Chapter II

Graphical User Interfaces & Types of Interactions

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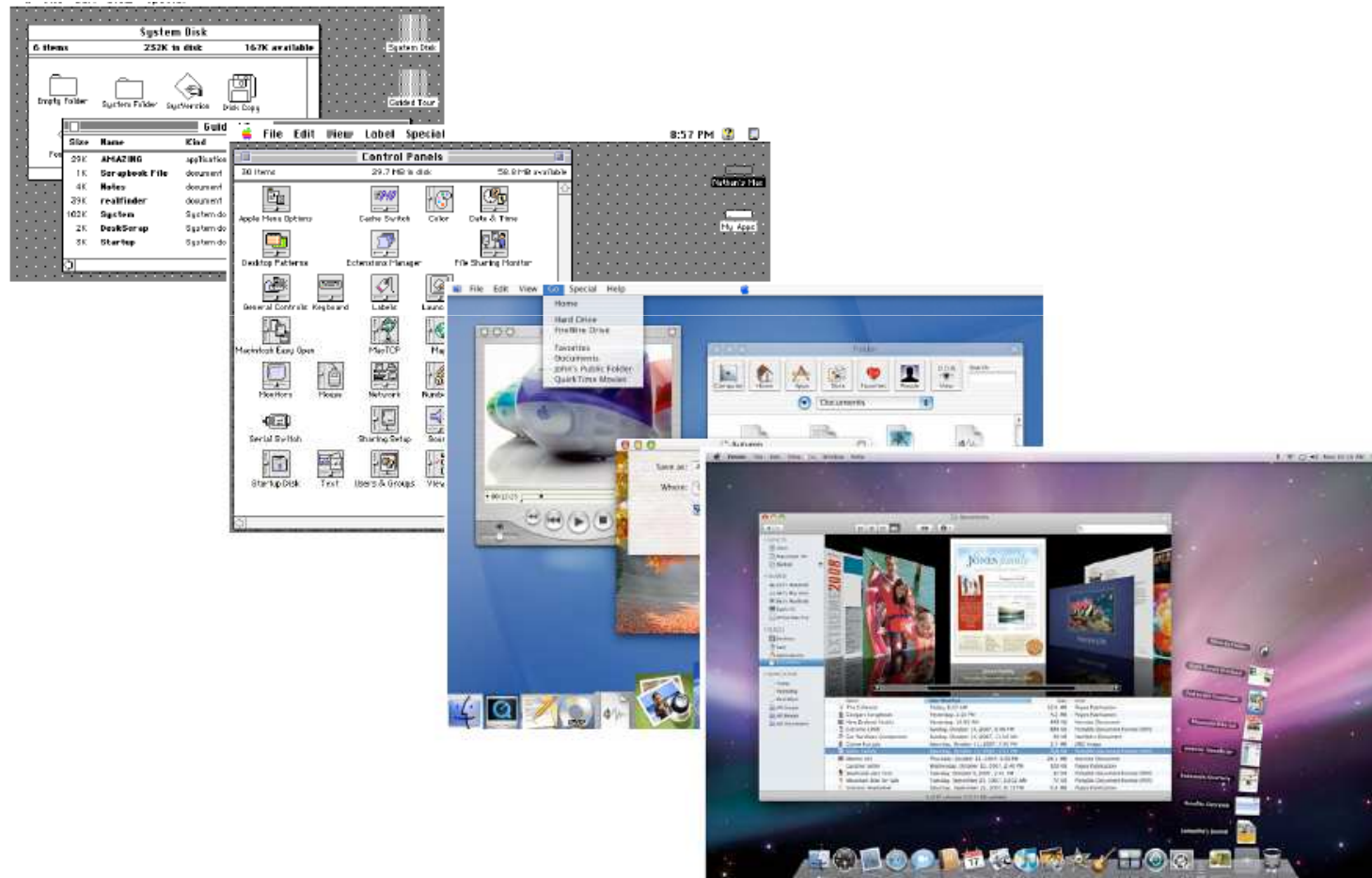
Outline

I.   Definitions

II. Elements of Graphical Interface

III. Graphical Interface Developpement

IV. Types of Interactions

V.   Conclusion

I. Interfaces Types

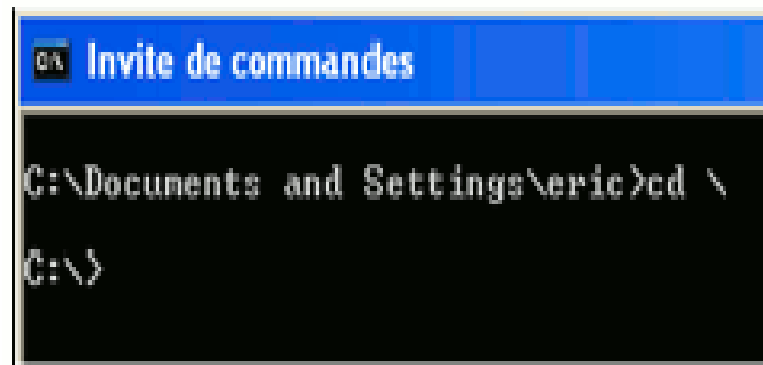There are two types of interfaces that allow the user to operate the applications of a software:

1. Command Line Interface:CLI

2. Graphical User Interface: GUI

1. Command-line Interface : CLI –Text based interface

A Command Line Interface, emerged in the mid-1960s, on computer terminals, allows the user to interact directly with the computer system by typing in commands (instructions: line of text) into a screen which looks similar to the one below:

Ex. for widows, the command
          dir /q d* /o:s

display ownership of files whose names begin with d (or D), sorted by size, smallest first.

CLIs are often used by programmers and system administrators, in engineering and scientific environments, and by technically advanced personal computer users.

Graphical User Interface : GUI (1/3)

GUI was a revolutionary invention developed at Xerox PARC (Palo Alto Research Center) in the 1970s, notably on the Xerox Alto computer.

This innovative interface introduced key modern computing concepts like the desktop metaphor, icons, overlapping windows, and the mouse for a user-friendly, point-and-click experience, moving away from command-line interfaces.

It also pioneered What-You-See-Is-What-You-Get (WYSIWYG) editing and was a foundational element of the Xerox Star workstation and early personal computers like the Apple Macintosh.
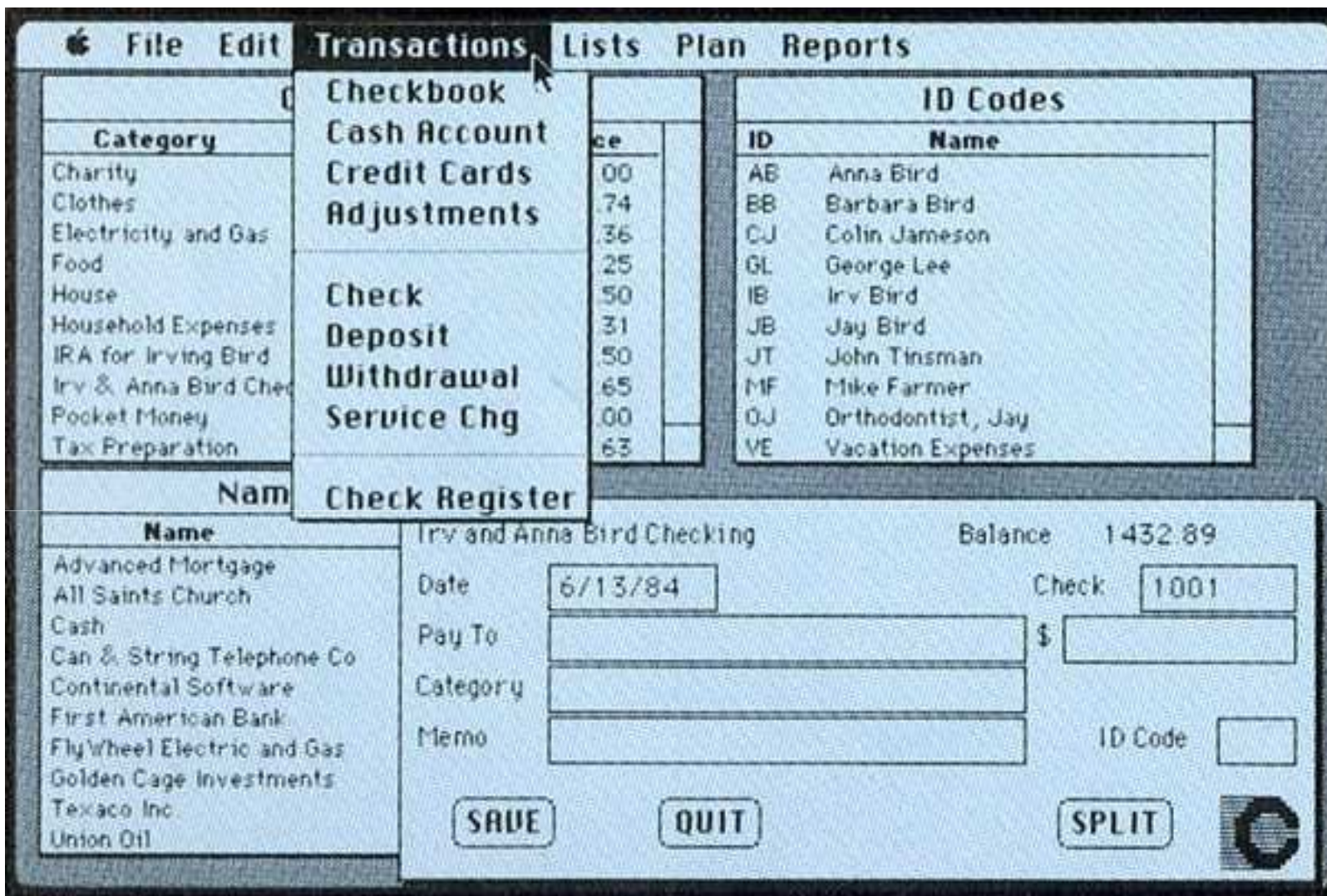
The Apple Macintosh graphical user interface

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Graphical User Interface (2/3)

GUIs employs graphical elements like icons, menus, and buttons to facilitate user interaction.

GUIs use a pointing device such as a mouse, touchscreen, or stylus, making computers and other digital devices more intuitive, accessible, and user-friendly.

GUIs are used in many handheld mobile devices such as MP3 players, portable media players, gaming devices, smartphones and smaller household, office and industrial controls.

GUIs hide the complexity of actions behind simple controls and offer immediate visual feedback.

Graphical User Interface (3/3)

A GUI is also known as a **WIMP** interface because it makes use of:

Windows : a rectangular area on the screen where the commonly used applications run

Icons: a picture or symbol which is used to represent a software application or hardware device
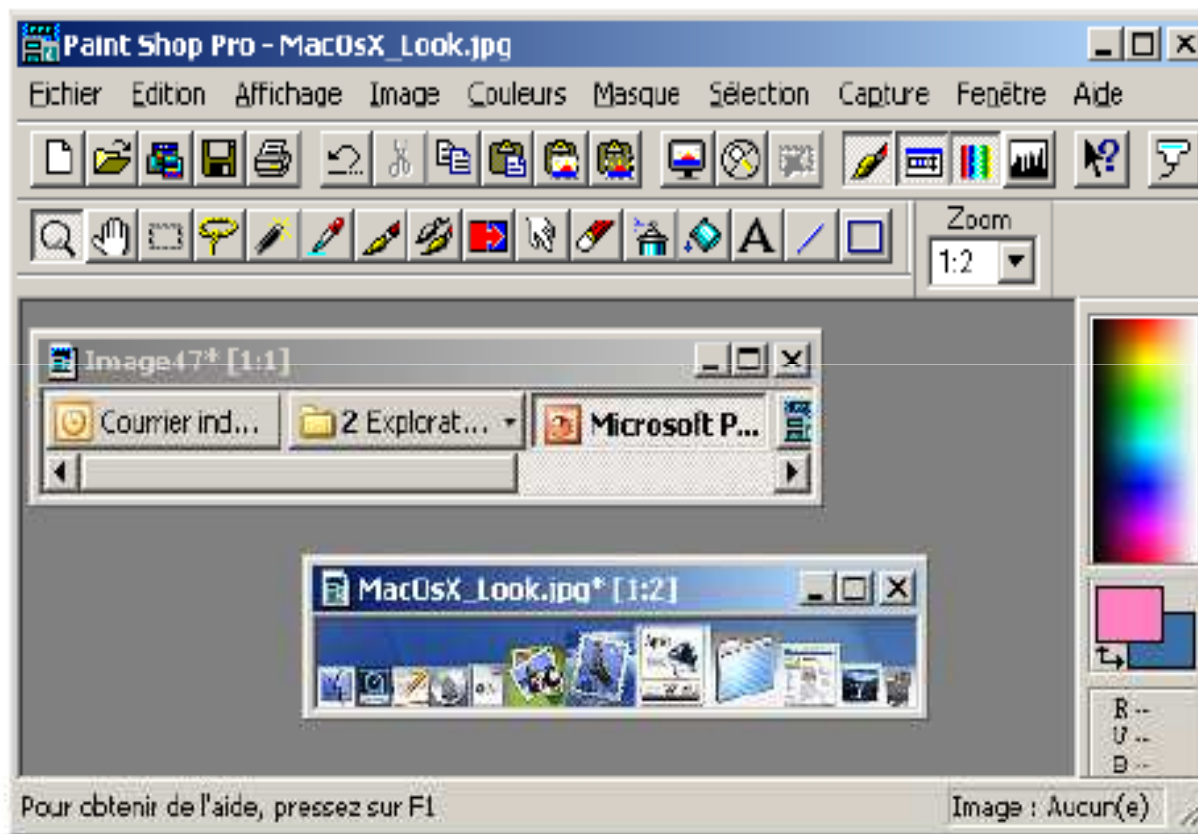
Menus: a list of options from which the user can choose what they require

Pointers: a symbol such as an arrow which moves around the screen as you move your mouse. Helps you to select objects.

WIMP:
Windows, Icons, Menus, Pointers

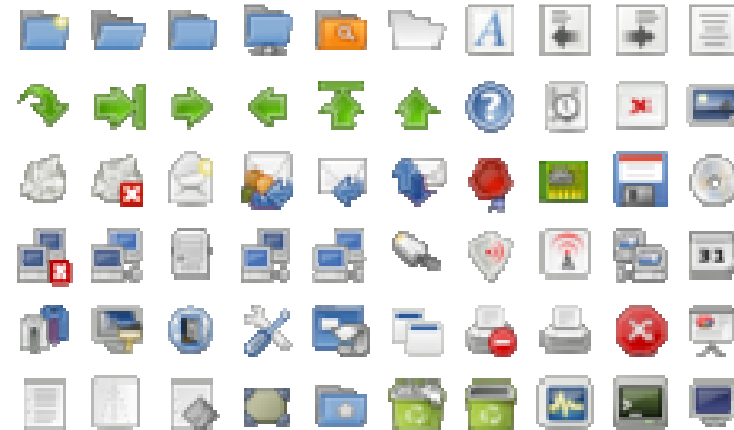barre de titre

barre de menu

ou Rubans

barres d'outils

barre d'état

II. Visual elements of GUI

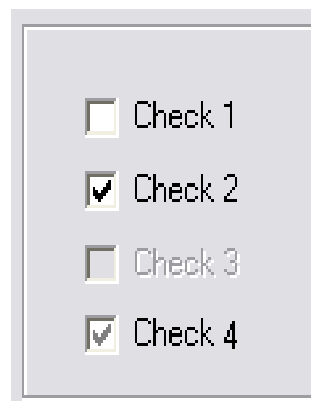## 1. Les éléments d'affichage simple

Étiquette (*Label*)
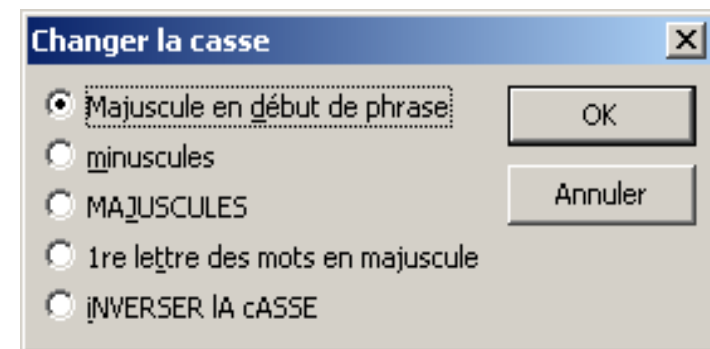Icône (*Icons*)

2. Buttons

Bouton poussoir
(*button*)

Case à cocher
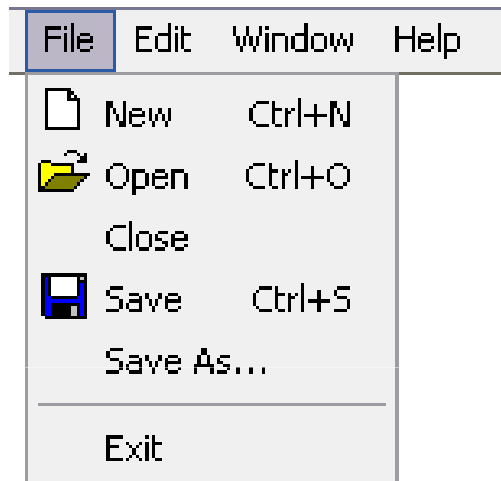(*Check box*)

Bouton radio (*Radio button*)

users can select
multiple options

users select one option from a collection of two or more mutually exclusive, but related, options

3.Menus

## 1. Menu de commande
(*Command menu*)

- includes a list of all available items (actions)

- To facilitate a mouse-free workflow, the Command Menu can be accessed using a keyboard shortcut.

2. Menu circulaire
(*Pie menu*)

options are presented as "pie slices" around a central point, allowing users to select an option by moving their pointer in a specific direction after invoking the menu.
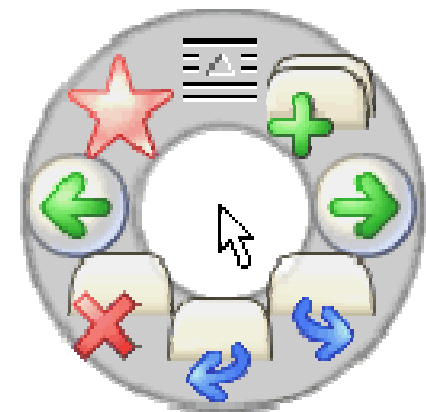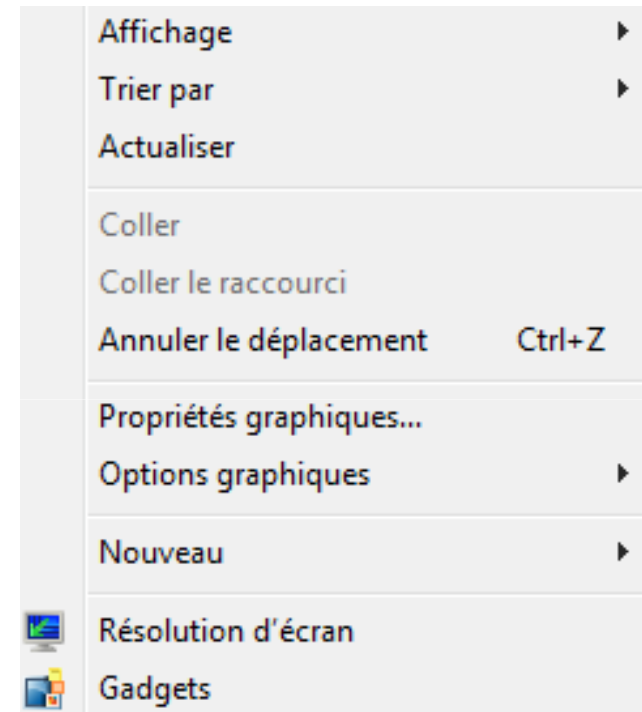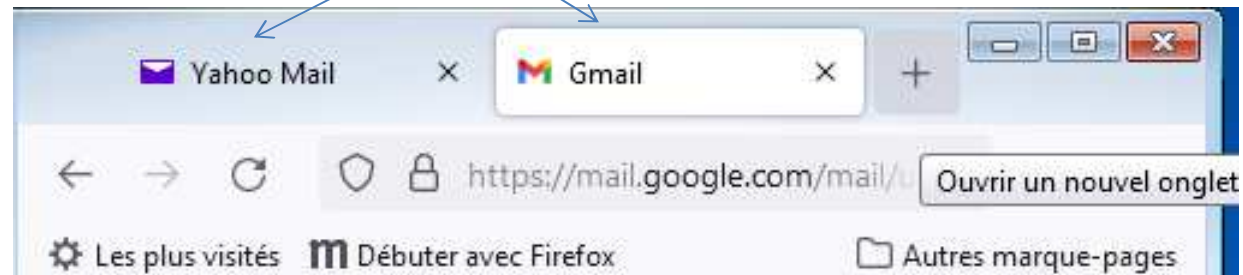
3. Menu contextuel
(*Context menu*)

appears when a user performs a specific action, such as a right-click or a long press on a touch device.

It provides a limited list of relevant commands or actions that are available based on the current "context" or state of the operating system or application.

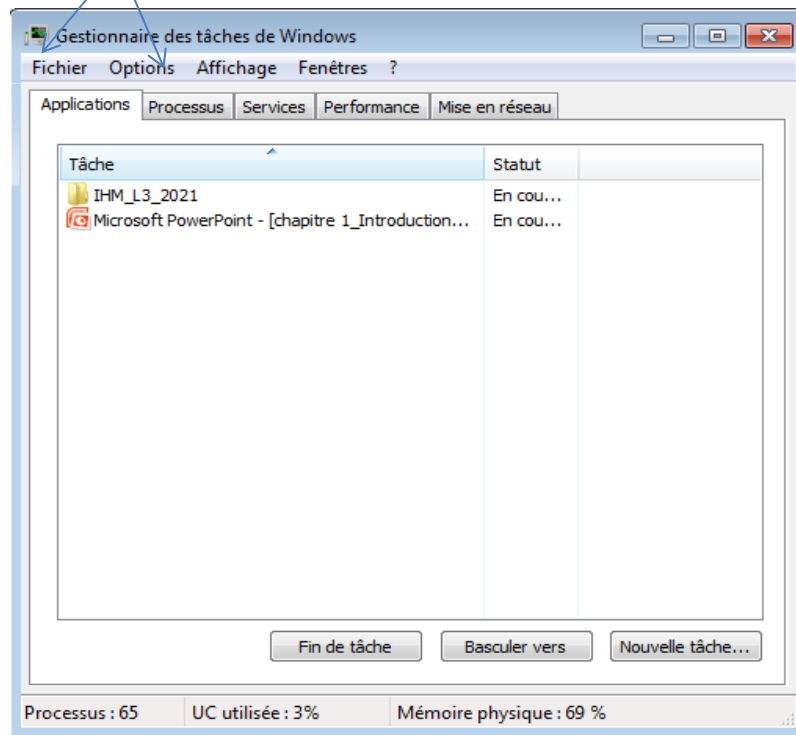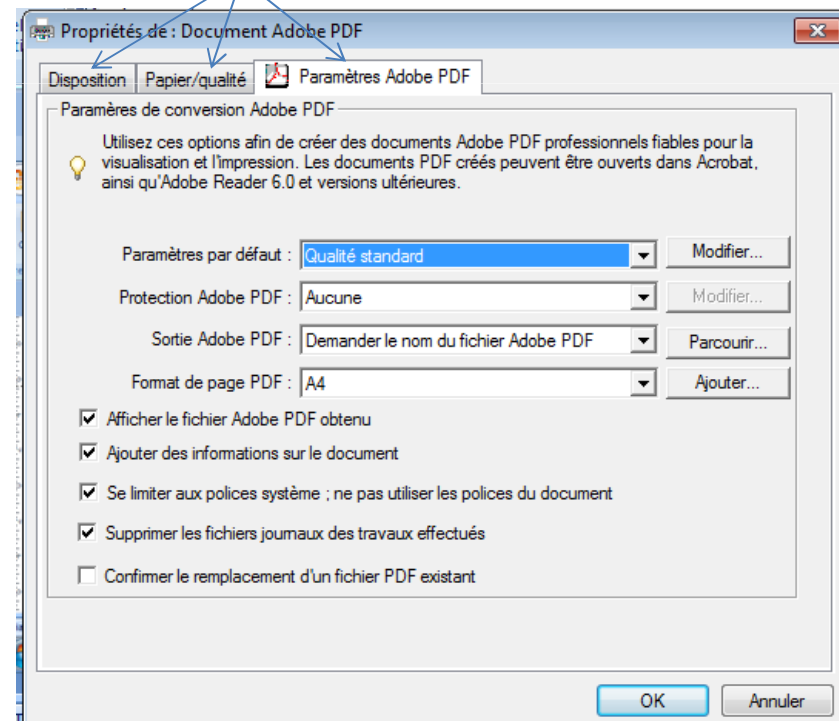|	
Affichage	▶
Trier par	▶
Actualiser	
Coller	
Coller le raccourci	
Annuler le déplacement	Ctrl+Z
Propriétés graphiques...	
Options graphiques	▶
Nouveau	▶
Résolution d'écran	
Gadgets	

Tabs

2 tabs

5 tabs

3 tabs

Ribbon (Rubans)

➢ The "ribbon"(ruban) was introduced in Microsoft Office 2007 that replaced traditional menu bars with a tabbed, visual command center to find tools more easily.
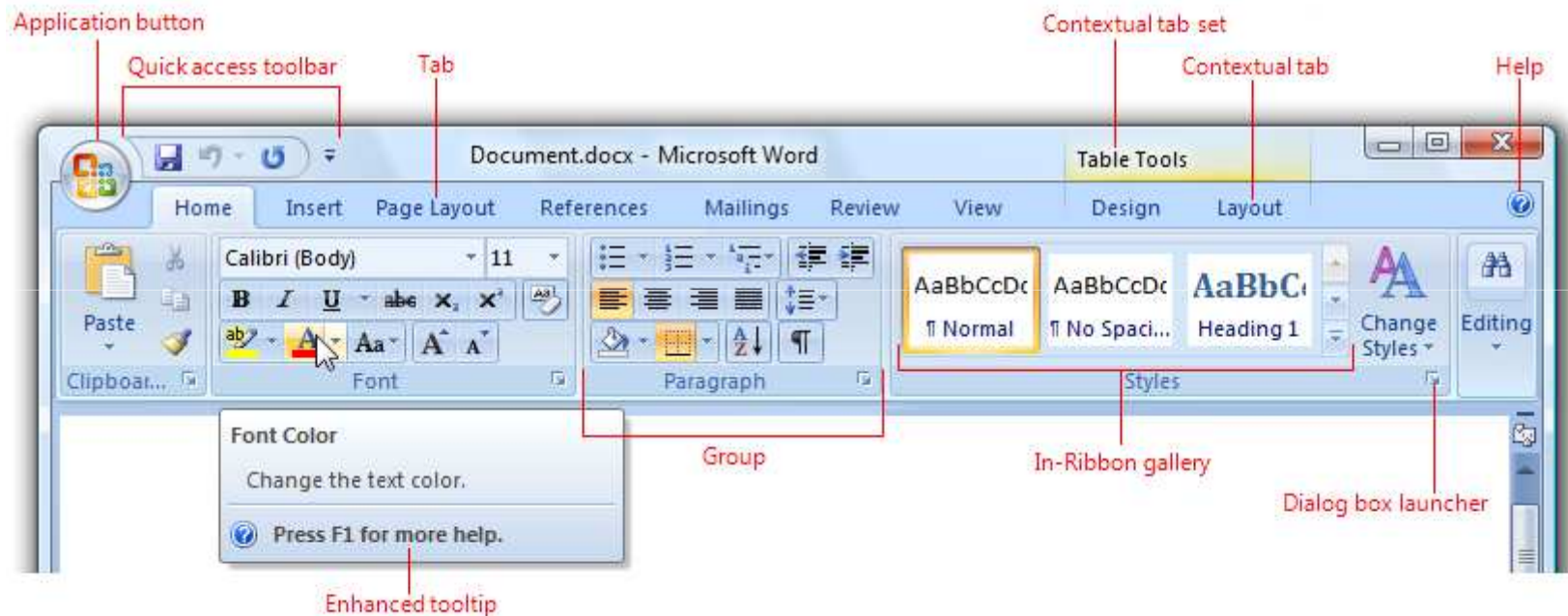
➢ Located at the top of Office applications, the ribbon features different tabs (like Home or Insert) which, when clicked, display related commands and options, providing a more intuitive way to access features compared to older menus.

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4. Combobox – List boxes

➢ A combobox is a graphical user interface (GUI) widget that combines an editable textbox with a dropdown list or another popup, allowing users to either select a predefined value or type in their own,

➢This composite control helps users find and enter values more quickly, especially when dealing with large lists of options, and it can also be used to prevent invalid entries

➢ use 3 to 9 items,

➢ use of scroll bar when there are hidden items.
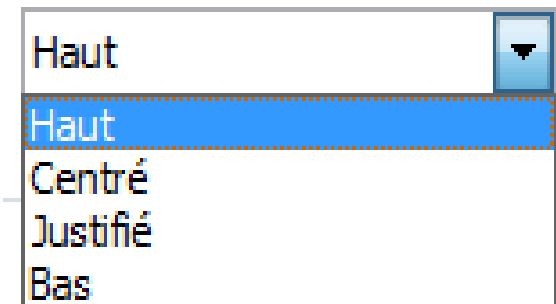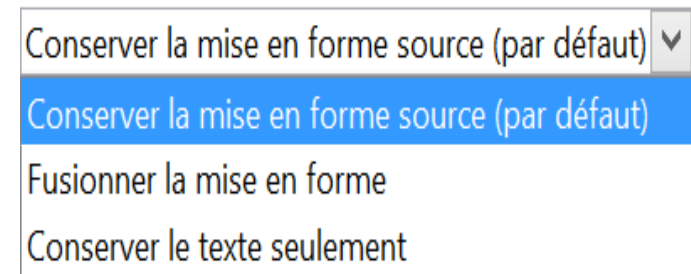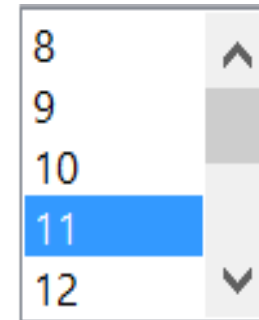
Tree view (Liste arborescente)

➢Tree views are suited for displaying text-based collections that have an important hierarchy that needs to be showcased.

➢Tree view items are collapsible/expandable, are shown in a visual hierarchy, can be supplemented with icons, and can be dragged and dropped between tree views.

5. Application Windows

Minimize button

Maximize button

Application icon   Title bar   Close button

About Windows

File Edit View   Menu bar

Vertical scroll bar

Sizing border

Client area   Horizontal scroll bar
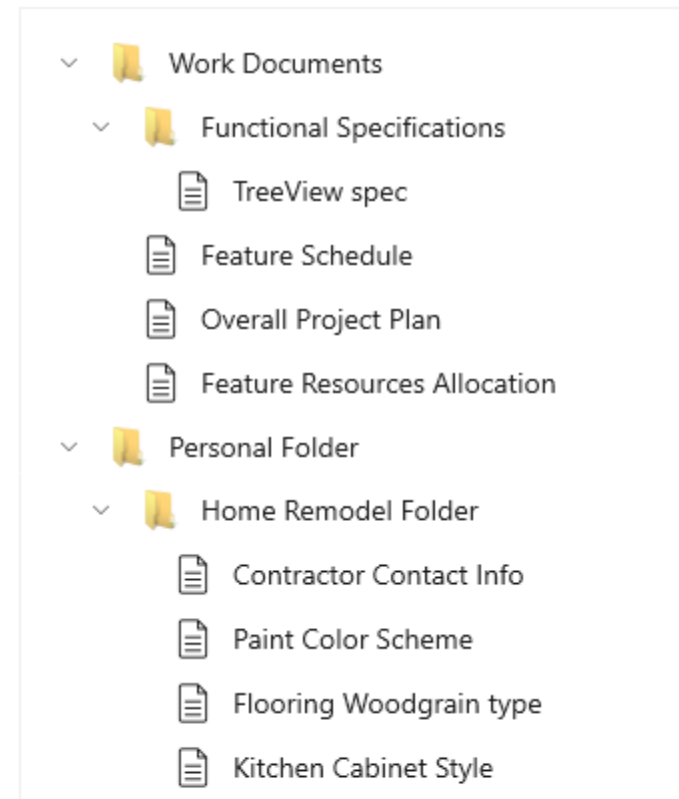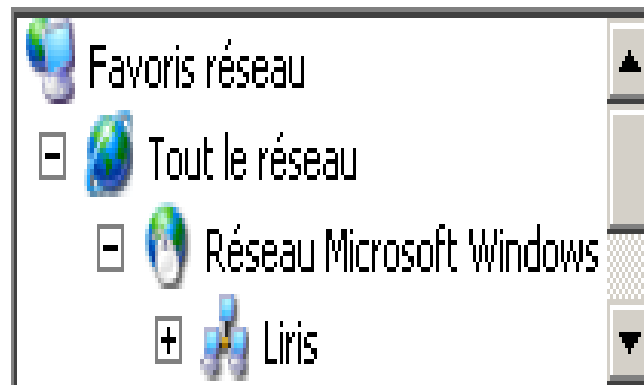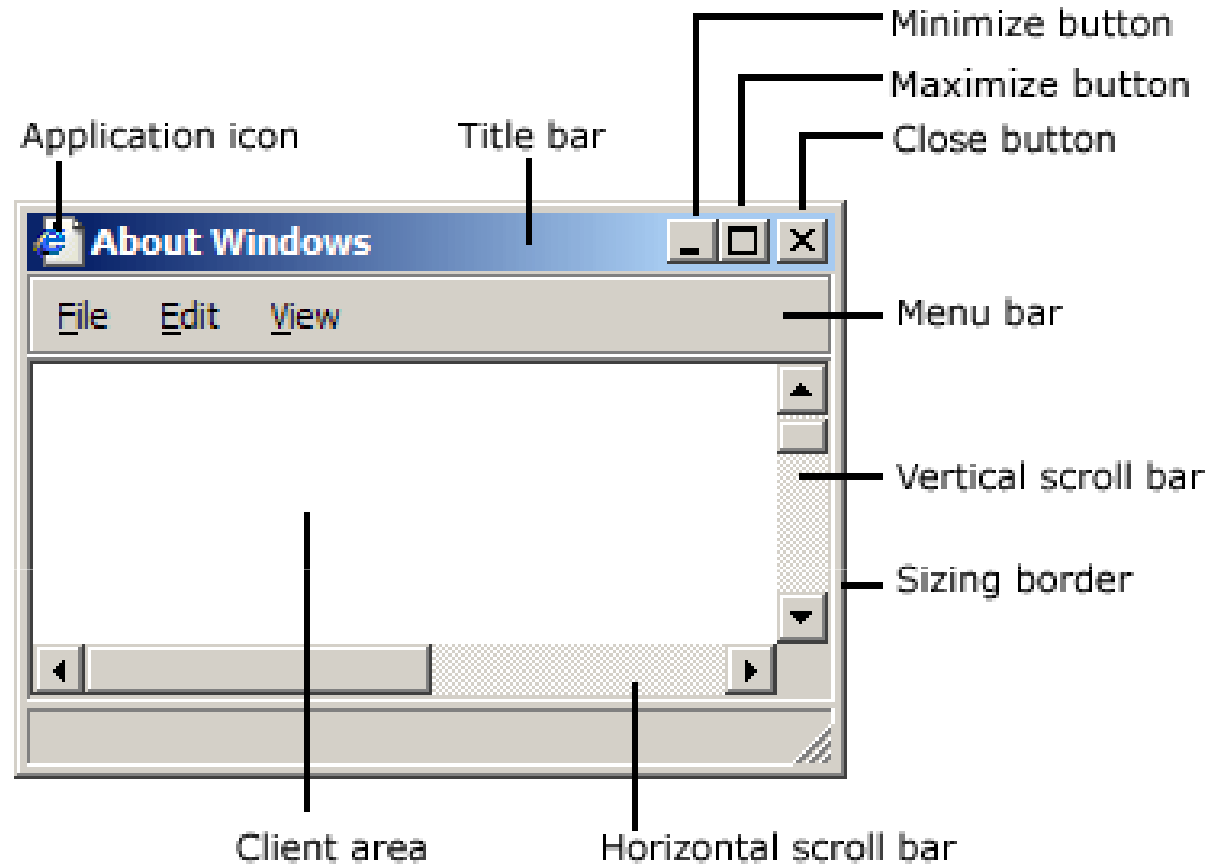
The primary rectangular graphical interface on a computer screen where a user interacts with an open application or program, such as word processors or web browsers.

side-by-side window

➢ Refers to arranging two or more application windows so they appear next to each other on the screen.
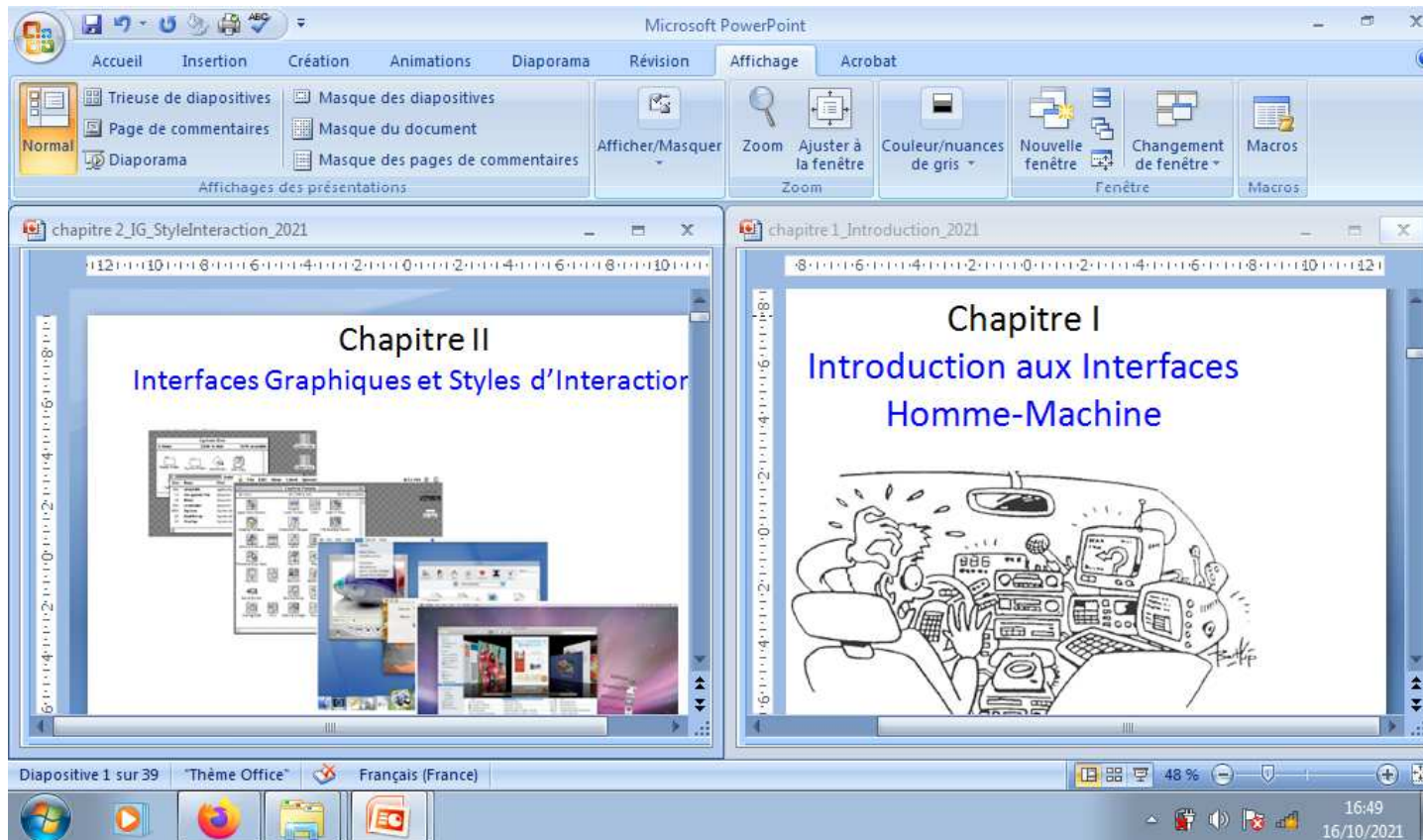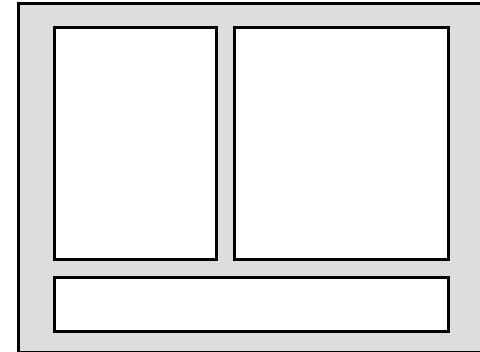
➢ Enhances productivity by allowing you to easily view and interact with multiple programs simultaneously.

Overlapping windows

➢ Multiple application windows on a computer screen that can partially or completely cover one another, allowing users to arrange and manage them freely in a "desktop metaphor" style,

➢ Widows are positioned and resized anywhere on the screen,

➢ To access a hidden window, the user clicks on it or its title bar to bring it to the front.
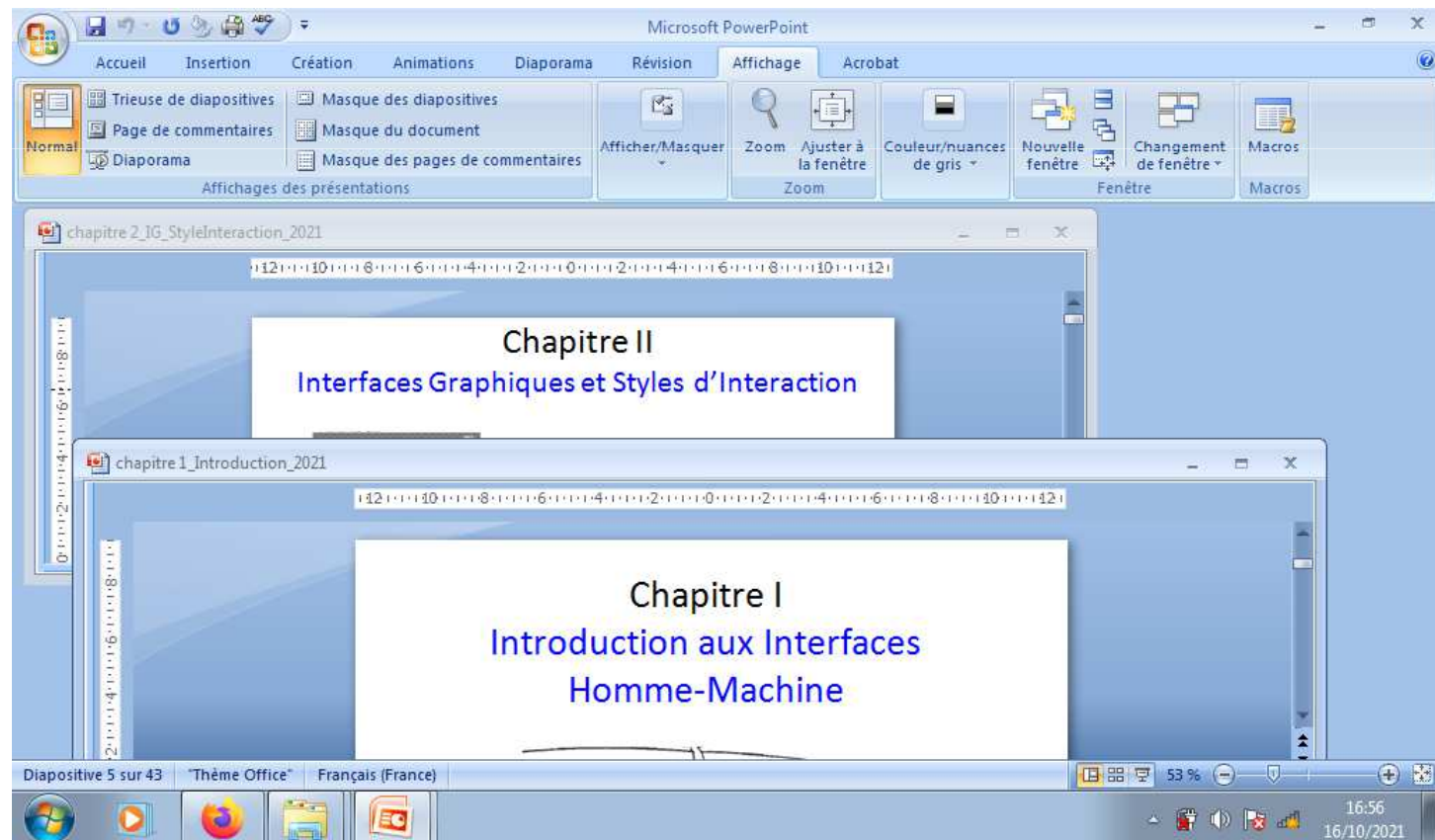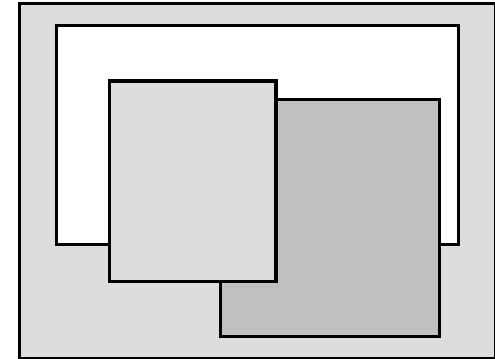
a. Modal window (fenêtre modale)

➤ Modal window creates a <u>mode</u> that disables user interaction with the main window but keeps it visible, with the modal window as a <u>child window</u> in front of it.

➤ Users *must* interact with the modal window before they can return to the <u>parent</u> window.

➤ Modal window is <u>moveable</u> to let the user see the parent window.
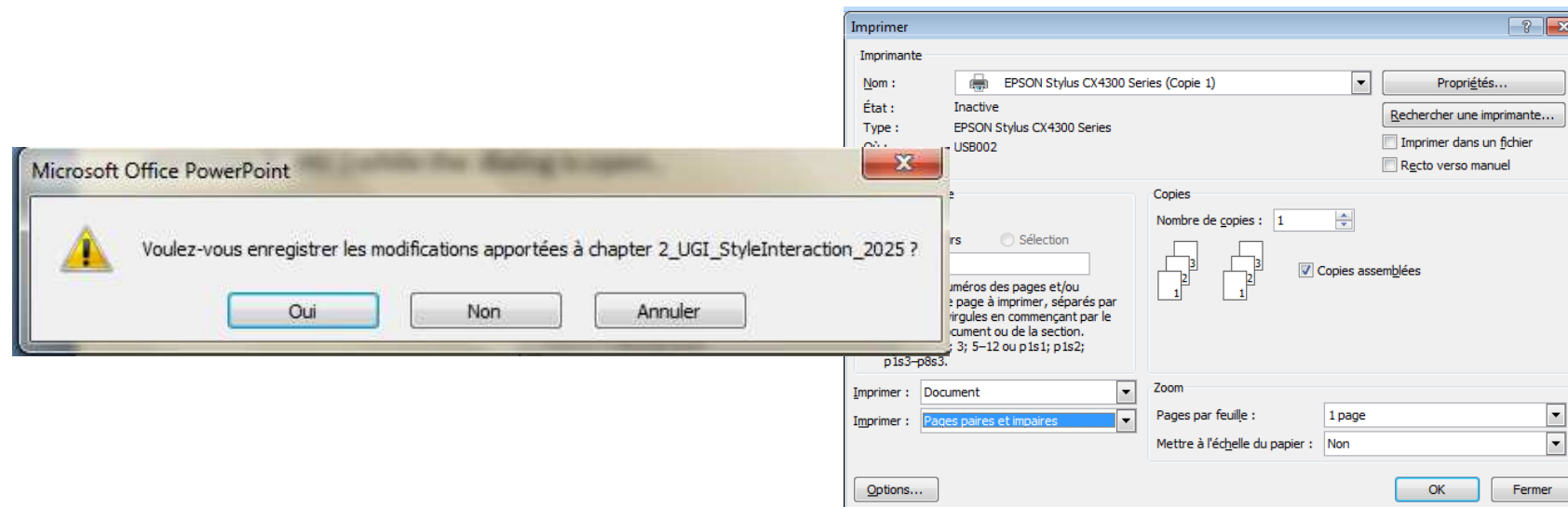
➤ Modal window are appropriate when <u>user's attention</u> needs to be directed toward important information: **Critical actions, Form submissions, Alerts or errors.**

b. Non-modal window (fenêtre non modale)

➢ The user can continue interacting with the main content (and perhaps even move the window, minimize it, etc.) while the dialog is open.

➢ They are used for components that don't require user attention or an immediate response
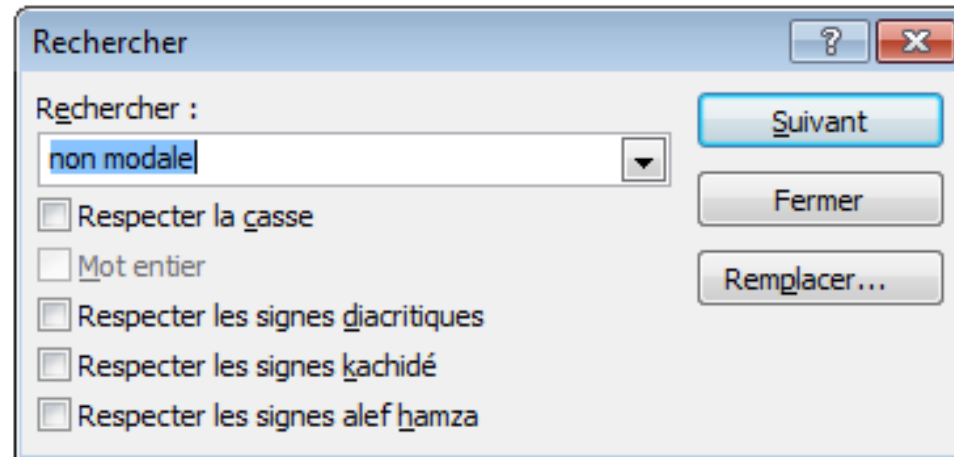
c. Dialog Box : Boite de dialogue

Title

Main instruction

Progressive disclosure

Internet Explorer - Security Warning

Do you want to run this software?

Name: Windows Live Messenger

Publisher: **Microsoft Corporation**

More options

Run   Don't run

While files from the Internet can be useful, this file type can potentially harm your computer. Only run software from publishers you trust. What's the risk?

Content area

Commit button

Footnote area

► boutons

> ► pas plus de 5
> ► au moins OK, Annuler (+ Aide)
>> ► Annuler : aucune entrée faite sur le dialogue ne doit être prise en compte

Microsoft Office PowerPoint

Do you want to run this software?

OK   Cancel

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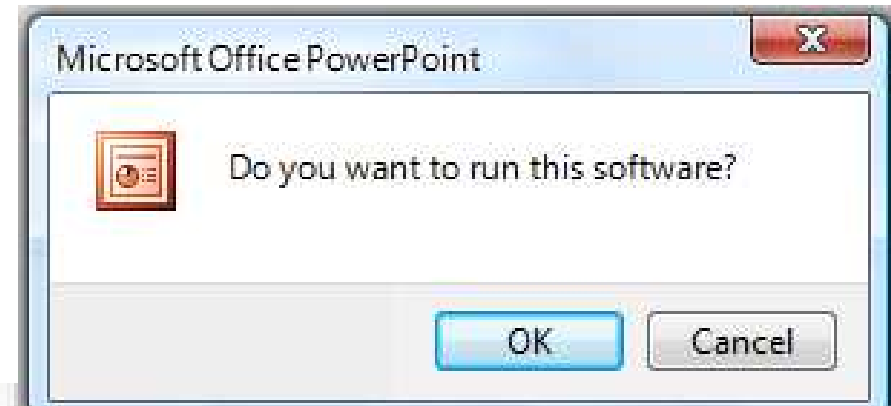
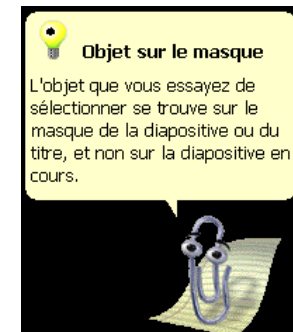## d. Floating window (Fenêtre flottante)

➢ can be moved around a screen, independent of other application windows, and can overlap them to display content.
➢ if the parent is minimized, the floating window will also be minimized.

e. Popup or pop-up (Fenêtre jaillissante)

➢ a small window that suddenly appears on a user's screen
➢ ex. Infobulle / Bulle d'aide

6. Zones de texte ou Champs de saisie
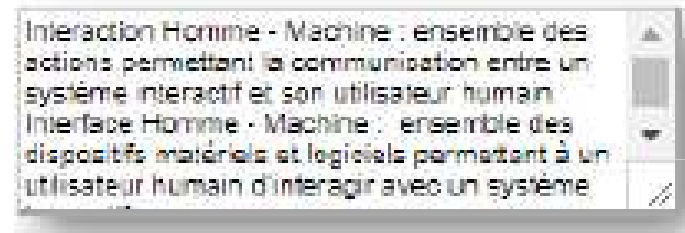
➢ Zones de saisie **mono-ligne**

    ➢ Texte sur une seule ligne

    ➢ Correspondant à une unité d'information

➢ Zones de saisie **multi-lignes**

    ➢ Redimensionnable

    ➢ Barre de défilement

➢ **Remarque:** à adapter au besoin
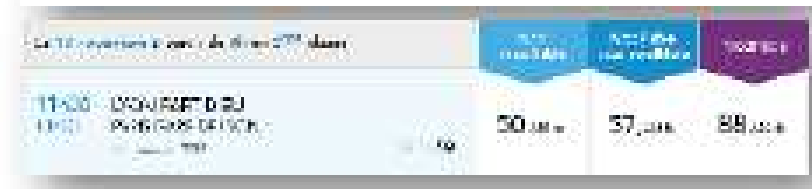
    ➢ Type (mono/multi-ligne)

    ➢ Dimensions

    ➢ Contraintes:

        ➢ Format

        ➢ Nombre de caractères max.

7. Autres composants

▶ Tableau/grille
  ▶ organisation visuelle à 2 dimensions
    ▶ pleinement lisible
  ▶ pour structurer des données
    ▶ lignes, colonnes, en-têtes

▶ Sélecteur de date
  ▶ organisation visuelle à 2 dimensions
  ▶ attention au cas de la naissance

▶ Lien hypertexte
  ▶ texte cliquable
  ▶ généralement associé à une URI
  ▶ liens visités affichés différemment

IV. GUI Developpement

For which operating system and on which hardware should this application be developed?
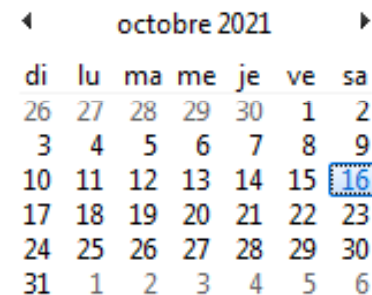
- Is it only for Linux? Windows? Maybe both? Maybe others etc.,

- to make it work on a PC, SON or Mac etc.

-it is important to look at whether there are cross-platform libraries that can be used to create these GI.

IV.1. GUI Toolkits

➢ A toolkit is a set of pre-written code libraries, functions, APIs, and other resources that developers can use to build a GI more quickly and efficiently.

➢ Toolkit provides the pre-built widgets (buttons, text fields, etc.) needed to build a UI.

➢ Toolkits are programmed using a programming language like C++, C#, Java.

IV.2. Examples of GUI Toolkits

➢ Qt , cross-platform, code editor supporting multiple languages like C++, QML, JavaScript, and Python.

➢ GTK+ , cross-platform

➢ Tk , cross-platform

➢ wxWidgets or formerly wxWindows , cross-platform

➢ Windows interface , called the Windows API or Win32

➢ Swing and SWT for Java

➢ …

V. Types of Human Computer Interactions

Les interactions homme-machines définissent les moyens et outils mis en œuvre afin qu'un humain puisse contrôler et communiquer avec une machine.

Différents styles d'interaction sont envisageables pour la communication entre l'homme et la machine. Ils font appel aux différents canaux d'entrée-sortie dont nous disposons:
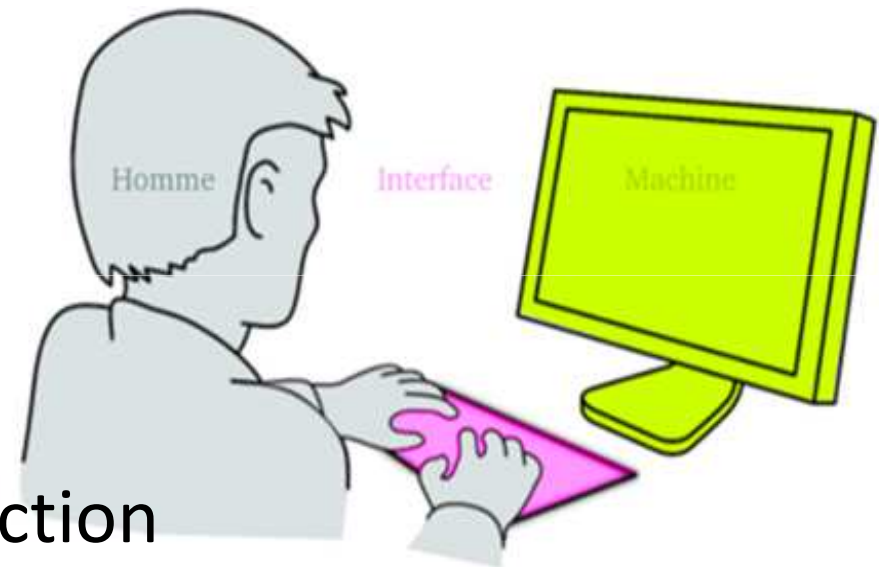
> En entrée : nos cinq sens (vue, ouïe, toucher, odorat, goût)

> En sortie : nos actuateurs (membres, doigts, yeux, tête, voix, ...)

V. Types of Human Interactions

There are several types of interaction:

1. Natural Language
2. Command-line
3. Menus
4. Direct Manipulation
5. Gesture / Touch Interaction
6. Multimodal Interaction, etc.

Homme   Interface   Machine

1. Naturel Language Interaction: NLI

➢ Allows people to interact with devices and systems using everyday language, rather than complicated commands.

➢ Examples: Siri, Alexa, Google Assistant or Cortana.

➢ Voice UIs are added to :

   ➢ cars,
   ➢ Operating Systems of computer,
   ➢ household devices such as washing machines,
   ➢ television remote controls, etc.

❖ **Advantages of NLI**
  ➢ Users do not have to learn the syntax or principles of a particular language.
  ➢ Suitable for users with physical disabilities/mobility issues.
  ➢ Can provide a safer interface in certain environments - Example: Driving a car.

❖ **Disadvantages of NLI**
  ➢ Misinterpretation due to ambiguous or unclear input (Variation in tone and accent)

Google Home sont des enceintes connectées associées à un Assistant personnel intelligent qui permettent aux appareils de réagir aux commandes vocales des utilisateurs.

Siri (Apple) et Google Assistant, sont des interfaces en langage naturel qui vous permettent d'interagir avec les système d'exploitation de votre appareil en utilisant votre propre langue parlée.

Google Assistant   Siri

Alexa

Alexa (Amazon) est un Assistant personnel intelligent capable d'interaction vocale, de lire de la musique, faire des listes de tâches, régler des alarmes, lire des livres audio, et donner la météo, le trafic et d'autres informations en temps réel et également contrôler plusieurs appareils intelligents.

2. Command Langage Interaction

➢ users type explicit commands and parameters into a system, such as a command prompt in a Linux/Unix shell, to execute operations.

Exemples : Dos, Unix
- ❑ delete *.*
- ❑ copy A:*.doc c:

❖Advantages
- ➢ Appeals to expert users.
- ➢ Supports creation of user-defined "scripts" or macros.

❖Disadvantages
- ➢ users must learn and remember the correct command syntax and available options to interact effectively.
- ➢ not suitable for non-expert users.

3.Menus

user selects a command from a predefined selection of commands arranged in menus and observes the effect.

Advantages

➢ Ideal for novice or intermittent users.
➢ expert users are rapid if appropriate "shortcuts" are implemented.
➢ users can "look around" in the menus for the appropriate command, unlike having to remember the name of a command *and* its spelling when using command language.

Disadvantages

➢ Too many menus may lead to information overload or complexity of discouraging proportions.
➢ May be slow for frequent users.
➢ May not be suited for small graphic displays.
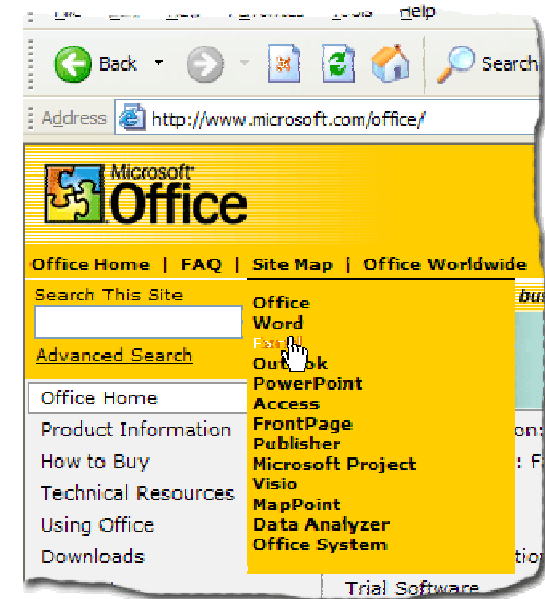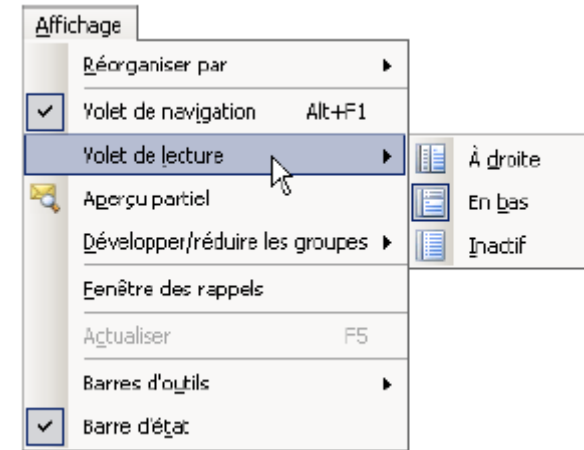
4. Direct Manipulation (1/2)

The term direct manipulation was introduced by Ben Shneiderman in 1982-1983.

"direct manipulation of the object of interest", means that objects of interest are represented as distinguishable objects in the UI and are manipulated in a direct fashion.
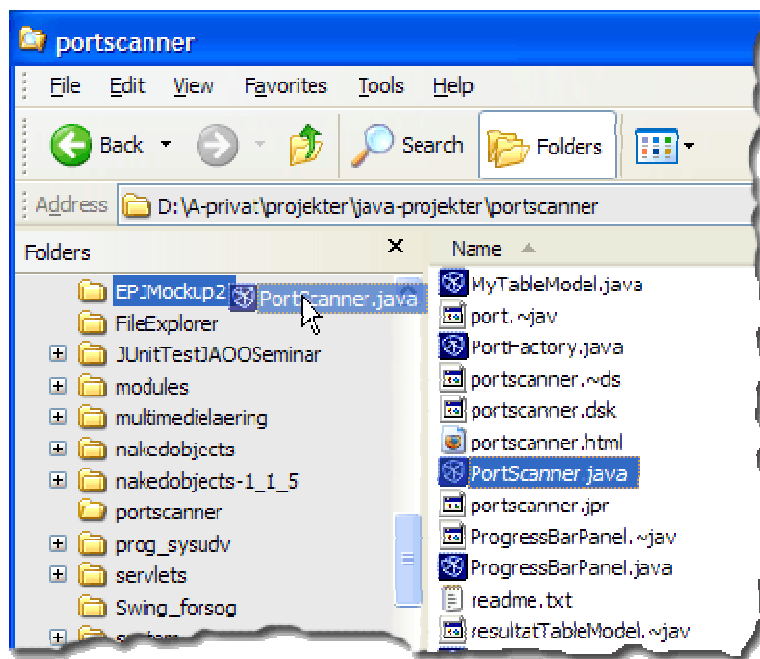
Direct manipulation systems have the following characteristics:

➢ Visibility of the object of interest.
➢ Rapid, reversible, incremental actions.
➢ Replacement of complex command language syntax by direct manipulation of the object of interest.

4. Direct Manipulation (2/2)

Advantages

➢ Easy to learn.
➢ Errors can be avoided more easily.
➢ High subjective satisfaction.
➢ Recognition memory (as opposed to cued or free recall memory)

Disadvantages

➢ Not suitable for small graphic displays.
➢ Spatial and visual representation is not always preferable.
➢ Compact notations may better suit expert users.

5. Gesture /Touch based interactions

➢ users use touchless technology to control digital systems with body movements, such as hand, finger, or facial gestures, eliminating the need for physical contact with a device.
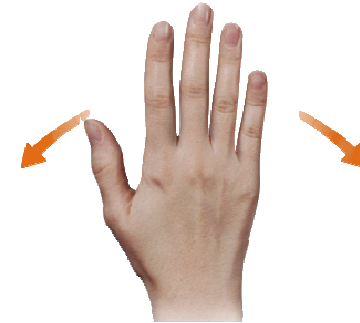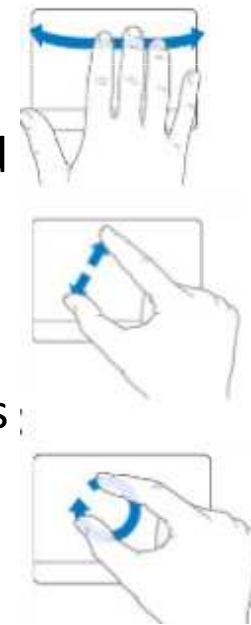
➢ **Smartphones and Tablets**
   Swiping, tapping, and pinching are common touch-based gestures.

➢ **Smart Homes**
   Users control smart home devices using simple gestures, such as waving to answer a call or making a fist to play a video.

➢ **Virtual Reality (VR) and Augmented Reality (AR)**
   Users can interact using hand gestures, making the experience more immersive.

Vidéo représentant la manipulation de cartes graphiques
Par Interaction **Gestuelle**

6. Multimodale Interaction

users can communicate with a system using a combination of different modes, such as speech, gesture, touch, and gaze, to perform tasks and receive information in a flexible and natural way.

"Put That There" Richard Bolt (1963) is a voice and gesture interactive system implemented at the Architecture Machine Group at MIT.

Vidéo représentant différentes IHM incluant des interactions par le Corps entier, la Capture de mouvements, la Reconnaissance faciale, et la Reconnaissance vocale.
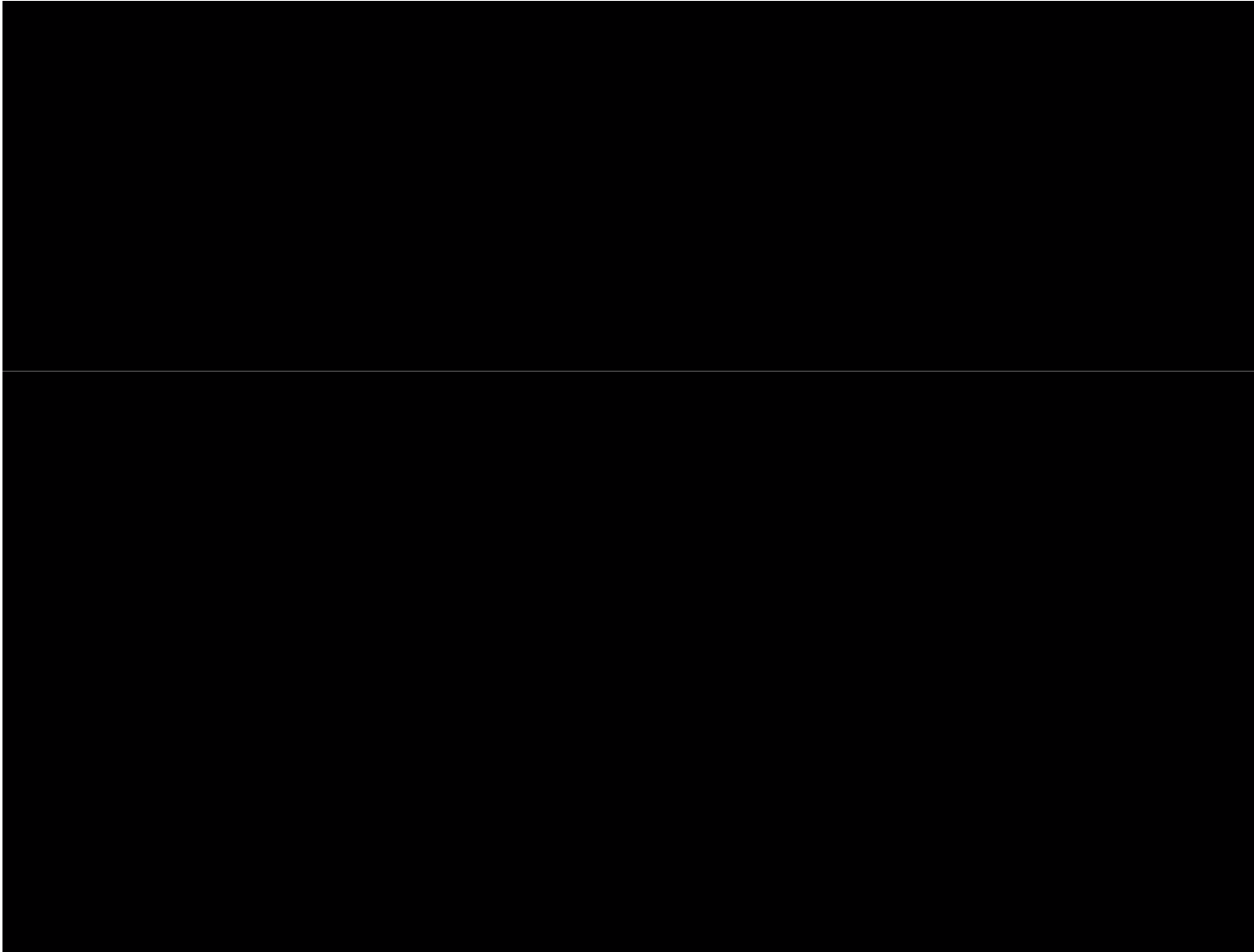
7. Brain Computer Interaction

"The goal of BCI technology is to give severely paralyzed people another way to communicate, a way that does not depend on muscle control." (Wadsworth Center)

Une femme tétraplégique contrôle un bras robotisé par la pensée – reportage – 4 min 29 – Nature video (2012)

Paralyzed person

➢ could control the movements of their prosthesis,

➢ could speak or write via a computer,

➢ could control a wheelchair, …

Questions …

Pour toutes vos questions, n'hésitez pas
à me contactez
c_rouabhia@yahoo.fr