WD-pic

User's Manual

by

Lihua Ou

August 2002

Contents

List of Figures

Chapter 1

Introduction

1.1 Product overview

pic is a troff [1, 3] pre-processor for drawing pictures that are included in troff documents [1, 2, 3]. WD-pic, as the name suggests, is a **W**YSIWYG (What You See Is What You Get), **D**irect-manipulation **pic**, a picture drawing program with the interchangeability of batch and WYSIWYG. It is built on top of the pic program, using the pic language as its internal picture representation. Therefore, it is an enhancement of the pic program.

It has been observed that the pic language is well suited for drawing computer science technical document illustrations, such as flow charts and state diagrams. Thus, WD-pic is also intended mainly for these kinds of diagrams. Figure 1.1 shows a flow diagram generated from the pic code shown in Figure 1.2.

WD-pic runs on the Solaris UNIX environments with the JAVA runtime environment, version 1.3.1 or later.

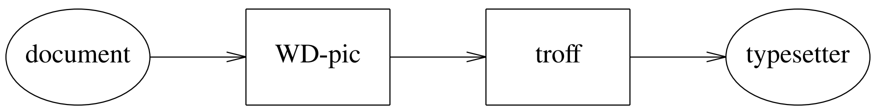


Figure 1.1: A flow diagram

```
ellipse "document"
arrow
box "WD-pic"
arrow
box "troff"
arrow
ellipse "typesetter"
```

Figure 1.2: pic code of Figure 1.1

1.2 First sample run

The picture in Figure 1.1 can be easily drawn with WD-pic. To start the program, run the following command:

wdpic [*filename*]

filename is an optional parameter, specifying the name of an existing file to load as the internal representation on start-up, or the name of a non-existent file that will receive the current internal representation whenever **Save** of the **File** menu is requested.

The screen layout of WD-pic is illustrated in Figure 1.3.

The following steps show one way to draw Figure 1.1. You will learn other ways to draw the same picture in later sections.

1. Left mouse click the **ellipse** button on the palette, and input **" d o c u m e n t "**[1] from the keyboard, without moving the mouse.

2. Left mouse click the **arrow** button.

3. Left mouse click the **box** button, and input **" W D - p i c "** from the keyboard, without moving the mouse.

4. Left mouse click the **arrow** button.

[1]White space is used to separate tokens; a blank token is denoted "␣".

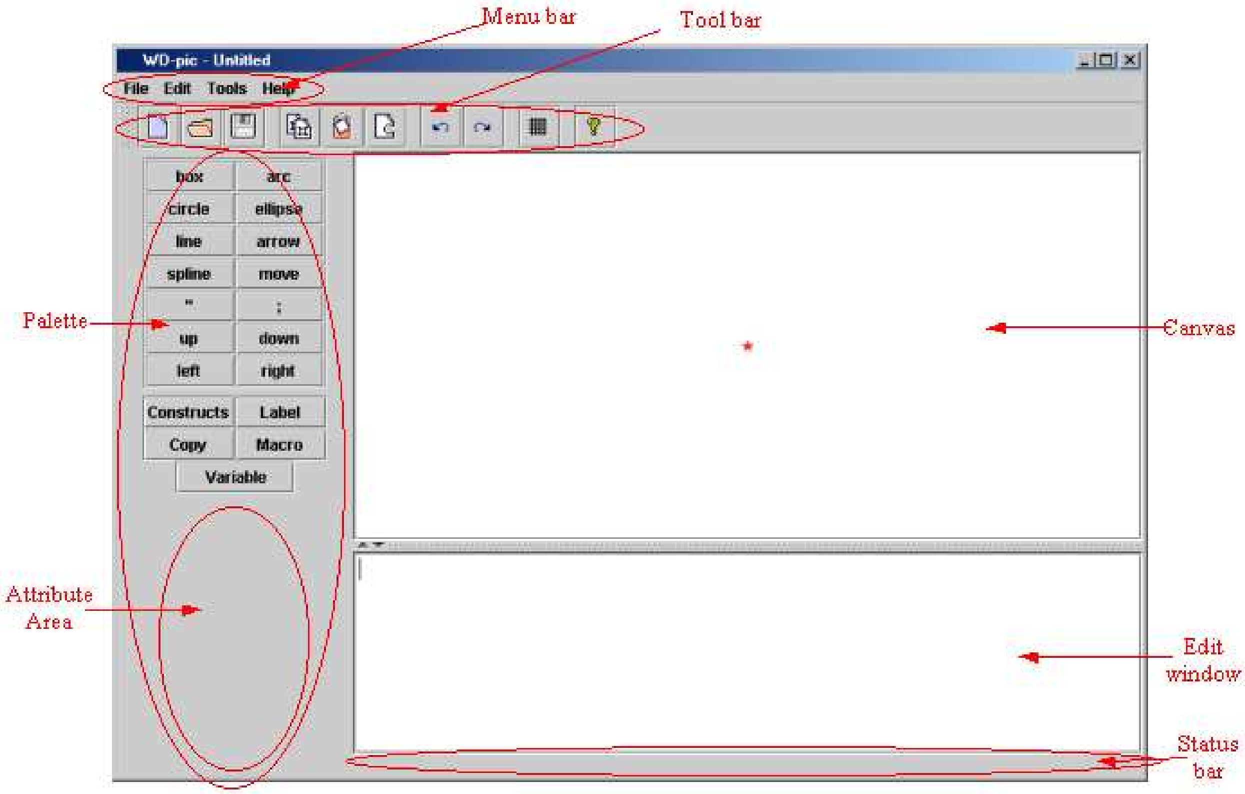


Figure 1.3: Screen layout of WD-pic

5. Left mouse click the **box** button, and input **" t r o f f "** from the keyboard without moving the mouse.

6. Left mouse click the **arrow** button.

7. Left mouse click the **ellipse** button, and input **" t y p e s e t t e r "** from the keyboard without moving the mouse.

As you are doing the above operations, the internal representation shown in Figure 1.2 is generated in the editing window and the picture shown in Figure 1.1 is drawn on the canvas, as illustrated in Figure 1.4.

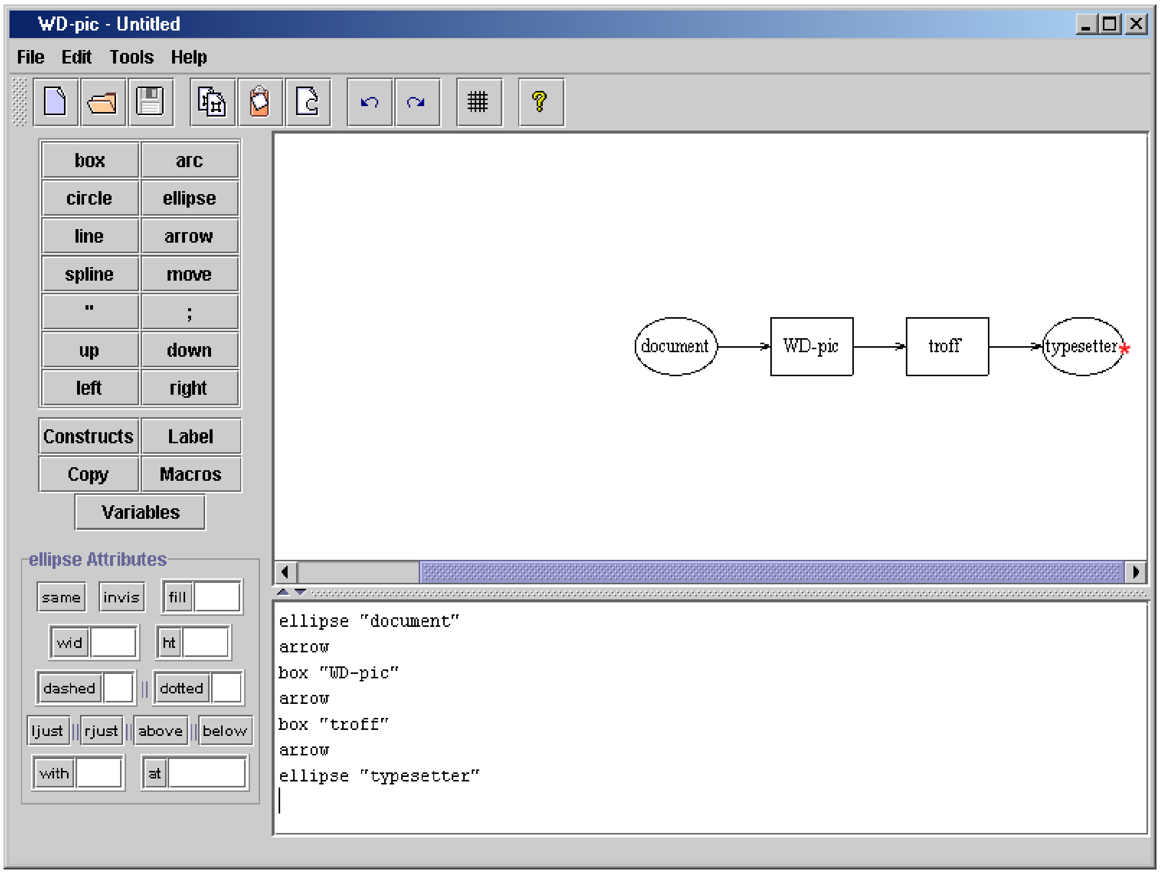


Figure 1.4: First sample

Chapter 2

Conventions

2.1 User assumption

You, the user of WD-pic, are assumed to know the pic language well. If not, please refer to a user's manual of the pic program [2].

2.2 Notational conventions

The following text conventions are used in the manual:

- Times Roman is used for normal text.
- *Times Italics* is used for emphasis and new terms in normal text.
- **Times Bold** is used for section names.
- Helvetica is used for program names and file names except in command lines.
- *Helvetica Oblique* is used for widget and key name variables.
- **Helvetica Bold** is used for widget and key name constants.
- `Courier` is used for internal representation contents.

- *Courier Oblique* is used for variables of pic internal representation syntax.
- **Courier Bold** is used for constants of pic internal representation syntax.
- Computer Modern Sans Serif is used for command code and use case names.
- *Computer Modern Sans Serif Italics* is used for variables of command syntax.
- **Computer Modern Sans Serif Bold** is used for constants of command syntax.
- <*A* + *B*>is used to specify the simultaneous combination of key *A* and key *B*.
- *MenuA*→*MenuItemB* is used to specify the menu item *MenuItemB* in the menu *MenuA*.

2.3 Terms

The following terms are used throughout the manual:

- WD-pic — the name of the program.
- user — the person who uses WD-pic, addressed by "you".
- pic primitive — abbreviate as "primitive", defined by the pic grammar, *e.g.*, **box**, **line**, **arrow**, **circle**, **ellipse**, **arc**, **spline**, and **move**.
- pic object — abbreviate as "object", a pic primitive together with its attributes.
- pic token — abbreviate as "token", a smallest semantically meaningful syntactic unit in the pic language, *e.g.*, **box**, **line**, **arrow**, **circle**, **ellipse**, **arc**, **spline**, **move**, **up**, **down**, **left**, **right**, **;**, **:**, **"**, and variable identifiers.
- attribute — used to give more information about a primitive, consisting of a keyword, perhaps followed by a value, *e.g.*,

h(eigh)t *expr*,	**wid(th)** *expr*,
rad(ius) *expr*,	**diam(eter)** *expr*,
up *opt-expr*,	**down** *opt-expr*,
right *opt-expr*,	**left** *opt-expr*,
from *position*,	**to** *position*,
at *position*,	**with** *corner*,
by *expr*,	**then**,
dotted *opt-expr*,	**dashed** *opt-expr*,
chop *opt-expr*,	**-> <- <->**,
invis,	**solid**,
fill *opt-expr*,	**same**,
text-list,	*expr*.

In these attributes, the parenthesized text describes an optional full spelling of the containing token.

- internal representation — abbreviate as "IR", the text file containing the pic code corresponding to the picture drawn on the canvas.
- session — an invocation of WD-pic.
- edit window — abbreviate as "EW", the window used to view and edit the IR.
- external editor — your preferred text editor, not part of WD-pic, indicated to your operating system by setting a shell variable, *e.g.*, setenv EDITOR vi.
- canvas — used for displaying the picture corresponding to the IR.
- palette — used for causing input to the IR, made up of the **box**, **circle**, **ellipse**, **line**, **arrow**, **spline**, **arc**, **;**, **"**, **Constructs**, **Copy**, **Macros**, **Label**, and **Variables** buttons, and an attribute area, whose content changes to provide the attributes for the object that was most recently inserted.
- menu bar — used for operating and adjusting current session, made up of the **File**, **Edit**, **Tools**, and **Help** menus.

- menu item — a unit of a menu.
- tool bar — shortcuts to some menu items, made up of the **New**, **Open**, **Save**, **Copy**, **Paste**, **Undo**, **Redo**, **Grid**, and **Help** buttons.
- screen layout — made up of a menu bar, a tool bar, a palette, a canvas and an EW, as shown in Figure 1.3.
- left mouse click — abbreviate as "LMC", a left mouse click.
- right mouse click — abbreviate as "RMC", a right mouse click.
- double click — two LMCs not more than 1 second apart.
- current insertion point — abbreviate as "CIP", the point in the IR in which the next object will be inserted, indicated by the cursor on the canvas and the cursor in the EW; normally, it is after the last inserted object.
- the picture corresponding to an IR — the picture generated by pic when it interprets the entire IR from start to end, regardless of where in the IR the CIP is.
- current file name — a name for the file into which a Save would cause writing of the entire IR.
- basic interpretation cycle — abbreviate as "BIC", the process starts with inputting into the IR, and ends with the picture on the canvas being redrawn. For example, following sequenced steps illustrate a BIC:
  1. LMC a pic token on the palette.
  2. The token is added to the IR.
  3. The picture on the canvas is redrawn.
- pop-up menu — a menu that is opened by a RMC on the canvas.
- grid — a network of horizontal and vertical lines that provide coordinates for locating points on the canvas; a grid is determined by *Center*, *dX*, and *dY* values, where *Center*

is the origin; dX is the distance between any two adjacent horizontal lines; dY is the distance of any two adjacent vertical lines.

- grid point — a point in a grid at which a horizontal line and a vertical line cross.
- gravity — used to control the restriction of positioning points; it has no effect on the IR.
- gravity tightness radius — abbreviate as "tightness radius", the radius of the area around a grid point or an object corner around which gravity is effective.
- approximate point — the point on the canvas that you LMCed.
- indicated point — the point corresponding to an approximate point that is finally indicated by WD-pic by use of gravity and inserted into the IR.
- type `xxx` — type `xxx` from the keyboard without concern for the location of the cursor; `xxx` is added to the IR at the CIP and is shown also in the EW.
- type `xxx` into the EW — make sure the cursor is in the EW; type `xxx` from the keyboard; `xxx` is added to the EW at the CIP.
- type `xxx` into the external editor — make sure the cursor is in the external editor, type `xxx` from the keyboard; `xxx` is added to the to-be-edited file, which is taken as the IR after you save and quit the external editor.
- type `xxx` into the *yyy* field of *zzz* dialog — make sure the cursor is in the *yyy* field of *zzz* dialog; type `xxx` from the keyboard; *xxx* is added to the *yyy* field of *zzz* dialog.

2.4 Abbreviations

- BIC — **B**asic **I**nterpretation **C**ycle
- CIP — **C**urrent **I**nsertion **P**oint
- EW — **E**dit **W**indow
- GUI — **G**raphic **U**ser **I**nterface

- IR — **I**nternal **R**epresentation
- LMC — **L**eft **M**ouse **C**lick
- RMC — **R**ight **M**ouse **C**lick
- WD — **W**YSIWYG **D**irect-manipulation
- WYSIWYG — **W**hat **Y**ou **S**ee **I**s **W**hat **Y**ou **G**et

2.5 Basic user interface goals

Compared to the pic program, the major advantage of WD-pic is its GUI. This GUI gives you the benefits of WYSIWYG and direction manipulation. Some other basic goals of the user interface of WD-pic are the following:

- All styles of input, *i.e.*, by mouse or by keyboard, are fully interchangeable, without the need to inform the application where its next input is coming from.
- There is no need to move the mouse to the canvas or the EW except to explicitly and directly identify a point or an object; therefore, the mouse movement is minimized.
- The internal representation should be as much as possible what a human would write in the pic language to achieve the picture shown on the canvas.
- When inputting text that is expected and that has a definite end, there is no need to move the mouse to a text window and to confirm at the end.

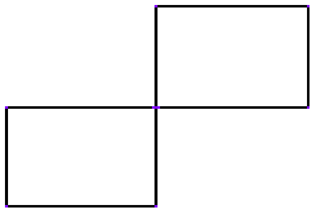
2.6 First sample redone

As mentioned in Section 1.2, there are always alternative ways to draw the same picture. Besides using the palette as described in Section 1.2, you can also type the whole IR given in Figure 1.2 into the EW or with an external editor.

The following sequenced steps illustrate another way to draw Figure 1.1 strictly from the keyboard:

1. Type **e l l i p s e**. The `ellipse` token is added to the IR at the CIP. After you enter a blank, an ellipse with default size is added at the CIP on the canvas.
2. Type **"** to start inputting text or you can LMC the **"** button on the palette. In either case, `"` is added to the IR at the CIP.
3. Type **d o c u m e n t**. `document` is added to the IR at the CIP.
4. End the text input by typing **"** from the keyboard. After `"` is added to the IR, the ellipse object is redrawn with text "document" in its center on the canvas.
5. Press the **Enter** key to finish inputting the ellipse object. A new line is started in the IR.
6. Type **a r r o w**. `arrow` is added to the IR at the CIP. After the **Enter** key is pressed, an arrow with default size is added at the CIP on the canvas.
7. Type **b o x ␣ " p i c "**. `box "pic"` is added to the IR at the CIP. After the **Enter** key is pressed, a box with "pic" at the center is added at the CIP on the canvas.
8. Type **a r r o w**. `arrow` is added to the IR at the CIP. After the **Enter** key is pressed, an arrow with default size is added at the CIP on the canvas.
9. Type **b o x ␣ " t r o f f "**. `box "troff"` is added to the IR at the CIP. After the **Enter** key is pressed, a box with "troff" at the center is added at the CIP on the canvas.
10. Type **a r r o w**. `arrow` is added to the IR at the CIP. After the **Enter** key is pressed, an arrow with default size is added at the CIP on the canvas.
11. Type **e l l i p s e ␣ " t y p e s e t t e r "**. `ellipse "typesetter"` is added to the IR at the CIP. After the **Enter** key is pressed, an ellipse with "typesetter" at the center is added at the CIP on the canvas.

If you see the text in red in the EW after inputting **;** or **Enter** key, you have made a syntax error. Check your input in the EW, and correct it. If you see the text in red in the EW before inputting **;** or **Enter** key, the text could be right. WD-pic marks it red because the sentence is not completed.



```
Box1:  box
box at Box1.c + (boxwid, boxht)
```

Figure 2.1: An example diagram

Figure 2.2: pic code of Figure 2.1

At this point, you should see the picture of Figure 1.1 drawn on the canvas while the pic code of Figure 1.2 is in the EW, as illustrated in Figure 1.4.

In the following sections, you will learn how to change the attributes of the objects and how to draw an object at a desired position.

2.7 Using grid & gravity

There are cases in which a specific position is desired. For instance, after having given an **`at`**, **`from`**, or **`to`** token, you would then need to specify a position. A position could be a (x, y) coordinate pair, or may be specified in other ways. For example, you might want to draw the diagram shown in Figure 2.1.

This diagram can be generated from the pic code shown in Figure 2.2.

One way to draw Figure 2.1 and to get the IR shown in Figure 2.2 is to use the keyboard to enter the text of Figure 2.2 into the IR. Another way is by direct manipulation.

Two key concepts of WD-pic are its grid and gravity. Their main purpose is to allow direct manipulation placement of objects while getting (x, y) coordinates that would be written by a human user when using pic in the batch mode. Gravity is used to map the approximate point that you can achieve with a mouse to a corner of an existing object or to a grid point. When gravity is off, the point you have LMCed, whatever its coordinates are as a pair of real numbers, is taken as the indicated point.

The following steps show one way of using grid and gravity to draw the diagram:

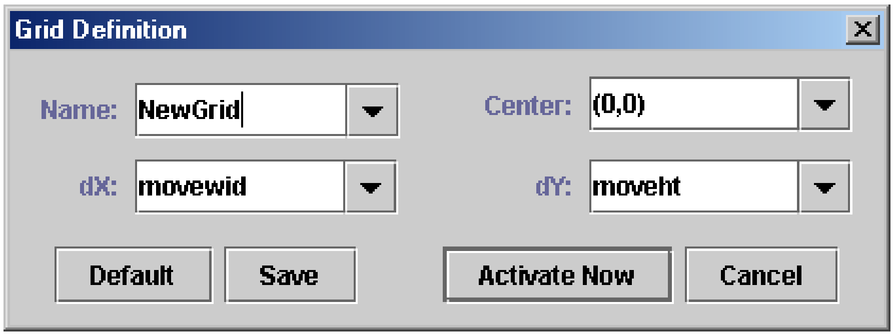


Figure 2.3: **Grid Definition** Dialog

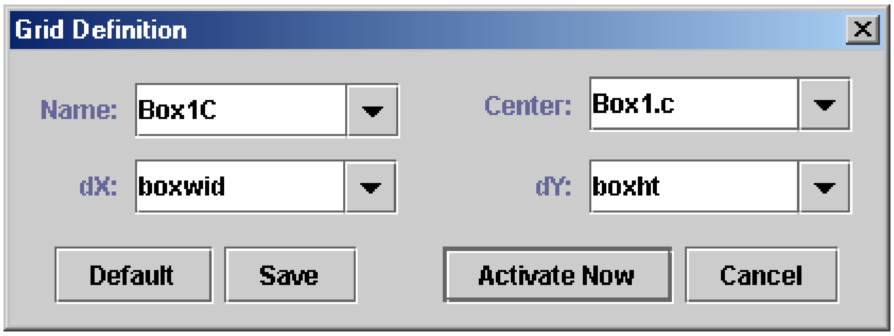


Figure 2.4: Grid Box1C

1. LMC the **box** button. `box` is added to the IR at the CIP. A box with default size is drawn on the canvas according to the IR.

2. LMC the **Label** button. Type **B o x 1** and end the label input by typing **:**. `Box1:` is added to the IR before `box`.

3. Select **Tools**→**Define Grid** from the menu bar. A **Grid Definition** dialog with fields filled with default values, as illustrated in Figure 2.3, shows up.

4. Type `Box1C` into the **Name** field, `Box1.c` into the **Center** field, `boxwid` into the **dX** field, and `boxht` into the **dY** field, as illustrated in Figure 2.4.

5. LMC the **Activate Now** button. A grid with name `Box1C`, center `Box1.c`, dX `boxwid`,

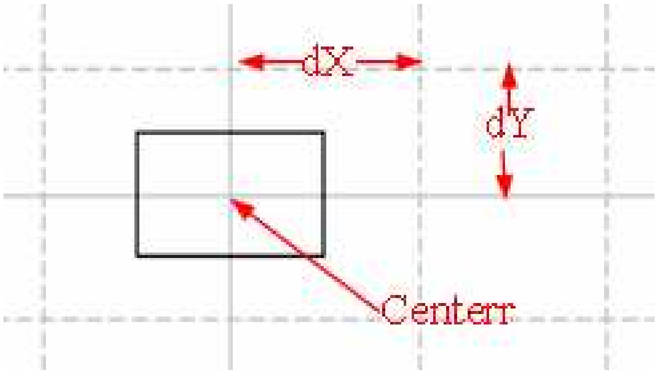


Figure 2.5: A sample of using grid & gravity - I

and dY `boxht` is saved. The canvas is redrawn according to the current complete IR with the activated grid `Box1C` superimposed, as illustrated in Figure 2.5.

6. Select **Tools**→**Set Gravity** from the menu bar. A **Gravity Settings** dialog with fields filled with default values, as illustrated in Figure 2.6, shows up.

7. Make sure that **on** and **medium** are selected, and **gravitate to grid points** and **gravitate to pic corners** are checked.

8. LMC the **OK** button.

9. LMC the **box** button from the palette. `box` is added to the IR at the CIP. The canvas is redrawn from the current complete IR.

10. LMC the **at** button from the palette. `at` is added to the IR at the CIP.

11. Move the mouse to the canvas, and LMC the grid point just northeast of the box's northeast corner in Figure 2.7.

12. `Box1.c + (boxwid, boxht)` is added to the IR after the `at` at the CIP. The whole picture is redrawn with the second box at the expected position, as shown in Figure 2.8.

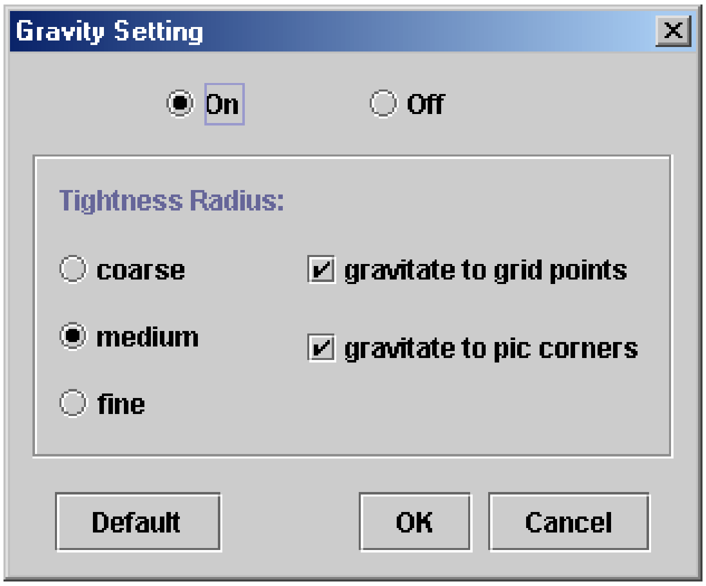


Figure 2.6: **Gravity Setting** Dialog

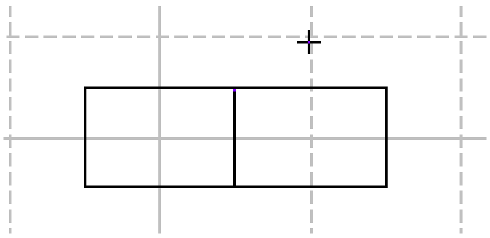


Figure 2.7: A sample of using grid & gravity - II

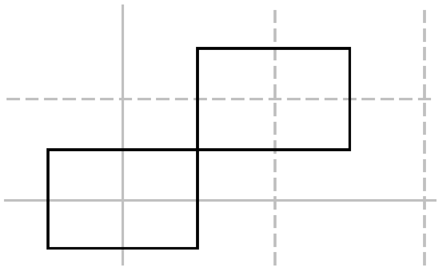


Figure 2.8: A sample of using grid & gravity - III

Grid and gravity are independent session concepts. They are used to help you work with the objects on the canvas by direct manipulation. Thus the grid appears on the canvas, but not in the IR. Details of grid and gravity setting are given in Sections 3.1.5 and 3.1.7.

2.8 Organization of this manual

The rest of the manual is organized mainly based on use cases. Chapter 3 describes the basic use cases affecting both the session and the IR. Chapter 4 describes the advanced features of the program. What to do if you have trouble and tips on how to use the program better are given in Chapter 5. Chapter 6 gives the limitations of the current version of WD-pic.

Chapter 3

Basic Use Cases

A use case is classified according to its effect, whether the effect is on the session or on the IR. All the manipulations in a use case are based on the assumption that the program is running, unless otherwise specified.

There are some basic dialog manipulations that happen in many use cases:

- The **Cancel** button and the **OK** button are used almost in every dialog. LMCing the **Cancel** button closes the dialog without having any effect. LMCing the **OK** button closes the dialog while causing the intended effect of the dialog.

- The **Default** button is given in dialogs in which values are to be input into fields. LMCing this button fills each field with the appropriate default value according to the purpose of the dialog.

- The **Reset** button is given in dialogs in which values are to be input into fields. LMCing this button clears every field. Then you can start filling the fields again.

3.1 Affecting the session

3.1.1 Basic file manipulations

There are four basic file manipulations: `New`, `Open`, `Save`, and `Save as`.

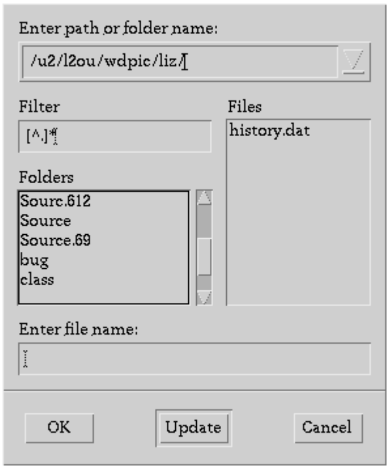


Figure 3.1: **Open** Dialog

- New: create a new IR. There are three ways:
  - With the menu bar: select **File**→**New** from the menu bar.
  - With the shortcut key: type <**Ctrl**+**N**>.
  - With the tool bar: LMC the **New** button in the tool bar.

  The IR is set to empty, and Untitled is established as the current file name.

- Open: open an existing file, which is assumed to contain pic code.
  - With the menu bar: select **File**→**Open** from the menu bar or select a recently opened files from **File**→**Recent Files**.
  - With the shortcut key: type <**Ctrl**+**O**>.
  - With the tool bar: LMC the **Open** button in the tool bar.

  An **Open** dialog, as illustrated in Figure 3.1, shows up on the screen. In any of the standard ways, indicate the name of the file you want to open. Then LMC the **OK** button.

  The indicated file name is established as the current file name. The content of the named file is established as the IR and shows up in the EW. Finally, the picture corresponding to the complete IR is drawn on the canvas.

- Save: save the current complete IR.
  - With the menu bar: select **File**→**Save** from the menu bar.
  - With the shortcut key: type <**Ctrl**+**S**>.
  - With the tool bar: LMC the **Save** button in the tool bar.

  Normally Save is done when a file name is established. If there is no current file name established, a **Save As** dialog, as illustrated in Figure 3.2, shows up. In any of the standard ways, indicate a file name. Then LMC the **OK** button. The file name is taken as the current file name. In any case, the current complete IR is saved in the file named by the current file name.

- Save as: establish a new current file name and save the current complete IR in the named file.
  - With the menu bar: select **File**→**Save As** from the menu bar.

  A **Save As** dialog, as shown in Figure 3.2, pops up. In any of the standard ways, indicate a file name. Then LMC the **OK** button.

  The indicated file name is taken as the current file name. Finally, the current complete IR is saved in the file named by the current file name.

3.1.2 Standard **Edit** menu items

The **Edit** menu has the following standard items:

- **Undo** - to undo the last action in the edit window,
- **Redo** - to redo the last action in the edit window,
- **Copy** - to copy the selected content in the edit window to the clipboard,
- **Paste** - to paste the content in the clipboard to the edit window,

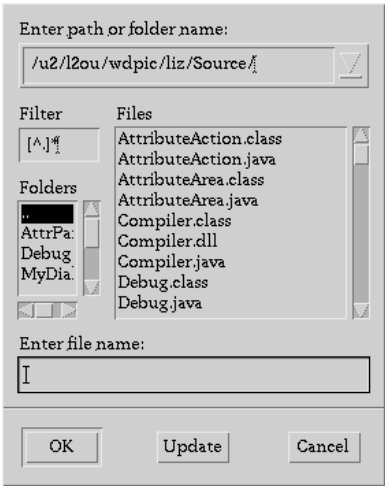


Figure 3.2: **Save As** Dialog

- **Cut** - to cut the selected content in the edit window,

Undo and **Redo** are not always available. **Undo** is enabled only when there has been some change made to the IR, *e.g.*, adding, deleting text. **Redo** is enabled when **Undo** has been done.

Please note that these standard items only work with the EW. You will see the use of other items in the **Edit** menu, such as **Change Attribute**, **Reset Font**, **Set CIP**, and **Run External Editor** in later sections.

3.1.3 Using external editor on the IR

Besides using the EW to review and edit the IR, you can also specify any external text editor that is accessible from your system to work on the IR. The following steps show you how to set and work with such an external editor:

1. Set the external editor. Two ways to do that are:

   - Before starting WD-pic, run the following command or whatever command your host system uses to set shell variables:
     setenv EDITOR *editorname* or **set EDITOR =** *editorname*,
     where *editorname* is the name of the editor that you prefer to use.

Figure 3.3: **Set External Editor** Dialog

- If you start WD-pic without having run the above command, choose **Tool**→**Set External Editor** from the menu bar. A **Set External Editor** dialog, as illustrated in Figure 3.3, pops up. Enter the name of your preferred text editor. Then LMC the **OK** button.

2. Run the external editor:

   - With the menu bar: choose **Editor**→**Run External Editor** from the menu bar.
   - With the shortcut key: type <**Ctrl**+**R**>.

   The external editor launches. The current complete IR is copied as the file to be edited by the external editor.

3. Edit the to-be-edited file as you wish.

4. Save and quit the external editor, causing the last version of the to-be-edited file to be taken as the IR.

The saved IR is copied into the EW. The picture corresponding to the complete IR is drawn on the canvas.

Note that any time you need to modify the IR, you can do it either by direct manipulation editing of the EW or by use of an external editor. However, the advantage of using an external editor is that you are able to invoke a specialized editor with powerful commands or your favourite editor whose commands are most familiar to you.

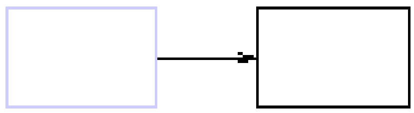


Figure 3.4: Sample of selected object, the box on the left

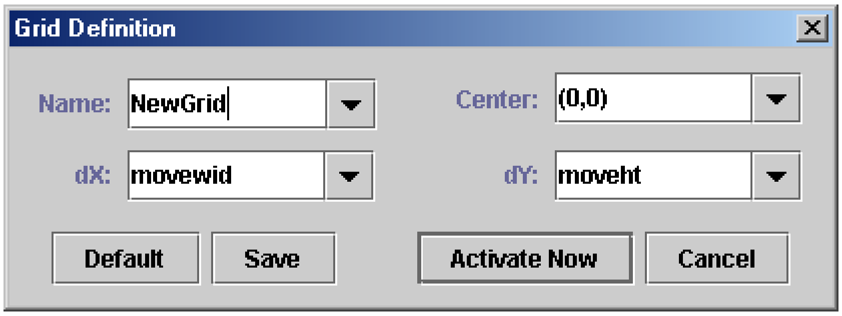


Figure 3.5: **Grid Definition** Dialog

3.1.4 Selecting an object

If you want to select an existing object, you can either LMC or RMC the object on the canvas that you want to select.

The indicated object is highlighted in a different color on the canvas, as illustrated in Figure 3.4. Also the related primitive in the EW of the object is highlighted in the same color.

3.1.5 Defining grid

In WD-pic, a picture could have several grids with different settings. Each grid is saved with a unique name given by you or the program by default. To define a new gird, choose **Tools**→**Define Grid** from the menu bar. A **Grid Definition** dialog, as illustrated in Figure 3.5, shows up, initialized to the default values.

The default values for the fields are:

- **Name**: `NewGrid`

- **Center**: `(0,0)`
- **dX**: `movewid`
- **dY**: `moveht`

If you do not like the name `NewGrid` for the new grid, input a new grid name *n* of your choice by typing into the **Name** field. Indicate the center of the grid by typing into the **Center** field or selecting from the field's pop-up list. The center must be some point, and could be specified by a symbolic expression, such as `Box1.c`, or by a constant, such as `(0,0)`. Define the **dX** and the **dY** field values by typing into the fields or selecting from the fields' pop-up lists. After you are done, LMC the **Save** button. The grid setting is saved with the given name *n*. You can activate the saved grid anytime later by giving its name, *n*. If you want to activate grid *n* right now, LMC the **Activate Now** button. The just defined grid *n* is activated. The canvas is redrawn according to the current complete IR with grid *n* superimposed. If you do not see the grid superimposed on the canvas, you have made an error when defining the grid. Check the status bar for further information and re-define the grid. Section 3.1.6 describes how the grid is determined from the data of the grid setting.

To modify a previously defined grid, choose its name from the field's pop-up list. Make the changes. Then LMC the **Save** button.

3.1.6 Activating grid

If you want to activate a previously defined grid, choose **Tools**→**Activate Grid** from the menu bar, or RMC the canvas and choose **Activate Grid** from the pop-up menu. If there is not a previously saved grid, a warning dialog shows up. You are asked to define a grid. Otherwise, a **Grid Activation** dialog, as illustrated in Figure 3.6, shows up. Select the name of the grid that you want to activate from the pop-up list of the **Name** field. Then LMC the **OK** button. The named grid is activated. The canvas is redrawn according to the current complete IR with the activated grid superimposed. This grid is determined by the previously defined *Center*, *dX*, and *dY* values in the **Grid Setting** dialog. *Center* is the origin. A horizontal line and a vertical line cross at this origin. The distance between any two adjacent horizontal lines of the grid is *dX*, and the distance between any two adjacent vertical lines of the gird is *dY*.

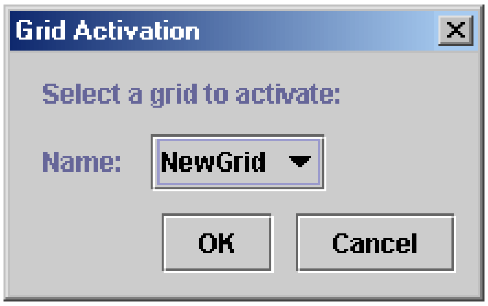


Figure 3.6: **Grid Activation** Dialog

3.1.7 Setting gravity

To set the gravity, choose **Tools**→**Set Gravity** from the menu bar. Or RMC the canvas and choose **Set Gravity** from the pop-up menu. A **Gravity Setting** dialog, as illustrated in Figure 3.7, shows up.

Click **On** or **Off** to turn the gravity on or off. Whenever gravity is off, whatever (x, y) coordinates are indicated by the mouse is taken as the indicated point. Gravity has three tightness radii: **coarse** at 1/4 inch, **medium** at 1/8 inch and **fine** at 1/16 inch. Choose any one. Select **gravitate to grid points** and **gravitate to pic corners** to cause the grid points and corners of existing objects to be indicated. Whenever the gravity is on, and the distance between the approximate point and a grid point or a corner is within gravity's tightness radius of the grid point or the corner, the grid point or the corner is indicated.

If a picture is scaled, the tightness radii are divided by the scale value at the CIP.

3.1.8 Setting the current insertion point

Normally, the CIP is just after the last inserted object, where the cursors are in the EW and on the canvas. There are two ways to change the CIP:

- Direct manipulation:
  - With the pop-up menu:

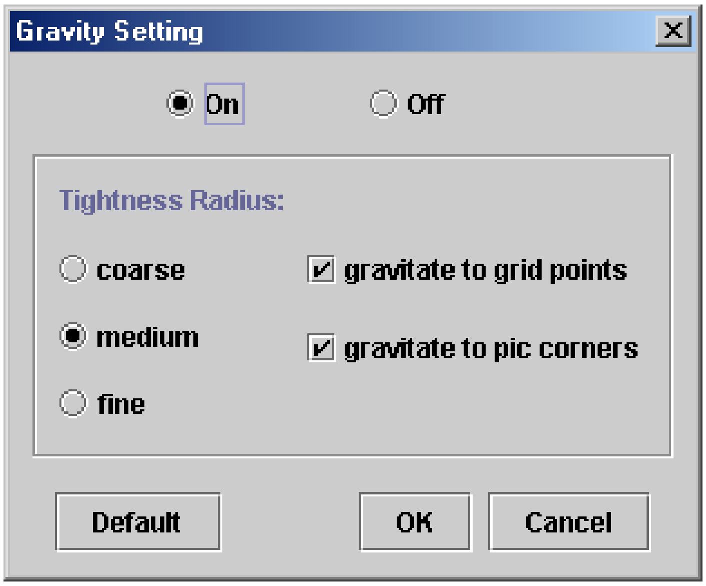


Figure 3.7: **Gravity Setting** Dialog

1. Point the mouse at the object whose definition in the IR is desired to position the CIP.
2. RMC the object, choose **Set CIP** from the pop-up menu.

– With the menu bar:

1. Select the object by LMCing it.
2. Choose **Edit**→**Set CIP** from the menu bar.

The cursor in the EW is moved to the new insertion point. The cursor on the canvas is moved too.

- In the EW: Move the cursor to the pic token after which you want the CIP to be positioned. The cursor on the canvas is moved too.

3.2 Affecting the IR

3.2.1 Inserting an object

There are two ways to insert an object at the CIP:

- With the palette: LMC the desired pic token on the palette.
- With the keyboard: type the related pic primitive and signal the end of the object either by typing a **;** token, or by pressing the **Enter** key.

For example, if you want to draw a box, you can either LMC the **box** button on the palette, or type **b o x** and press the **Enter** key from the keyboard. The pic code `box` is added to the IR at the CIP. The canvas is redrawn according to the complete IR. The result is that a box of default size is drawn after the previous CIP and the CIP follows the just added box.

3.2.2 Adjusting attributes during insertion

There are several ways to change the attributes of an object during insertion:

Assume a primitive has just been inserted into the IR.

- With the palette: All possible attributes of the primitive are shown in the attributes area of the palette as buttons. Figure 3.8 illustrates the palette after a box has been added to the IR. There are several types of buttons in the attributes area.

  1. an independent button, *e.g.*, **fill** and **invis**. LMCing one of these buttons will add its token, *e.g.*, `fill` and `invis` to the IR at the CIP.
  2. a button with a value field, *e.g.*, **wid**, **ht** and **at**. LMCing one of these buttons causes the addition of both its token and the value shown in the field to the IR. You can change a value by typing into its field. If a value field is empty, only the token is added to the IR. In this last case, WD-pic will be expecting that you will provide the required value by another means, *e.g.*, typing, typing into the EW, or direct manipulation.
  3. a button in a set of buttons connected with ||s, *e.g.*, **solid** || **dashed** || **dotted**. You can LMC only one of them to add its token to the IR.

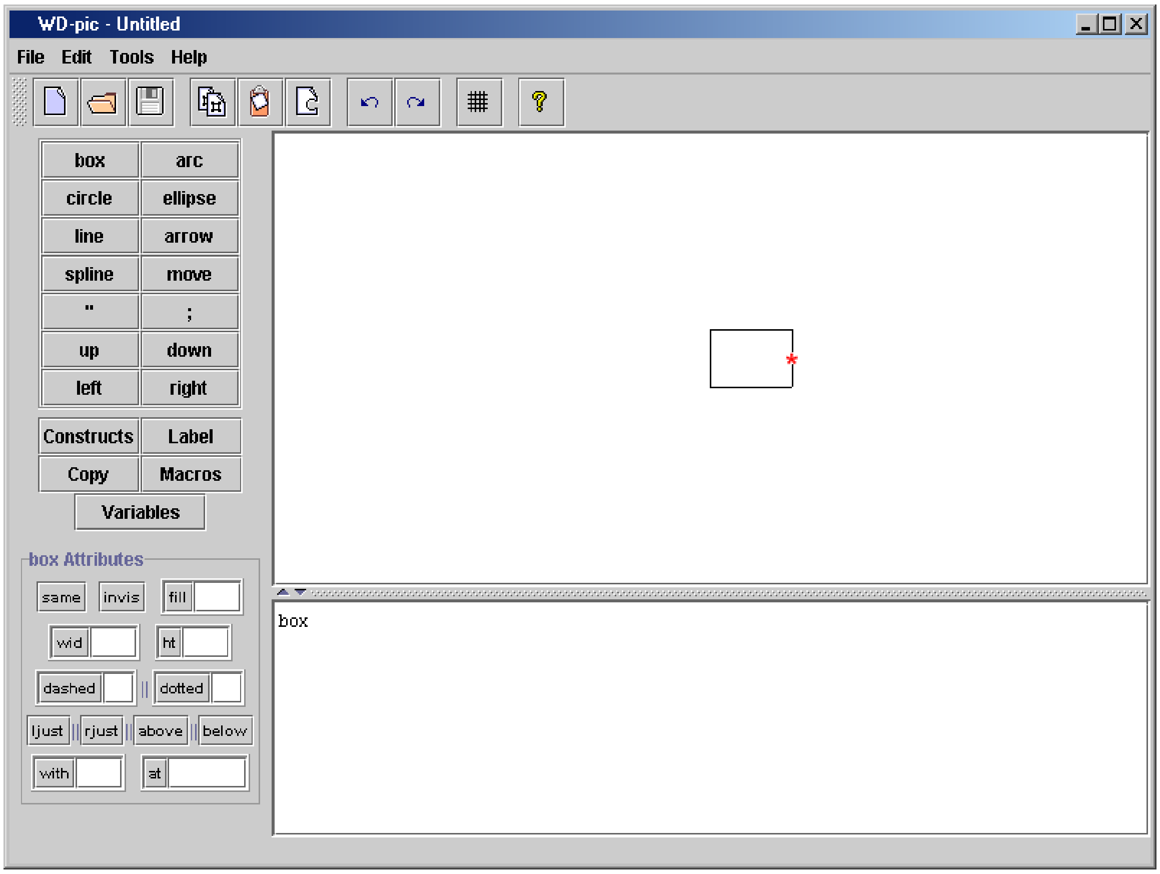


Figure 3.8: **`box`** Attributes

To change the attributes of the object, change the values in the fields if necessary and LMC the related buttons in the attributes area.

- With the keyboard: Type the attributes at the CIP. For the example, type **w i d =** *`expr`*. End inputting the object by typing **;** or pressing the **Enter** key. `wid=`*`expr`*`;` is added to the IR at the CIP.

In either case, the picture on the canvas is redrawn according to the current complete IR.

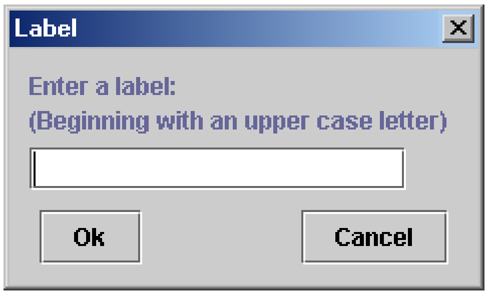


Figure 3.9: **Label** Dialog

3.2.3 Indicating x, y coordinates

There are two ways to indicate x, y coordinates, direct manipulation and textually.

- Direct manipulation: If you want to specify a point by direct manipulation, *e.g.*, after an **`at`**, **`from`**, or **`to`** token, you may wish to make sure the grid and gravity are set properly. Otherwise the exact point the mouse is at is taken as the indicated point and this will need to be expressed as a pair of real numbers, (x, y). As mentioned in Section 3.1.7, when gravity is on, a grid point or a corner of an existing object could be taken as the indicated point.

  Move the mouse close to the point that you want to indicate on the canvas. Its exact (x, y) coordinates of the point are shown at the right side of the status bar. LMC the point. There are three cases:

  – Corner: If the indicated point is a corner of an object, the expression of this corner consisting of the object's label and the corner's designation, *e.g.*, `n`, `e`, or `ne`, is added to the EW. If the object has no label, a **Label** dialog, as illustrated in Figure 3.9, shows up. Input a label for the object in the field. Then LMC the **OK** button.

  – Grid point: If the indicated point is a grid point, a symbolic expression for the indicated point, as specified below, is added to the IR at the CIP:

```
Center + (n * dX, m * dY)
```

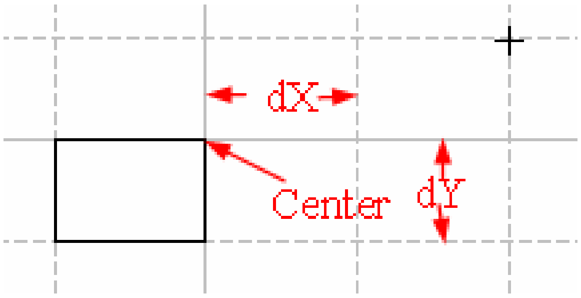


Figure 3.10: Indicate points with grid & gravity

where $|n|$ is one less than the number of horizontal lines from the origin to the indicated point inclusive, and $n = -|n|$ if the indicated point is to the left of *Center*; $|m|$ is one less than the number of vertical lines from the origin to the indicated point inclusive, and $m = -|m|$ if the indicated point is below *Center*. `Center`, `dX` and `dY` are the values of *Center*, *dX*, *dY* of the current activated grid, respectively.

For example, assume the current activated grid is defined as: *Center* = `Box1.ne`, *dX* = `boxwid`, *dY* = `boxht`. The symbolic expression of the point marked "+" in Figure 3.10 is :

```
Box1.ne + (2*boxwid, boxht).
```

This expression is added to the IR at the CIP.

– Arbitrary other (x, y) point: If the LMCed point is not any corner or grid point, the coordinates of the point are added to the IR at the CIP.

When gravity is off, the exact point the mouse is at is taken as the indicated point.

- Textually: Type *`position`*, where *`position`* is a pic expression for the position of the desired point. *`position`* is added to the IR at the CIP.

3.2.4 Adding text

In pic, text can be either an attribute of any pic primitive except **move**, or a standalone object. Each line of text is a separate quoted string.

- Adding text as an attribute is the same as adjusting other attributes. Assume that you have just inserted an object, such as a `box`, into the IR at the CIP.
  - With the palette:
    1. LMC the **"** button. `"` is added to the IR.
    2. Type the text that you want to attach to the object, and end by typing **"**. The typed text followed by `"` is added to the IR at the CIP as you type.
  - With the keyboard:
    1. Type **"**, and `"` is added to the IR.
    2. Type the text you want to attach to the object, and end by typing **"**. The typed text followed by `"` is added to the IR at the CIP as you type.

  A way to get multiple text items associated with an object, each in a separate line centered inside the object is to repeat Steps 1 through 2 for each text item.

- Adding text as a standalone object is the same as adding text as an attribute, except that the quoted text is not following any other object.

Chapter 4

Advanced Features

4.1 Affecting the session

4.1.1 Setting font and size of text

If you want to change the font format of some text, even as small as one character, LMC one end of the text. Drag the mouse to highlight the text that you want to change. Choose **Tools**→**Font** from the menu bar. A **Font** dialog, as illustrated in Figure 4.1, shows up. In a standard way, select your preferred font format including style and size, then LMC the **OK** button.

The selected text on the canvas is changed to the selected font format. As there is no font information in the pic language, the IR is not changed. Consequently, the setting of the font and size affects only the appearance of the text in the canvas for the current session.

In pic, text in quotes is passed verbatim to troff which does the font and size changes according to troff font and size change commands in the quoted text. So pic itself does nothing with fonts and sizes. To be able to see what the result would look like when printed, use these font and size settings session commands to make the font and size of the displayed text be what troff thinks it is. You can make the troff commands themselves invisible so that they are not displayed. For instance, assuming that the current canvas font is Times Roman, to get the result of a box with "Hello" in Helvetica, size 8, follow the steps:

1. Insert `box "\fH\s8Hello\s0\fP"` into the IR. The canvas is drawn with a box centered with text "\fH\s8Hello\s0\fP", as illustrated in Figure 4.2.

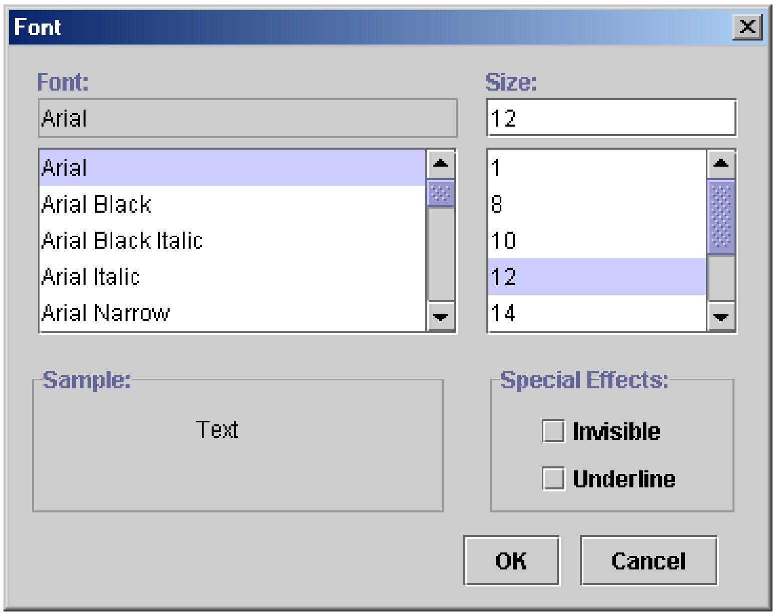


Figure 4.1: **Font** Dialog

2. Select "\fH\s8" on the canvas, choose **Tools**→**Font** from the menu bar, select **Invisible** in the **Font** dialog, or set the size to 0.

3. LMC the **OK** button. "\fH\s8" is made invisible and zero width on the canvas.

4. Select "\s0\fP" on the canvas, choose **Tools**→**Font** from the menu bar, select **Invisible** in the **Font** dialog, or set the size to 0.

5. LMC the **OK** button. "\s0\fP" is made invisible and zero width on the canvas.

6. Select "Hello" on the canvas, choose **Tools**→**Font** from the menu bar and set the font to Helvetica or Arial, size 8.

7. LMC the **OK** button. You see "Hello" in Helvetica size 8 centered in the box on the canvas, as illustrated in Figure 4.3.

Once any text is set to invisible, you cannot select it on the canvas. To see the invisible text on the canvas, RMC the object which the text is an attribute, choose **Reset Font**. Alternatively,

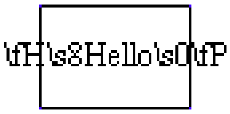


Figure 4.2: A sample of setting font, before

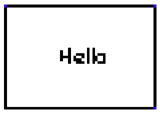


Figure 4.3: A sample of setting font, after

you can select the object by LMCing it. Then choose **Reset Font** from **Edit** menu. In either case, the font of the selected object is set back to the system default font.

4.1.2 Preferences

Choose **Tools**→**Preferences** from menu bar. A **Preferences** dialog, as illustrated in Figure 4.4, shows up. You can set your preferred values for the attributes of **`box`**, **`circle`**, **`ellipse`**, **`line`**, **`arrow`**, **`arc`**, and **`spline`**. After you are done, LMC the **OK** button.

The changes you make will affect the new inserted objects by using the palette from now on, until the next time you change the preferences again. By this means, whenever you add a primitive into the IR by LMCing the buttons on the palette, the preferred attributes of that primitive that you set in the **Preferences** dialog are added to the primitive automatically as they are added to the IR. For instance, if you change the line style of **`box`** to **`dotted`**, then `dotted` will be added to the IR to each `box` that is inserted into the IR by LMCing the **box** button on the palette after the preference is changed.

4.2 Affecting the IR

4.2.1 Changing values of variables

The pic program has 20 variables, *e.g.*, **`boxwid`** and **`boxht`**. There are two ways to change any of these values:

- With the palette:

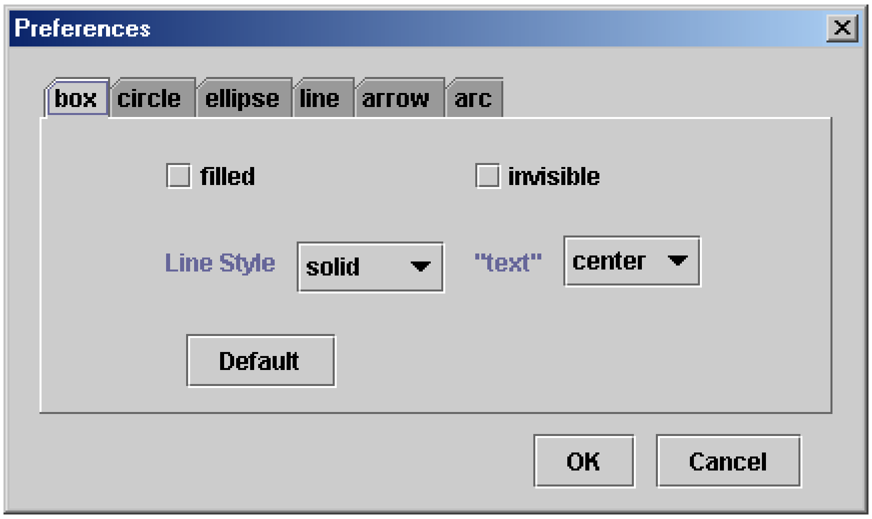


Figure 4.4: **Preferences** Dialog

1. LMC the **Variables** button on the palette. A **Variables** dialog, as illustrated in Figure 4.5, shows up.
2. Choose the variable `var` that you want to change from the field's pop-up list. `var`'s value at the CIP and the default value show up.
3. Type a valid pic expression `expr` into the **New Value** field.
4. LMC the **OK** button.

- With the keyboard: type assignment for the variable `var` that you want to change, *e.g.*, `var=expr`.

An assignment statement for the changed variable, *e.g.*, `var=expr`, is added to the IR at the CIP. The canvas is redrawn according to the current complete IR.

4.2.2 Changing attributes of an existing object

You can change the attributes of an existing object with the palette during insertion, as described in Section 3.2.2, or you can change the attributes later in any of the following ways:

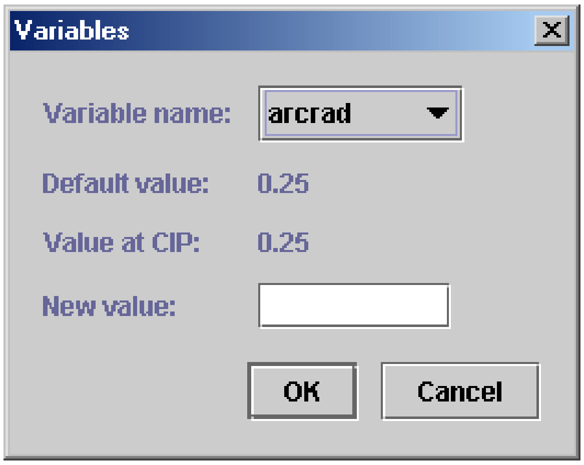


Figure 4.5: **Variables** Dialog

- Direct manipulation:
  - With the palette:
    1. Select the object, as described in Section 3.1.4. The available attribute tokens of the selected object show up in the attributes area on the palette.
    2. Make the changes.
    3. LMC the attribute buttons to change the values. The modifications are saved into the IR.
  - With the pop-up menu:
    1. RMC the object.
    2. Choose **Change Attribute** from the pop-up menu. An *Object* **Attributes** dialog shows up based on what kind of object is selected. Figure 4.6 illustrates a **Box Attributes** dialog.
    3. Make the changes.
    4. LMC the **OK** button. The modifications are saved into the IR.
- With the keyboard: Find the object in the EW whose attributes you want to change. Add or change the values of attributes.

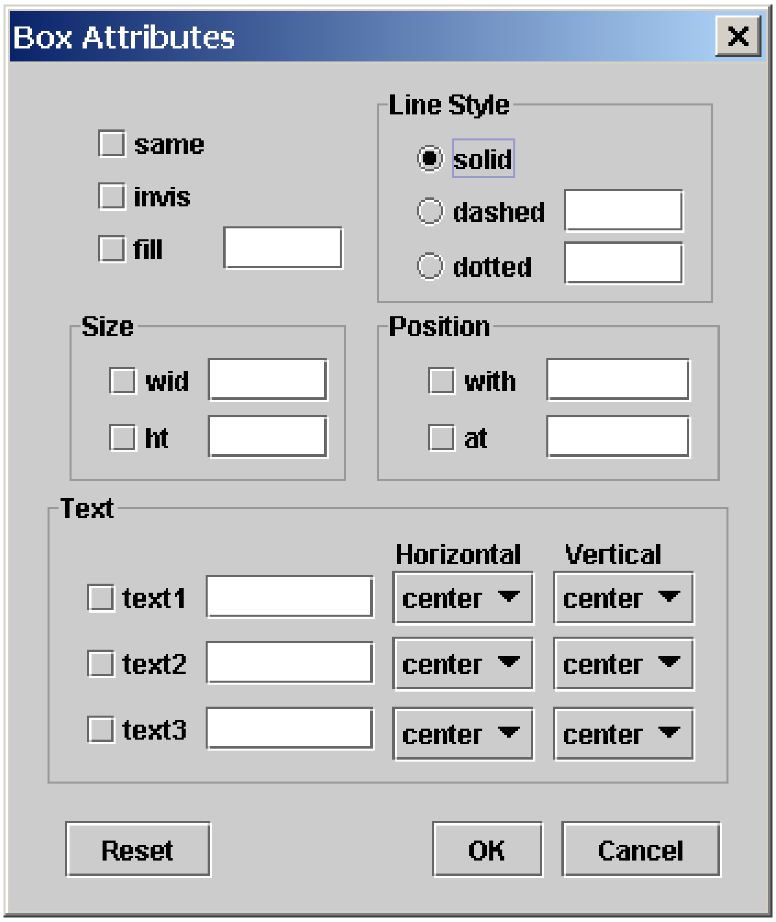


Figure 4.6: **Box Attributes** Dialog

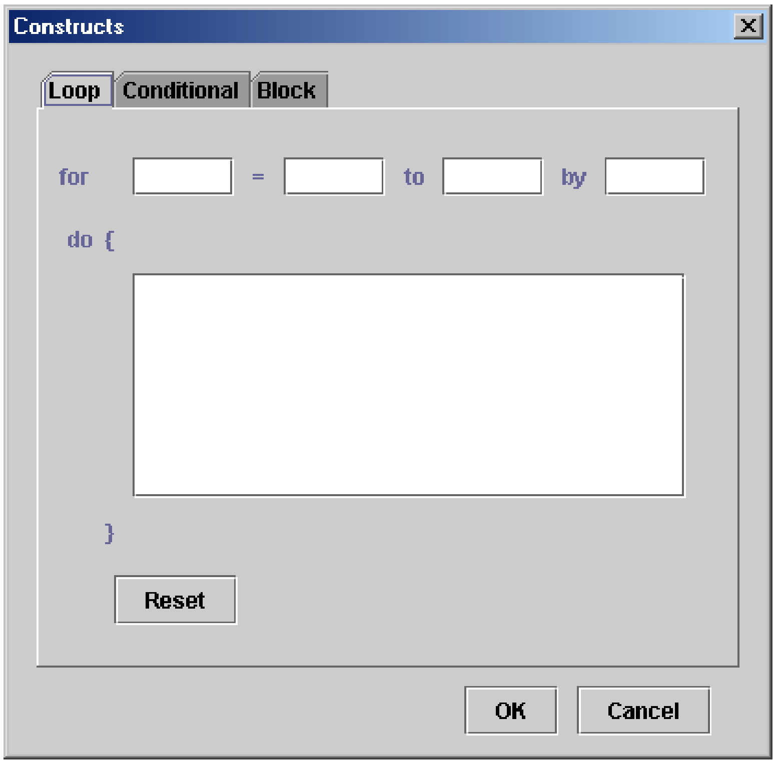


Figure 4.7: **Constructs** Dialog - Loop

In any case, the picture on the canvas is redrawn from the complete IR.

4.2.3 Constructs

Loops

- With the palette:

  1. LMC the **Constructs** button on the palette. A **Constructs** dialog, as illustrated in Figure 4.7, shows up.
  2. If the **Loop** tab is not in front of the other tabs, LMC the **Loop** tab.
  3. Fill in the parts of the `for` statement. The parts are **for**, **to**, **by**, and **do**.

4. LMC the **OK** button.

- With the keyboard: Type **f o r** ␣ *expr1* ␣ **t o** ␣ *expr2* ␣ **b y** ␣ *expr3* ␣ **d o** ␣ { *anything* } at the CIP.

In any case, `for` *expr1* `to` *expr2* `by` *expr3* `do` { *anything* } is added to the IR at the CIP. The picture on the canvas is redrawn from the complete IR.

Conditionals

- With the palette:

1. LMC the **Constructs** button on the palette. A **Constructs** dialog, as illustrated in Figure 4.7, shows up.
2. If the **Conditional** tab is not in front of the other tabs, LMC the **Conditional** tab. An empty **`if`** statement shows up, as illustrated in Figure 4.8.
3. Fill in the parts of the **`if`** statement. The parts are **if**, **then** and **else**.
4. LMC the **OK** button.

- With the keyboard: Type **i f** ␣ *expression* ␣ **t h e n** ␣ { *anything1* } ␣ **e l s e** ␣ { *anything2* } at the CIP.

In any case, `if` *expression* `then` { *anything1* } `else` { *anything2* } is added to the IR at the CIP. The picture on the canvas is redrawn from the complete IR.

Blocks

- With the palette:

1. LMC the **Constructs** button on the palette. A **Constructs** dialog, as illustrated in Figure 4.7, shows up.
2. If the **Block** tab is not in front of the other tabs, LMC the **Block** tab. An empty block statement shows up, as illustrated in Figure 4.9.

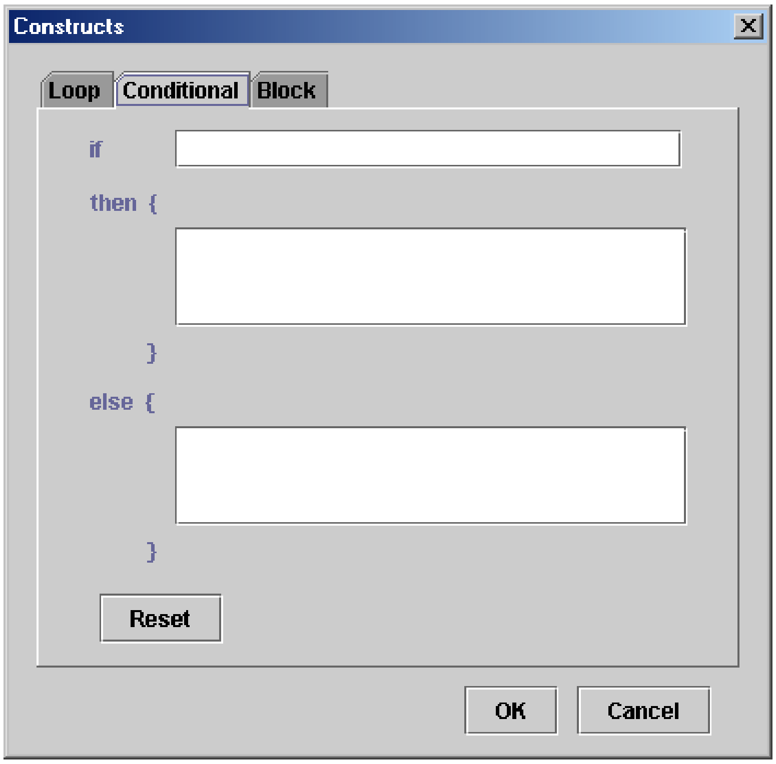


Figure 4.8: **Constructs** Dialog - Conditional

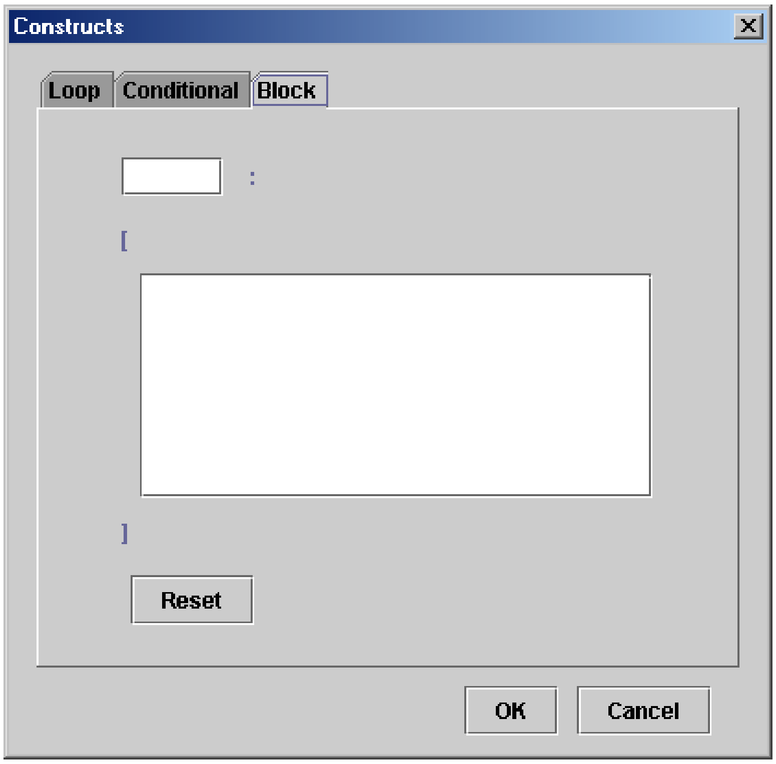


Figure 4.9: **Constructs** Dialog - Block

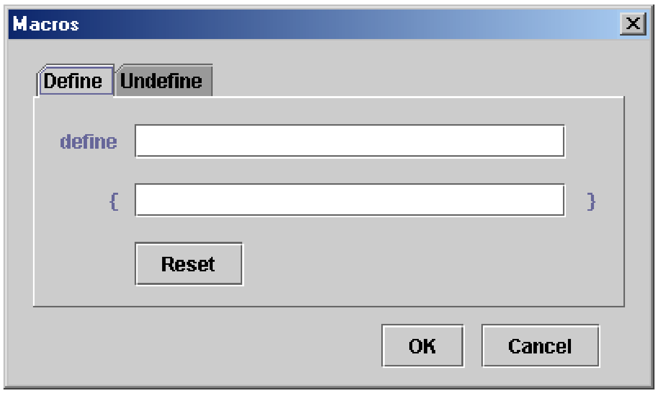


Figure 4.10: **Macros** Dialog - Define

3. Fill in the parts of the block statement. The parts are block name and body.
4. LMC the **OK** button.

- With the keyboard: Type *`blockname`* **:** { *`anything`* } at the CIP.

In any case, *`blockname`* **:** { *`anything`* } is added to the IR at the CIP. The picture on the canvas is redrawn from the complete IR.

4.2.4 Macros

Define

- With the palette:

1. LMC the **Macros** button on the palette. A **Macros** dialog, as illustrated in Figure 4.10, shows up.
2. If the **Define** tab is not in front of the other tabs, LMC the **Define** tab.
3. Fill in the parts of the **`define`** statement. The parts are macro name and replacement text.
4. LMC the **OK** button.

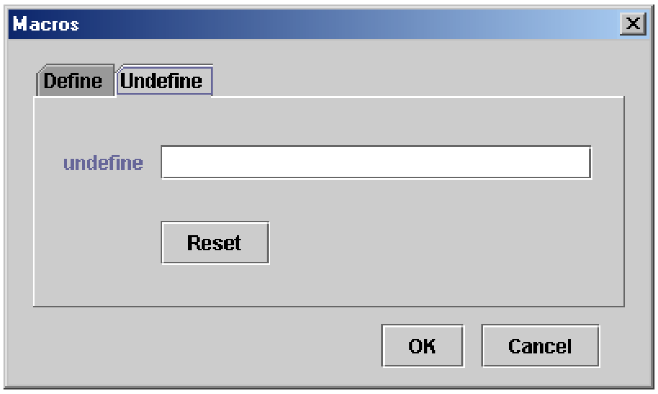


Figure 4.11: **Macros** Dialog - Undefine

- With the keyboard: Type **d e f i n e** ␣ *`name`* ␣ { *`replacement text`* } at the CIP.

In any case, `define` *`name`* { *`replacement text`* } is added to the IR at the CIP. The picture on the canvas is redrawn from the complete IR.

Undefine

- With the palette:

  1. LMC the **Macros** button on the palette. A **Macros** dialog, as illustrated in Figure 4.10, shows up.
  2. If the **Undefine** tab is not shown in front of other tabs, LMC the **Undefine** tab. An empty **`undef`** statement, as illustrated in Figure 4.11, shows up.
  3. Fill in the macro name that you want to undefine in the **`undef`** statement.
  4. LMC the **OK** button.

- With the keyboard: Type **u n d e f** ␣ *`macro-name`* at the CIP.

In any case, `undef` *`macro-name`* is added to the IR at the CIP. The picture on the canvas is redrawn from the complete IR.

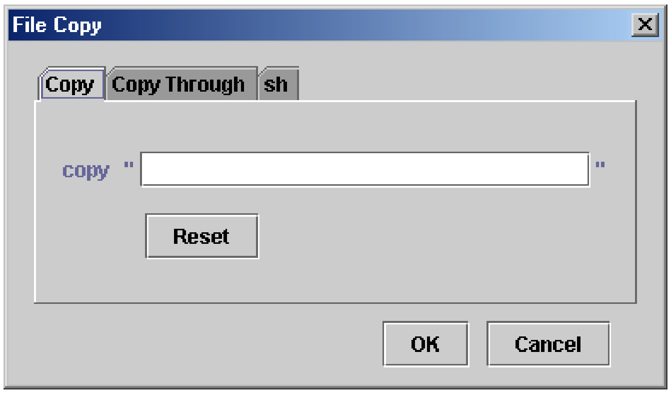


Figure 4.12: **File Copy** Dialog - Copy

4.2.5 File copy

Copy

- With the palette:

  1. LMC the **File Copy** button on the palette. A **File Copy** dialog, as illustrated in Figure 4.12, shows up.
  2. If the **Copy** tab is not in front of the other tabs, LMC the **Copy** tab.
  3. Fill in the name of the file that you want to copy in the **copy** statement.
  4. LMC the **OK** button.

- With the keyboard: Type **c o p y ␣ "** `filename` **"** at the CIP.

In any case, `copy "filename"` is added to the IR at the CIP. The picture on the canvas is redrawn from the complete IR.

Copy Through

- With the palette:

  1. LMC the **File Copy** button on the palette. A **File Copy** dialog, as illustrated in Figure 4.12, shows up.

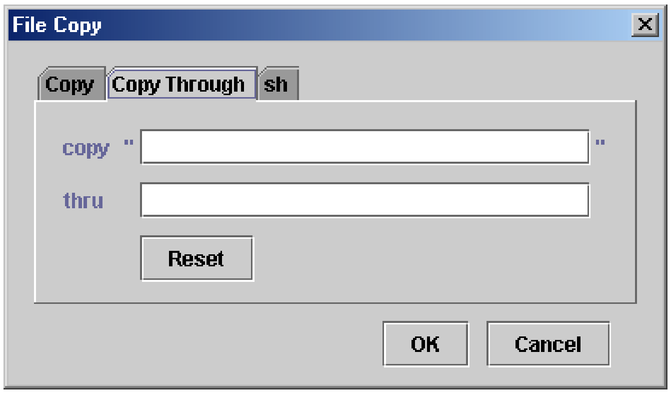


Figure 4.13: **File Copy** Dialog - Copy Through

2. If the **Copy Through** tab is not in front of the other tabs, LMC the **Copy Through** tab. An empty **`copy thru`** statement is shown up, as illustrated in Figure 4.13.
3. Fill in the parts of the **`copy thru`** statement. The parts are file name and macro name or macro replacement text.
4. LMC the **OK** button.

- With the keyboard: Type **copy␣"***`file`***"␣thru␣***`macro-name`* or **copy␣"***`file`***"␣thru␣**{ *`macro replacement text`* } at the CIP.

In any case, `copy "`*`file`*`" thru` *`macro-name`* or `copy "`*`file`*`" thru` { *`macro replacement text`* } is added to the IR at the CIP. The picture on the canvas is redrawn from the complete IR.

sh

- With the palette:

1. LMC the **File Copy** button on the palette. A **File Copy** dialog, as illustrated in Figure 4.12, shows up.
2. If the **sh** tab is not in front of the other tabs, LMC the **sh** tab. An empty **`sh`** statement is shown up, as illustrated in Figure 4.14.

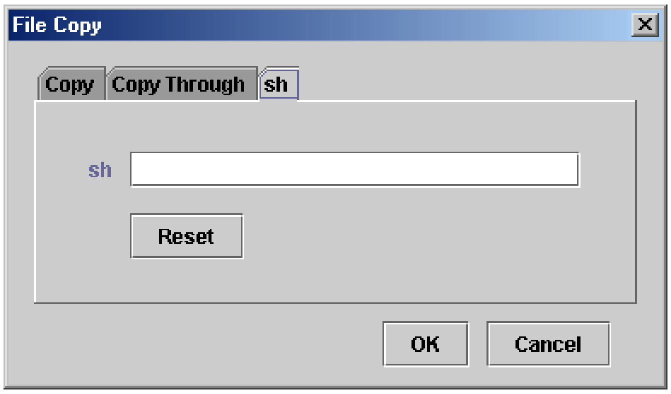


Figure 4.14: **File Copy** Dialog - sh

3. Fill in the body of the **`sh`** statement.
4. LMC the **OK** button.

- With the keyboard: Type **s h** ␣ { *`anything`* } at the CIP.

In any case, `sh` { *`anything`* } is added to the IR at the CIP. The picture on the canvas is redrawn from the complete IR.

4.2.6 Labelling

- With the palette:

  1. LMC the **Label** button on the palette. The CIP moves to the beginning of the being-edited object.
  2. Type the name of the label, beginning with an uppercase letter.
  3. Type **:** to signal the end of label name. The CIP moves back to wherever it is before LMCing the **Label** button.

- With the keyboard:

  1. Find the object in the EW to which you want to add a label and set the CIP to the beginning of the object.

2. Type the name of the label, beginning with an uppercase letter.
3. Type **:** to signal the end of the label name.

In either case, the label is added to the being-edited object in the IR.

Chapter 5

Trouble Shooting & Tips

5.1 Trouble shooting

Choose **Help**→**Content** from the menu bar or LMC the **Help** button on the tool bar. You can also press the **F1** key on the keyboard.

5.2 Tips

- Construct a picture sequentially.
- Work in the EW, as it helps to check the syntax error while typing.
- Work carefully with insertion if direction is changed.

Chapter 6

Limitations

- The sizes and positions of objects cannot be changed by direct mouse manipulations.
- Copy, paste, cut, undo, and redo work only with the EW, not the canvas.
- One cannot do search and replace in the EW.
- Font information of the text is not saved.
- One cannot directly manipulate constructs, *e.g.*, **`for`**, **`if`**, and block, on the canvas.
- One cannot output pictures in a standard graph format, *e.g.*, gif and png, or print from WD-pic. You have to feed the saved pic file to pic or to another program that is capable of dealing with pic input.

Bibliography

[1] Narain Gehani. *Document Formatting and Typesetting on the Unix System second edition*. Silicon Press, Summit, NJ, 1987.

[2] Brian W. Kernighan. PIC - A Graphics Languages for Typesetting. *Bell Laboratories, Computer Science Technical Report No.116*, December 1984.

[3] B. Srinivasan. *Unix Document Processing and Typesetting*. World Scientific, Singapore, New Jersey, London, 1993.