Universidade de Aveiro
Departamento de Electrónica,
Telecomunicações e Informática

Direct Manipulation

Human-Computer Interaction   **Beatriz Sousa Santos, 2021**

Interaction/ Dialog styles
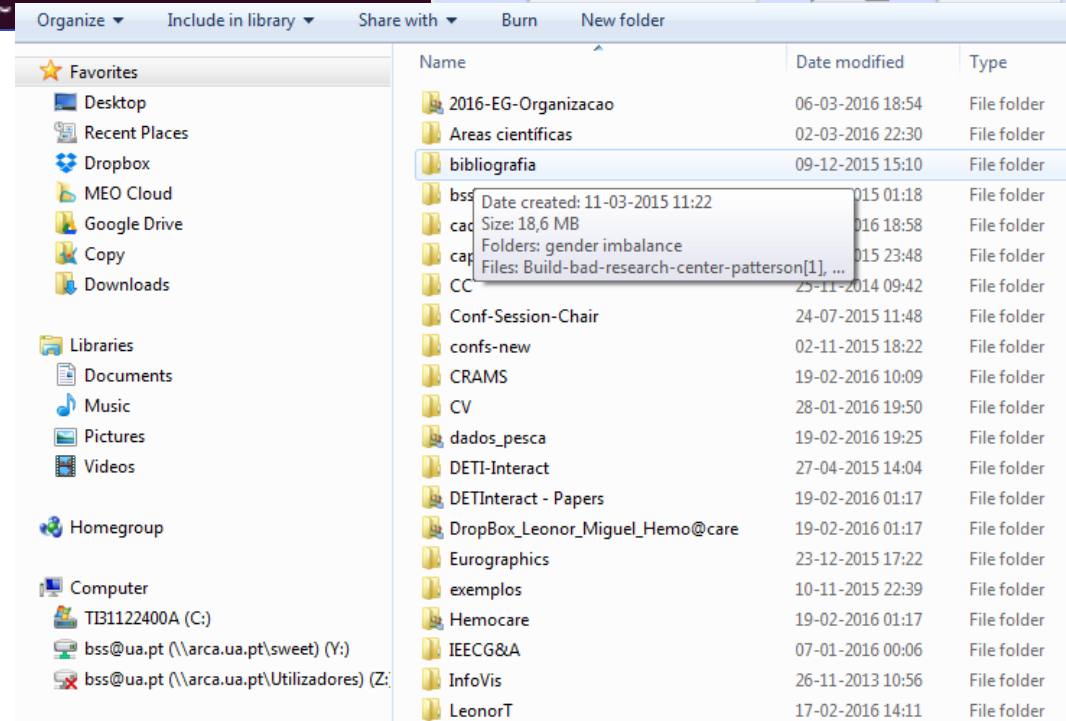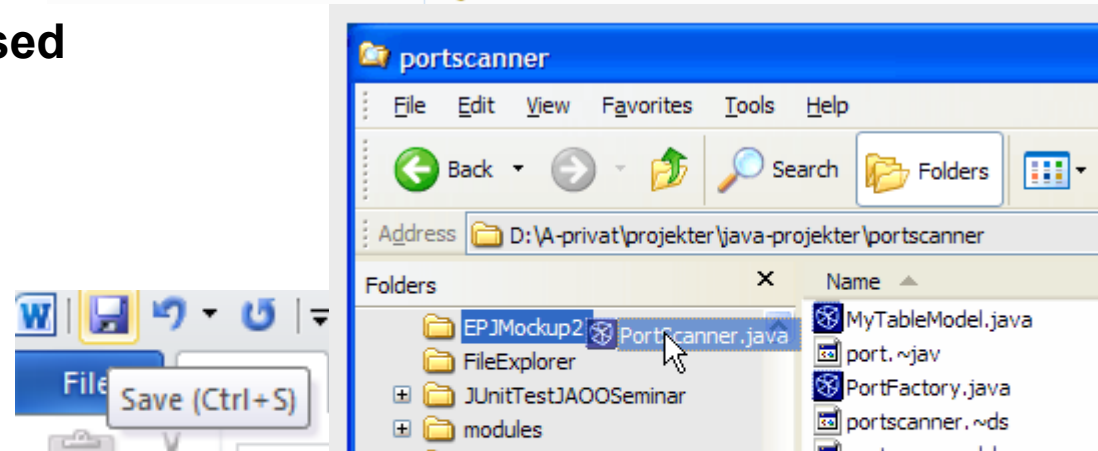
A possible classification:

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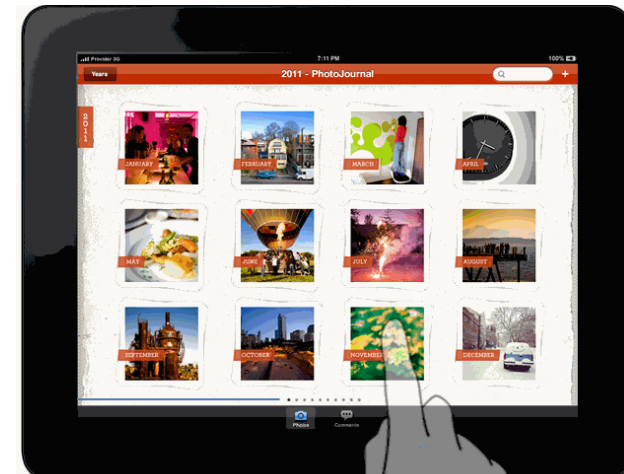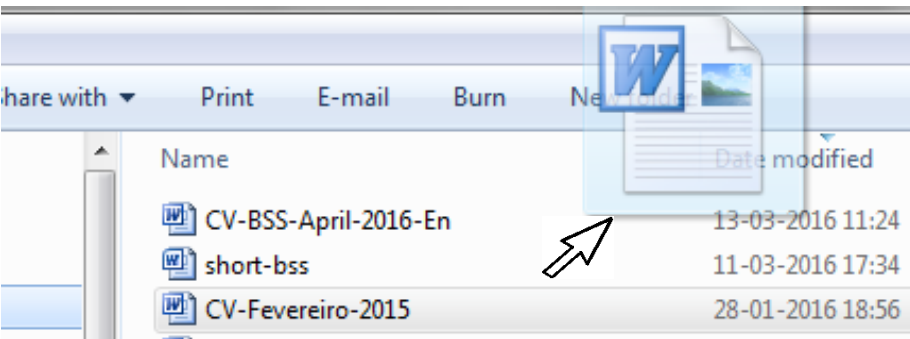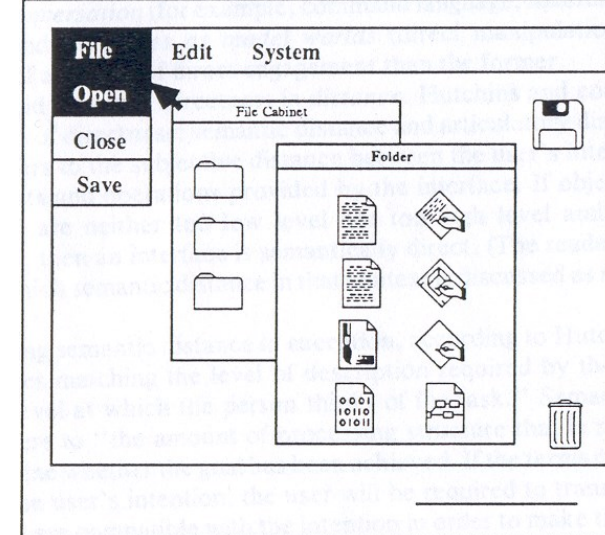
Direct manipulation does not necessarily imply icons; however, in most situations they are involved

2 RELATED WORK

Despite the growing interest in usability related research in the VE community, not as many papers concerning usability evaluation exist, as compared to papers proposing new methods, techniques or systems. For instance, in a research recently conducted, we were able to find only a few studies directly comparing user performance while using VEs in desktops and systems including a HMD [Sousa Santos,2008] [Sousa Santos,2009]. Analyzing these studies, it can be observed that controlled experiments involving users have been the most used evaluation method, complemented in some cases with a questionnaire. We can also observe that most studies were performed in a general context (as opposed to applied to a specific situation), and that search and navigation were the chosen tasks in a significant part of them.

User studies have been considered an important method in other contexts, as Scientific Visualizations and Augmented Reality [Kosara,2003][Gabbard,2008]. We believe that they can, likewise, contribute to optimize VEs informing their design within a usability engineering approach; however, they can also be used to compare alternatives, validate solutions, and more fundamentally help seeking insight into why a particular solution is effective, thus allowing establish design guidelines.

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To study and compare usability issues concerning our low cost platforms we had to choose a context or use since usability cannot be defined in abstract. In fact, it is associated to users performing certain tasks [Nielsen,1993] (page 27) [Dix,2004] (page 192). Given that we had not a
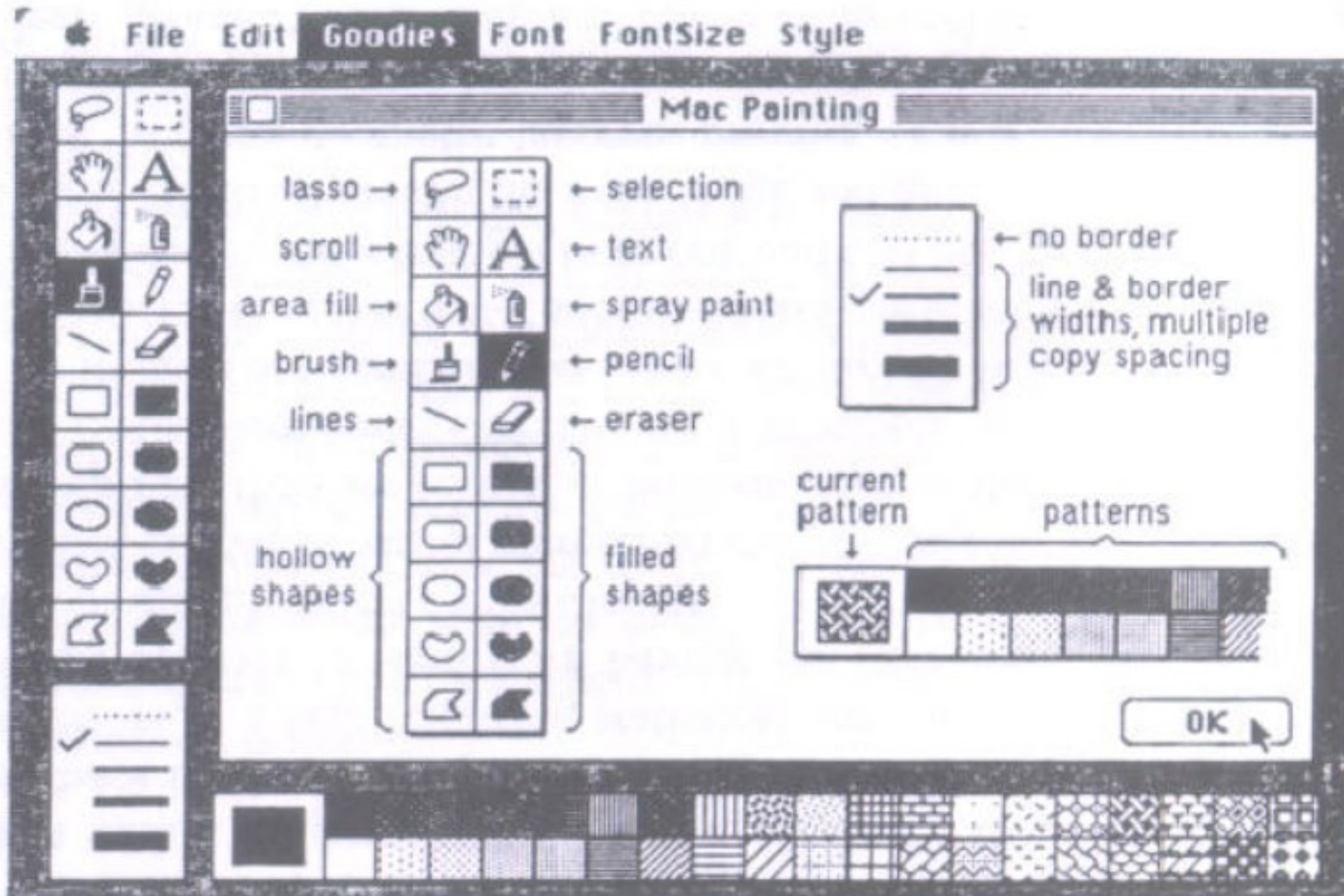
Example: When a section of a text is selected and draged elsewhere icons are not used, yet an action is performed on a visual representation of an object (text section)

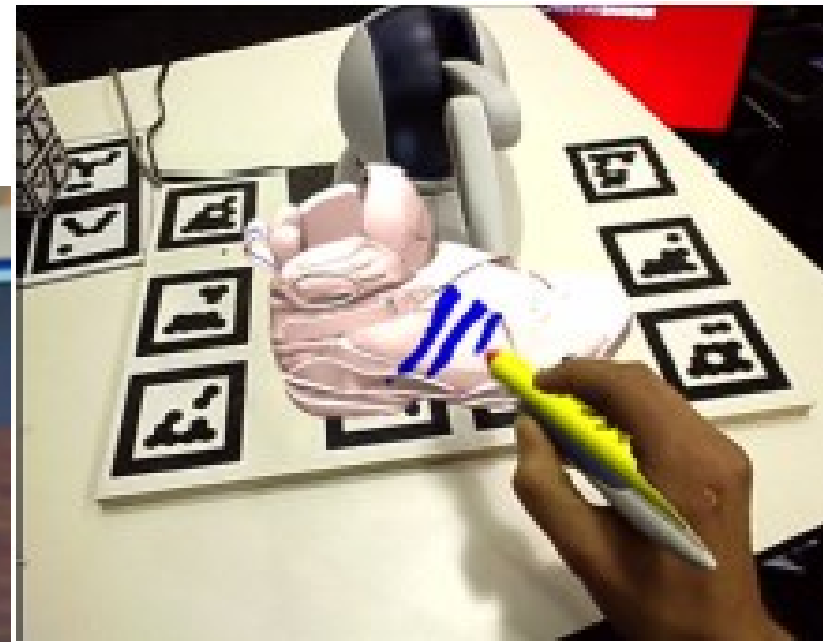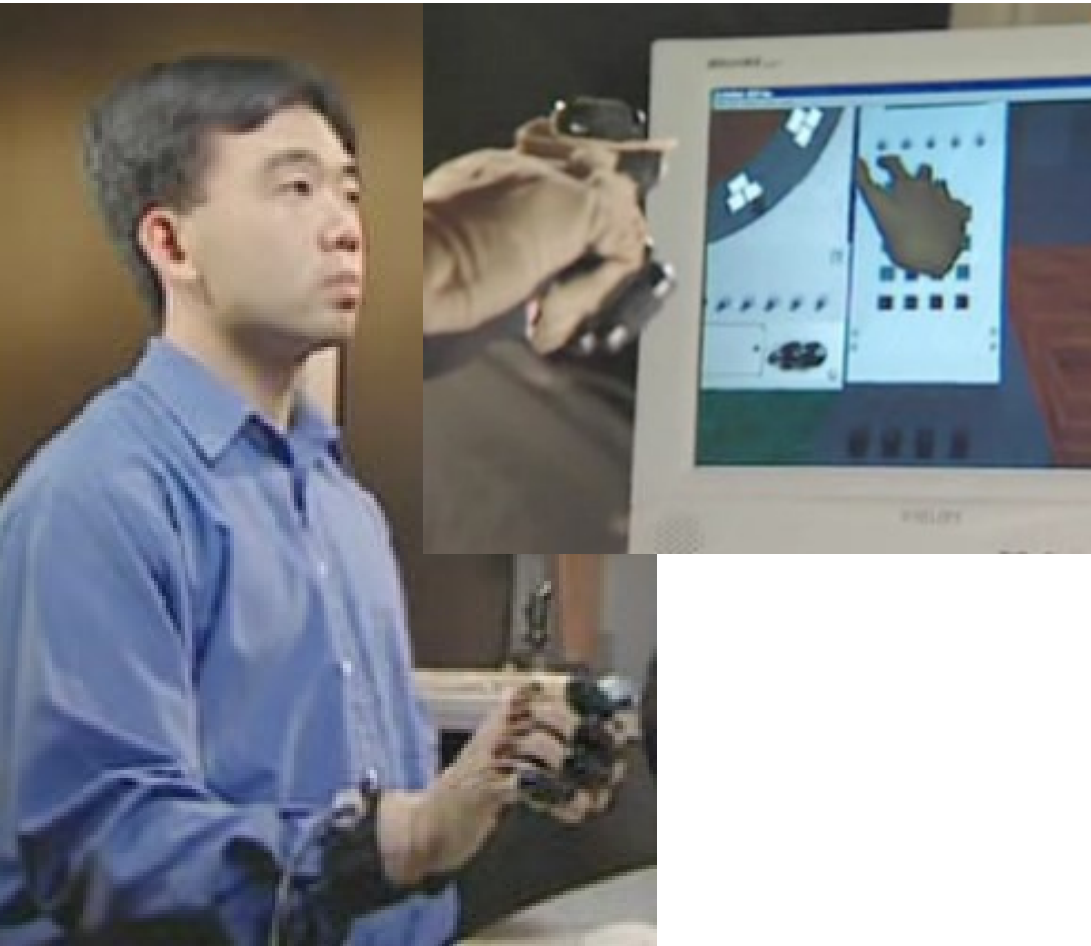Some applications are adequate to use direct manipulation:
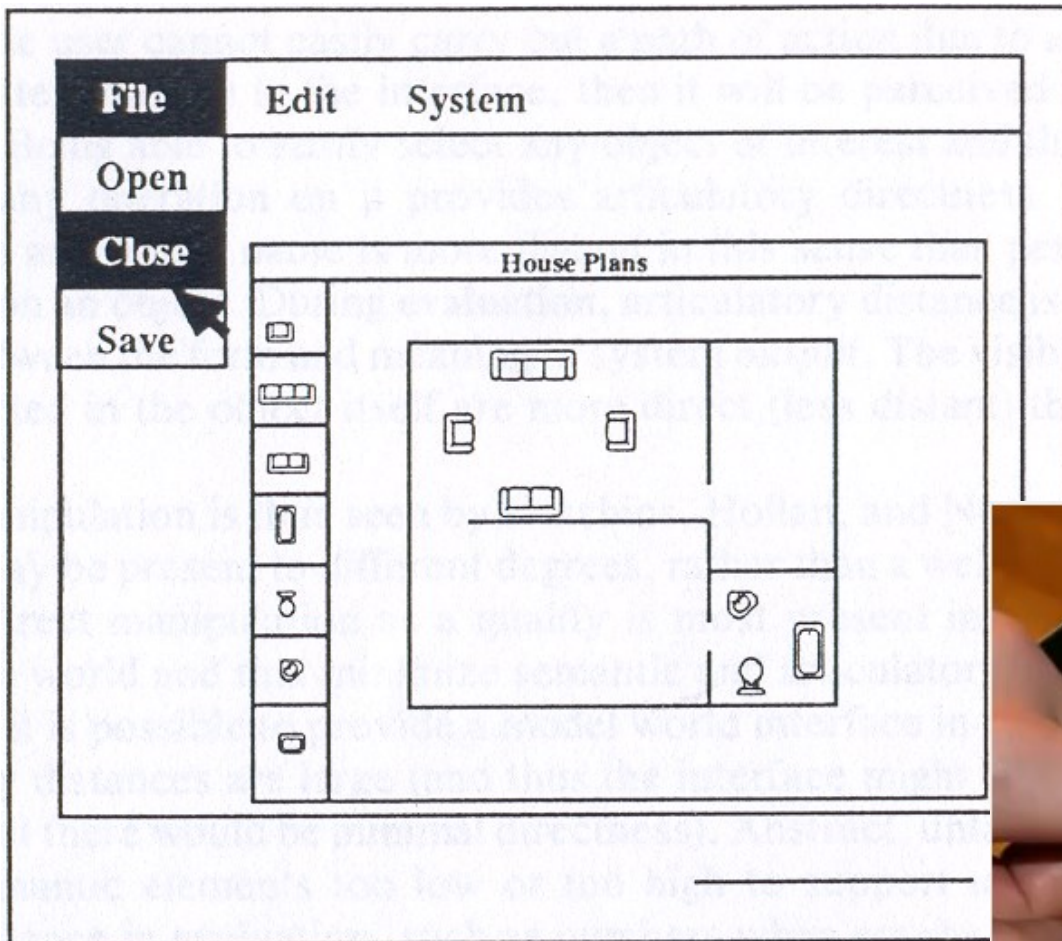
One of the earliest commercially available UI using Direct Manipulation (MacPaint)
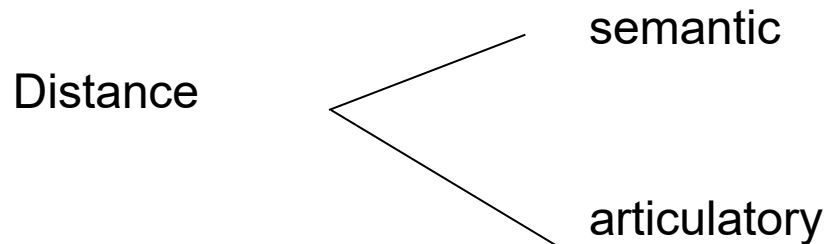
Virtual and augmented reality

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
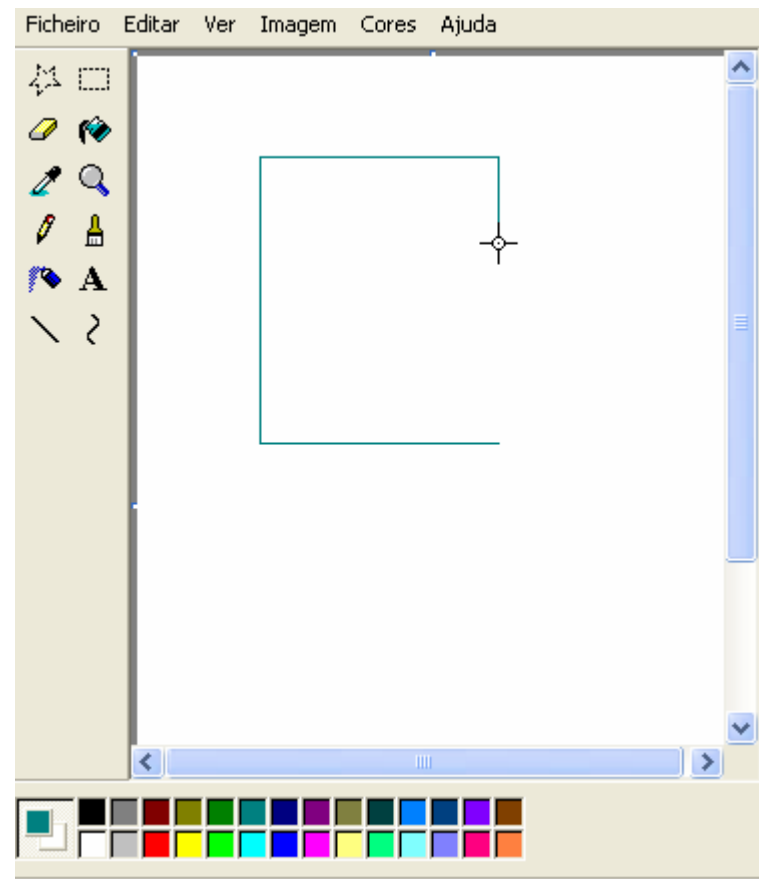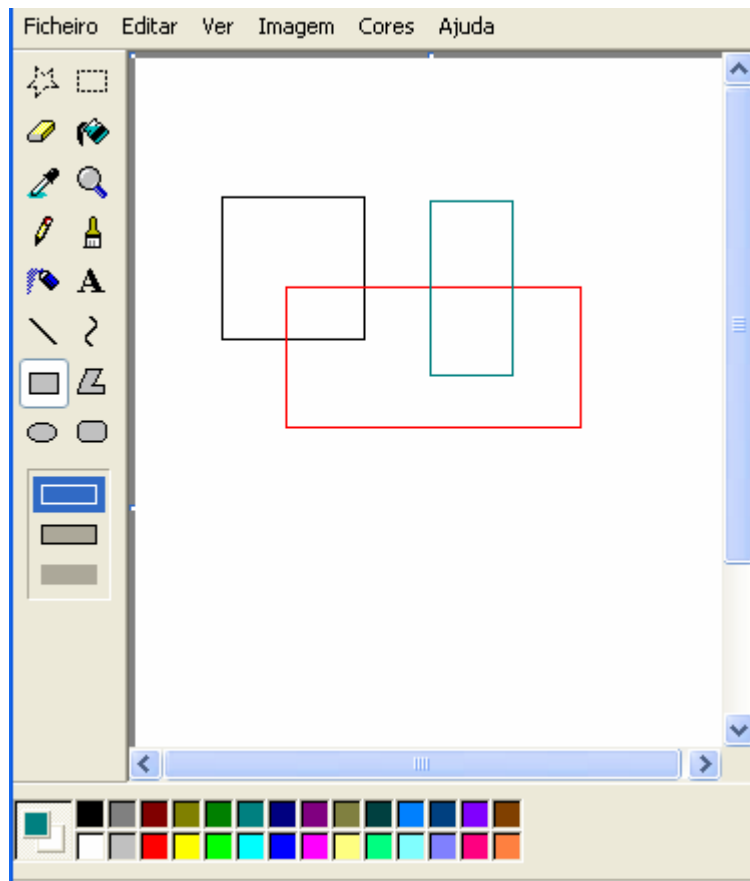
If the user wants to draw rectangles this application has a smaller semantic distance
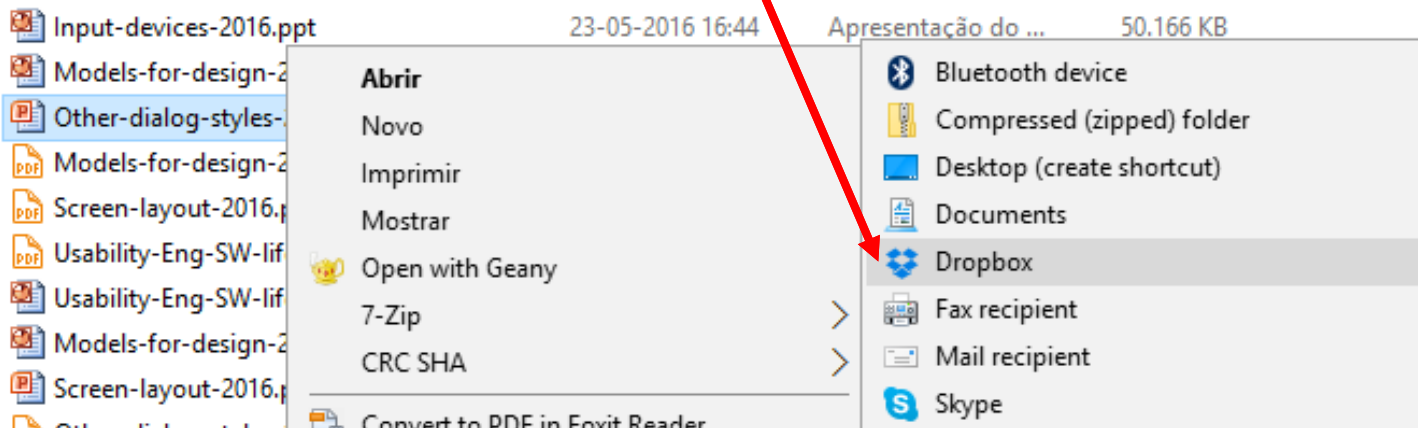
Articulatory Distance

When the physical way actions are performed is more similar to their meaning, articulatory distance is smaller
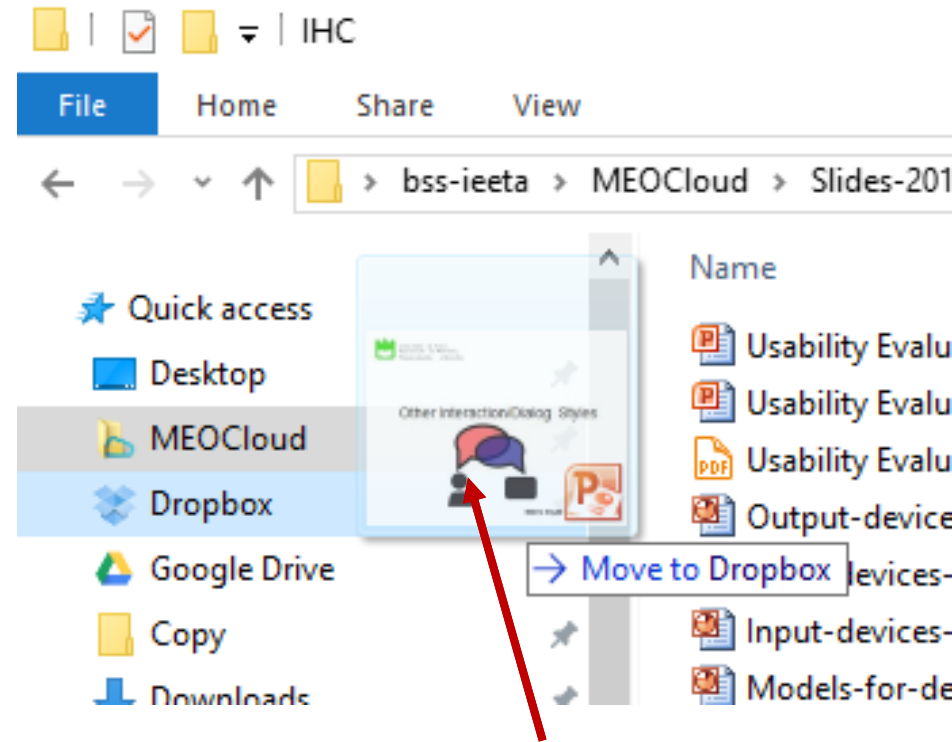
Selecting an option corresponds to a greater articulatory distance

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

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
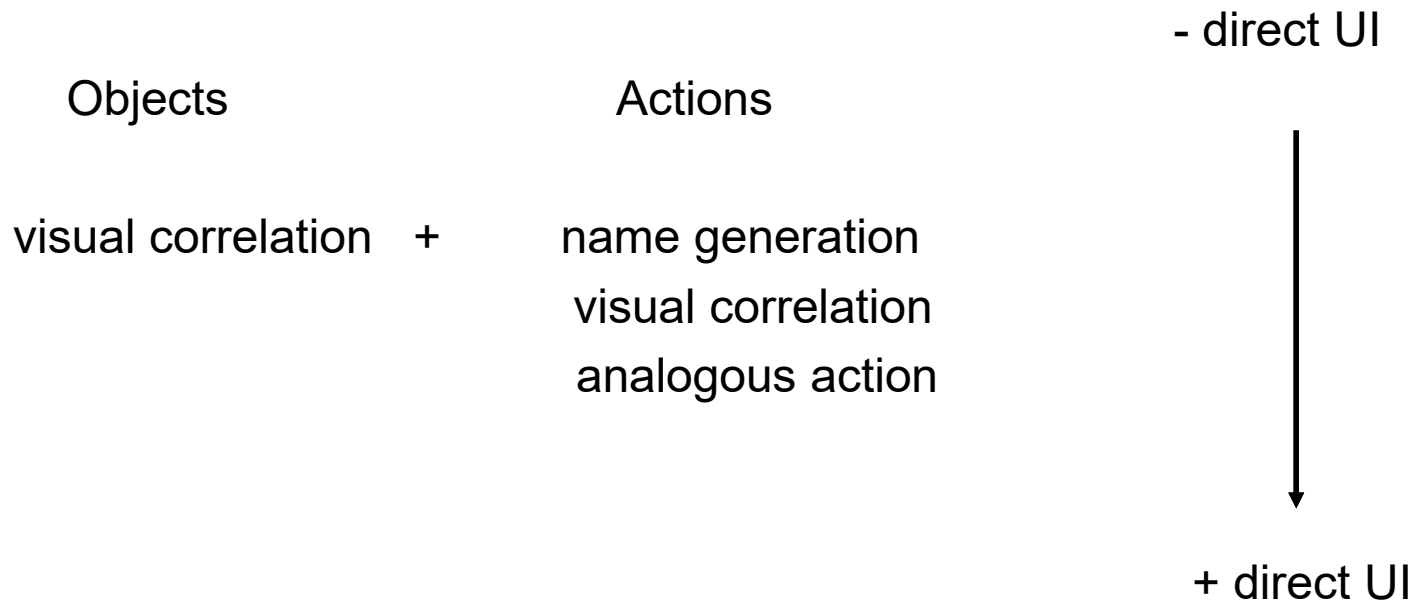
+ direct UI

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
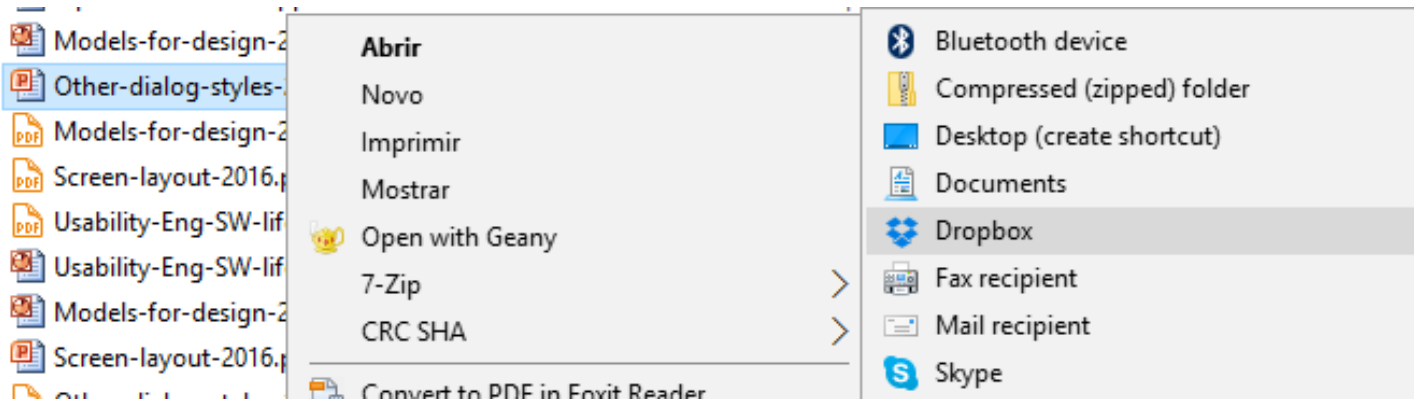
Direct manipulation UI:
visual correlation + visual correlation

+ Direct manipulation UI:
visual correlation + analogous action

Main advantages and disadvantages
of direct manipulation UIs

Advantages (potential)
- Easy to learn and remember
- Direct, WYSIWYG (What you see is what you get)
- Flexible, easily reversible actions
- Immediate visual and context feedback
- Less prone to errors

Disadvantages
- Not auto-explanatory
- May be inefficient
- Difficult to draw recognizable icons (particularly for actions)
- Icons occupy more screen real estate then text

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

Tools

videos
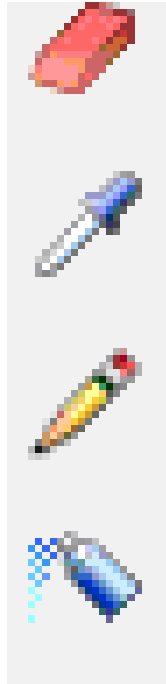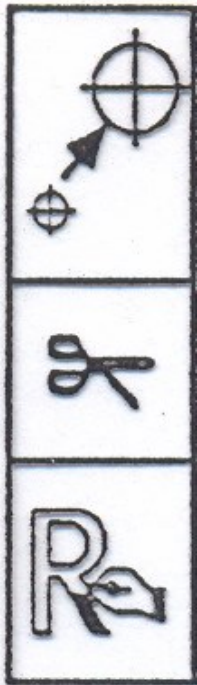
Adding names
(+ recognizable)

18
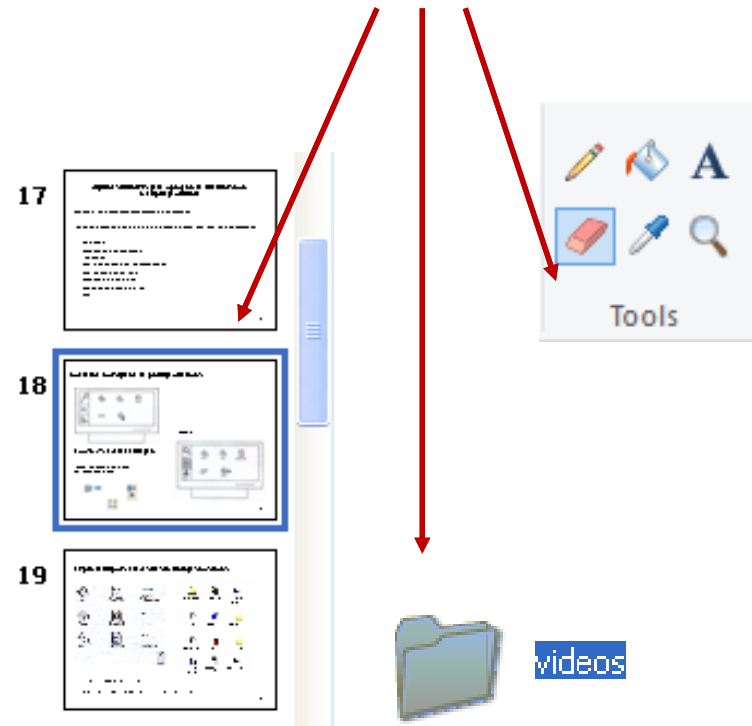
Express relation through icon similarity

CHI2017-recommended sessions.pdf

IHC-ECT-aulas-2017.htm

IHC_PlanoAulas_BSS.xlsx

TASK ANALYSIS 4250.doc

Tips for Working Successfully in a Group.docx

assign3-task-analysis-esm.pdf

HTA.docx

Task Analysis template.doc

writing reports

folder

testes-antigos   traqueia   Visualization models for ...

GIT2000ses...   IHM-HCI'200...   IHM-HCI'200...

folders

IHM-HCI'200...   irs2000   lixo

Backup of revalidar2   BioEng-Cito...   BioEng-Flow...

Same type of file

Coherence in the icons production scheme

Add names to icons to make them more recognizable (recognition rather than recall)
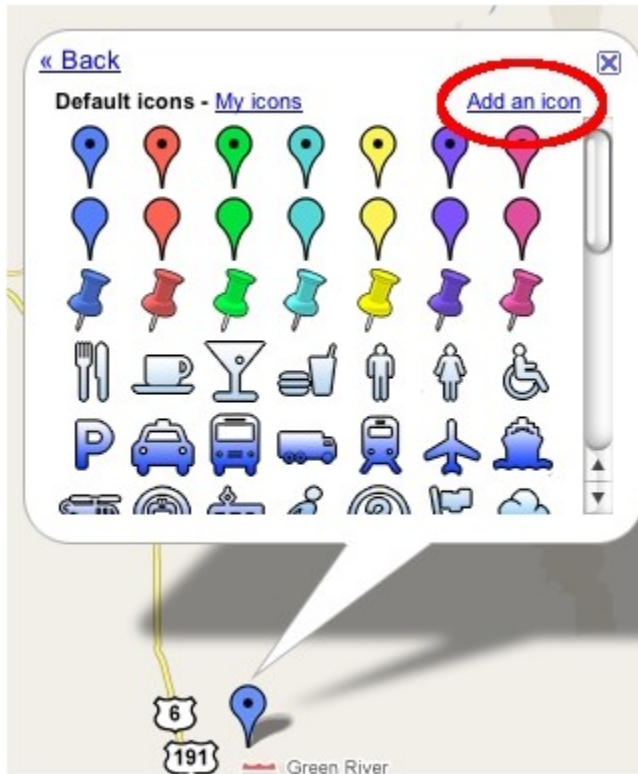
Allow name definition
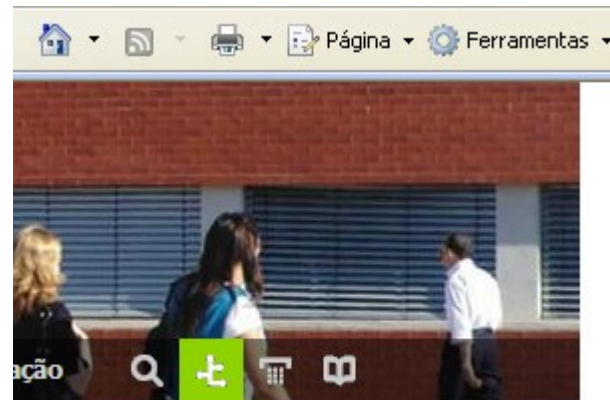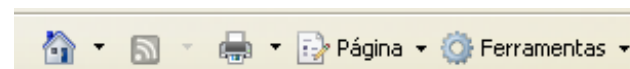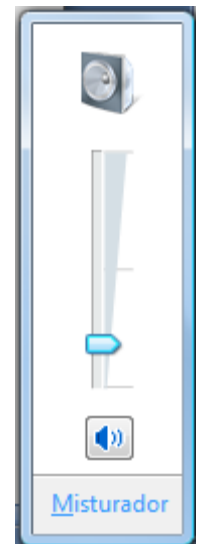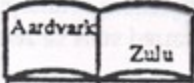
Icons must be conceptually and visually distinctive
(recognition rather than recall)
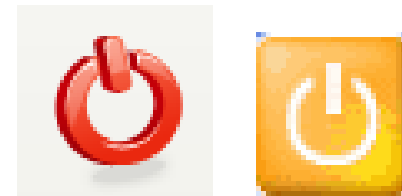
Conceptually similar icons

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)

synced

empty

In progress

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