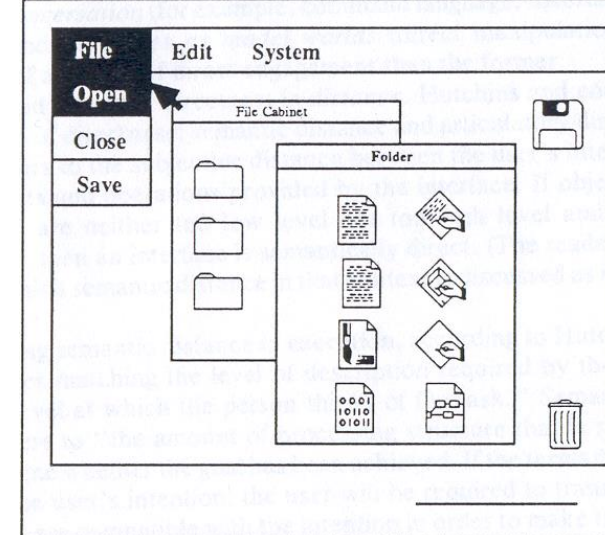https://www.youtube.com/watch?v=495nCzxM9PI

- **Actions are performed directly on visual representations** of the objects

- It is characterized by:

1- Continuous representation of objects

2- Physical actions instead of command languages

3- Fast, incremental, reversible actions with visible results

Direct manipulation **does not necessarily imply icons**; however, in most situations they are involved

Example: When a section of a text is selected and dragged elsewhere icons are not used, yet an action is performed on a visual representation of an object (text section)

Direct manipulation does not necessarily imply icons; however, in most situations they are involved

Another example:
On a mobile phone you can pinch out/in to zoom into an image or to zoom out

https://www.nngroup.com/articles/direct-manipulation/

Some applications are adequate to use direct manipulation:
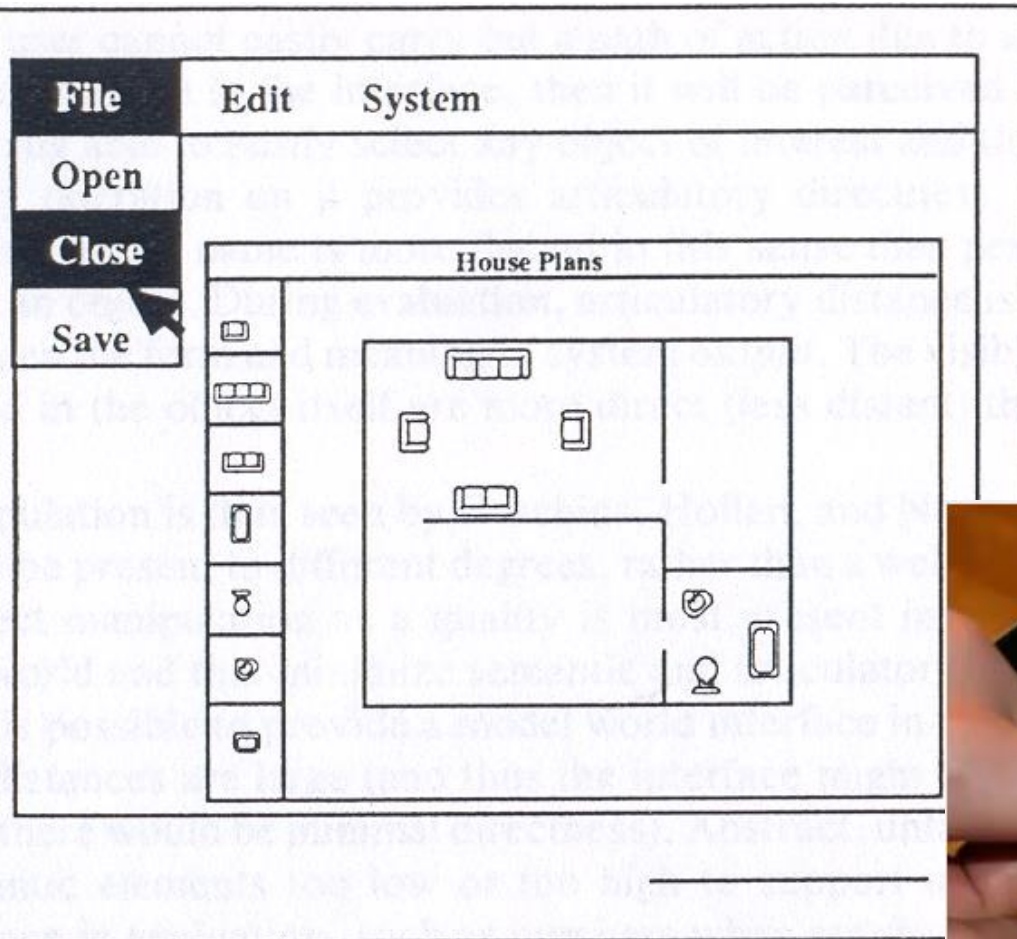
One of the earliest commercially available UI using Direct Manipulation (MacPaint)
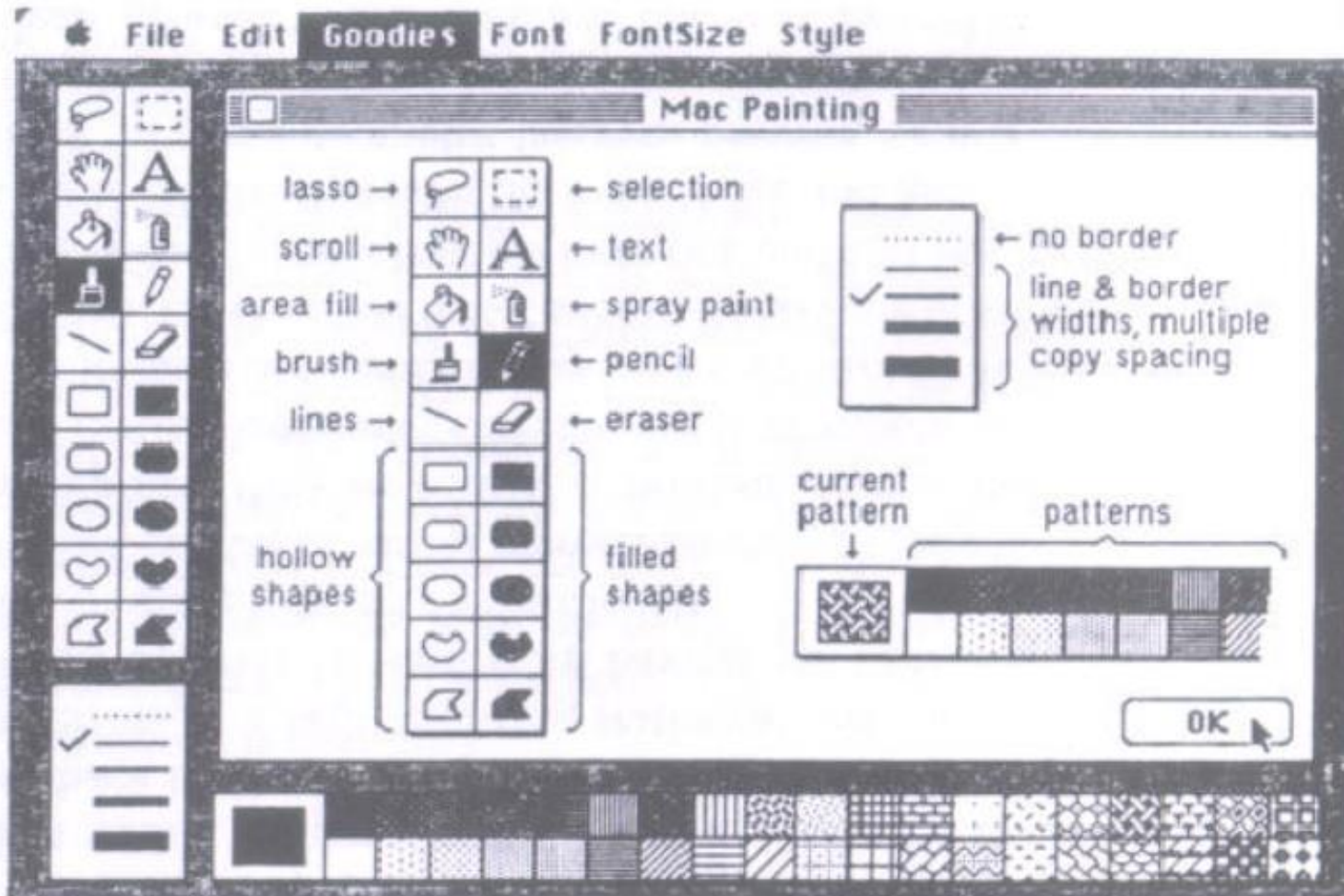
Virtual and augmented reality

Take direct manipulation to another level

- It does not exist a "pure" direct manipulation User Interface (UI)

- Direct manipulation is a **quality which may be present in different degrees**

- According to Hutchins, Hollan e Norman (1986) a UI has the following aspects:

Distance
- **semantic**
- **articulatory**
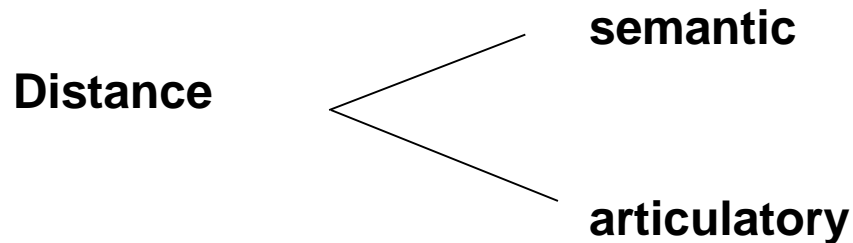
Semantic and articulatory distance

- Semantic Distance – **subjective distance** between the **user's goal** and **interface semantics**

- Articulatory distance – distance between the **meaning of the actions** and their **physical form**

Semantic Distance

If the objects and actions do not support the users' goals, semantic distance is high
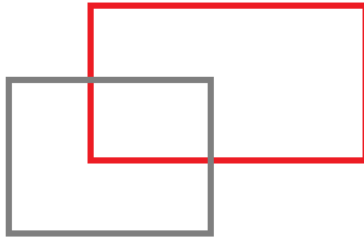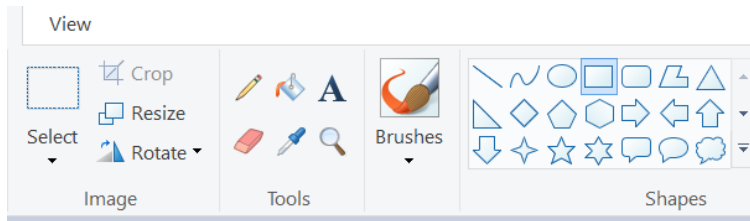
If the user wants to draw rectangles this application has a smaller semantic distance

,
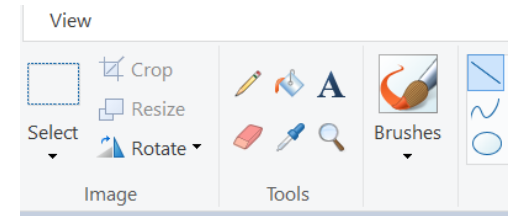
In this case the user is still able to draw rectangles, yet the application has a greater semantic distance (feels less direct)

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Articulatory Distance

When the physical way actions are performed is more similar to their meaning, articulatory distance is smaller

Selecting an option corresponds to a greater articulatory distance
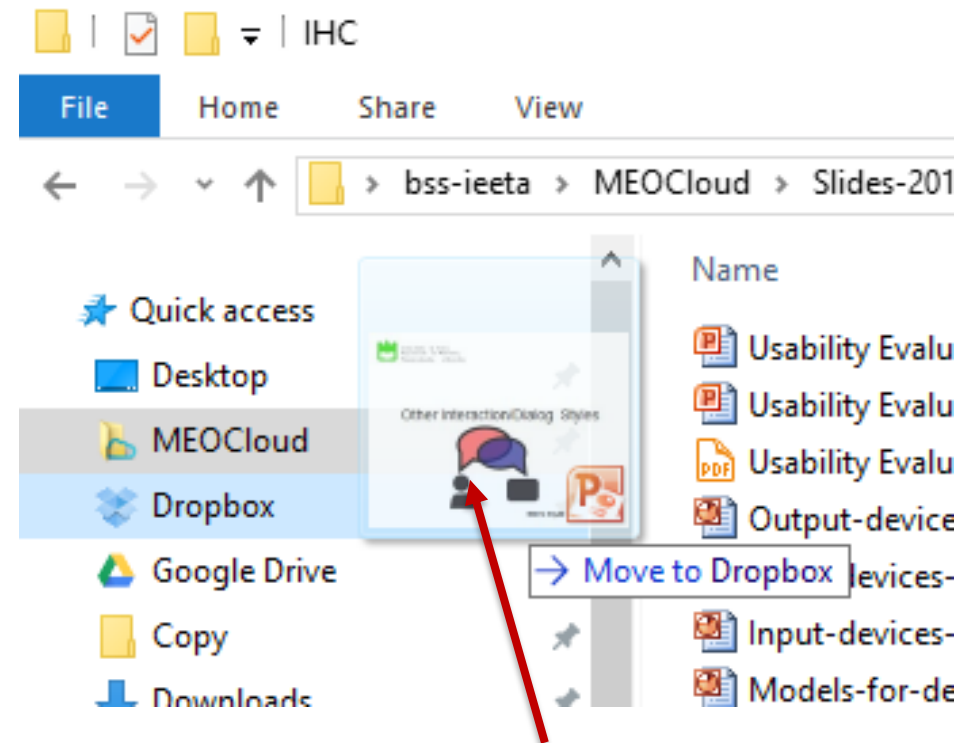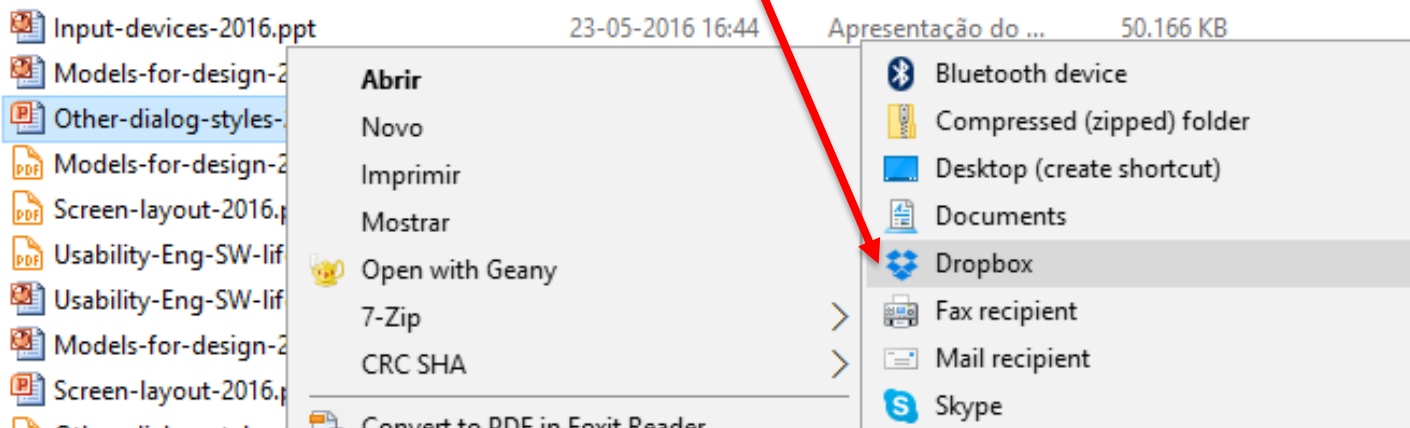
Dragging an icon corresponds to smaller articulatory distance

- According to Wolf e Rhyne (1987) there are two relevant aspects in any user interaction:

Object specification	Action specification

Object specification

name generation

visual correlation

Action specification

name generation (write a name)

visual correlation (select)

gesture generation (draw a symbol)

analogous action

coded selection (write a command)

- Specifying objects by visual correlation implies the presence of direct manipulation

- How actions are specified defines the degree of direct manipulation

- direct UI

Objects   Actions

visual correlation +   name generation
                           visual correlation
                           analogous action
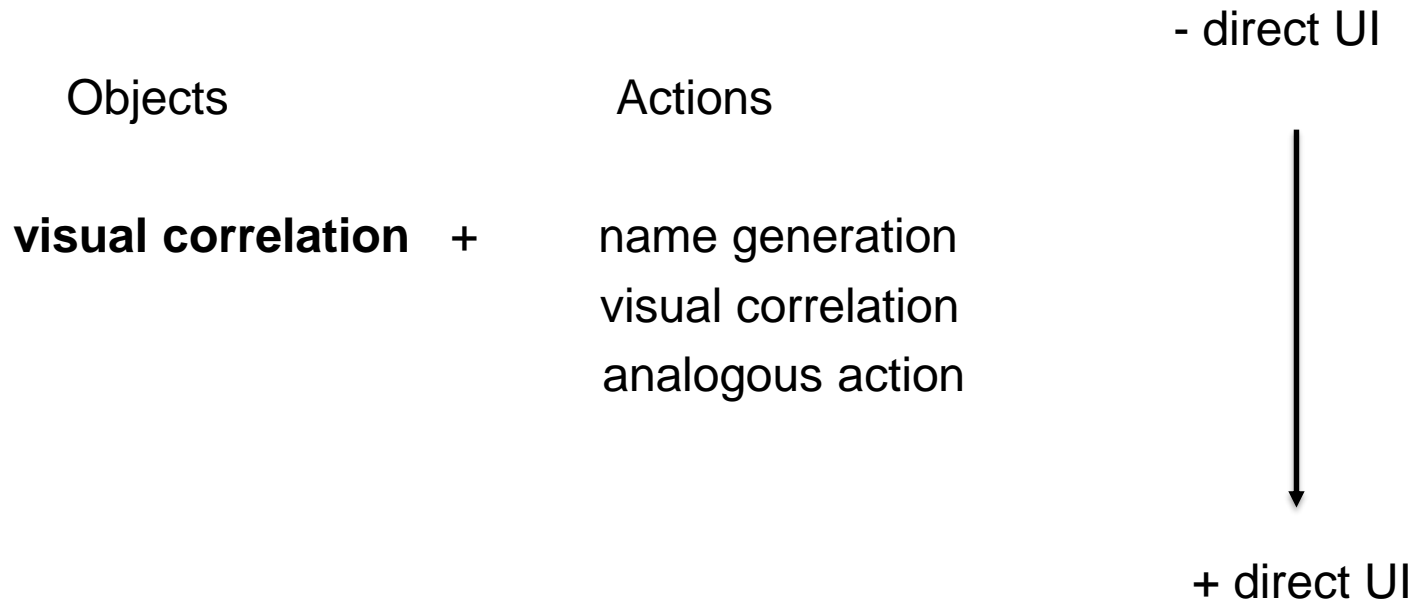
+ direct UI

Examples

```
bi@ub:~/Desktop$
bi@ub:~/Desktop$ mv java-how-to.txt smartbike_paper/
bi@ub:~/Desktop$
bi@ub:~/Desktop$
```

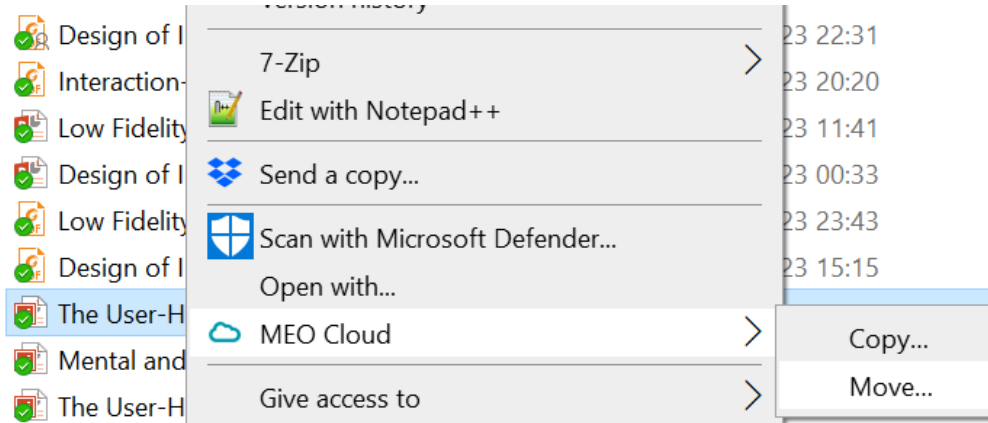Not direct manipulation UI: name generation + name generation

Direct manipulation UI:
visual correlation + visual correlation

+ Direct manipulation UI:
visual correlation + analogous action

Main advantages and disadvantages
of direct manipulation UIs

Advantages (potential)

- Easy to learn and remember (are great for novices with good design
- Direct, WYSIWYG (What you see is what you get)
- Flexible, easily reversible actions
- Immediate visual and context feedback
- May be less prone to errors

Disadvantages

- Not auto-explanatory
- May be inefficient
- Repetitive tasks are not well supported
- Some gestures can be more error-prone than typing
- Difficult to draw recognizable icons (particularly for actions)
- Icons occupy more screen real estate then text

https://www.nngroup.com/articles/direct-manipulation/

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User profile to whom direct manipulation is adequate:

Knowledge and experience:
- Moderate system experience
- Moderate to high task experience
- Frequent usage of other systems
- Low computational literacy

Work and task
- Low frequency of use
- Moderate training
- Optional usage
- Low structured tasks

Direct Manipulation design: some guidelines

Minimize articulatory and semantic distance

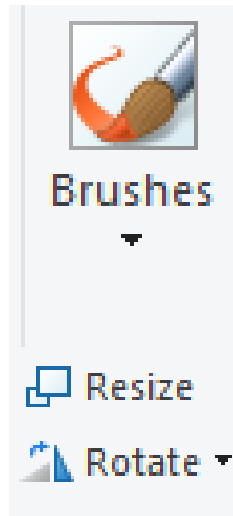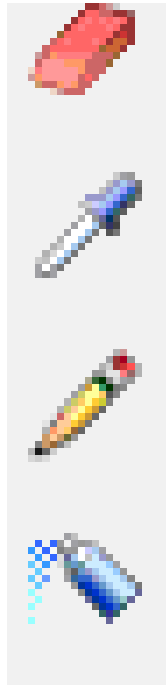Use general guidelines to design a usable UI:

- Coherence
- Good conceptual model
- Feedback
- Adequate organization of functionality
- Adequate screen layout
- Adequate colour usage
- Adequate error handling
- Etc.

https://www.interaction-design.org/literature/article/a-brief-history-of-the-origin-of-the-computer-icon
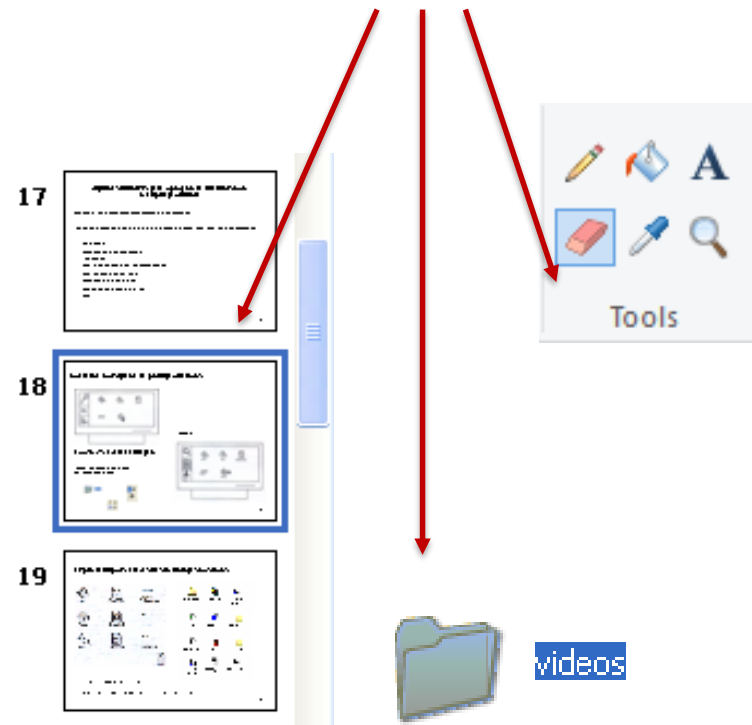
Use a coherent Icon scheme
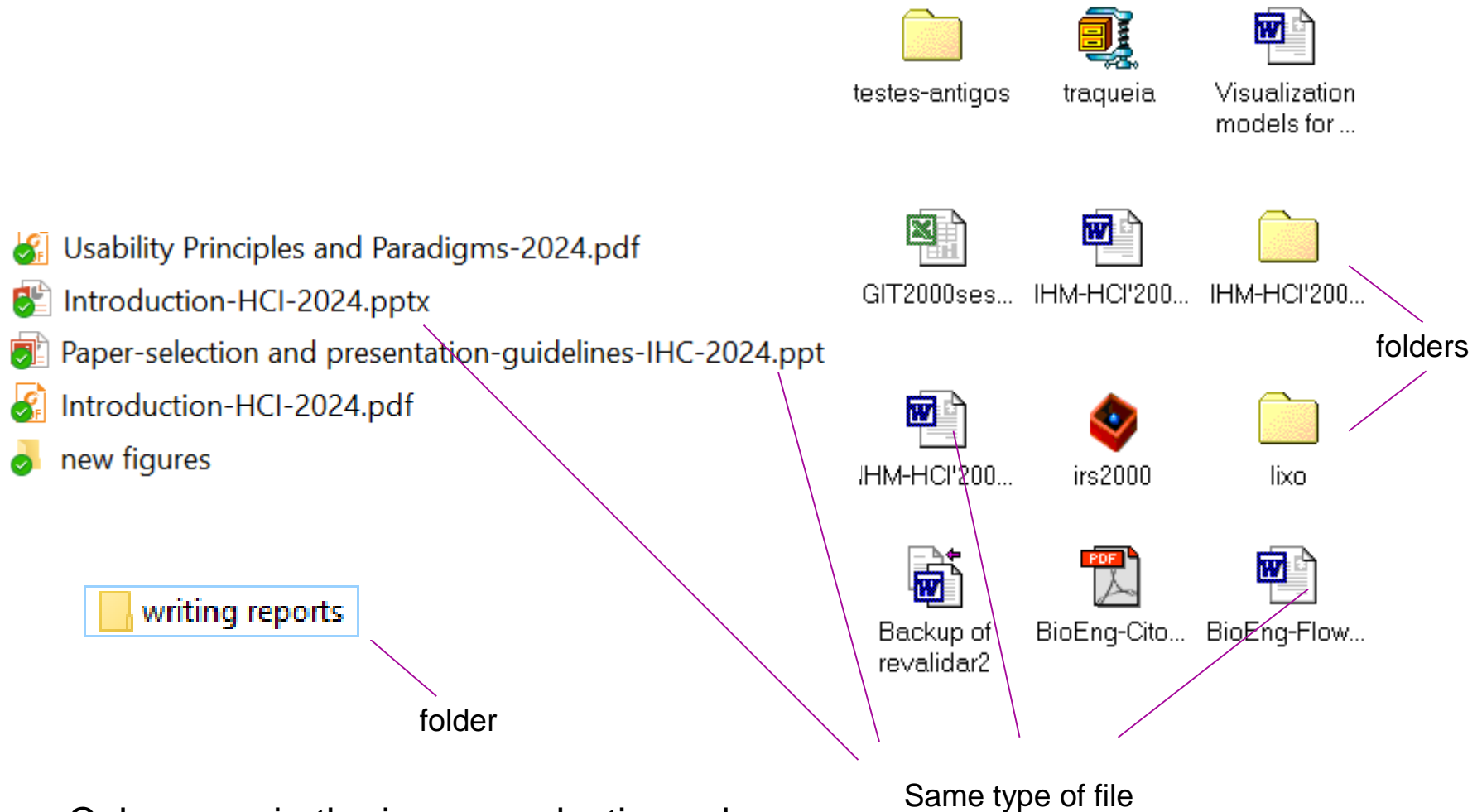
Different schemes:

better: same scheme

Visual selection feedback

Brushes

⊡ Resize

◣ Rotate ▾

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Tools

videos

Adding names
(+ recognizable)

Express relation through icon similarity

Usability Principles and Paradigms-2024.pdf

Introduction-HCI-2024.pptx

Paper-selection and presentation-guidelines-IHC-2024.ppt

Introduction-HCI-2024.pdf

new figures

writing reports

testes-antigos

traqueia

Visualization models for ...

GIT2000ses...

IHM-HCI'200...

IHM-HCI'200...

IHM-HCI'200...

irs2000

lixo

Backup of revalidar2

BioEng-Cito...

BioEng-Flow...

folders

folder

Same type of file

Coherence in the icons production scheme

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Add names to icons to make them more recognizable (recognition rather than recall)
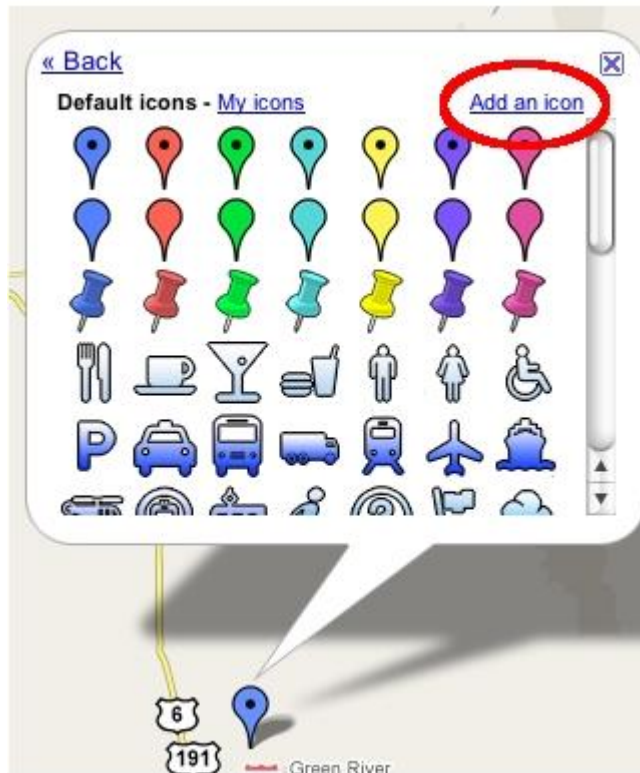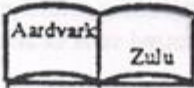

Allow name definition
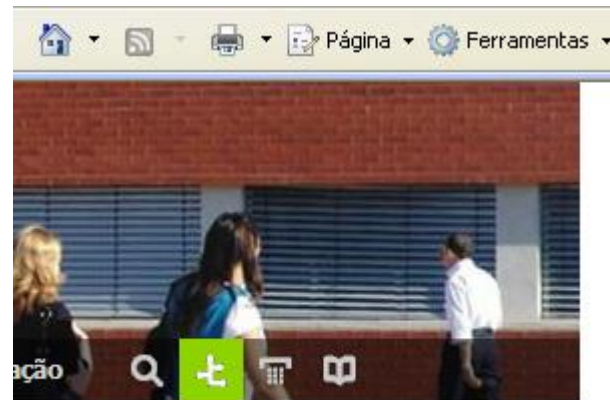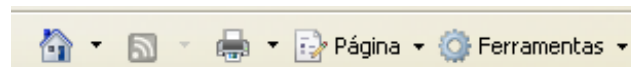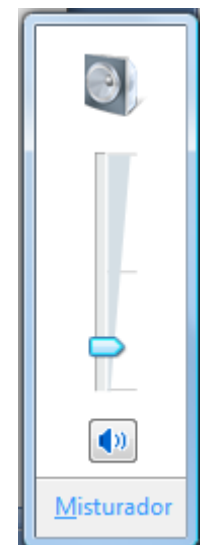
Icons must be conceptually and visually distinctive
(recognition rather than recall)

Conceptually similar icons

Best solution: conceptually and visually distinct
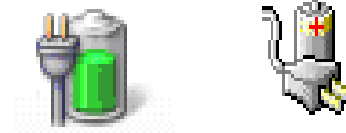
Icons should be specific/familiar not abstract/non-familiar (familiarity)

Familiar Icons?

Express objects' attributes through icons
(visibility of the system status)

Boston City Flow   Costa Rican Frog   Pensive Parakeet

icons
Microsoft Word Document
63 KB

How to use the Photos folder
Rich Text Format
1 KB

synced

Reciclagem   Reciclagem
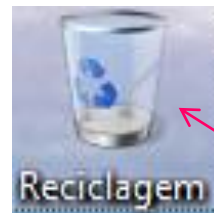
empty

In progress

Direct manipulation - Concluding remarks

"It's hard to imagine modern interfaces without direct manipulation …

Augmented-reality and virtual-reality systems will push DM to even newer limits …

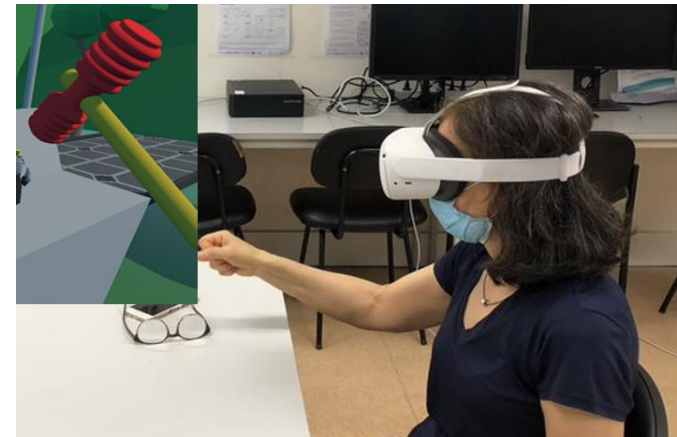Despite the many downsides, we still recommend a heavy dose of direct manipulation for most UIs"

https://www.nngroup.com/articles/direct-manipulation/

Main Bibliography

- B. Shneiderman, C. Plaisant, M. Cohen, S. Jacobs, *Designing the User Interface- Strategies for Effective Human–Computer Interaction*, 5th ed., Addison Wesley, 2010

- H. Sharp, J. Preece, and Y. Rogers, *Interaction Design: Beyond Human-Computer Interaction*, 5th Edition Wiley, 2019

- M. Soegaard, Interaction Styles, *Interaction Design Foundation Encyclopedia*, 2nd edition,

  http://www.interactiondesign.org/encyclopedia/interaction_styles.html