

# **Biomedical and hospital informatics**

## **Master 1**

**Human Machine Interface**  
**Interface Homme Machine**  
**GB 722**

# **Chapter 3: Ergonomics principle of web software and mobile interfaces**



# 1. Introduction

# 1. Introduction

- In work as in daily life, man seeks both comfort and simplicity.
- This wish is summed up by the notion of ergonomics.



# 1. Introduction

- Understanding the interaction problems existing between man and his daily environment is a major problem, and constitutes the goal which defined by ergonomics.

# 1. Introduction

- Ergonomics aims to design products, environments and systems with a view to making them compatible with the needs, skills and people used.
- This improves the well-being of users and the efficiency of the system.



# 1. Introduction



## **2. Software ergonomics**



## 2. Software ergonomics

- All software design must be part of an ergonomic approach.
- Paradoxically the designer will have to write software that fits perfectly into a working environment, with fixed action-event rules, while coping with possible changes in the needs of the user.
- Whatever **the software performance of the system, if it is not ergonomic, it cannot be used or sold.**

# 2. Software ergonomics

- **Ergonomic recommendations**

- Smith and Mosier's design guide, Ergonomics in 128 points (BIT, IRSST)
- Rule compilations: Vanderdonckt (1992, more than 3000 rules)
- The style guide: specific to an environment: Windows, Mac, etc., or to a company (Template)
- Standard design: ISO 9241
- AFNOR Z67-110 standard, January 1988
- AFNOR Standard Z67-133-1, December 1991
- Criteria of Bastien and Scapin, 1993



# 2.1 Software ergonomics: **AFNOR standards**

- Includes 8 criteria:
  - Compatibility,
  - Guidance,
  - Homogeneity,
  - Flexibility,
  - Explicit control,
  - Error management,
  - Conciseness.

## 2.1 Software ergonomics: **AFNOR standards**

- **Compatibility**

- It is the ability of the system to integrate into user activity,
- It 's to match the user's knowledge and the software's capacity.
- This criterion is essential because it conditions the relevance of all the others.



## 2.1 Software ergonomics: **AFNOR standards**

- **Example's Compatibility** : same menu bar between Word and Excel



## 2.1 Software ergonomics: **AFNOR standards**

- **Guidance**

- All the means made available to the user to know the state of the system during the execution of a HMI, so that he can establish the causal links between actions and state of the system and evaluate the system and guide its action on it.



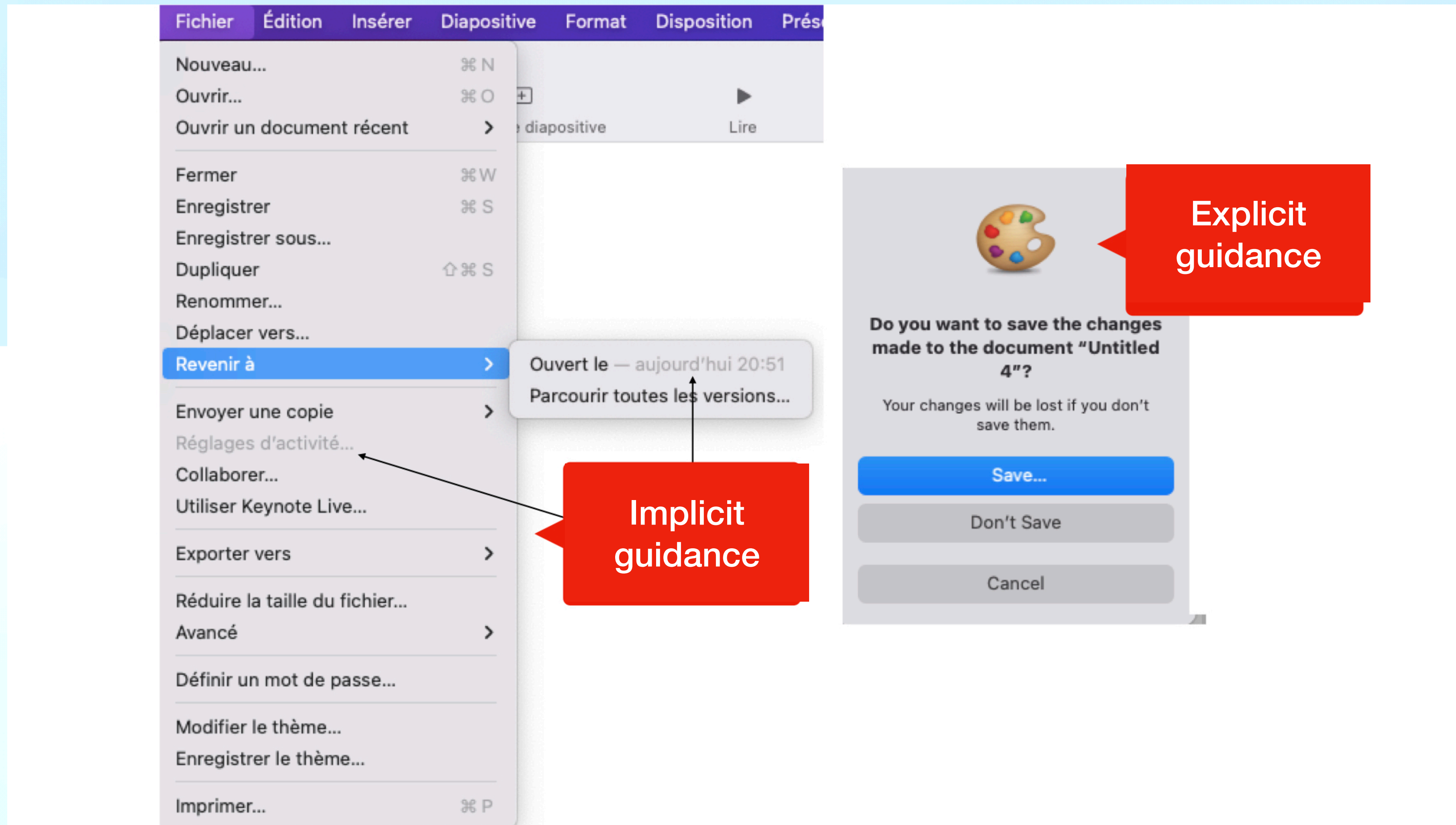
# 2.1 Software ergonomics: **AFNOR standards**

- **Guidance**

- There are 2 types of guidance:
  - Explicit: warning message, error avoidance, online help, clear, explicit and unambiguous codes
  - Implicit: structuring of the display, differentiation by typography (color, computer attributes, etc.) of categories of information

# 2.1 Software ergonomics: **AFNOR standards**

- **Guidance's Example**





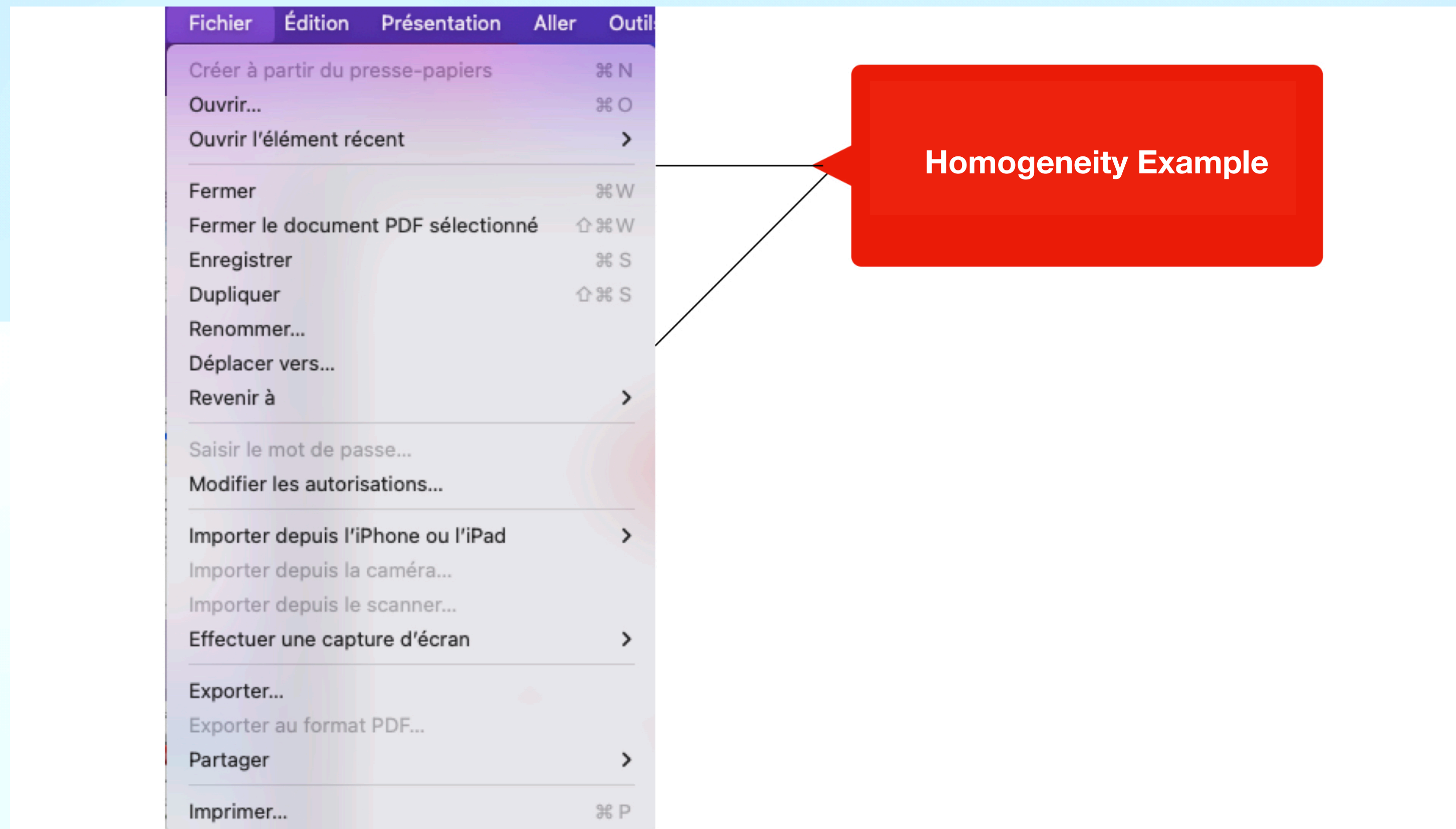
## 2.1 Software ergonomics: **AFNOR standards**

- **Homogeneity**

- Also called consistency, it is the capacity of a computer system to maintain a constant logic of use in an application or from one application to another (procedure level and information presentation level), and this with the aim of to render the behavior of the system.
- Example: Using shortcuts that are similar within the same menu item category

## 2.1 Software ergonomics: **AFNOR standards**

- **Homogeneity Example** : Using shortcuts that are similar within the same menu item category





## 2.1 Software ergonomics: **AFNOR standards**

- **Workload (concision)**

- Set of means which contribute to the user's reduction of their perception and memorization activities.
- The objective of conciseness is to optimize information and decision-making by presenting precise and brief information and to minimize the number of actions or operations and handling time.

## 2.1 Software ergonomics: **AFNOR standards**

- **Workload' examples:**
  - Name instead of last name as champion.
  - One click instead of two.
  - Check boxes instead of filling in input fields



## 2.1 Software ergonomics: **AFNOR standards**

- **Explicit control**

- It is all the elements of the dialogue which allow the user to control the launch and progress of operations, in order to promote the prediction of interface reactions by making the effects of commands predictable.

# 2.1 Software ergonomics: **AFNOR standards**

- **Explicit control's example**

The image shows a software interface with a printer settings dialog and a context menu. The dialog includes fields for printer selection, number of copies, and page range. The context menu lists various editing actions. A red callout box labeled "Explicit control" points to the "Imprimer" button in the dialog and the "Annuler Coller" option in the menu.

Imprimante : LBP3010/LBP3018/LBP3050

Copies : 1

Pages :  toutes  
 Sélection  
 de : 1 à : 1

PDF

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Annuler Coller ⌘ Z  
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Coller les résultats de la formule  
Supprimer  
Tout effacer  
Dupliquer la sélection ⌘ D  
Tout sélectionner ⌘ A  
Tout désélectionner ⇧ ⌘ A  
Sélectionner le parent ⌘ ⌵  
Supprimer les surlignages et les commentaires  
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Orthographe et grammaire >  
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**Explicit control**



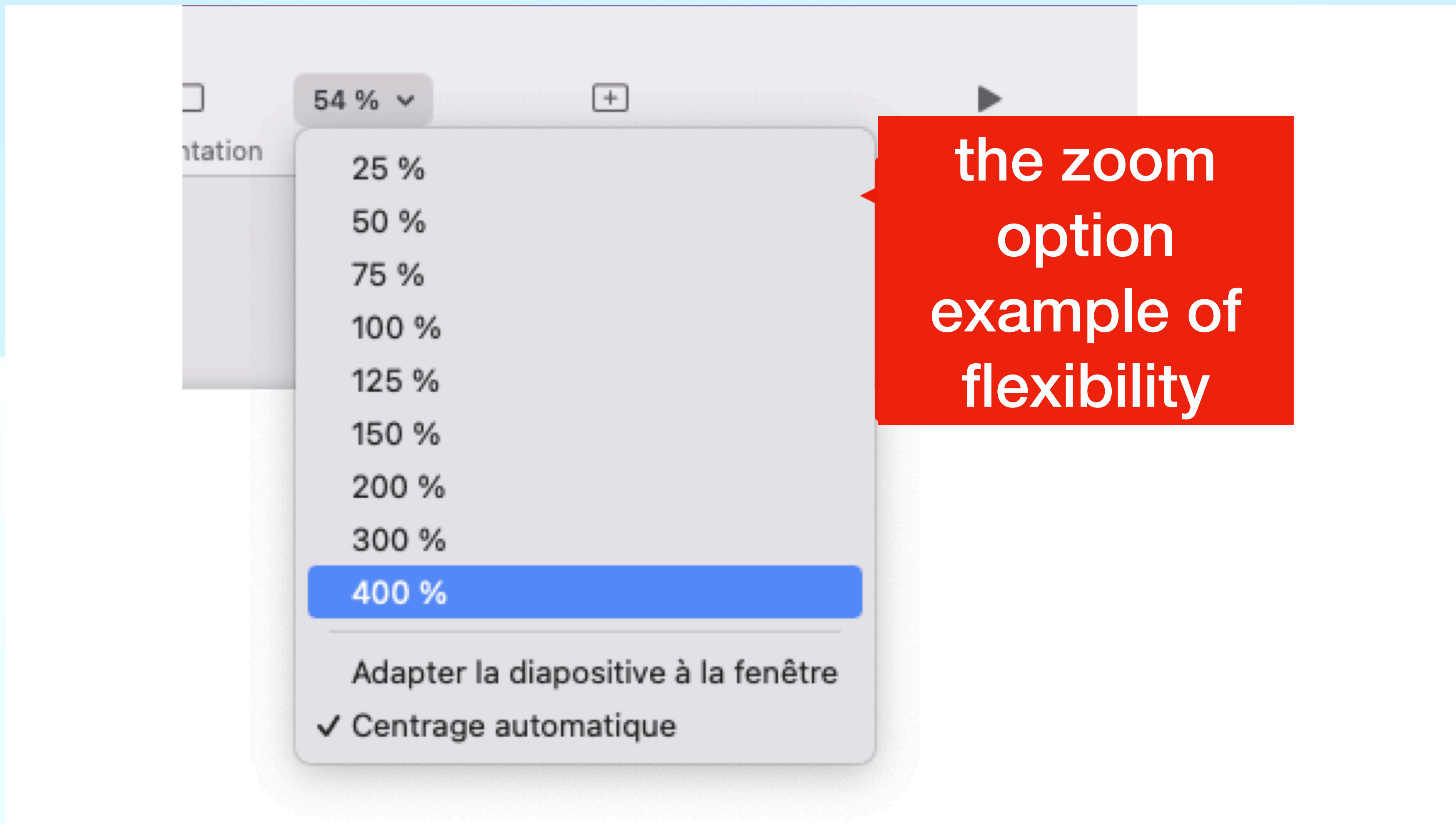
# 2.1 Software ergonomics: **AFNOR standards**

- **Adaptability**

- Also called flexibility. It is the ability of the interface to adapt to the different requirements of the task, to the various habits and knowledge of users, whether in operation (adaptation of the software to various populations of users), or in use (various procedures, options and commands to achieve the same objective).
- This flexibility makes it possible to achieve the following objectives:
  - Adaptation to the diversity of users
  - The tool must adapt to the man and not the other way around.

## 2.1 Software ergonomics: **AFNOR standards**

- **Adaptability's example**





## 2.1 Software ergonomics: **AFNOR standards**

- **Error management**
  - Set of means to guide the user in the perception and identification of their errors and maintain the integrity of the application in order to allow the user to locate, understand and correct precisely and thus promote exploration and learning by a system tolerant of user decision change

## 2.1 Software ergonomics: **AFNOR standards**

- Error management's example: confirming the deletion of a file



example of  
error  
handling



# 2.1 Software ergonomics: **AFNOR standards**

- **Meaning of codes and names**

- This is the adequacy between the object or information displayed or entered, and its referent.
- The goal here is to keep conventions and not use overly technical vocabulary (keep explicit vocabulary).

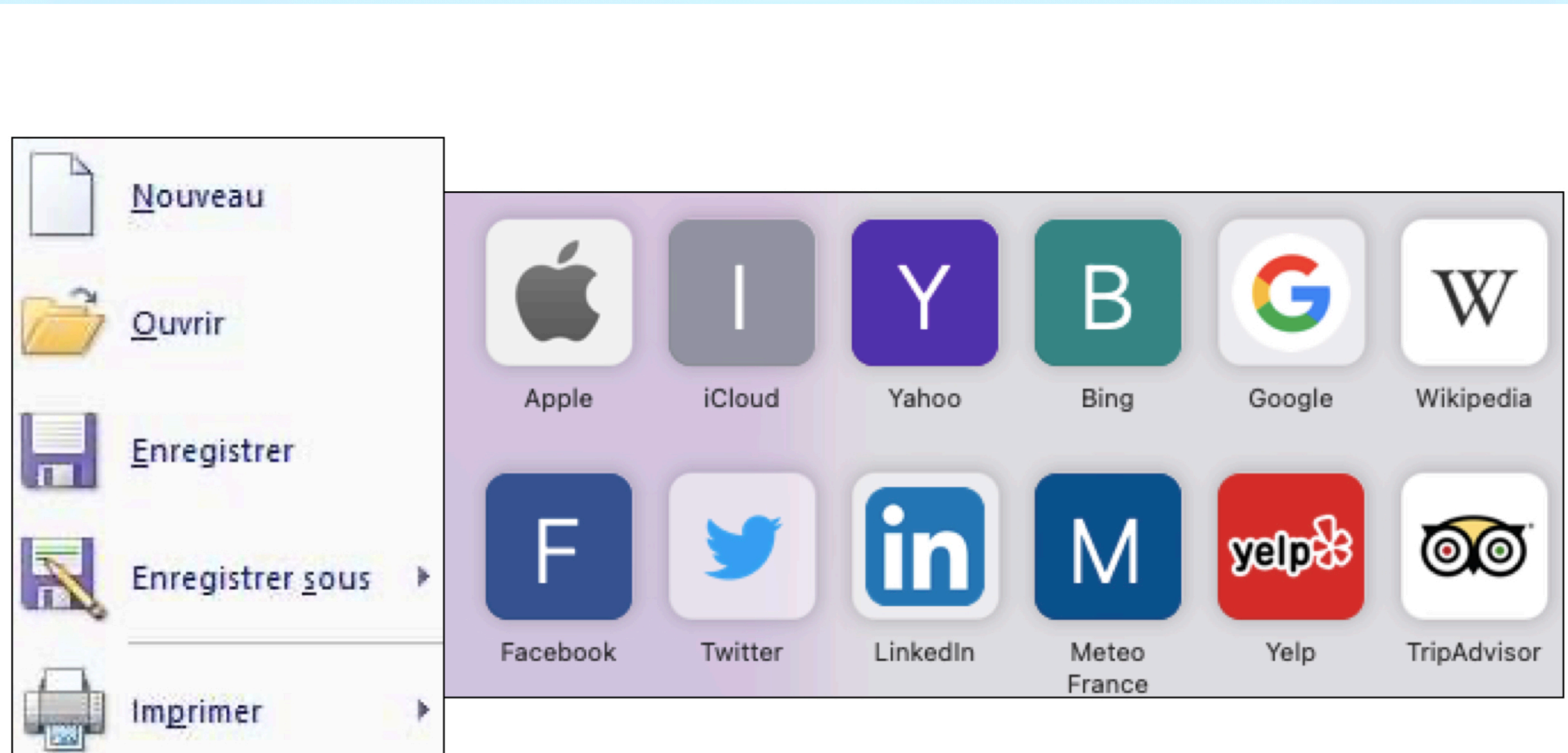
## 2.1 Software ergonomics: **AFNOR standards**

- **Meaning of codes and names**
- Codes and names must be meaningful, in order to have consistency between an icon or symbol and their meaning :
  - Meaningful and familiar codes and names,
  - The right logos.



# 2.1 Software ergonomics: **AFNOR standards**

- Example of meaning of codes and names



# **3. Ergonomics of WIMP interfaces**



# 3.1 WIMP interfaces

- The acronym WIMP (Windows, Icons, Menus, Pointing device) designates a type of graphical interface.
- WIMP interfaces allow the user to interact with the system from the computer screen using a pointing device (the mouse), and interface elements such as windows, drop-down menus and icons , which represent actionable commands. We are therefore talking about a direct manipulation graphical interface.
- The content is presented in WYSIWYG form ("What you see is what you get"), unlike command-line interfaces or textual.

# 3.1 WIMP interfaces

- WIMP interfaces are characterized by the presence of primary windows containing a symbolic representation or not of objects (data, software, files, texts, images, etc.).
  - Using a mouse allows you to manipulate (select, move, etc.) these objects.
  - Menus contain actions and properties applicable to these objects. These may require a dialogue which will take place in a secondary window.
  - The use of metaphors (icons, desktop, folders, etc.) allows the reuse of knowledge and promotes getting started.



## 3.2 WIMP interface elements : **Window**

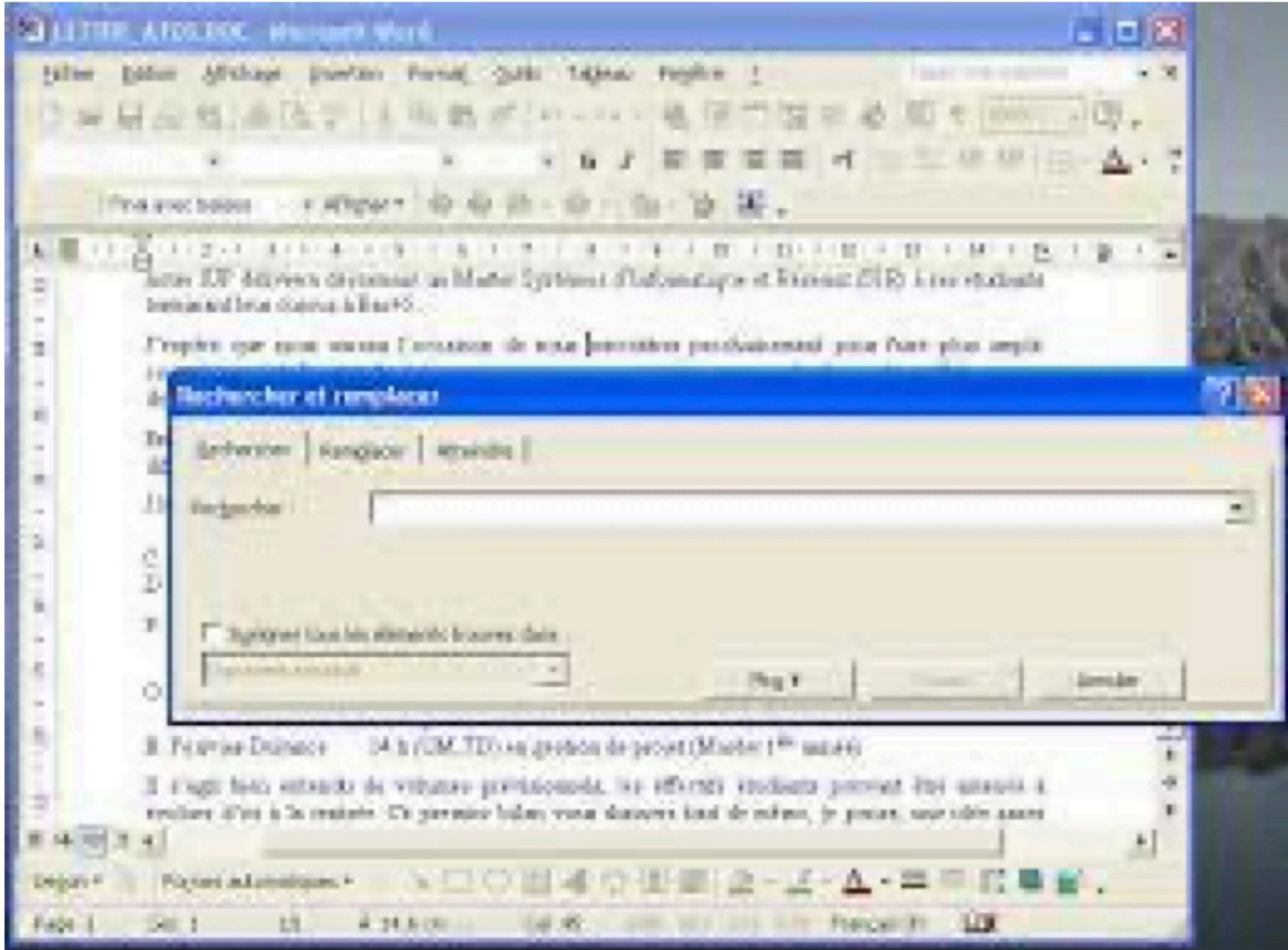
- The window is the basis of any interface.
- The multi-window strategy is a multitasking environment.
- Having multiple windows running at the same time allows you to make the most of large screens.
- There are several strategies to manage access time to windows hidden by others, such as tile strategy, overlap strategy.

## 3.2 WIMP interface elements : **Window**

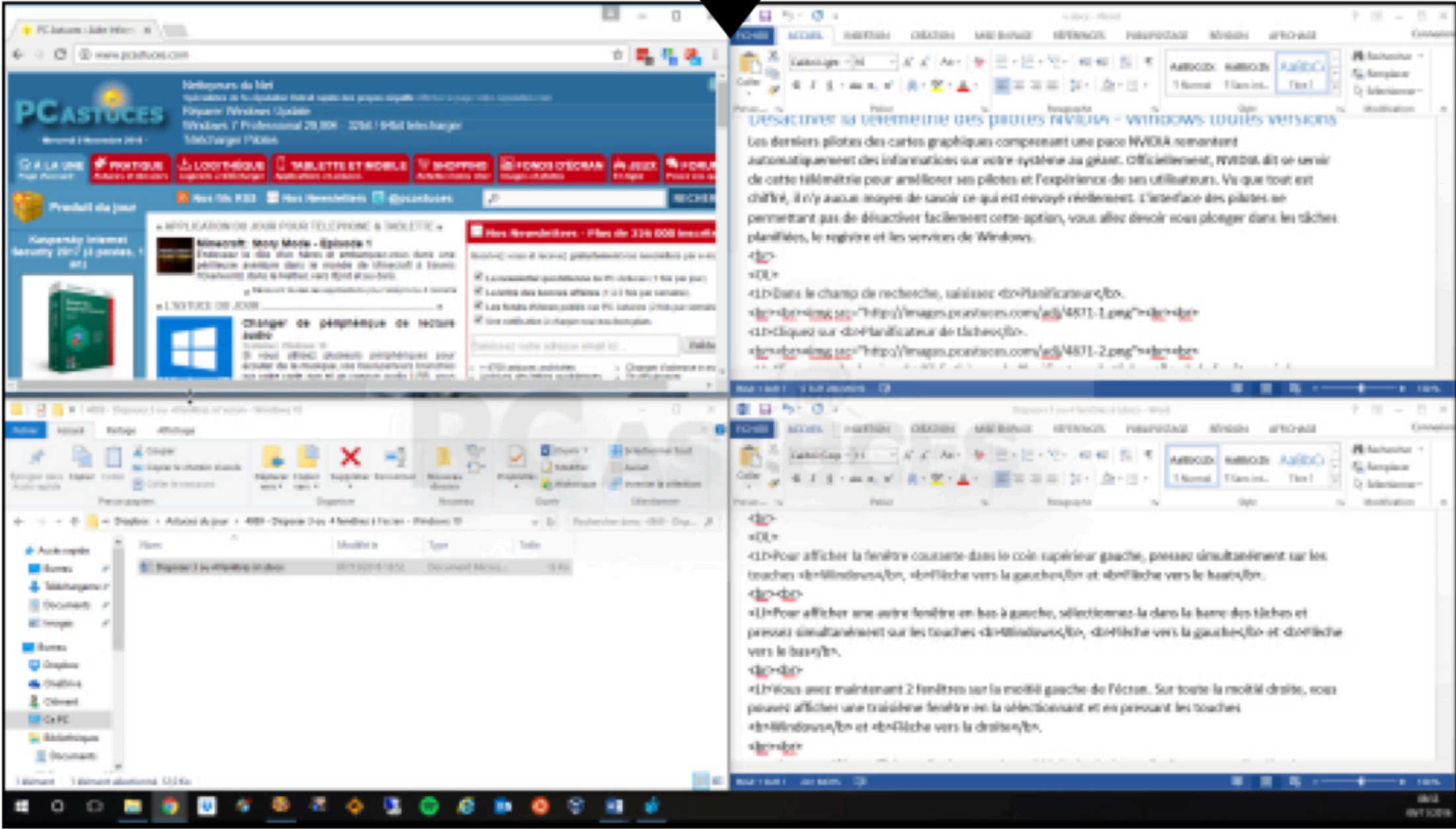
- **Window mosaic (tiling):** this involves displaying several windows at the same time, which increases the quality of observability, except that the edge effect is undesirable.
- **Overlapping window:** is characterized by flexible organization by the user as well as potential hiding of information which can be remedied by the use of a taskbar, translucent windows or by Use of keyboard shortcuts to manage the alternation of windows.



# 3.2 WIMP interface elements : Window



Overlapping windows



Window tiling



## 3.2 WIMP interface elements : **Window**

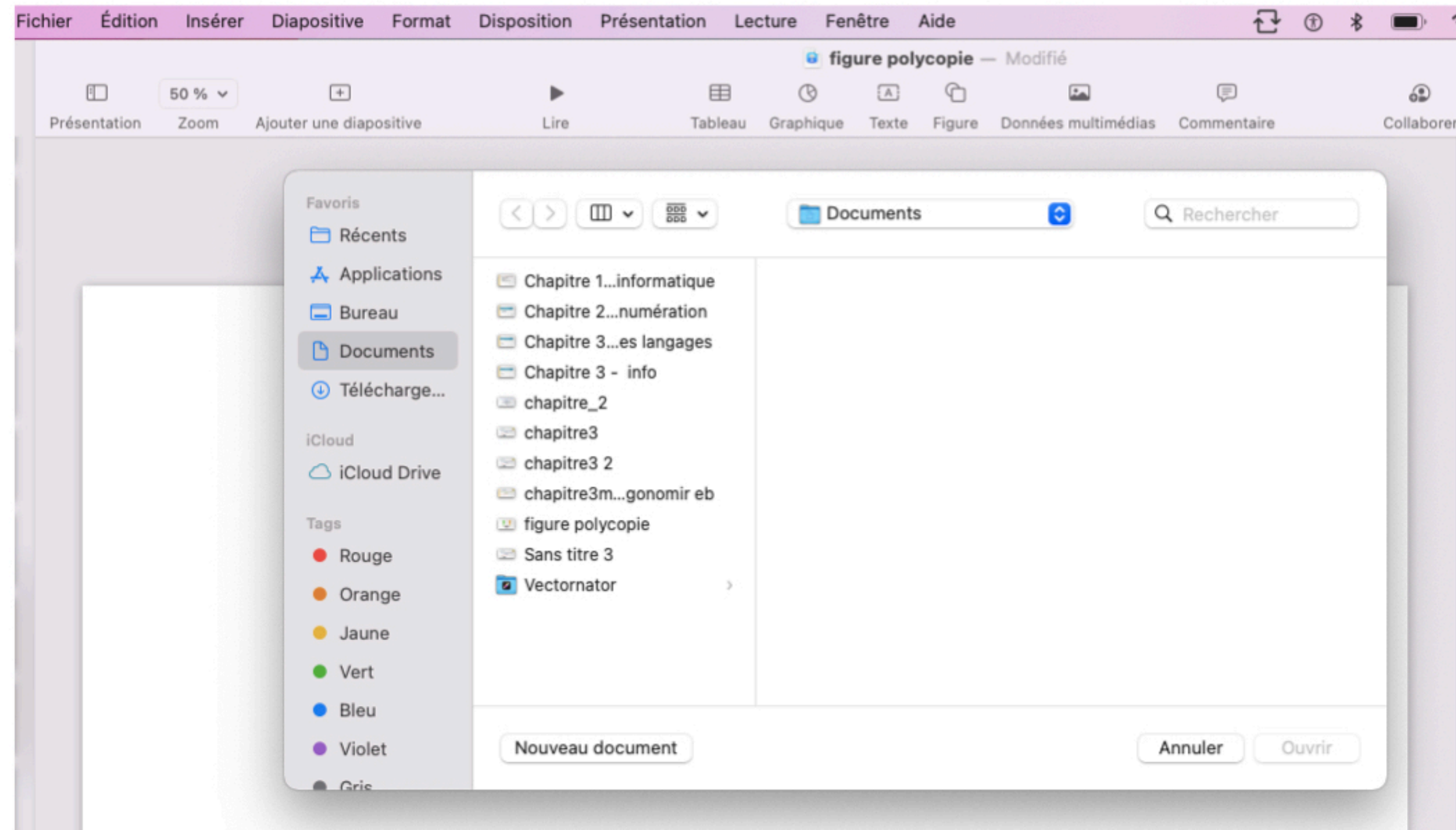
- In order to ensure proper use of the different types of strategy, window coverings or tilting should be authorized for users with a minimum of experience.
- An application can contain different types of windows: main (primary) window which is the first contact with the user, secondary window, and dialog window which allows interaction between the system and the user



## 3.2 WIMP interface elements : **Window**

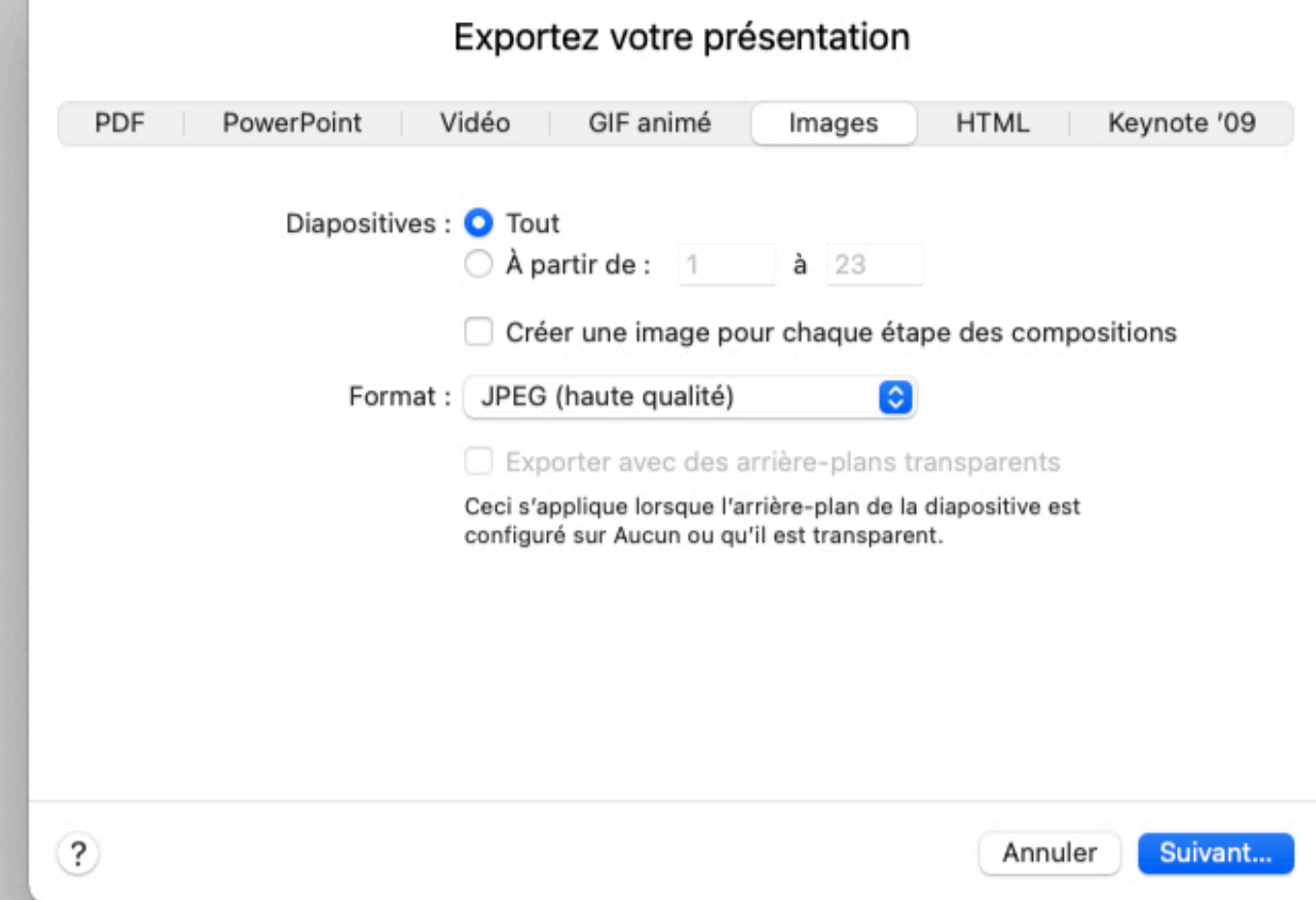
- There are two types of dialog boxes: modal windows and no-modal windows.
  - **Modal windows:** This type of window takes full control of the keyboard and screen. The user must close the dialog to return to the main window. This type of window is mandatory when the current order cannot be suspended.
  - **No-modal windows:** in this case you can move from the dialog window to the main window. The user can temporarily abandon the current task (example: search dialog box).

## 3.2 WIMP interface elements : Window



No-modal windows

Modal windows





## 3.2 WIMP interface elements : **Icon**

- Icons are graphic symbols displayed on the screen associated with objects that can be accessed when selected by a pointing device. they make it possible to associate graphic representations and meanings, they make it possible to quickly identify objects on the screen.
- An icon must respect the criterion of homogeneity and must maintain its representation for the entire application.

## 3.2 WIMP interface elements : Icon

- The use of icons favors direct manipulation, the user has the impression of directly working hard on the object, however this criterion must be used with moderation because this can lead to clutter on the screen and the ambiguity of the icons .
- The designer must follow a certain methodology when using icons. He must first identify all the commands to be iconified and create them at the same time, limit the icons to frequent commands and always validate the design through experimentation.



## 3.2 WIMP interface elements : the menu

- Menus are areas used to present the possible action choices to the user. The objective of using menus is to structure system functionalities following a coherent logical organization that is therefore easily memorized: recognition rather than recall. There are different types of menus, the choice is up to the designer depending on the task to be accomplished:
  - **Drop-down menus (linear):** set of items opened by clicking on the label in the menu bar (depth);
  - **Hierarchical menus:** to offer additional options;
  - **Contextual menus (pop-up):** set of items accessible outside the menu bar, where the mouse is located;
  - **Circular menus, (economical);**
  - **Dynamic or static menus.**

## 3.2 WIMP interface elements : the menus

- In order to ensure a good HMI, you should think about:
  - Minimize the size of menus by offering between three and ten menus in the menu bar;
  - Limit the use of drop-down menus (no more than ten options for the novice and 20 for the expert);
  - Organize menus width-first: minimize depth;
  - Show unavailable commands in gray in the menu;



## 3.2 WIMP interface elements : the menus

- Organize the menu according to use, according to sequentiality (items appear in the order in which they are used), frequency of use (the most frequently used items are placed at the top of the menu), or importance (the most important items are placed at the top and the others follow in descending order of importance);
- Associate a keyboard shortcut with all menus (item);

## 3.2 WIMP interface elements : the menus

- Menus in the menu bar must not be direct actions: they must provide access to drop-down menus;
- In the menu bar, if possible use a single word for the label of each menu, the initial of the word must be in capital letters);
- The user must also be able to access drop-down menus via the keyboard using the left and right arrow keys



## 3.2 WIMP interface elements : the menu

- Use items as names for submenus);
- Prefer brief item names.
- The user must also be able to access the drop-down menus using the keyboard
- Using the left and right arrow keys;
- Use items as names for submenu);
- Prefer brief item names.

## 3.2 WIMP interface elements : Pointers

- A pointer represents the location of a device movement, typically a mouse used to make selections in the GUI.
- The commands are assigned to the mouse buttons. Their role must be constant: the left button is used for selection, and the right button for displaying the contextual menu.

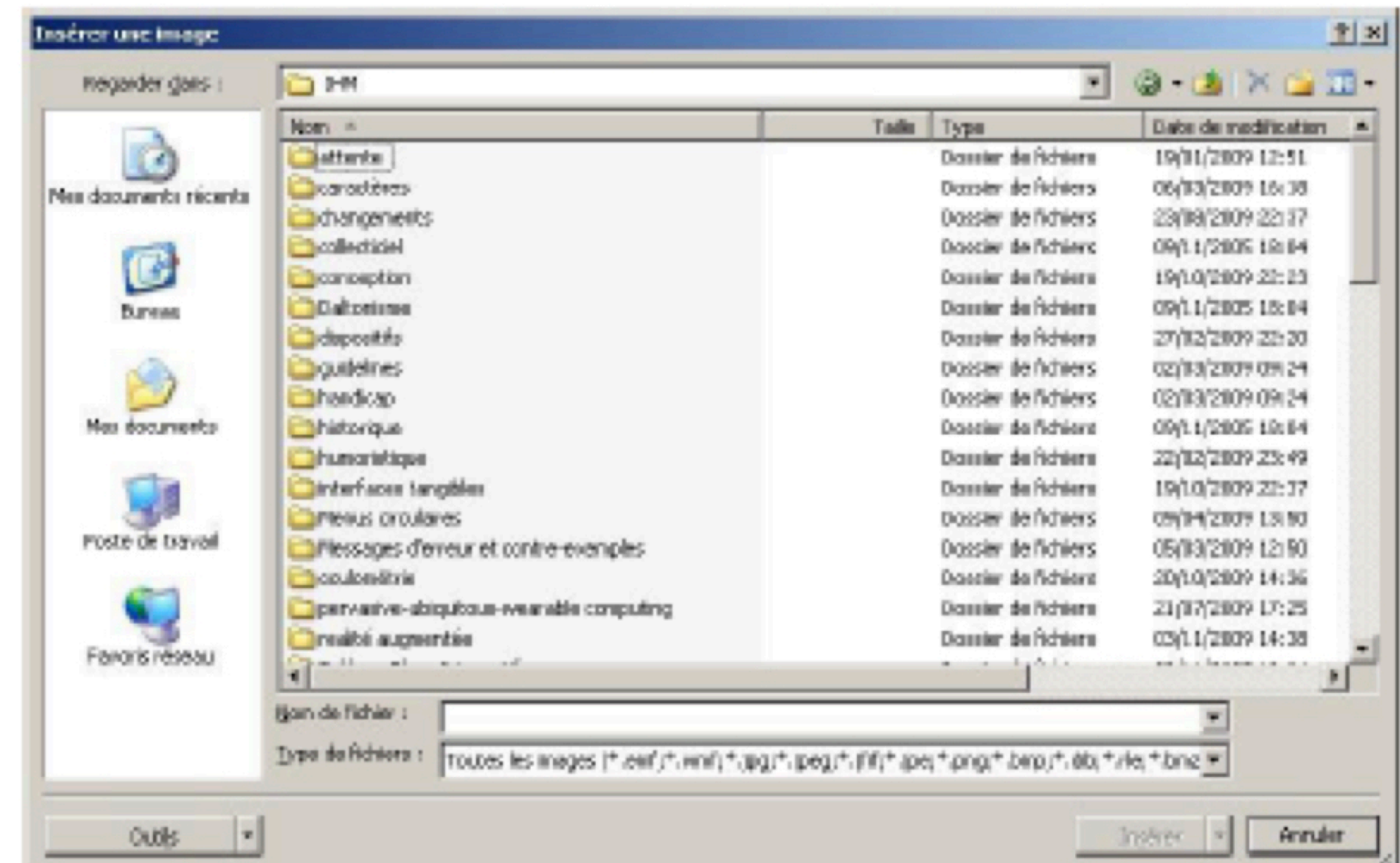
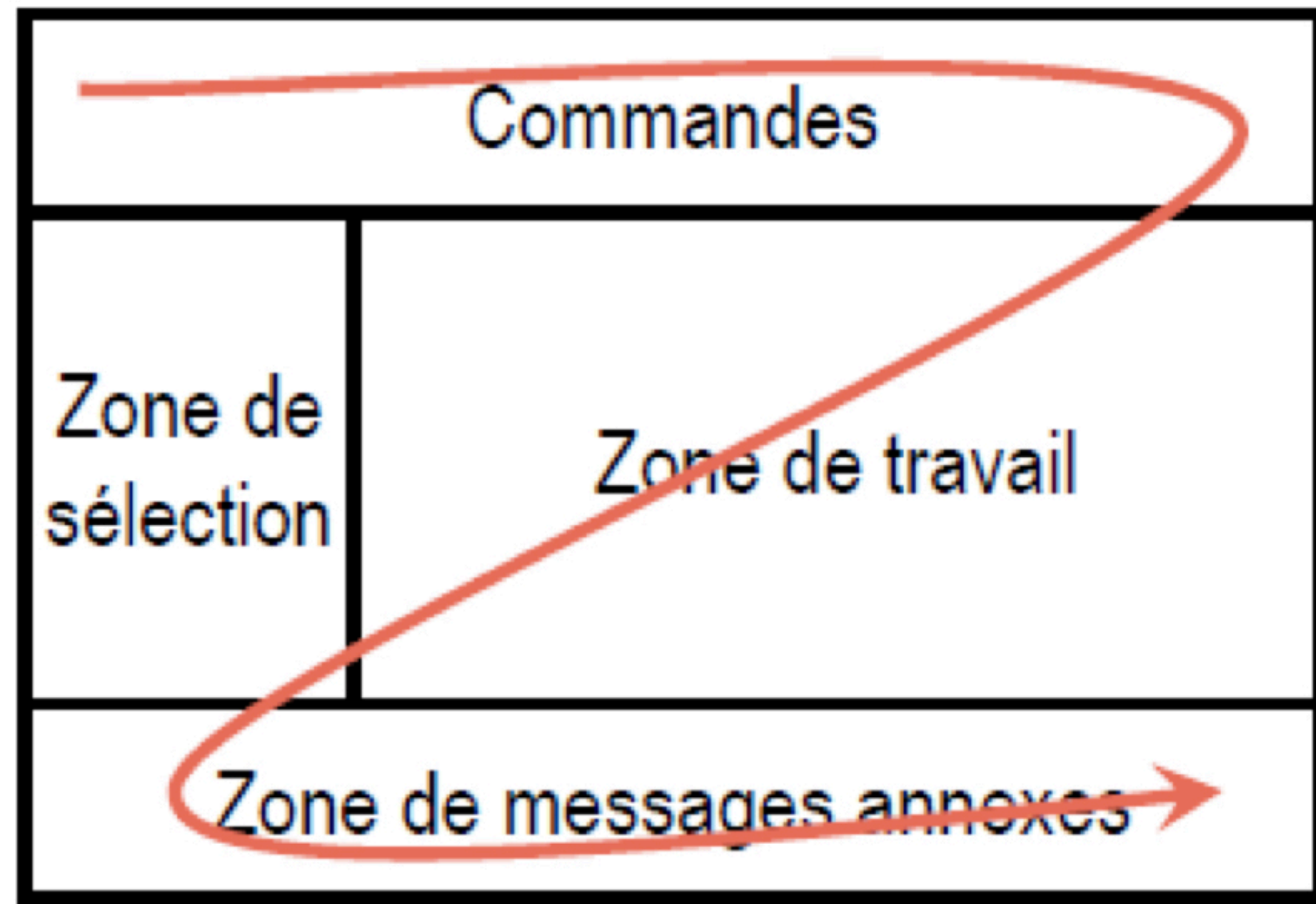


## 3.3 Style guide

- It is necessary in any HMI design to follow a certain style guide in relation to a certain element of the interface. There is a certain general layout to follow in the interface such as:
  - Provide all the essential information for decision-making
  - Ensure consistency in the location of types of information
  - Group items semantically
  - Distribute the white areas in a balanced manner and organize the lists vertically
  - The work area must be placed in the middle of the window because there is better visibility and accessibility knowing that the path of the screen (oculomotor) by the human eye during a first viewing is in Z



# 3.3 Style guide





## 3.3 Style guide

- The two essential attributes in an interface are the choice of text and colors,

## 3.3 Style guide : **Text**

- The text can be of three different types:
  - **Messages:** messages must be brief and concise, adapted to the level of the user, affirmative in form, constructive rather than critical. They must place the user in a commanding situation. If an action is indicated, use words consistent with the action.
  - **Prompts (short indications):** prompts must have consistent terminology, be well localized and adapted to the user level, grammatically simple (active, affirmative form)
  - **Instructions:** these are more complex indications but which use simple and clear text



## 3.3 Style guide : **Text**

- To represent the text on the screen, certain display recommendations must be respected:
  - Favor sans-serif fonts which are more readable on the screen (Arial, Calibri, Helvetica, Geneva, etc.)
  - Bold, italics, underline slow down reading
  - UPPERCASE LETTERS are less readable than lower case letters



## 3.3 Style guide : **Text**

L'interface Homme-machine étudie la façon dont les humains interagissent avec les ordinateurs ou entre eux à l'aide d'ordinateurs, ainsi que la façon de concevoir des systèmes informatiques qui soient ergonomiques, c'est-à-dire efficaces, faciles à utiliser ou plus généralement adaptés à leur contexte d'utilisation.

L'INTERFACE HOMME-MACHINE ÉTUDIE LA FAÇON DONT LES HUMAINS INTERAGISSENT AVEC LES ORDINATEURS OU ENTRE EUX À L'AIDE D'ORDINATEURS, AINSI QUE LA FAÇON DE CONCEVOIR DES SYSTÈMES INFORMATIQUES QUI SOIENT ERGONOMIQUES, C'EST-À-DIRE EFFICACES, FACILES À UTILISER...

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## 3.3 Style guide : Colors

- The other important attribute to consider when designing HMI is color. For better color readability
  - Favor good character/background contrast :
    - dark characters on a light background
    - preferably black characters on a white background
  - Avoid certain color combinations
  - Limit the number of colors (7 maximum)
  - Pay attention to color portability :
    - depending on the screens (think about the number of colors on the screens) — depending on the people: choose colors that are easy to distinguish
    - color blindness:

## 3.3 Style guide : Colors

- Meaning of colors
- Respect cultural habits:
  - in the West: red = stop / green = go
  - in China: red = joy, marriage
- Use colors to mean something
  - same type of information: same color
  - different types of information: contrasting colors
  - similar types of information: low contrast colors



# **4. Ergonomics of web interfaces**

# 4.1 Ergonomics of web interfaces

- The Internet is a decentralized technology, available to everyone; web applications reach a wide audience, mostly new to IT.
- Web ergonomics has particularities which require certain specific recommendations, which should not overshadow the general rules concerning all interactive software.
- The designer of ergonomic websites must aim for two main objectives:
  - **Learnability**: ease of use and predictability are at the center of user expectations
  - **Usability**: encompasses both the performance in carrying out the task, the satisfaction derived from using the object and the ease with which one learns to use it.



# 4.2 Website concept

- A website is a set of pages linked by hyperlinks. Setting up a website is a strategic choice, the operation of the site must be designed over time. There are two types of websites:
  - **The institutional site:** it is the public web, it must be attractive, rich and user-friendly. The target is unknown, so it must rely on standards and have pages of reasonable weight
  - **The intranet site:** is a collection of domains, which group together information by profession and process. It is defined by a graphic charter to which the entire intranet conforms, and a coherent navigation system. In an intranet site, efficiency takes precedence over the spectacular,

# 4.2 Website specifics

- Any website design must respect certain specificities such as:
  - Remain standard; No proprietary solutions not valid on all browsers.
  - Example: Seamless integration of plug-ins into current browsers
- Stay sober and simple
  - Limited number of colors (3-4 significant per page)
  - Do not multiply images or animations: Christmas tree effect



# 4.2 Website specifics

- Respect the page and its context The WWW is not multi-document/multi-contexts
  - Always think about the PIP user effect (Lazy Ignorant Rush User) — Keep it simple
  - Easy to understand because the internet client is universal
  - Establish a graphic charter for the design of any site.

## 4.2 Main element of the web

- The web is based on two main elements which are: the page and the navigation.



# 4.2 Main element of the web

- Page

- The home page is the first to be seen by the user; it is through it that they will form an opinion about the site, it has no right to disappoint. Its aim is to convey a strong message through text or graphics and to guide the user in navigating the site. This page must be quickly downloadable (weight less than 50 kb).
- The home page of a site contains links to each domain as well as the overall pages of the site (site map, search engine news, etc.). It must also contain the date of the last update and the address of the webmaster.

# 4.2 Main element of the web

- Page

- A website is a set of pages grouped into several categories. The page template must respect the graphic charter which defines the sizes, colors, aspect of banners, and positioning of objects in a page, the types of objects (list, input fields), as well as the font styles of the text.
- A web page can be of different types: Home page, form pages, list page, result pages, presentation pages.



# 4.2 Main element of the web

- **Navigation**

- Web ergonomics also involves navigation. It is necessary to define the main axes of the site, the desirable shortcuts, as well as the methods and means useful for navigation (menus, images, button list, etc.) Define the summary in order to give the site a logic compatible with that of the users .
- The web browser offers dedicated functions (backspace, bookmark management, etc.). But an application must avoid the abusive use of back and Fordwar.

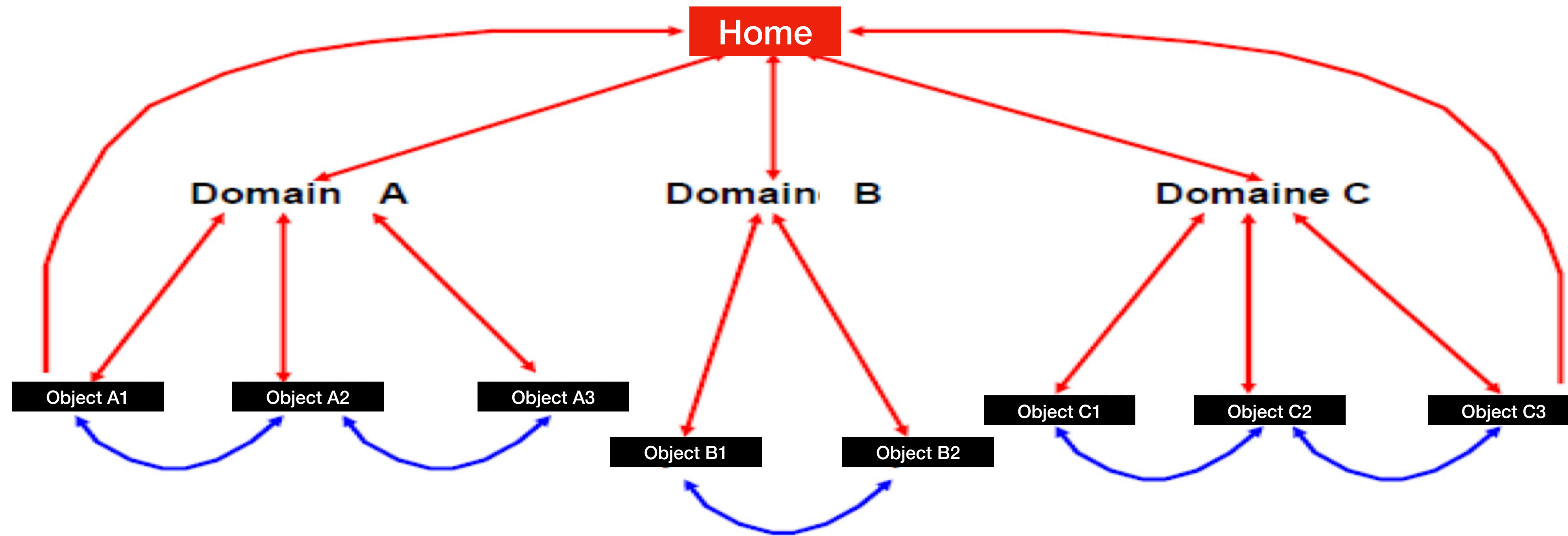
# 4.2 Main element of the web



- **Navigation**

- A website is tree-like in nature. Two types of navigation allow you to move between nodes : Horizontal navigation: for movement within the same level (between domains or themes of the same domain) Vertical navigation: which is structured by navigation banners to go down or up several levels in a domain.



# 4.2 Main element of the web



Horizontal navigation   
Vertical navigation 

# **5. Ergonomics of mobile interfaces**



# 5. Ergonomics of mobile interfaces

- Today, thanks to technological advances, mobile devices and applications have become more and more used (smartphones, tablets, etc.) on a daily basis.
- Mobile ergonomics is a special case of software ergonomics because the screens are smaller and the means of interaction (finger, stylus) as well as the widgets are different, etc. In this case, ergonomics aims to find all the solutions that make mobile pages, content, functionalities and interactions of mobile pages useful and usable with as much comfort and efficiency as possible.

# 5. Ergonomics of mobile interfaces

- A mobile interface would be considered ergonomic if it meets user expectations, and allows them to navigate satisfactorily (on the site and within the body of the pages) and to achieve the expected interactions or conversions.
- Here are some basic rules of ergonomics for mobile HMIs:



# 5. Ergonomics of mobile interfaces

## 1. Display adapted to the small screen

- Since phone screens are much smaller than computer screens, it is necessary to purify your content. Only the main content and buttons should appear.

## 2. Large clickable areas

- Indeed, don't forget that your users use their fingers to interact with your application. We must therefore think about clickable mobile ergonomics. According to Microsoft, your clickable elements must have a minimum size of around 7mm and be spaced at least 2mm apart, in order to prevent any aiming problems.

# 5. Ergonomics of mobile interfaces

## 3. A breadcrumb trail

- It's important that your user knows where they are in the app. Indicate via titles, in which part it is located: home, contact, etc. You must specify the name of the page otherwise confusion can quickly set in.

## 4. Internal tools used

- Smartphones are full of features: geolocation, camera, microphone etc. Do not hesitate to use them consistently.



# 5. Ergonomics of mobile interfaces

## 5. Recognizable clickable elements

- It is necessary for the user to be able to identify which elements are clickable. For
- To do this, it will be necessary to harmonize the application buttons.

## 6. Explicit icons

- The choice of icons is very important because they represent actions, the latter must be explicit and recognizable, simple and evocative. They should in no case leave your users in doubt.

# 5. Ergonomics of mobile interfaces

## 7. A Web – Mobile link

- In the majority of cases a mobile application is linked to a website. So it is essential to check the mobile and web links: if your users have provided information on the website, it is important that they can find it on their mobile application.

## 8. Reduced keyboard usage

- Virtual keyboards remain painful to use today. This is why it is important to reduce the use of the latter, and this by different means for example you must give the possibility of logging in via Facebook or Google, use the geolocation of the phone to prevent your user from entering their position manually. You can also use drop-down lists when you can.



# 5. Ergonomics of mobile interfaces

## 9. An adaptable graphic charter

- It is important to adapt your graphic charter to the different uses that consumers make of your application. This will greatly improve mobile ergonomics as well as the user experience.