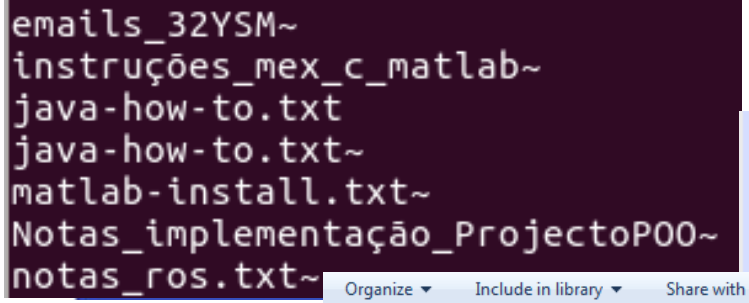
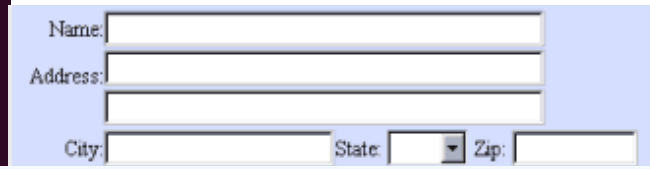
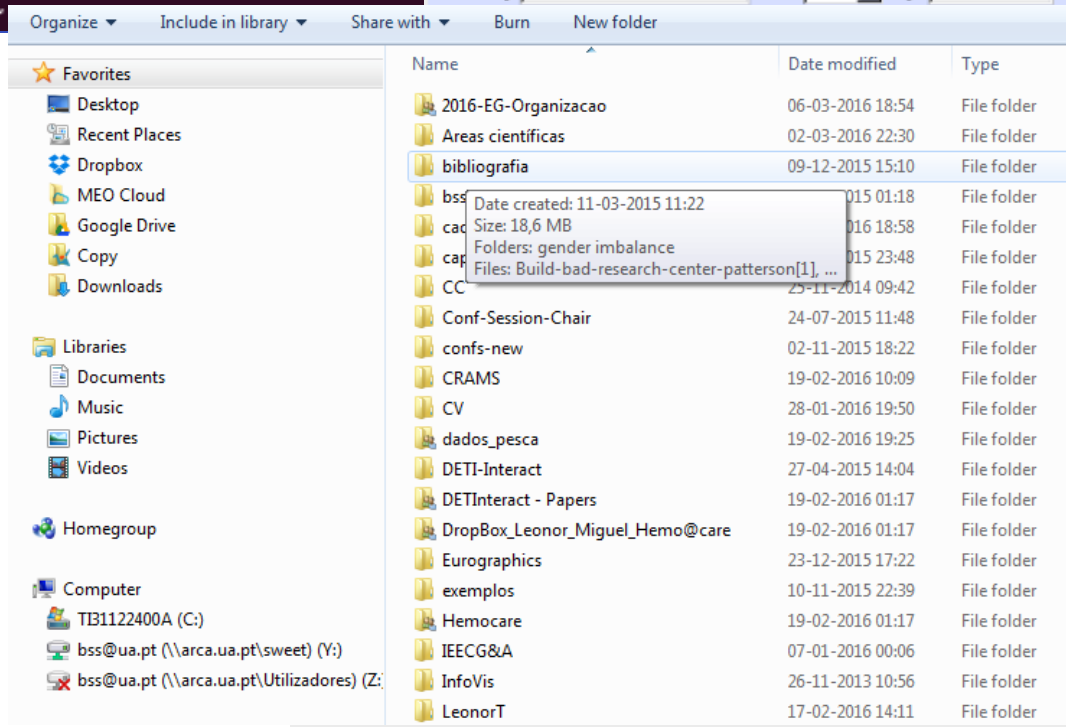
Universidade de Aveiro
Departamento de Electrónica,
Telecomunicações e Informática

Direct Manipulation

Interaction/ Dialog styles



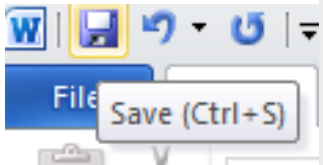


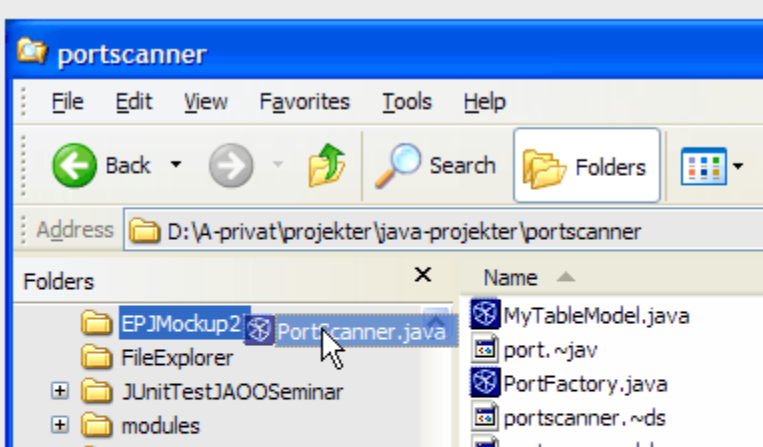


- Menus
- Fill-in-forms
- Direct manipulation
- Function keys
- Question and answer
- Command languages
- Natural languages

A possible classification:

Often two or more styles are used simultaneously



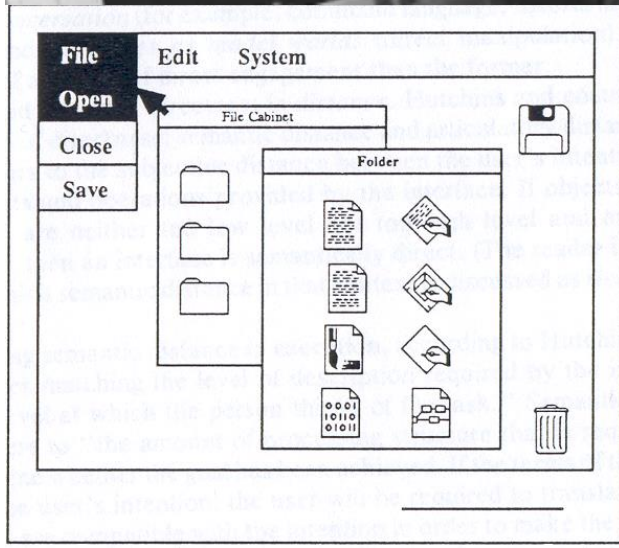


Direct manipulation

(name coined by Shneiderman, 1982)

- Can be traced down to Sketchpad

https://www.youtube.com/watch?v=495nCzxM9PI

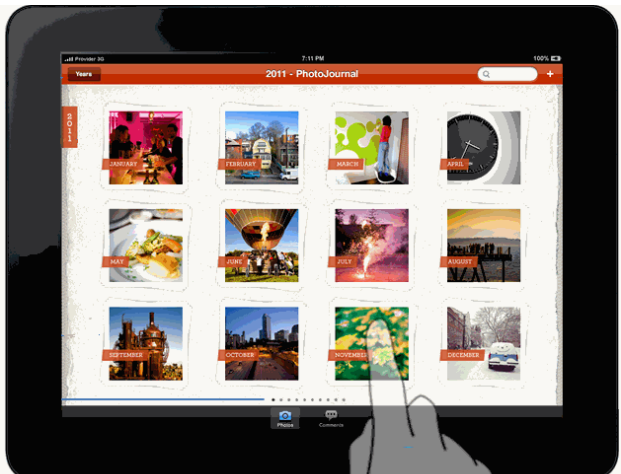


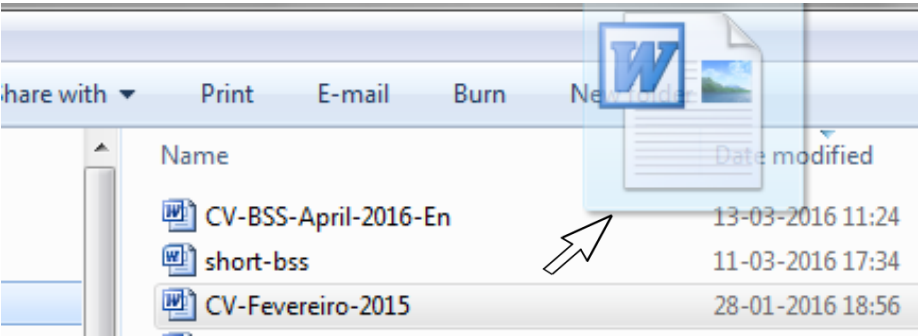
- **Actions are performed directly on visual representations** of the objects
- It is characterized by:

1- Continuous representation of objects

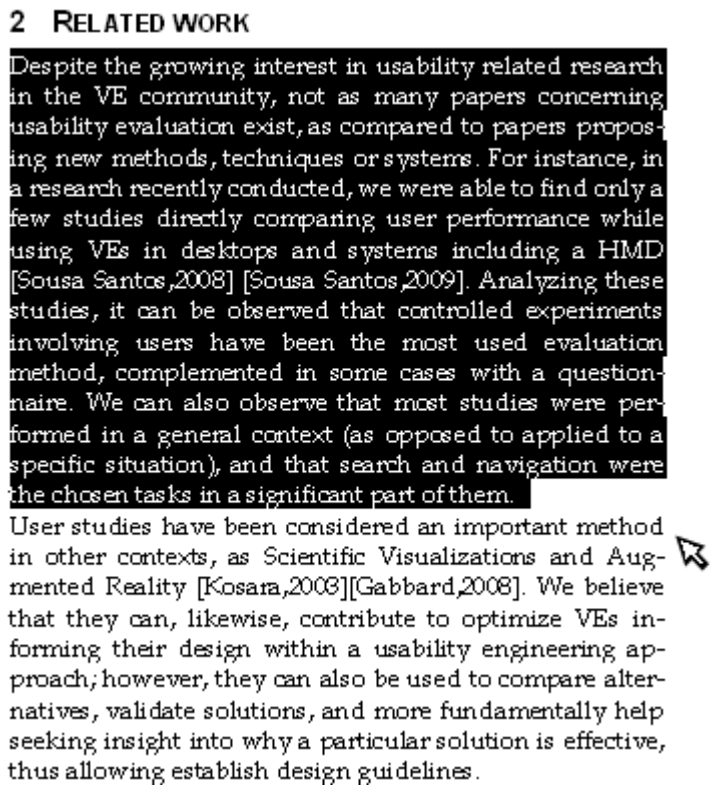
2- Physical actions instead of command languages

3- Fast, incremental, reversible actions with visible results





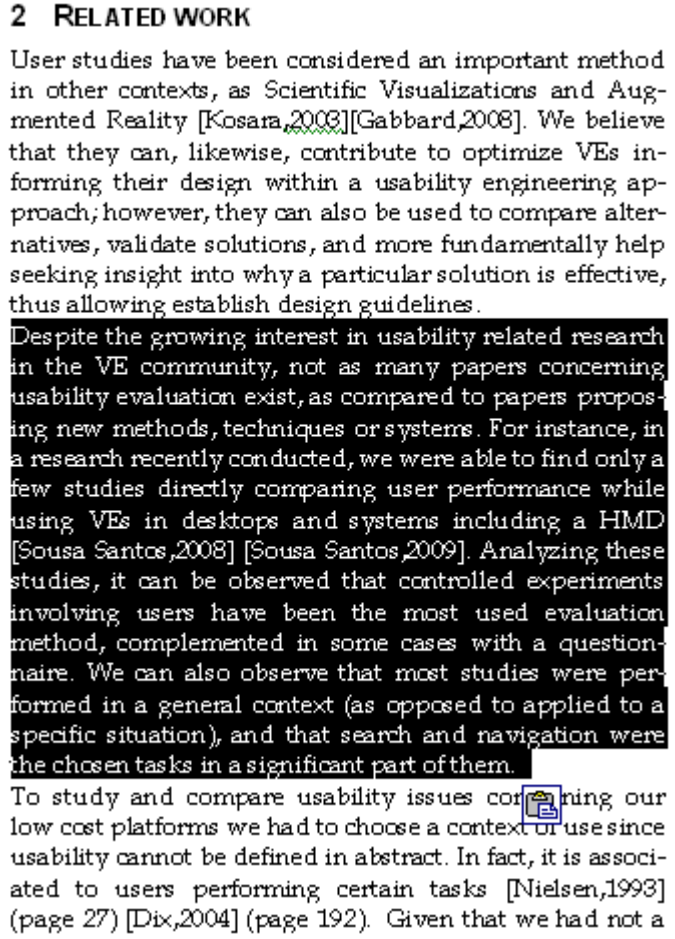
Direct manipulation **does not necessarily imply icons**; however, in most situations they are involved



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 of 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

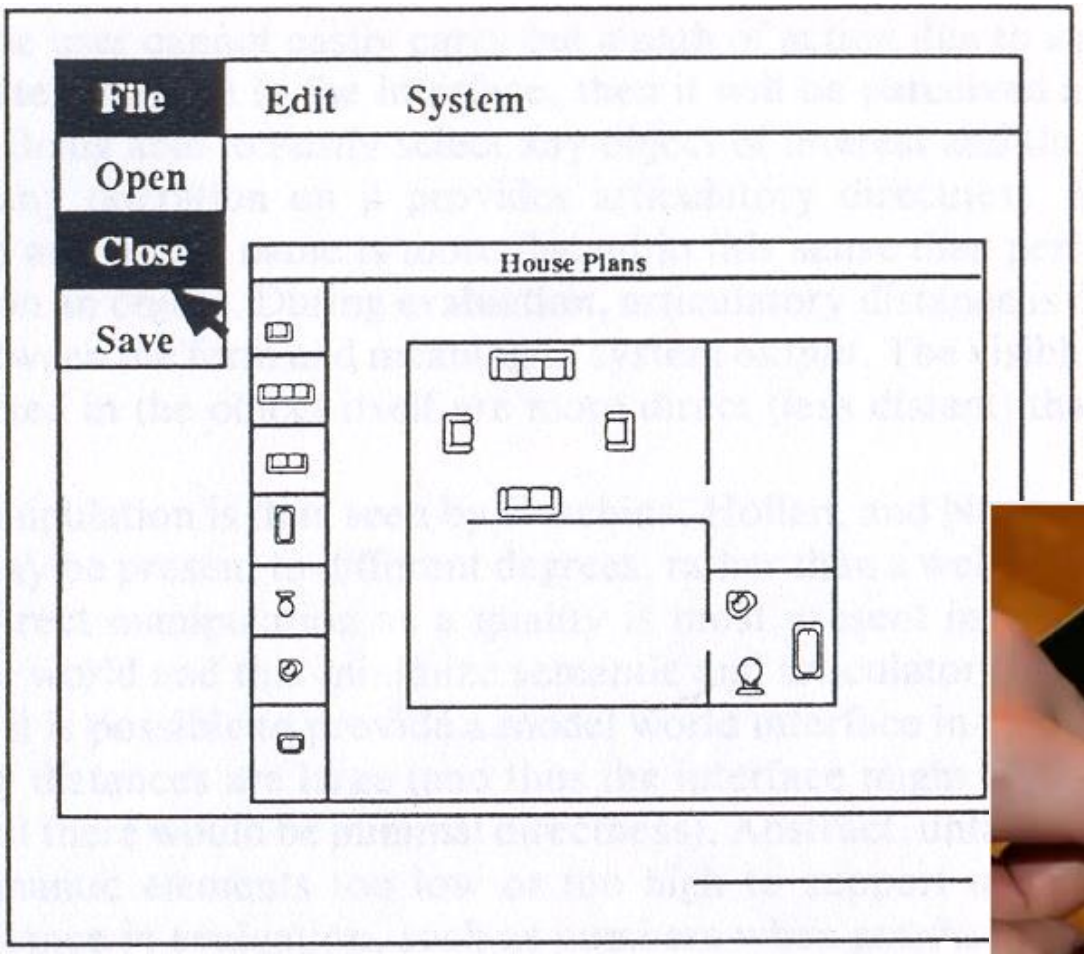
Example: When a section of a text is selected and dragged elsewhere icons are not used, yet an action is performed on a visual representation of an object (text section)

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

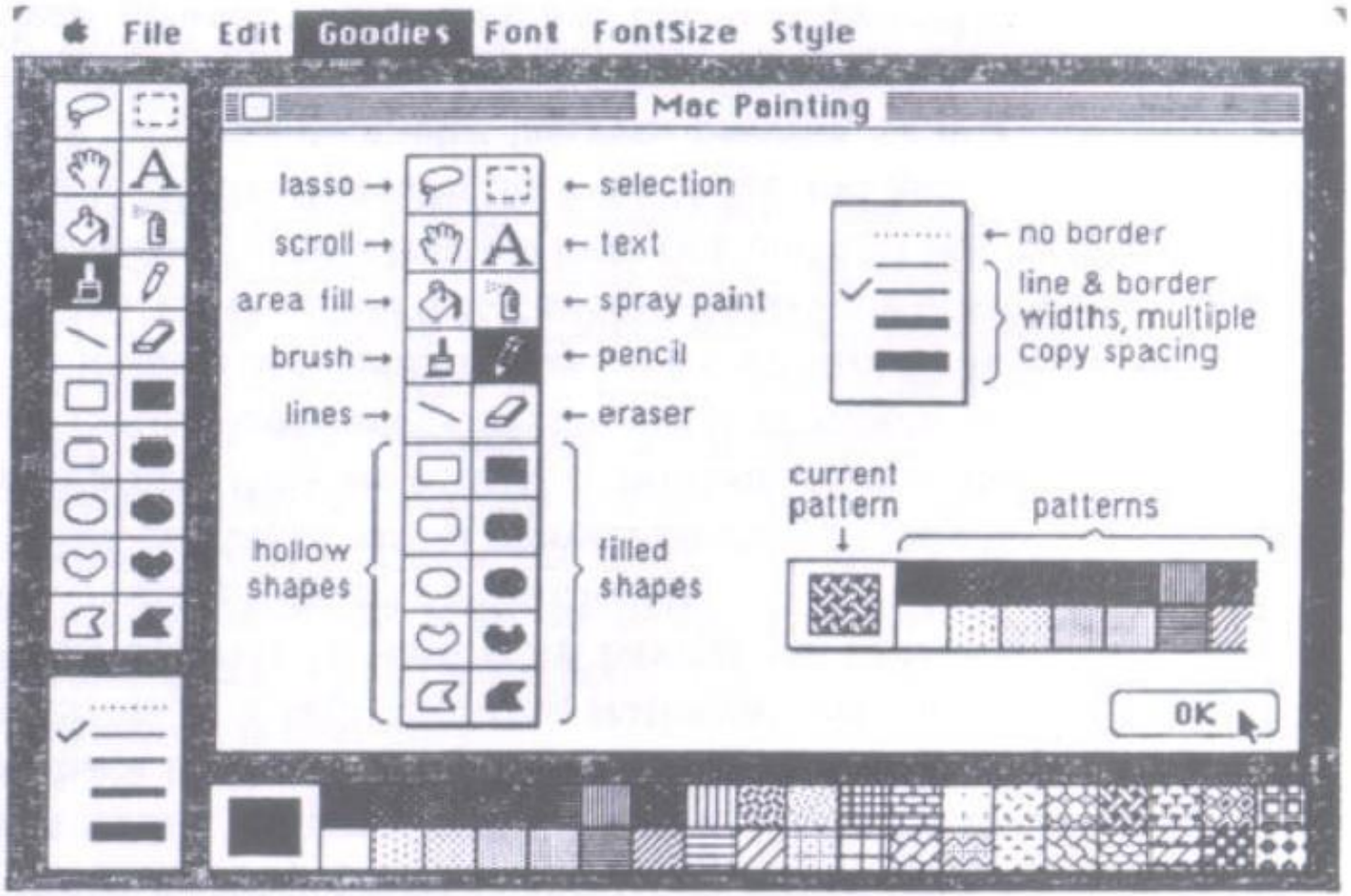
Another example:
On a mobile phone you can pinch out/in to zoom into an image or to zoom out

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

Some applications are adequate to use direct manipulation:

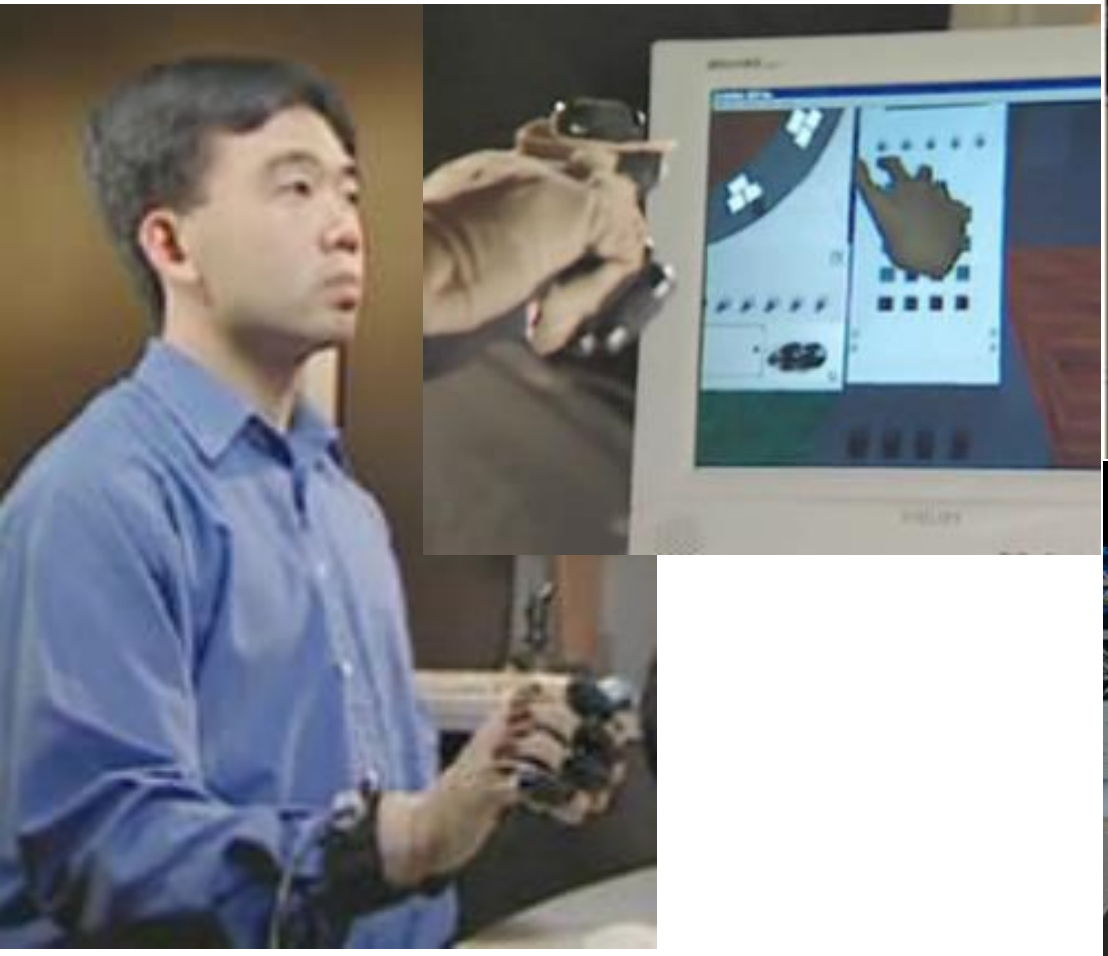


One of the earliest commercially available UI using Direct Manipulation (MacPaint)



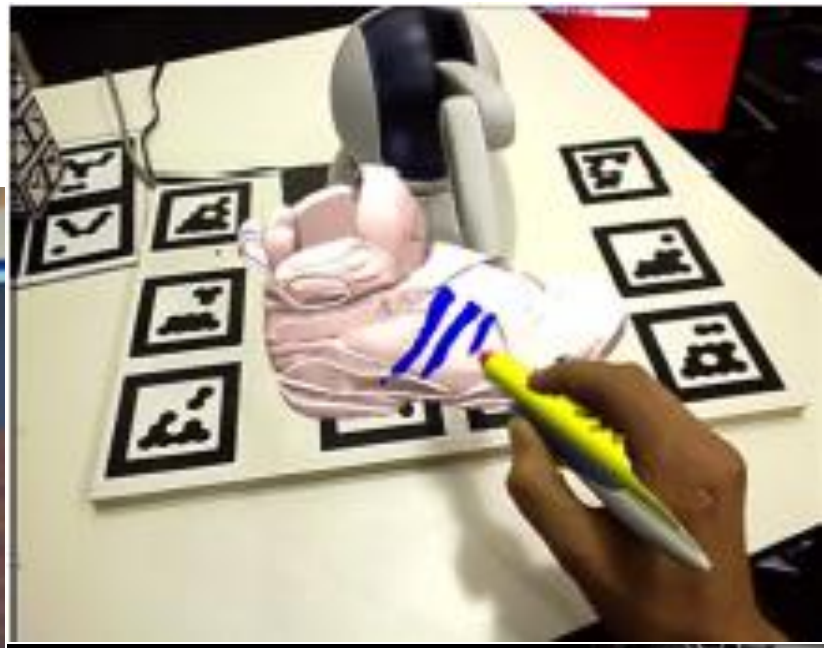
Virtual and augmented reality

Take direct manipulation to another level

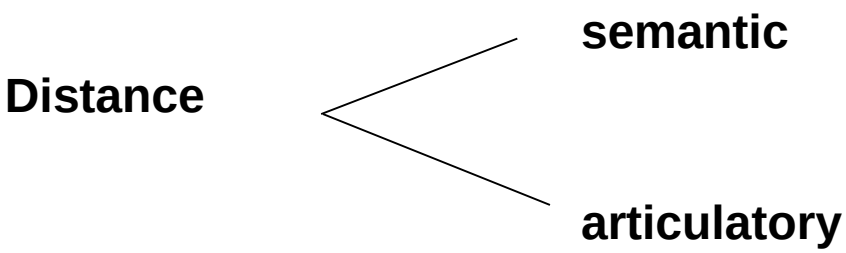


http://www.cyberglovesystems.com/cad-evaluator

http://www.magicvisionlab.com/pub/eck_ieeevr13/paper.pdf

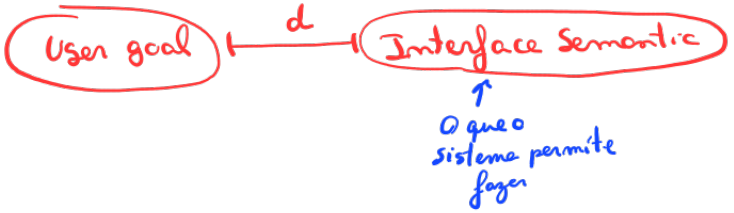


- It does not exist a “pure” direct manipulation User Interface (UI)
- Direct manipulation is a **quality which may be present in different degrees**
- According to Hutchins, Hollan e Norman (1986) a UI has the following aspects:



Semantic and articulatory distance

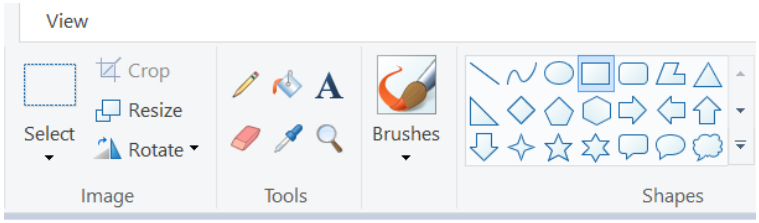
- Semantic Distance – **subjective distance** between the **user's goal** and **interface semantics**

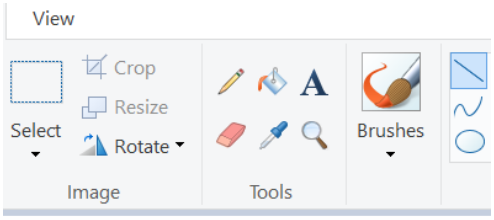


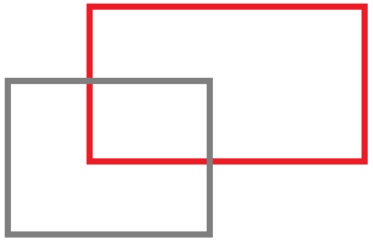
- Articulatory distance – distance between the **meaning of the actions** and their **physical form**

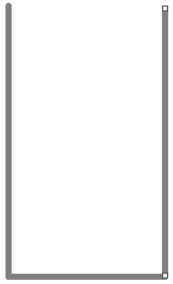
Semantic Distance

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)

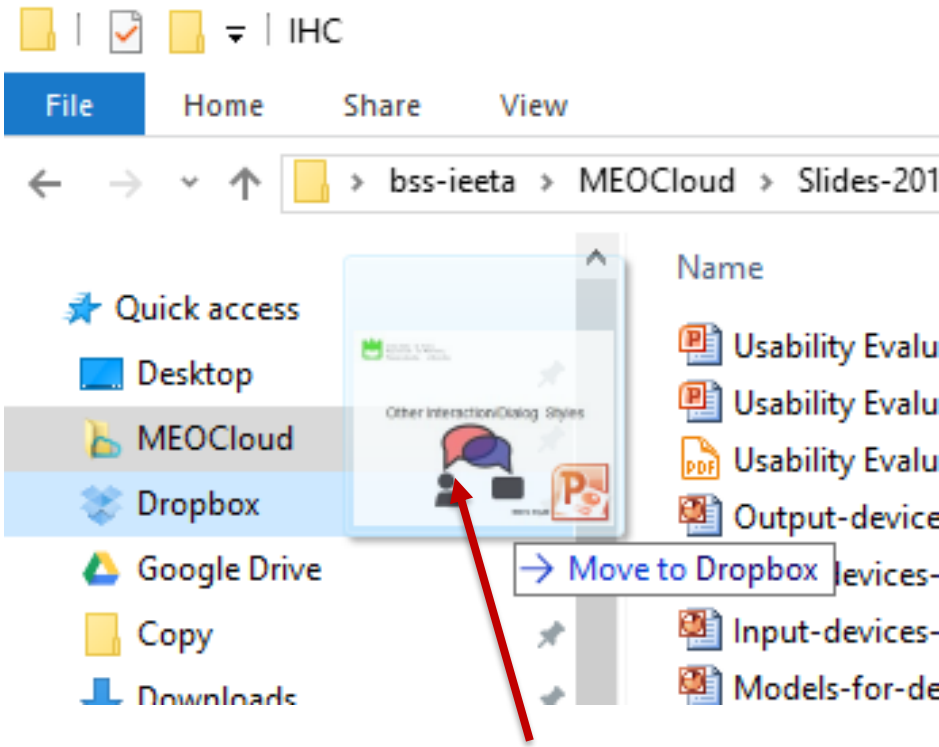
,

é possível mas...

Articulatory Distance

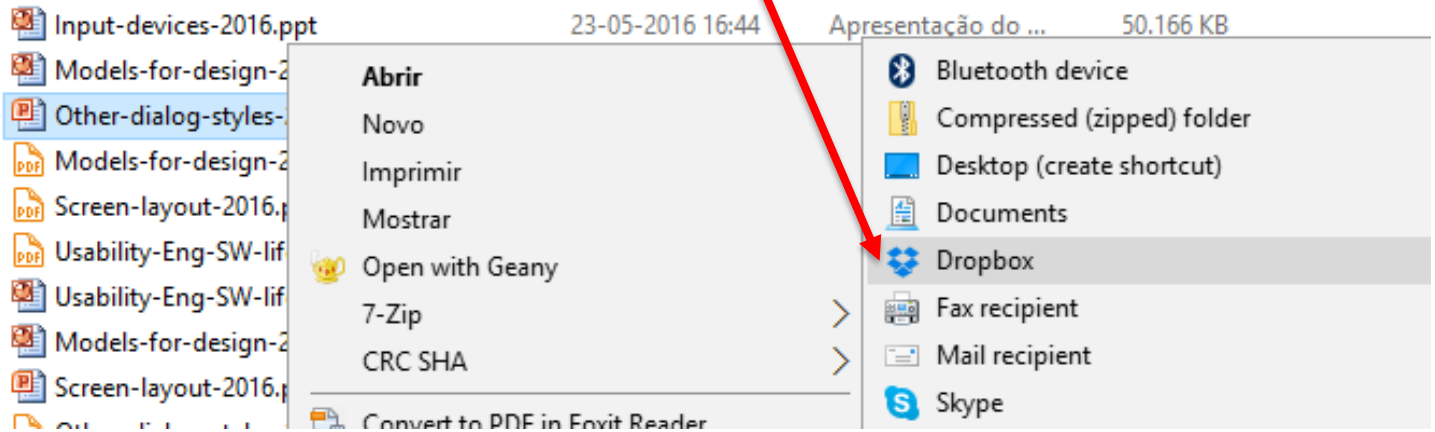
When the physical way actions are performed is more similar to their meaning, articulatory distance is smaller

Perceção de significado maior



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
name generation	name generation (write a name)
visual correlation	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

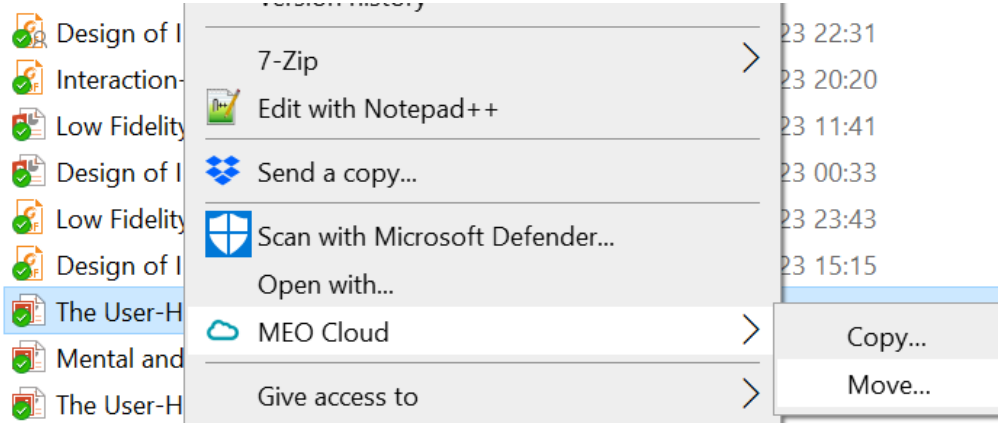
Objects		Actions
visual correlation	+	name generation
		visual correlation
		analogous action

+ 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

Sem usar comandos complexos!

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/

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:

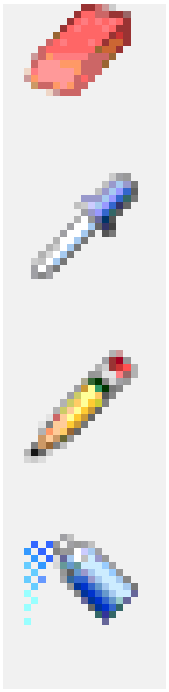
- Coherence
- Good conceptual model
- Feedback
- Adequate organization of functionality
- Adequate screen layout
- Adequate colour usage
- Adequate error handling
- Etc.

https://www.interaction-design.org/literature/article/a-brief-history-of-the-origin-of-the-computer-icon

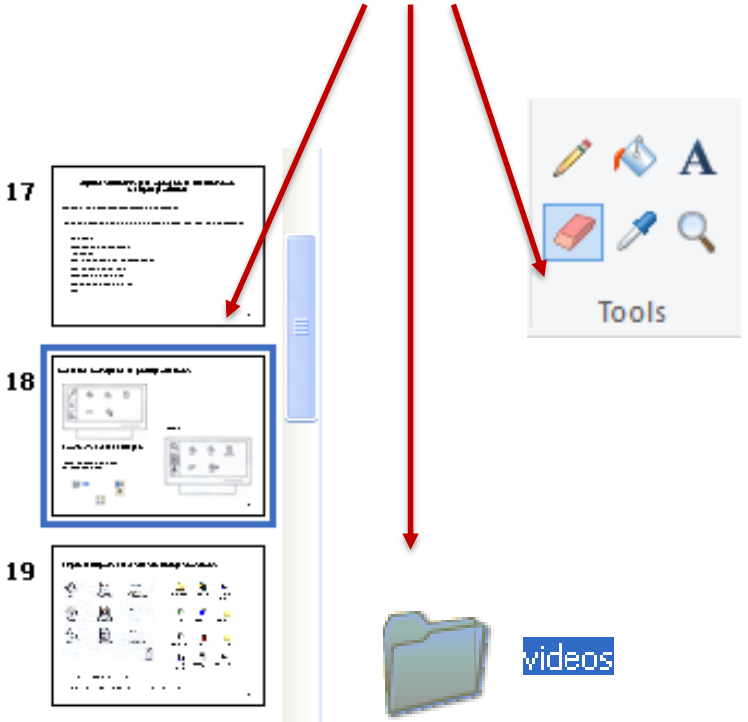
Use a coherent Icon scheme

Different schemes:

better: same scheme

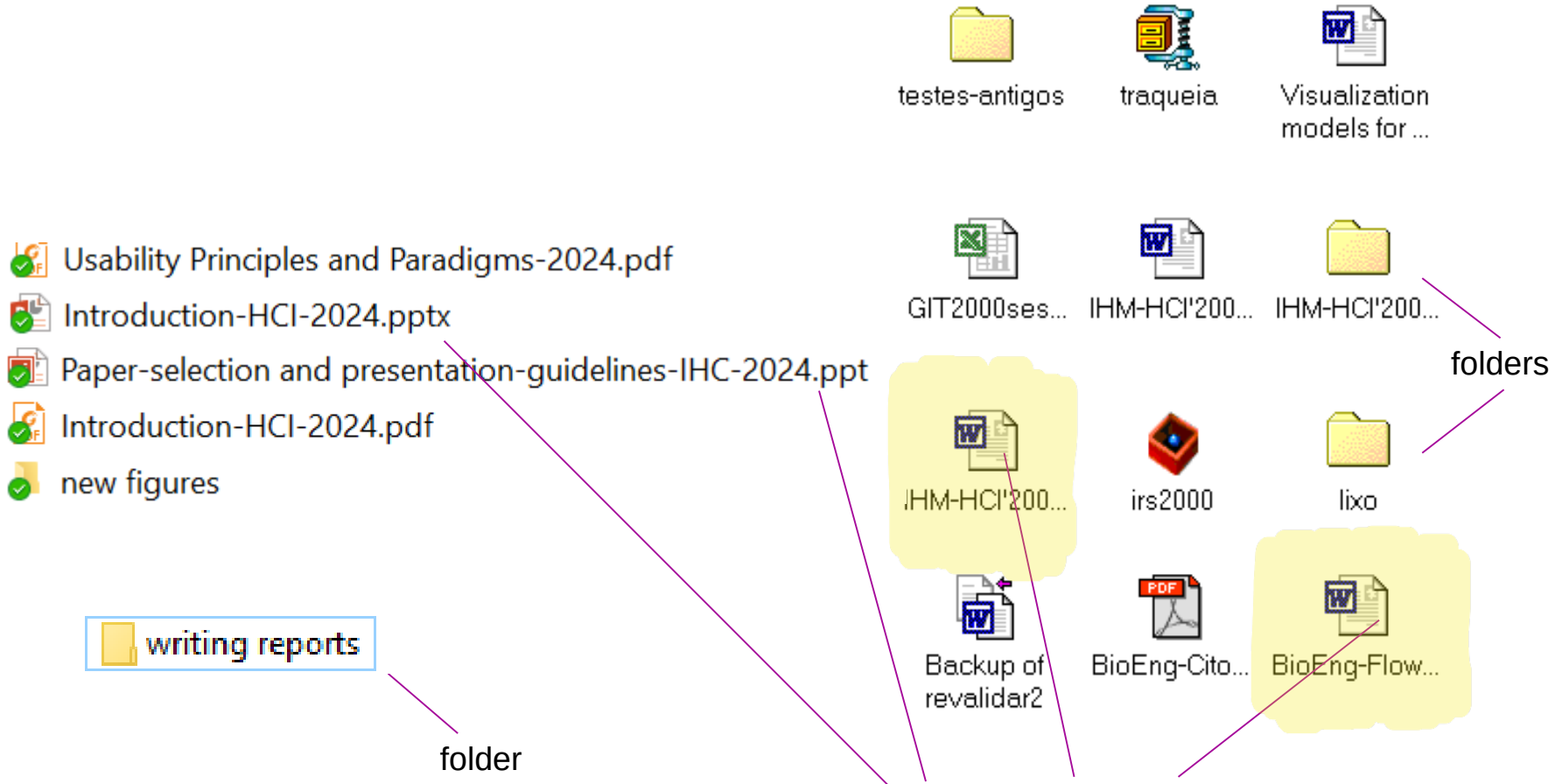


Visual selection feedback



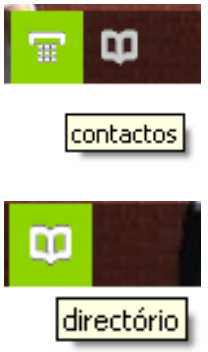
Adding names
(+ recognizable)

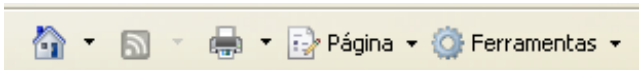
Express relation through icon similarity

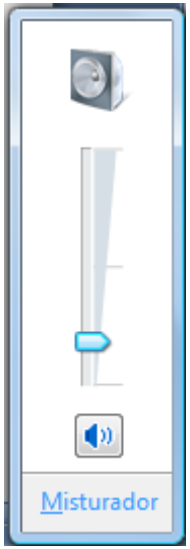


Coherence in the icons production scheme

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

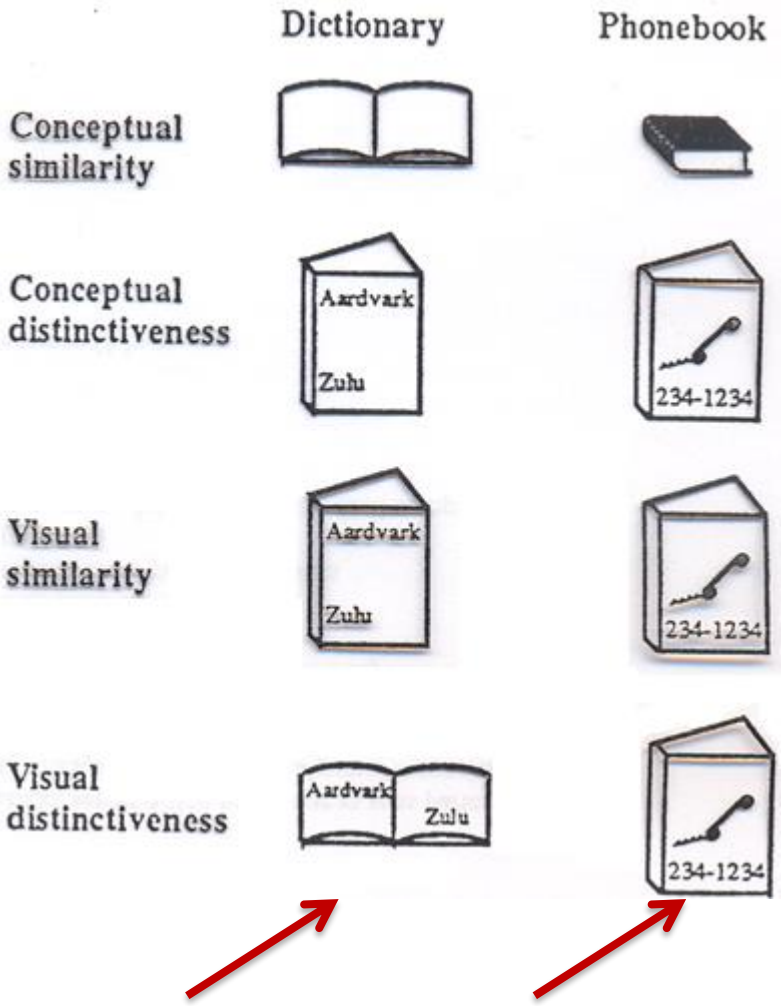




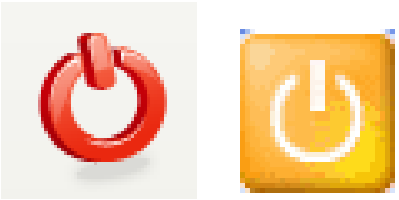


Allow name definition

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



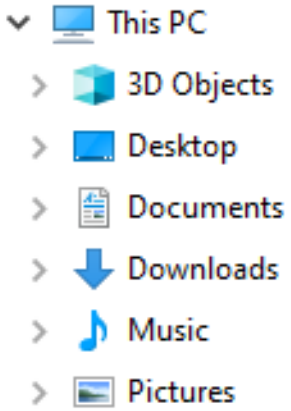
Mais !



Conceptually similar icons

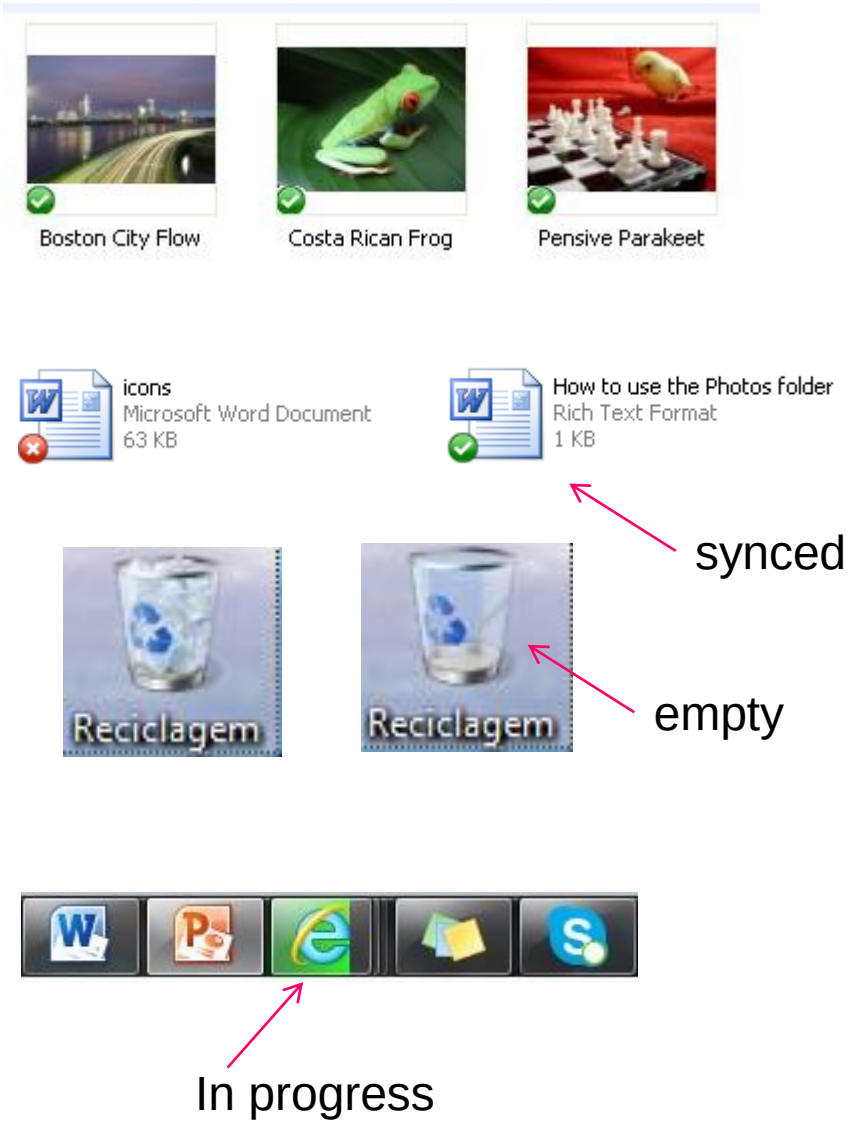
Best solution: conceptually and visually distinct

Icons should be specific/familiar not abstract/non-familiar (familiarity)



Familiar Icons?

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



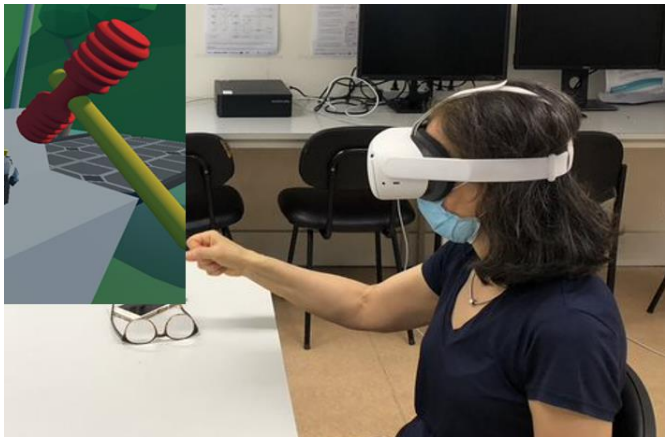
Direct manipulation - Concluding remarks

“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

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