

## GUI aspects and literature concerning GUI access by blind users

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GUI aspects and literature  
concerning GUI access by  
blind users

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# 1 Introduction

Due to the extending use of Graphical User Interfaces (GUI's) in the office environment, blind or partially sighted users of computer programs are no longer able to work with their computer and its applications. In order to find a way to make the GUI's accessible for those people, a categorization is made of all the GUI aspects. It appears that GUI's look more different then they really are. This of course can help us in finding a translation of the GUI environment to an environment that is accessible by the blind or partially sighted user. We can here think of reconstructing a command-line structured interface, which has proven to be accessible to blind or partially sighted users with the assistance of Braille or synthetic speech.

This report will discuss the different aspects of GUI's, as far as they are related to the use in an office environment. Also this report will give a list of literature references related to this subject and the general subject of making GUI's accessible for the blind.

Nowadays several Graphical User Interfaces (GUI's) are available for different machines or even the same machines. The following three are presumed to be the most commonly used GUI's in an office environment:

**Finder:** Used on the Apple Macintosh.

**Presentation Manager (PM):** Used on personal computers which are running the operating system OS\2.<sup>1</sup>

**Microsoft Windows (MS Windows):** Used on personal computers which are operated by MS-DOS or PC-DOS.

Chapter 2 and 3 will give a summary of the objects and action that all three GUI's have in common. Extensions or exceptions of a particular GUI will be mentioned separately.

## 2 GUI basics

The basic idea behind a GUI is to provide the user of a computer an environment which is consistent in its use and allows the *user* to control the dialog (so called direct manipulation.) For this reason the windows environment and its applications are build with the help of objects. All GUI-environment manufacturers have defined a set of standard objects, which should be used by programmers writing GUI application programs in order to garantee consistency between programs. The easiest way to extract the

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<sup>1</sup>OS\2 version 1.x is considered in this article. Version 2.0 will be analysed as soon as possible.

objects of a GUI is therefore to look into the programmers guides provided by the GUI-manufacturers.

### **3 GUI objects**

All objects consist of graphical items which can be divided into three classes:

1. Text
2. Arrays
3. Graphics

Items from one class can be mixed with items from another or even with items from the same class. E.g. an array can contain text, graphics or both, or another array which contains etc.

As mentioned previously, all GUI objects are build with items from one or more of these classes. The objects can be divided into the following groups:

1. Pointers
2. Icons
3. Buttons and scroll bars
4. Windows
5. Dialog boxes
6. Menu's

Each group will be discussed in the next paragraphs. Apart from their graphical representation the manipulability of these objects will be discussed.

#### **3.1 Mouse pointer**

The mouse pointer is a small graphic that can be moved around the screen by moving an input device named a mouse. The shape of this pointer indicates the state of the system. Normally it has the shape of an arrow, but images indicating e.g. a busy state (a wristwatch in the Finder) are also provided (see figure 1) A mouse has one or more buttons but all GUI's support a mouse with a single button. If a mouse has more than one button we mean by speaking of the button the left button of a mouse. With this pointer and the mouse the user can manipulate the several GUI objects. Possible actions are:

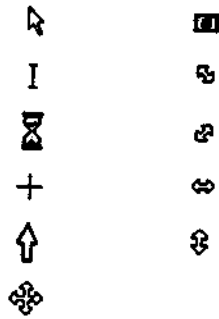


Figure 1: Several shapes of the mouse pointer

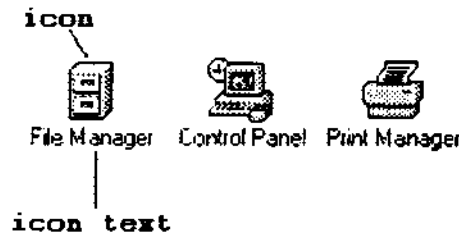


Figure 2: A few icons

**pointing:** Placing the mouse pointer on an object.

**selecting:** Clicking the mouse button once after pointing to an object. In case of the object being a button we can also speak of pressing.

**activating:** Pressing the mouse button twice after pointing to an object.

**dragging:** Holding down the mouse button after pointing to an object and moving the pointer. This will cause the object to move to another location.

## MS Windows & PM

These GUI's support mouses with two or more buttons but in general all the necessary actions can be performed by using the left mouse button.

### 3.2 Icons

Icons are graphical symbols that can serve several purposes. A few examples of an icon is are shown in figure 2.

They can be used to represent programs, datafiles etc. on the screen. The files can be selected by moving the mouse pointer to the icon and pressing the button of a mouse twice. An icon can also be moved around by 'dragging' it with the mouse pointer. Basic idea behind these icons is that pictures sometimes say more than words.



Figure 3: A default button and a non-default button

## MS Windows & PM

In these interfaces an icon can also represent a running program. Activating this icon by the mouse will make the original application window reappear. Pressing the mouse button once with the pointer on this icon will show a so called system pop-up menu which will be discussed in section 3.6.

### 3.3 Buttons and scroll bars

#### 3.3.1 Buttons

Buttons can be used to initiate certain actions. A button can be 'pressed' by clicking the mouse button once. The action that will be initiated by pressing a button is represented by a text or a small graphic on the button. Except from selecting a button with the mouse a default button can be pressed by pressing the 'Enter' or 'Return' key of the keyboard. A default button has a thick line around it's borders.

#### MS Windows & PM buttons

MS Windows and PM buttons are also accessible by short keys or so called accelerators. The short key to select and press a button is indicated by an underlined character of the button text. Pressing this key on the keyboard will select the button.

#### 3.3.2 Scroll bars

A scroll bar is a graphical representation of three related numbers: a minimum, a maximum and a current value that lies between the two. The objects that form a scrollbar are listed in figure 4. By dragging the slider box, the contents of a related single dimensional array can be moved between a minimum and a maximum. Selecting a scroll arrow button moves the slider box and the contents of the related array a little bit in the arrows direction.

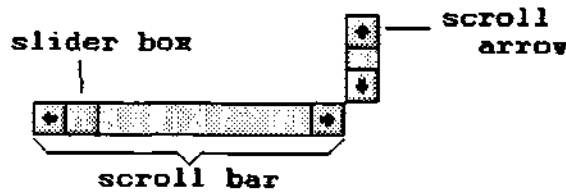


Figure 4: A vertical and horizontal scroll bar

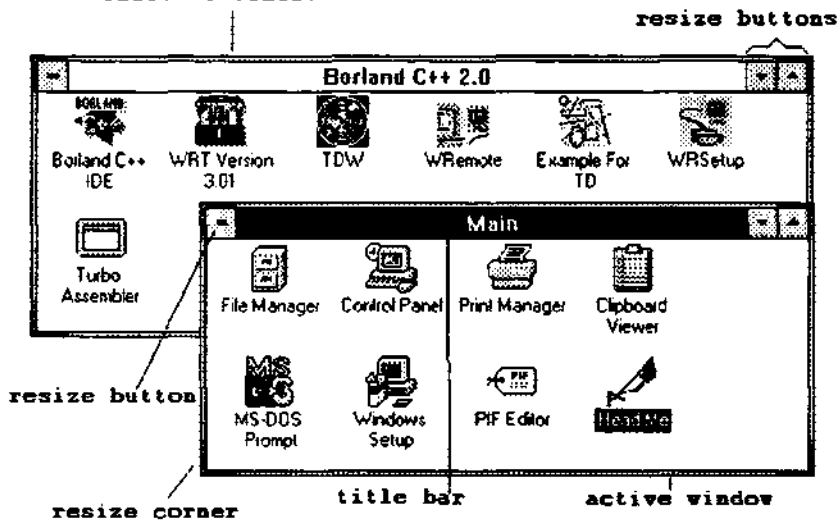


Figure 5: Active and inactive windows

### 3.4 Windows

Windows are rectangles of variable size. They can be moved around the screen and also overlap each other. A window can be active or inactive (See figure 5). The user can manipulate the contents of an active window. An active window will also be the top window, in other words will overlap windows that have (partly) the same location. An inactive window can be activated by selecting it. Only one window can be active at a time. An exception are the multiple documents. Here a main window and one of its child windows can be active at the same time! (See figure 6). A window can be divided in two areas: a client and non-client area. The client area is formed by the inner rectangle that contains the specific application, e.g. the text editing area of a wordprocessor (See also figure 5). The non-client areas contain those objects that are directly related to the window itself. These items will now be discussed. The objects that might be available in the non-client area are:

**resize corner:** This graphic is located at the bottom right corner of a window. Dragging this graphic to an other location resizes the window.



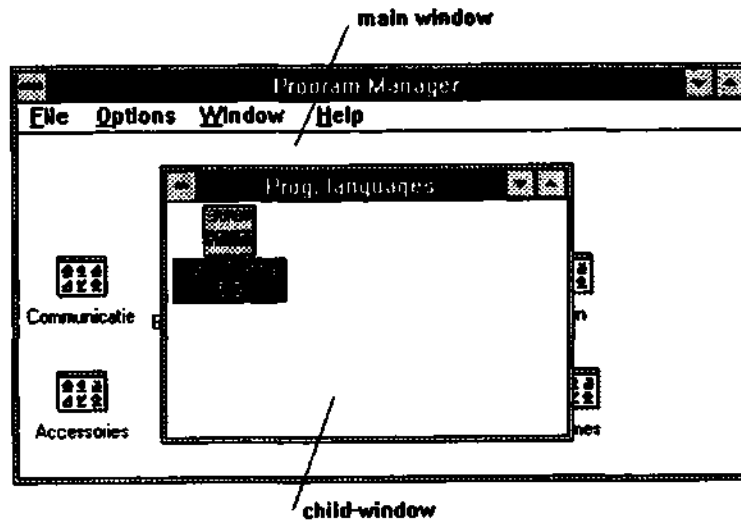


Figure 6: An example of the multiple document interface

**close button:** Pressing this button will close the window.

**title bar:** This bar on top of the window contains the title of the window. Dragging this bar will move the entire window.

**scroll bar:** The function of a scroll bar is already discussed in paragraph 3.3.2.

### MS Windows & PM

These GUI's offer a few extensions to the general GUI windows.

- a maximize button at the top right corner of the window.
- a minimize button next to the maximize button.
- the resize corner is available in all or no corners of the window.
- a window can also be resized by dragging the borders of a window. If no resize corner is available no window resizing can be done at all.

The close button in these interfaces is in fact no real button but actually behaves more like an icon. To close the window the close "button" has to be pressed twice instead of once. Selecting this icon will show a system menu just like the system menu of icons that represent running programs (3.2).

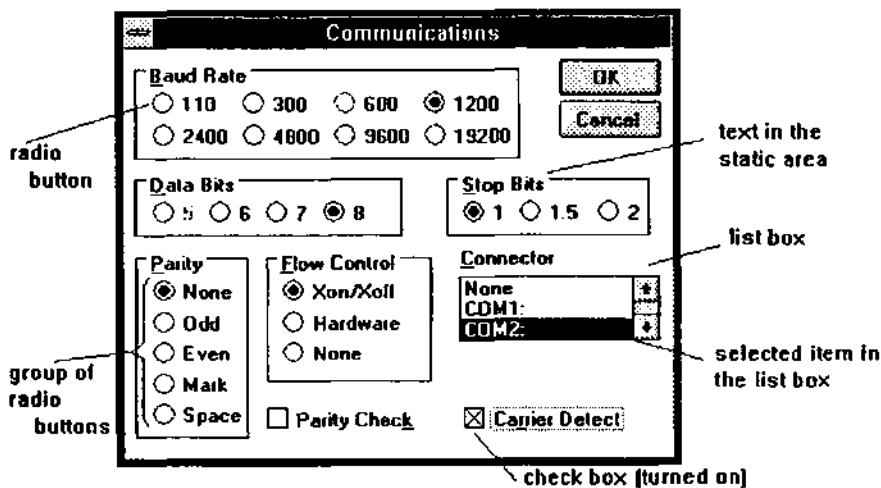


Figure 7: Several tools in a dialog box

### 3.5 Dialog boxes

A special kind of window is a so called dialog box. Users provide the dialog box with information that an application needs to continue. Dialog boxes can be moved by dragging them but the size can't be changed. Generally there are two types of dialog boxes:

**modal boxes:** These boxes prevent the user from interacting with other windows of the application until the information request of a box is handled properly. Dialog boxes may be specified as a system modal or application modal. Application modals allow a user to work in a window of another application before completing the dialog box. System modals should be finished before the user is allowed to work in another window.

**modeless boxes:** These boxes allow a user to interact with other windows of another or even the same application without first completing the dialog box.

To receive information from the user in a consistent manner the following tools are used within dialog boxes (See also 7):

**push button:** Already discussed in paragraph 3.3.1

**scroll bar:** Already discussed in paragraph 3.3.2

**radio button:** Radio buttons always appear in groups. Only radio of the same group can be turned on at a time. If another radio button of the group is selected the previous one will be turned off automatically.

**check box:** A check box can appear alone or in related sets. A check box acts like a switch. Program features can be turned on and off by selecting the check button. Multiple buttons of a related set can be turned on or off.

**edit control:** This object allows the entering of text or a selection . There are four types of edit controls.

1. Single-line edit.
2. Multiple-line edit.
3. Multiple-line edit that allows vertical scrolling.
4. Multiple-line edit that allows vertical and horizontal scrolling.

An edit control appears as a single rectangle in which text can be edited. In case of tools of type 3 and 4 scroll bars are available to allow entering text of a larger size than the size of the rectangle.

**list box:** This box shows the user a set of items that can be selected (e.g. a list of fonts). The most common type of list box contains text, but graphic images can also be drawn into the a list box if a set of choices is best represented by a picture instead of words. If it is a list in a list box is

**static areas:** The static areas can contain objects like icons, text labels, filled rectangles etc. that contribute to the general function of a dialog box but do not interact with the user directly. A special object of a static area is a group box. This is a rectangle with a title that is used to group radio buttons or to define a set of related check boxes.

**dials:** Programmer definable controls that can indicate things like values, magnitudes, or position of something in the application or system, and optionally allow a user to alter that value of one of these controls. In fact a scroll bar is a special kind of dial.

## **MS Windows & PM**

A control box in one of these GUI's can also contain a combination box or combo box. This is a combination of an edit control and a list box. The list box is placed underneath the edit control. Items selected in the list box are placed automatically in the edit control. Separate entering of text or altering of text in the edit control is also possible. A special kind of combo box is the drop-down combination box. Only the edit part of the control is shown in the dialog box. If this part is selected, the list part appears under the edit control. As soon as a selection is made or the editing is done the list box

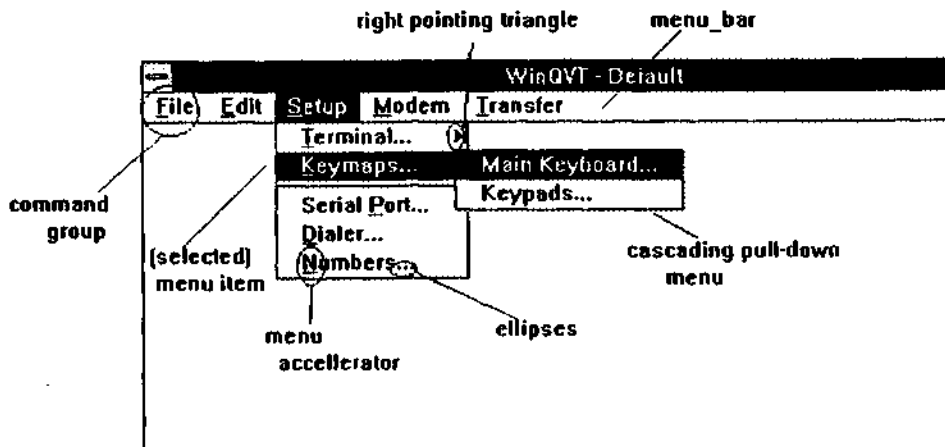


Figure 8: Menu based GUI command interpreter.

disappears. Sometimes it is not possible to edit the text in the edit control. To indicate that an edit control will turn in a drop-down combination box as soon as selected, a visual clue is added to the right of the entry field. A dialog box can be closed in several ways depending on the type of box:

- A modal dialog box can be closed by:
  1. pressing the 'OK' button or another button that completes the dialog.
  2. pressing the 'Cancel' button.
- modeless dialog box can be closed by:
  1. pressing the 'Cancel' pushbutton.
  2. closing the window of the dialog box.

### 3.6 Menu's

Each application can have its own menu action bar which is placed at the top of a window. A menu bar consists of verbs and adjectives which summarize the possible command groups. If a command group is selected the command is highlighted and a pull-down menu list appears as long as the mouse button is pressed. A menu bar and a pull-down menu list are displayed in figure 8. The menu list contains command items which can be activated by moving the mouse pointer to the item to select and the release of the mouse button will finally select the command. Pointing to an item of the list with the mouse pointer automatically highlights the item. Sometimes the menu list is divided by horizontal lines in subgroups of command options. Apart from the menu item text itself several visual cues can be used to give an indication of the kind of action a selection invokes:

- A command item can also be followed by an ellipsis indicating that a dialog box will appear if the command is selected.

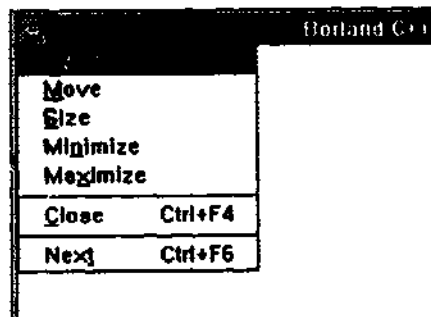


Figure 9: MS-windows 3.0 system pop-up menu

- A right pointing triangle indicates that selection of the item will activate a cascading pull-down menu.
- Verbs indicating options can be preceded by a check mark showing that the option is selected. These kind of check marks are called current state indicators.
- A dimmed text of a menu item means that the particular menu item is currently not available.

Other visual cues are concerned with alternative ways of accessing the menu items:

- Some menu items can also be directly activated by the keyboard. The key combinations to do this (so called accelerators) are displayed on the right next to the menu item, if available.
- The underlined character of a menu item can also be used to activate it without the use of a mouse. These will be called menu accelerators.

Except from text also graphics can be used to indicate menu choices.

## MS Windows & PM

As mentioned in paragraph 3.2 and paragraph 3.4 selecting the icon of a running program or selecting the close button of a window activates a system pop-up menu (Figure 9). This menu behaves in the same way as the pull-down menus of an action bar.

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