Pan I Version 4.0
An Introduction For Users

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Abstract

Pan is a prototype and testbed for language-based editors and views. Its design addresses the needs of experienced users who manage complex objects such as large software systems. All of *Pan*'s components are multilingual, incremental, description-driven, customizable, and extensible. Viewing is facilitated by semantics-based browsing and an object model that integrates text and structure. *Pan* is intended to share information with other tools, allowing integration into a larger language, program, and document development environment.

This document, a users manual, describes the basic operational facilities of *Pan I* (version 4.0), the current implementation. It explains the concepts behind *Pan*'s editing environment, introduces editing commands, and discusses techniques for customization. Appendices list command bindings (to both keystrokes and menus), view options, and view flags.

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1 Introduction

Pan is an editing system for text- and language-structured documents that uses the mouse. menus. and multiple windows to provide both textual and language-based browsing and editing. *Pan* is implemented in COMMON LISP with PCL and *C*. It runs on Sun3 and Sparc Workstations[1] under SUNOS and X11R4.

This document is an informal introduction to *Pan I* Version 4.0. It contains essential information for editing with *Pan*. All of the commands necessary for editing files, programs. and directories are described along with the key-sequences or menu choices which make them quickly accessible. With the help of this manual and the on-line help system, a new user should be able to edit text files with *Pan*. If you have not used *Emacs* or a similar editor before this, you can get started on *Pan* by focusing on the cursor motion commands (see Section 4.1) and using *Pan*'s menus to visit files. open views, use the clipboard, and get help.

The text-oriented facilities of *Pan* are modeled partially on the *Emacs* family of text editors. so users familiar with an *Emacs*-style editor will have little trouble learning *Pan*. *Pan* is extensible and customizable in the spirit of *Emacs*[7].

Some information for extending the system is included in this document. Using the information contained in the manual, any user should be able to set up a "`.panrc`" file which alters key- and menu-bindings and changes the default value for any options to customize the editing environment (see Section 7). For more help, you may want to contact the *Pan* group (panpipes@sequoia.berkeley.edu) directly. For more general background on *Pan*, consult a recent description of the project [2].

Pan also provides for manipulating and editing programs using the syntax and semantics of the language being edited. *Pan* understands descriptions of language syntax using the language-definition language *Ladle*[3]. The semantics of the language may also be described using the semantics-description language *Colander*[1]. To effectively use the language-based facilities within *Pan*. all the user should need to know is the language in question. The most useful of *Pan*'s language facilities, operand-sensitive commands, is described in this manual and in *Pan*'s help system. For more information and background on *Pan*'s language-based features, see *Coherent User Interfaces for Language-Based Editing Systems*[8].

Adding new language definitions to *Pan* is beyond the scope of this manual.

2 Concepts

This section is a brief introduction to the terminology and notation of *Pan*.

2.1 Views

A **view** represents a format for presenting the contents of or information about a file, directory, program, or other editable object. A view may also provide services with which a user may browse, explore, and modify the object being presented. For example, a text view and a graphical view of a program would be considered different views on the same program.

[1]Sun Workstation is a registered trademark of Sun Microsystems, Inc.

Each view has a configurable environment which includes specifications for many aspects of the view's behavior, such as:

- key, menu, and operand-level bindings,
- definitions of character sets,
- option values, and
- flag specifications.

All views in *Pan* are named. The name of a view is composed of the name of the object being edited in that view, the type of the view, and possibly some extra qualifying information. In the current release, the name of a text view is the name of the file being edited.

Special Views

The **view list** is your doorway to *Pan*; within its edit window are the names of the views being edited. As new views are created, their names are added to this list. The view list appears in the upper left of Figure 1 on page 3, a typical workstation screen running *Pan*; it lists two other views, the help view and a view named "`manual.tex`".

The **help view** is a special text view which is used for displaying help and other information. A window on the help view appears in the upper right of Figure 1 and, currently shows the key bindings in effect for the active view. There can be only one help view at any given time (although this view can have several windows). Most commands which output information to the help view clear its contents first. See Section 3.8 for more about help facilities.

Views vs. Windows

Most commands act on the **active window** of the **active view**. The active window is the window in which the most recent keystroke or mouse action occurred. The active view is the view which owns the active window.

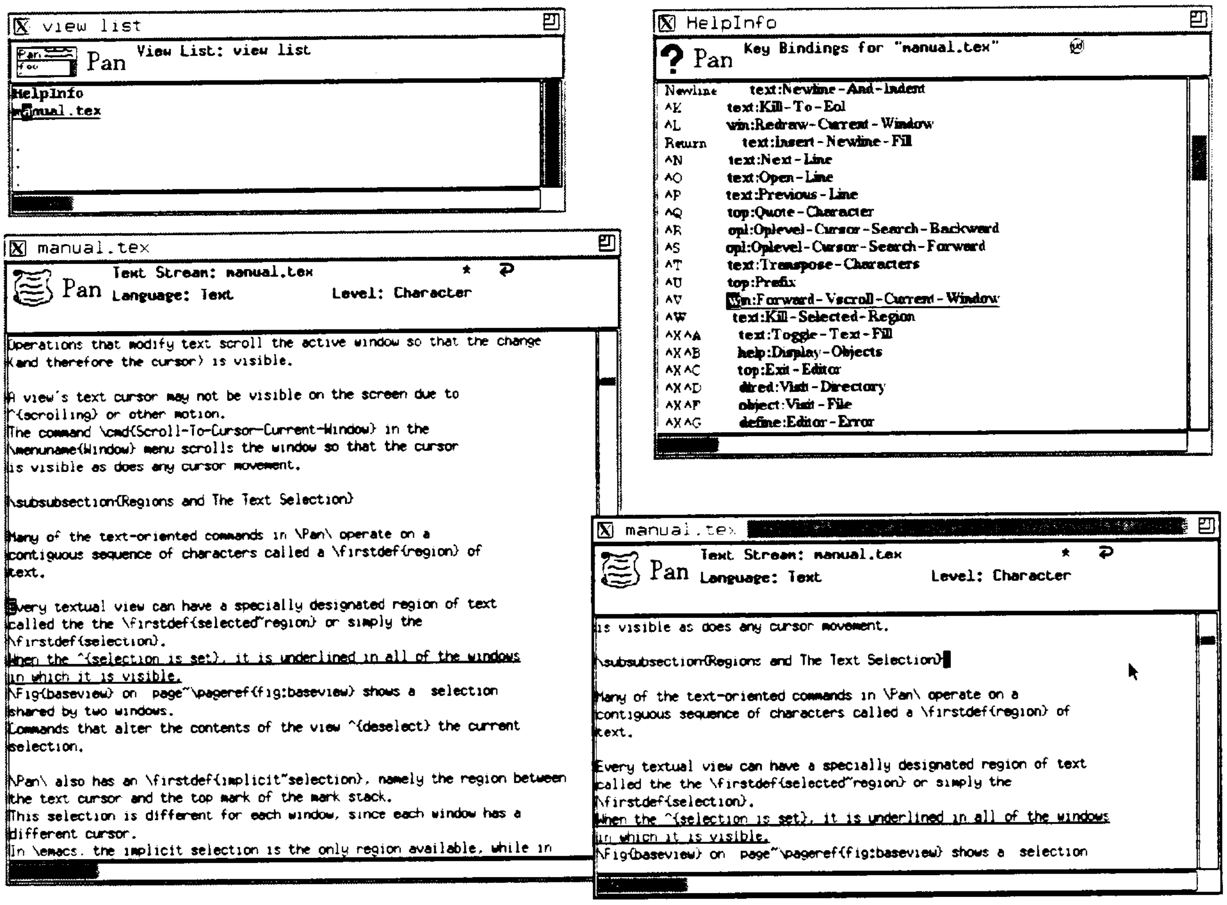
Views exist independently from the windows (see below) in which they are displayed. Thus there can be views that are not visible on the workstation.

In Figure 1, the text view "`manual.tex`" (containing a file of the same name) is currently active and has two separate windows open onto it.

2.2 Windows

A **window** represents the actual X window in which the contents of the view are displayed. A view may have any number of independent windows. For example, the text view "`manual.tex`" in Figure 1 has two separate windows open onto it.

A window provides a display mechanism, scroll bars, a message line, view flags, and a text cursor as seen in Figure 1. Every window also has its own operand level (see Section 2.6). All of the windows opened onto a single view share that view's contents: its bindings, its option values, and its flag specifications. A textual view (see Section 2.4) may at times have a single text selection,



```
View List: view list
HelpInfo
manual.tex
```

```
Key Bindings for "manual.tex"
Newline   text:Newline-And-Indent
^K        text:Kill-To-Eol
^L        win:Redraw-Current-Window
Return    text:Insert-Newline-Fill
^N        text:Next-Line
^O        text:Open-Line
^P        text:Previous-Line
^Q        top:Quote-Character
^R        opl:Oplevel-Cursor-Search-Backward
^S        opl:Oplevel-Cursor-Search-Forward
^T        text:Transpose-Characters
^U        top:Prefix
^V        win:Forward-Vscroll-Current-Window
^W        text:Kill-Selected-Region
^X^A      text:Toggle-Text-Fill
^X^B      help:Display-Objects
^X^C      top:Exit-Editor
^X^D      dired:Visit-Directory
^X^F      object:Visit-File
^X^G      define:Editor-Error
```

```
Text Stream: manual.tex                 *   ⮐
Language: Text          Level: Character

Operations that modify text scroll the active window so that the change
(and therefore the cursor) is visible.

A view's text cursor may not be visible on the screen due to
^{scrolling} or other motion.
The command \cmd{Scroll-To-Cursor-Current-Window} in the
\menuname{Window} menu scrolls the window so that the cursor
is visible as does any cursor movement.

\subsubsection{Regions and The Text Selection}

Many of the text-oriented commands in \Pan\ operate on a
contiguous sequence of characters called a \firstdef{region} of
text.

Every textual view can have a specially designated region of text
called the the \firstdef{selected~region} or simply the
\firstdef{selection}.
When the ^{selection is set}, it is underlined in all of the windows
in which it is visible.
\Fig{baseview} on page~\pageref{fig:baseview} shows a selection
shared by two windows.
Commands that alter the contents of the view ^{deselect} the current
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In \emacs, the implicit selection is the only region available, while in
```

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\Fig{baseview} on page~\pageref{fig:baseview} shows a selection
```

Figure 1: Screen image of *Pan* showing view list, help view, and a text (TEX) view

shared by all of the view's windows, but each text window has its own independent text cursor and any window may show a different part of the view.

The horizontal scroll bar, and horizontal scrolling commands allow you to see text to the right (or left) of the current edit window (see Section 3.10). If the Text-Fill option is on then the flag "⮐" appears in the information panel and newly typed lines are caused to wrap around rather than being truncated (see Section 4.6).

Pan windows can be manipulated like any X window according to the window manager you are using. Closing a window from the window manager causes that window to be iconified. Closing a window from within *Pan* will cause the window to be iconified if the option Window-Close-With-Icon is set to be true, otherwise no icon is created. In any case the window can be reopened from the view list or by opening a view or window on that file. Internal state of the window is retained even when the window is not visible (see Section 3.9).

A window is partitioned into two areas: the information panel and the editing area.

The Information Panel

At the top of the window appears the **information panel**, which displays information about the view. It includes the view name, a **message line**, and the values of various flags. For example, Figure 1 on page 3 shows the Object-Modified? and Text-Fill flags in the "`manual.tex`" view and the Object-Protected? flag in the help view.

It also may display the language being edited and the operand selection level (see Section 6). Clicking the right mouse button over the name of the current operand level will bring up a menu of all of the possible operand levels for the view.

The Editing Area

Below the information panel is the **editing area**. This area includes horizontal and vertical **scroll bars**, and the actual **edit window**. Pressing the right button of the mouse over the edit window activates the *Pan* menus for that view. Selecting an item from those menus executes the command bound to that selection (see Section 3.2).

In a text window, pressing the left button of the mouse sets the text cursor to the position of the mouse (see Section 4.1). Pressing the middle button of the mouse selects the region between the text cursor and the mouse (see Section 4.4).

Windows onto textual views display text as if it were an infinite quarter-plane of characters, with newlines separating each line. Rather than wrapping lines when they reach the right-hand edge of the viewport, the lines appear truncated.

In a graphical window, there is no text cursor but the behavior of the panel, the menu selection mechanism, and the scroll bars is the same (see Section 5).

2.3 View Styles

Within *Pan* there are many different editing contexts. These different contexts are called **view styles**. Each view must be associated with a view style. For example, the help view uses the help-view-style, directory editors use the dired-view-style, and views on ordinary text files use the text-edit-view-style. Every *Pan* view style is either graphical or textual. For a list of all of the available view styles, see Appendix G.

All views of a particular view style inherit its configuration information (see Section 2.6). The menus, key-bindings, flags, and fonts as well as many other less visible aspects of *Pan*'s behavior provide a look and feel for each view style which may be individually tailored to provide a comfortable environment for different editing purposes.

2.4 Textual Views

Most views in Pan are based on the textual display and manipulation of information. Many, but not all, of the services in textual views reflect familiar styles of text-based editing. This section presents a brief overview of those services. Section 4 contains more detail.

The Text Cursor

Each text window has a single **text cursor** independent of any other cursors in other windows on the view. A text cursor appears on the screen as an inverse-video or outlined box highlighting the character selected by that cursor.

All textual insertions and deletions occur at the position to the left of the character selected by the cursor. If a command alters text not located at the cursor (for instance, by deleting the current selection), the cursor is moved to the point of change . Operations that modify text scroll the active window so that the change (and therefore the cursor) is visible.

A view's text cursor may not be visible on the screen due to scrolling or other motion. The command Scroll-To-Cursor-Current-Window in the Window menu scrolls the window so that the cursor is visible as does any cursor movement.

Regions and The Text Selection

Many of the text-oriented commands in *Pan* operate on a contiguous sequence of characters called a **region** of text.

Every textual view can have a specially designated region of text called the the **selected region** or simply the **selection**. When the selection is set, it is underlined in all of the windows in which it is visible. Figure 1 on page 3 shows a selection shared by two windows. Commands that alter the contents of the view deselect the current selection.

Pan also has an **implicit selection**, namely the region between the text cursor and the top mark of the mark stack. This selection is different for each window, since each window has a different cursor. In *Emacs*, the implicit selection is the only region available, while in *Pan*, it is secondary to the visible selection. Commands that operate on the implicit selection are provided mostly for *Emacs* compatibility. The command Select-Region-Dot-To-Mark which is usually bound to the key sequence "**Esc** `^W`" makes the implicit selection into the selection.

Pan's style of selection is similar to, but not the same as, X's. Clicking the middle button of the mouse selects and underlines the region between the cursor and the mouse, but placing or dragging the cursor does *not* affect the selection. The selection, the position of the mouse, and the position of the text cursor are all independent.

Rings

A **ring** is a circular bounded stack. Adding an item to a ring pushes the other items just like a bounded stack. The oldest value in the stack may be discarded to preserve the boundedness.

Rings can also be "cycled", where the top value is moved to the position of the oldest value, and all of the other values move up—the second youngest becoming the top. Cycling a ring by n values moves the nth element (modulo the size of the ring) to the top. The top value in a ring is called the "contents" of the ring.

Both the clipboard and the kill rings are implemented as rings.

The Clipboard

The **clipboard**—a holder for regions of text—is shared among all views. A selection can be copied (or cut) to the clipboard and then pasted in another view. These operations are modeled on the Macintosh[2] user interface. Unlike the Macintosh clipboard, *Pan*'s clipboard is a ring that contains several items. The size of the clipboard is determined by the value of the option Clipboard-Max-Size.

Kill Rings

The **kill ring** is a a repository for deleted text. Commands that kill text place the killed text into the kill ring. This text can be retrieved at a later time by yanking it.

The size of the kill ring is determined by the value of the option Killring-Max-Size.

In *Pan*, the kill ring is local to a view rather than global to all views as it is in *Emacs*. The kill ring and the clipboard are independent entities; cutting text to the clipboard does not affect the contents of the kill ring and killing text does not affect the clipboard. However, if the option Kills-To-Clipboard is set, then the "Kill-" commands use the global clipboard instead of the kill ring and text killing and yanking is then effectively global.

Marks and the Mark Stack

A **mark** is a character position in a textual view. Marks associate with the character to the left of the position; when text is deleted, affected marks migrate to the beginning of the deletion.

Each view has a stack of marks called the **mark stack**. Marks in *Pan* are used for two purposes: to remember a cursor position, and to construct regions. The top mark on the stack is usually referred to as "the mark".

2.5 Graphical Views

For any program or other structure-based view, a **graphical view** of the internal tree representation may be created. Graphical views may be generated on the entire internal tree or on any subtree of it. The contents of the nodes in the graph may contain the names of the nodes or other information about the node, depending on the command used to generate the view.

The contents of the text stream from which the view was generated can not be altered from within the graphical view. In the current version of *Pan*, the graph is a display only and not a graphical editor; not even the structural cursor may be set from within a graphical view.

Graphical views may be navigated by thumbing the window to a fixed position by pressing the middle mouse button over the scroll bars or by "Zoom-"ing in and out.

A graphical view also contains a **global image** in the upper-left corner of the window. Within this image a miniature of the entire graph or subgraph being viewed is displayed, and the region of the graph which is currently visible in the window is outlined. This global image may be resized or toggled on and off.

Graphical views of the tree structure of programs are the only kind of graphical view implemented at present. Because the graphical view functions only as a display of the tree representation

[2] Macintosh is a registered trademark of Apple Computer, Inc.

and has no interactive capability, its usefulness is limited mostly to system extenders, particularly to authors of language descriptions.

Other types of graphical views are possible, such as a program call graph, but have not yet been implemented. This sort of view would have more practical use to the programmer.

2.6 Configuration

Most of the user interface and much of the operation of *Pan* may be customized. Each view in *Pan* is a separate editing context in which many aspects of *Pan*'s behavior and user interface may be configured. The default configuration of *Pan* is defined by a collection of declarations in the same format as those a user might write to customize one or more of *Pan*'s editing contexts (Section 7). A **binding** associates a sequence of keyboard or mouse actions with a command. *Pan* provides for adding key- and menu-bindings, setting options, configuring operand-level bindings, describing character sets, creating and manipulating flags, and creating new editing environments for specific uses. The on-line help system provides documentation for any configurable *Pan* command, option, or other object. All of these are scoped to provide flexible control of the editing environment.

Scopes

There are normally three possible **scopes**[3] for any binding or option:

- `:global` - global to all views,
- `:view-style` - restricted to all views of a particular view style, and
- `:view` - local to a single view.

Any configurable data can lie within any of these scopes. Therefore they are either *local* to a view, shared by all views of a particular view style, or *global* to all views. Thus, every view may have its own set of key bindings, and even its own menus and menu selections. Naturally, local bindings take precedence over global bindings.

Key Bindings

Key bindings associate keystroke sequences with commands. They provide the user with a quick way to execute commands. Most commonly used commands are bound to some key sequence. *Pan*, like *Emacs*, provides a live keyboard. Keystrokes (including mouse buttons and special keyboard keys) are read until a valid binding is detected. When a binding is detected, the associated command is executed.

A key binding associates a keystroke sequence with a command. These key sequences are generally one or two characters but there is no restriction on how long a binding can be. The keys "`Escape`", "`^X`", "`^C`", and "`^Z`" are, by convention, used as prefix keys. The "`Shift`" and "`Control`" keys are modifier keys rather than prefix keys. Any keystroke sequence may be bound to any command. In your configuration, you can set aside other keys to be prefixes as well as those

[3]The scope `:buffer`, which consists of all views on a single editable object, is also defined internally but is not often used for configuration.

mentioned above. However, if you bind a key sequence to a command, that binding will shadow any previously defined bindings which have that sequence as a prefix or which are a prefix of that sequence. For example, if you bind "`^A ^X`" to a command, you will no longer have the usual binding for "`^A`" or if you bind "`^X`" to a command, you will no longer have any of the key bindings for which "`^X`" is a prefix.

Any key sequence can be bound in any scope. A binding in a `:view-style` scope will shadow a binding to the same sequence in the `:global` scope; a binding in the `:view` scope will shadow a binding in its `:view-style` scope or the `:global` scope. Thus each view-style or view can have its own customized editing environment.

Mouse buttons and function keys can be bound to commands just like the standard keyboard keys. In fact, it is the standard binding of the right-most mouse button to Execute-Menu that implements *Pan*'s menu selection service. The function keys available vary between keyboards and key mappings. *Pan*'s default key bindings for the special keyboard keys generally reflect the standard usage for the keys. For example the "`Undo`", "`Cut`", and "`Paste`" keys on the left and the "`Up-`" and "`Down-Arrow`" keys on the right are bound to commands which reflect their purpose.

The default bindings for mouse buttons are similar to the X bindings. Appendix A lists *Pan*'s default key bindings.

Menu Bindings

Each view has a default menu, often inherited from the view's view style, but bindable in any scope. A *Pan* menu contains a collection of **menu bindings**, each of which associate menu item selections with commands. A menu binding consists of a menu, a menu item, and a command name.

The advantages of a menu binding are that you don't need to remember a command name or a key binding to execute the command, because you need only recognize the command in the menu and select the corresponding menu item with the mouse. Because of this, menu bindings are extremely useful for the new user. Like key bindings, menus and menu bindings may be scoped by `:view`, `:view-style`, or `:global`. The default menus associated with a view appear when the right button of the mouse is pressed while the mouse is positioned over the edit window. Figure 2 on page 9 shows a menu selection being made.

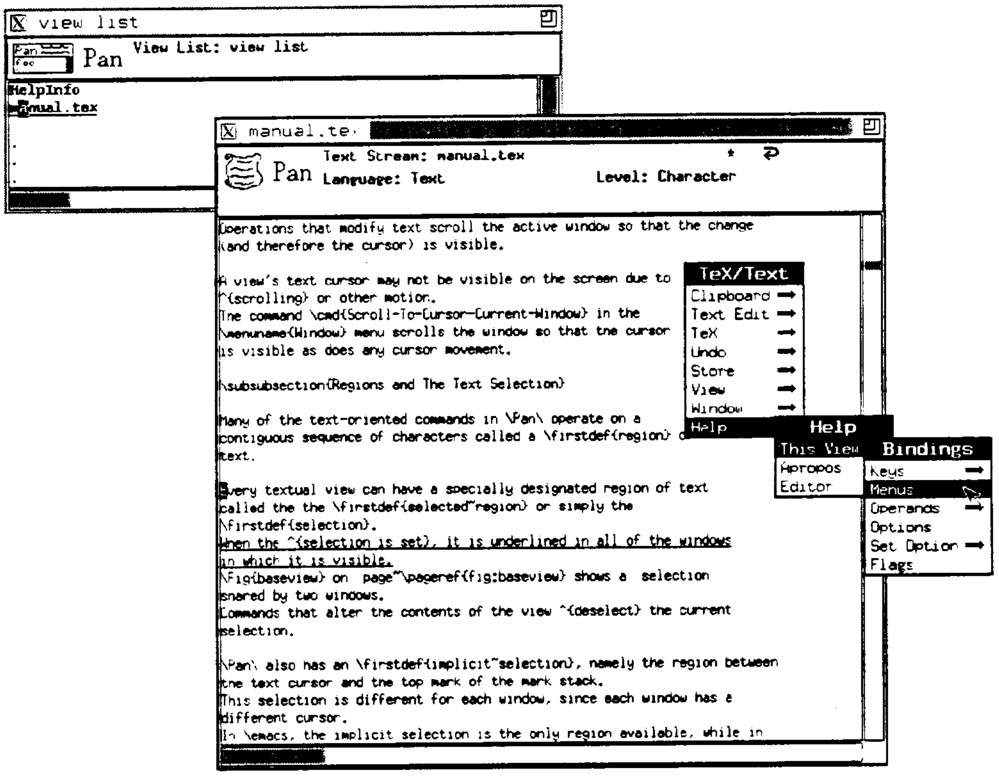
A menu binding is designated by a menu title and a selection name, denoted typographically by MenuTitle: `SelectionName`. For example, the selection **Menus** in Figure 2 is bound to the command Display-Default-Menu. It is not necessary for the selection name to be identical to the name of the command bound to the selection.

Default menu bindings are best discovered by mousing around. Appendices B.1–B.4 list the default menu bindings for a text view, for the view list, and for the help view.

As with key bindings, any command may be bound to a menu item. Each different menu or submenu is globally defined. The binding of a submenu or a menu selection to a menu affects the global definition of the menu. However, menus may be copied and the copy may be altered to achieve a `:view-style` or `:view` local configuration.

Operand Level Bindings and Menus

Operand level bindings associate generic operations, such as Cursor-Forward or Delete with



View List: view list

Text Stream: manual.tex
Language: Text
Level: Character

```
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In \emacs, the implicit selection is the only region available, while in
```

Figure 2: *Pan* with a default menu visible

operands designated by the current operand level (see Section 6). A keystroke sequence or menu item can be bound to a command that implements a generic operation. The generic operation, in turn, consults the operand level bindings and the current operand level of the active window to determine the actual command to execute.

Each window has a **current operand level** which can be used to control the actions of operand-generic operations. The generic operations are: Cursor-Forward, Cursor-Backward, Cursor-To-First, Cursor-To-Last, Cursor-In, Cursor-Out, Select, Cursor-To-Mouse, Mouse-Extend, and Delete as well as the search operations: Query-Replace-All, Replace-All, Cursor-Search-Forward, and Cursor-Search-Backward. The Oplevel-Menu command, which is normally bound to "`^C Mouse-Right`" brings up a menu which contains all of the operand-level operations for the current level.

For example, the key "`Right-Arrow`" is bound to the command Oplevel-Cursor-Forward. If the current operand level is "Character", and the binding of the generic command Cursor-Forward at the level "Character" is the command Next-Character, then Oplevel-Cursor-Forward will execute Next-Character.

Setting the operand level is a bit like changing modes in a moded editor, except that it *only* affects the generic bindings. The current operand level persists across operations. In pure text editing, the operand level is of limited usefulness. When editing views that have a richer operand domain, for example programs supported by one of *Pan*'s language descriptions, the ability to select and navigate using the operand level bindings is a bonus. For instance, a programming language might define operand levels such as "Expression", "Statement", and "Declaration". Figure 4 on page 39 shows the operand-level choices for a language-based view.

The current operand level affects only those commands that consult it. These commands are syntactically distinguished by containing the phrase "Oplevel-" in their name. An operand level binding is designated by a generic operation and an operand level denoted typographically by Operation *at level* "OperandLevel".

As with key-bindings, operand level bindings may also be scoped by `:view`, `:view-style`, or `:global` to provide a specialized editing environment for different views.

Character Sets

A **character set** has a name and may contain any number of ASCII characters. For example, the set indentation-characters contains the characters { Tab Space }. The default character sets are listed in Appendix F. Any character may belong to any number of sets or to no set. Character sets are used to recognize white-space, to identify matching brackets, and to find the extent of a word among other things. Commands for finding and altering the contents of a character set are described in Section 7.6.

Character set definitions are scoped and local definitions shadow global definitions. For example, the set word-characters is defined differently in the help view than in text views. The command Display-Char-Sets will display the contents of the character sets in the active view.

Options, Flags, and Variables

An **option** is implemented as a variable which is used to control user-configurable settings. Option variables, flags, and variables are provided for controlling and extending the system.

Option variables, or simply "options" are used to control user-configurable settings. They are implemented as strongly-typed, scoped variables. Appendix D lists the basic options, their types, and their default values. The effective value of an option is obtained using the command Announce-Option-Variable (see section 7.5). All options along with their values for a particular view may be listed with the command Display-Option-Variables.

A **flag** is an option that can be made visible. Flags can be displayed on the information panel by adding the associated option to a list of flag specifications along with an "on-icon" and an "off-icon". When the flag is set, i.e. the associated option is non-nil, then the "on-icon" is displayed in the information panel. The "off-icon" is often invisible. For instance, if the Object-Modified? flag is set (meaning that the text of a view has been modified since last saved), a "$\star$" appears on the information panel. Appendix E lists the default set of flags, together with their display properties.

A *Pan* **variable** is scoped, like an option, but is used for internals and not accessible to the user.

Font Maps

Every character in *Pan*'s internal text representation contains a font code. This code determines the font used when the character is displayed in a window. Each view has an associated **font map**, which associates font codes with internal font descriptors. A font map contains from 1 to 8 entries.

Internally, fonts are referred to as "font 0", "font 1", etc. The first element of the list (font 0) is the **default font**; unspecified font codes revert to the default font.

Pan maintains a default font map option which may be scoped. You can alter these defaults by setting the option Text-Window-Fontmap globally, in the scope of the view-style you want to affect, or in a particular view.

The standard specification for a font map is a zero-indexed list of font names containing from 1 to 8 names, for example:

```
("-adobe-times-medium-i-normal--17-120-100-100-p-84-iso8859-1"
 "-b&h-lucida-medium-r-normal-sans-12-120-75-75-p-71-iso8859-1"
 "-adobe-times-bold-i-normal--17-120-100-100-p-86-iso8859-1")
```

Standard text views use only the default font. Section 6.2 describes a more elaborate use of font maps in conjunction with language-structured documents.

2.7 Language Description

Adding new **language descriptions** is the most important of *Pan*'s extension mechanisms. A *Pan* language description is distinct from a language definition, which is written by the designer of the language, although it typically relies heavily on the definition. The language description is a configuration mechanism that enables *Pan* to deliver services to the user which are based on the underlying language structure and which can be tailored to the particular language. There may be more than one *Pan* description for a given language definition, each delivering different services (e.g. demonstration descriptions SIMPLE and SIMPLE2).

Language descriptions have many components, but they fall roughly into three categories: A syntax description (for the syntactic analyzer), a semantic description (for the semantic analyzer), and a specification of the editing interface (for the user's services).

- The syntax description consists of a *Ladle* file plus panic declarations. The *Ladle* description consists of a specification of the lexical tokens followed by a description of the grammar of the language in a format similar to YACC input format These are accompanied by directives to *Pan* on how to construct the abstract syntax tree [3].

- The semantic description is optional and consists of one or more "`.col`" (*Colander*) files. A *Colander* description consists of a set of goals associated with the rules of the grammar, each of which specifies a context-sensitive constraint that should be satisfied at each instance of a grammar rule in the internal tree. These are expressed in the language *Colander* (a Logical Constraint Grammar [1], and are accompanied by supporting declarations and function definitions.

- the editing interface is configured mostly in a COMMON LISP run-time library file for each language named "*<language>*`-mode.cl`" This file may configure nearly all of the parameters described in Section 2.6, especially language-specific operand levels, operand menus, font maps, and other special-purpose functionality.

Further information on constructing these interface description files is found in Section 7.

Errors in a program being edited (with respect to the language description) are divided into two categories in *Pan*'s underlying implementation: syntactic errors and unsatisfied constraints. **Syntactic errors** are structural inconsistencies between the program and the *Ladle* syntax description. **Unsatisfied constraints**, also referred to sometimes (somewhat inappropriately) as semantic errors, are unsatisfied contextual constraints in the program, as specified in a *Colander* semantic description. These may include, for example, type checking (based on the language's definition) and naming conventions (based on the language's intended use).

Default error definition and handling is automatically provided by *Pan*. However, the error handling mechanism may be configured for each specific language description. For example both syntactic errors and unsatisfied constraints may be treated as one via a single operand level definition (e.g. as in demonstration language SIMPLE). Alternately, the two basic categories may be divided further, for example unsatisfied language constraints vs. stylistic constraints.

When you are editing a file with a complete *Pan* language description, *Pan* maintains:

- an internal structural representation of the program based on the *Ladle* description of the language which is updated incrementally with each analysis

- a database of semantic information, structural annotations, and other data derived from the program and the *Colander* description, also updated with each analysis

- a configuration that controls the look and feel of user interaction with the language as well as a number of user services that exploit the derived information

3 Basic Interaction

This section is an introduction to general kinds of interaction with the *Pan* system. At the beginning of each subsection is a list of the commands discussed, together with their default bindings. Control keys are represented by prepending the character "`^`" in front of the key, e.g., "`Control-X`" is shown as "`^X`", and the keystroke sequence "`Control-X`" "`Control-F`" is shown as "`^X ^F`". The prefix "`Escape`" is denoted "`Esc`".

Menu bindings are denoted by MenuTitle: `SelectionName` where MenuTitle is the title of the menu which appears at the top of the menu and `SelectionName` is the name of an item appearing in the menu. Operand-level bindings are denoted by Command *at level* "OperandLevel". All of the configurable bindings are described in Section 2.6 and details of creating and altering bindings are contained in Section 7.4.

3.1 Getting Started

When *Pan* is started, the files named on the command line are read in as *Pan* text views and prepared for editing. Once initialization is complete, the view list will appear. Section 7.1 provides more specific details about *Pan*'s start-up processing.

3.2 Executing Commands

Execute-Command	`Esc x`
Execute-Menu	`Mouse-Right`

The simplest and most common way to execute a command is via a key or menu binding (see Section 2.6), but it is also possible to execute any *Pan* command by name. To execute a *Pan* command by name, type "`Esc x`", the keystroke sequence bound by default to Execute-Command. Execute-Command prompts for a command name. The prompt is *case-sensitive*, so you have to capitalize the command name correctly or it won't be recognized.

To select an item from a view's default menu, hold down "`Mouse-Right`" within the edit window of the view in which you want to execute the command. When the menu appears, continue to hold down the button and move the mouse over the menu item of your choice. When the item you want is highlighted, release the button. If you choose a sub-menu, do not release the button but move to the appropriate item in the sub-menu and repeat the process.

3.3 Quitting

Exit-Editor	`^X ^C`
Exit-Editor	View List: `Quit`
Interrupt-Editor	`^X ^Z`

Exit-Editor is the normal method for terminating a *Pan* session.When modified views exist you will be asked whether they should be saved.

Interrupt-Editor stops the system and control goes to a break loop in the underlying COMMON LISP. You can resume editing by typing "`:cont`". This is usually used for debugging.

3.4 Supplying Arguments to Commands

There are three ways to provide arguments to *Pan* commands: by a numeric prefix argument, by setting the current selection, or by responding to a prompt. The actual method used depends on the particular command. Commands that can use a numeric argument normally check for the presence of a numeric prefix, while commands that require textual arguments may use the selection or may prompt for an argument.

Numeric Prefix Arguments

Prefix	`^U`

The behavior of many commands can be altered by supplying **numeric prefix** arguments. In most cases, the argument is interpreted as a repetition factor, and the effect of the command is simply repeated. Prefix reads the prefix arguments from the keyboard. There are two ways to type such arguments: by typing a sequence of digits, or by repeating the keystroke sequence bound to Prefix. In the latter case, each repetition corresponds to multiplication by the value of the option Prefix-Arg-Multiplier (default value 4). For example, the key sequence "`^N`" is normally bound to the command Next-Line which takes a prefix argument. Typing "`^U ^N`" would cause the cursor to move forward four lines; typing "`^U ^U ^N`" would cause the cursor to move forward 16 lines; typing "`^U 3 ^N`" would cause the cursor to move forward 3 lines.

Prompts and Pop-Ups

Pan prompts for input by making a small **pop-up window** appear on the screen. The pop-up remains on the screen until you complete the input. When a pop-up is visible, *Pan* is effectively stopped until the pop-up is dismissed. Pop-ups may be manipulated by the window manager, though.

Pop-ups have one or more "buttons" on their lower edge: clicking the left button of the mouse over one of those areas completes and confirms the prompt. When typing a textual argument into a pop-up, standard UNIX editing characters serve to edit the input. Pop-ups for textual arguments are confirmed by selecting a button or by hitting the "`Return`" key. The "`Return`" key has the same effect as clicking on the button with the bold outline.

3.5 Cancelling Commands

Editor-Error	`^G`
Editor-Error	`^C ^G`
Editor-Error	`Esc ^G`
Editor-Error	`^X ^G`
Editor-Error	`^Z ^G`
Editor-Error	"`Cancel`" on Pop-ups

To cancel a keystroke sequence, type "`^G`" with any prefix. To cancel a menu selection, move the mouse cursor outside (away from) the menu, and release the mouse button. When responding to a prompt, select the "`Cancel`" button.

Once a command is initiated, there is little you can do to stop it. If the command takes more than an instant to complete, the mouse cursor image, normally an arrow, may be replaced by a clock.

3.6 Reviewing Message History

Prev-Message-Current-Window	`Esc p`
Next-Message-Current-Window	`Esc n`

These commands allow you to review the messages which have been displayed in a window's message line. Each time one of these commands is invoked, a message is displayed on the message line along with an index that indicates which message is being displayed; the most recent message is indexed [0], the one previous to that is [-1], etc.. A history of the significant messages which have been printed is stored for each window. The size of this history is controlled by the option Window-Message-History-Size whose default value is 32 messages. Insignificant messages are not part of the history, e.g. empty announcements that clear the message line and messages announcing that the system is garbage collecting.

3.7 Undoing Actions

Undo	`^X u`
Undo	`L4`
Undo	Undo: `Undo`
Redo	`^X r`
Redo	Undo: `Redo`
Sub-Undo	Undo: `Sub-Undo`
Sub-Redo	Undo: `Sub-Redo`

The **undo** facilities of *Pan* allow you to undo the most recent action or series of similar actions. The effect of undoing an action is to return the text to the state it was in before that action was executed.

Invoking Undo will undo the most recent action. Invoking Undo a second time will undo the action previous to that. The command Redo will redo the last command undone. For instance, typing a series of characters and then invoking Undo will remove the entire series of characters just typed. Invoking the command Redo after the first Undo restores the text removed by the first Undo. A sequence of consecutive Undo commands are coalesced into a single action and so may be undone as one action after other commands have been executed.

Both Undo and Redo use the numeric prefix argument to determine the number of previous actions to undo or redo. The option Undo-Size specifies the maximum number of consecutive commands which can be undone.

Sub-Undo and Sub-Redo operate on commands that are subdivided into separate commands such as Replace-All and Query-Replace-All. Sub-Undo will undo the last portion of the previous command (i.e. the last replacement in Replace-All).

3.8 Getting Help

Reset-Help	Help View: `Reset Help`
Visit-Help-View	`Help`

Pan is largely self-documenting. Each view has an associated Help menu that provides access to the help information supplied by the system. This information will be displayed in the **help view**—a special view known to the system. Figure 1 on page 3 shows the help view in the upper right-hand corner of the screen. The help view acts like a normal text view, except that it is altered only by the help commands.

Most help commands delete any pre-existing text in the help view before adding their contribution. Others, such as Describe-Selection add additional information to the view. The information in the help view can be saved to a text file at any time. The command Reset-Help empties the help view. If there is not already a window open onto the help view, the command Visit-Help-View opens one window onto the help view, otherwise it brings the already open window to the front of the screen. This command is implicitly called every time information is printed to the help view.

Apropos

Apropos-String	Help: Apropos
Display-Apropos-Index	Not bound

The "Apropos-" family of commands associate a keyword with a list of command names. For instance, invoking the command Apropos-String and supplying the argument "clipboard" lists, in the help view, all of the commands that use the clipboard. Display-Apropos-Index [4] will list all of the possible "Apropos" arguments and their corresponding commands.

Help Commands

Document-Symbol	Help View: Describe
Visit-Symbol-Definition	Help View: Visit Definition
Visit-Symbol-Definition	Esc .
Display-Objects	^X ^B
Display-All-Key-Bindings	Help⇒This View⇒Keys: Display All
Display-Key-Binding	Help⇒This View⇒Keys: Key -> Command
Display-Key-Bindings-For-Command	Help⇒This View⇒Keys: Command -> Key
Display-Default-Menu	Help⇒This View: Default Menu
Display-Operand-Level-Bindings	Help⇒This View⇒Operand Cmds.: By Level
Display-Operand-Command-Bindings	Help⇒This View⇒Operand Cmds.: By Command
Display-Operand-Level-Menus	Help⇒This View: Operand Menus
Display-Option-Variables	Help⇒This View: Options
Display-Flags	Help⇒This View: Flags
Display-Char-Sets	Help⇒This View: Char. Sets
Display-Objects	Help⇒Pan: Objects Being Viewed
Display-Language-List	Help⇒Pan: Language Descriptions Loaded
Display-Commands	Help⇒Pan: Commands Available
Display-Auto-Load	Help⇒Pan: Filename Auto-Load Map
Display-Auto-Exec	Help⇒Pan: Filename Auto-Exec Map
Display-Version	Help⇒Pan: Version

[4] Many help commands are of limited value to new or casual users, and are therefore not bound to the default menus. Invoking the command Debug adds auxiliary menus in which more help commands are available.

Display-Bug-Report-Info	Help⇒Pan: `How To Report Bugs`
Display-View-Class-Key-Bindings	Not bound
Display-Configuration	Not bound
Display-File-Ids	Not bound
Display-Hooks	Not bound
Display-Notifiers	Not bound

Commands beginning with "Display-" simply list the names of all things of a given type for the current view. (e.g.. all commands or all options). Commands in the This View sub-menu refer to things which are scoped and the commands give the values for those things in the current scope. Commands in the Pan sub-menu refer to things which are global to the editor. For more about Auto-Load and Auto-Exec see Section 7.1. For more about hooks and notifiers see section 7.8, and for setting options see Section 7.5.

Documentation Commands

Display-Command-Documentation	Not bound
Display-Operand-Level-Documentation	Not bound
Display-Operand-Command-Documentation	Not bound
Display-Option-Documentation	Not bound
Display-Char-Set-Documentation	Not bound
Display-Variable-Documentation	Not bound
Display-Constant-Documentation	Not bound
Display-Function-Documentation	Not bound
Display-Macro-Documentation	Not bound
Display-Hook-Documentation	Not bound

"-Documentation" commands display the names of all things of a given type along with a documentation string.

3.9 Views and Windows

The commands presented in this section support basic view and window management.

Visiting Files and Other Objects

Visit-Selected-View	View List: `Visit View`
Visit-Selected-View	`f` in View List
Visit-File	`^X ^F`
Visit-File	View List: `Visit New`
Visit-File	Store: `Visit New...`
Protected-Visit-File	`^X ^R`
Visit-Backup	Not bound
Visit-Checkpoint	Not bound

Visit-Directory	`^X ^D`
Visit-Directory	`^X d`
Set-Working-Directory	Not bound
Visit-View	`^X b`
Visit-View-List	`R7`
Scratch-View	View List: `New Scratch`
Rename-View	Not bound
Remove-Selected-View	View List: `Remove`
Remove-Selected-View	x in View List
Remove-View	`^X k`
Remove-View	View: `Remove`
Remove-Object	Not bound

To edit a file, one must first create a view onto it with the command Visit-File or the command Dired-Visit (see below). Visit-File prompts for a file name. If a view does not already exist for that file, a new view is created for it and the file is read and prepared for editing.

To visit an existing view, you can use the Visit-Selected-View command from the view list. This command normally appears as **`Visit View`** in the View List menu. It is used by first selecting a name in the view list.

To edit a directory, either use Visit-File with the name of the directory or use the command Visit-Directory. The Visit-Directory command allows you to specify a pattern for file names. For example, if you give it the argument "`~/pan/*.tex`", it will give you the directory editor for "`~/pan`" listing only files whose names end in "`.tex`".

Visit-View prompts for the name of a view and opens a window for that view if it is in the view list. Scratch-View creates a new text view named "`**scratch**`" that is not associated with any file.

The Remove-Object command removes all views which share the given editable object and offers you a chance to save any changes.

Remove-Selected-View and Remove-View remove one view from the view list. If that is the only active view that exists on that data then it is removed as in Remove-Object. Once a "Remove-" command has been executed, all of the state associated with the removed object is lost.

Directory Editor

Dired-Visit	Dired: `Visit`
Dired-Visit	`f`
Dired-Visit-Read-Only	Dired: `Visit Read Only`
Dired-Visit-Read-Only	`^R`
Dired-Mark-Selection	Dired: `Mark`
Dired-Mark-Selection	`d`
Dired-Unmark-Selection	Dired: `Unmark`
Dired-Unmark-Selection	`u`
Dired-Delete-Files	Dired: `Delete marked files`

Dired-Delete-Files	`x`
Dired-Mark-Editor-Files	Dired: `Mark backup files`
Dired-Mark-Editor-Files	`#`
Revert-Object	Dired: `Reread directory`
Revert-Object	`g`
Visit-Directory	`^X ^D`
Visit-Directory	`^X D`

The **directory editor** view-style is useful for editing objects which are directories. To visit any file in the directory, select that file with the mouse or by normal cursor movement and invoke the command Dired-Visit. The command Dired-Visit-Read-Only works the same except that the view is protected so that its contents cannot be altered.

The directory editor allows you to mark files to be deleted with the command Dired-Mark-Selection then to delete those files with the command Dired-Delete-Files. Dired-Mark-Editor-Files marks for deletion all of the files in the directory which were created by *Pan* as backups.

Saving and Writing Files

Save-Object	`^X ^S`
Save-Object	Store: `Save`
Preserve-All-Objects	`^X Return`
Exit-Editor	`^X ^C`
Save-Object-Copy-As	`^X ^W`
Save-Object-Copy-As	Store: `Save Copy As` ...
Write-Selection-To-File	Text Edit⇒File: `Write Selection To` ...
Append-Selection-To-File	Text Edit⇒File: `Append Selection To` ...
Revert-Object	`^X Backspace`
Revert-Object	Store: `Revert`
Backup-Object	Not bound
Checkpoint-Object	Not bound
Revert-Object-To-Backup	Not bound
Revert-Object-To-Checkpoint	Not bound
Toggle-Object-Protection	`^X ^Q`
Toggle-Object-Protection	Text Edit: `Toggle Protection`
Toggle-Object-Modification	Not bound

Save-Object saves the contents of the current view in its associated file; Preserve-All-Objects save s all of the modified views being edited. Exit-Editor performs the standard termination sequence of saving modified views and exiting. The commands Preserve-All-Objects and Exit-Editor prompt for whether a particular view is to be written to file.

All of the commands Save-Object-Copy-As, Write-Selection-To-File, and Append-Selection-To-File prompt for the name of a file to write. The command Save-Object-Copy-As does not rename the view.

Revert-Object replaces the contents of the object underlying the view in memory with the stored copy.

Toggle-Object-Protection toggles the Object-Protected? option in the view. When this option is set, the flag "@" appears on the information panel and you will be prevented from modifying or writing that file. This option is set by default when you commence editing a file for which you do not have permission to write. Toggling the Object-Protected? flag does not affect the permissions on the stored file itself.

If the option Backup-Object? is set, then the first time a file is saved, a backup of the original is created. The command Revert-Object-To-Backup can be used to restore the original file.

The file will be checkpointed after a number of modifications given by the option Checkpoint-Modification-Interval. The command Visit-Checkpoint allows you to edit the last checkpoint of the file and the command Revert-Object-To-Checkpoint allows you to revert the file to that state.

Toggle-Object-Modification allows you to toggle the Object-Modified? which appears as the flag "⋆" in the information panel.

Manipulating Windows

Open-A-Window-In-View	Not bound
Open-Another-Window-In-View	`^X 2`
Open-Another-Window-In-View	Window: `Open Another`
Close-Current-Window	`^X 0`
Close-Current-Window	Window: `Close`
Redraw-Current-Window	`^L`
Redraw-Current-Window	Window: `Redraw`

When you visit a view that has no visible windows, *Pan* will reopen the view's most recently closed window. If the view has no windows, a new window is created. To open a second (or third, or fourth, ...) window onto a view, execute the command Open-Another-Window-In-View.

Closing a window causes it to disappear from the screen. If the option Window-Close-With-Icon is set, then the window will be iconified when it is closed from within *Pan*. Closing a window from the window manager will always cause it to be iconified. The internal state of the view is retained even when it has no windows so that windows onto that view can be reopened later. You can not remove the view list.

Windows are reopened using the same commands as are used for opening new windows. They are reopened in last-in, first-out order relative to the order in which they were closed.

Redraw-Current-Window redraws the active window.

3.10 Scrolling

Forward-Vscroll-Current-Window	`^V`
Backward-Vscroll-Current-Window	`Esc v`
Left-Hscroll-Current-Window	`^X <`
Right-Hscroll-Current-Window	`^X >`

Scroll-To-Cursor-Current-Window Window: `Scroll To Cursor`

Pan's scrolling behavior is a simplified version of the X scrolling protocols. The scroll bars in a window respond to simple scroll commands. For vertical scrolling, pressing the left button in the vertical scroll bar scrolls the window toward the end of the file, the right button scrolls the window towards the beginning of the file, and the middle button thumbs the window to the point indicated by the scroll "bubble". Holding down the middle button and moving the mouse allows you to scan, or "thumb", the file.

When scrolling horizontally, pressing the left button in the horizontal scroll bar scrolls the window toward the end of the line, the right button scrolls the window towards the beginning of the line, and the middle button thumbs the window to the point indicated by the scroll bubble.

The first four of the above commands permit scrolling from the keyboard instead of from the mouse. During vertical scrolling, when the option Text-Window-Proportional-Scroll is set to be true (in COMMON LISP, `'t`), the amount that the edit window is scrolled depends upon the distance between the mouse cursor and the top of the scroll bar. For small movements, place the mouse cursor near the top of the scroll bar. For larger movements, place the mouse cursor near the bottom of the scroll bar. To scroll an entire screen, place the mouse cursor opposite to the last line of text visible in the window.

When the option Text-Window-Proportional-Scroll is set to be false (in COMMON LISP, `'nil`), the vertical scrolling commands scroll the window by a full screen at a time.

To "thumb" the view to an absolute position, place the mouse cursor in the scroll bar and press **`Mouse-Middle`**. The window will be scrolled to the position corresponding to the relative distance between the top of the scroll bar and the position of the mouse cursor.

Scrolling the screen by a full screen at a time can also be achieved by using Forward-Vscroll-Current-Window and Backward-Vscroll-Current-Window. Both of those commands consult the numeric prefix argument to determine the number of screens to move.

Left-Hscroll-Current-Window and Right-Hscroll-Current-Window are keyboard variants of the horizontal scrolling commands.

The command Scroll-To-Cursor-Current-Window redraws the window and scrolls so that the cursor appears in the center of the window. The position of the cursor is *not* affected by scrolling. Therefore, scrolling may cause the cursor to be not visible in the window.

Any cursor motion or alteration of the text will scroll the window so that the cursor is visible.

3.11 When Things Go Wrong

```
:panic
:resume
```

Pan has been remarkably (well, reasonably) robust throughout its long development period. Most problems are routinely handled by printing a message on the message line of the active view. However, provisions have been made for recovering from major catastrophes.

We'd probably all agree that a catastrophe has occurred if *Pan* failed either by returning to the underlying COMMON LISP system or by dying altogether. Fortunately, the first rarely happens, and the second won't occur without returning to COMMON LISP.

If an unanticipated COMMON LISP error occurs, *Pan* enters a COMMON LISP break loop. If you do somehow end up in a COMMON LISP break loop, a prompt will appear in the tool window in which the system is running. (If *Pan* is running from a menu, the prompt will appear in the console.). The prompt will look like "{*nn*}" or "*nn* ⇒" where "*nn*" is a small integer.

In the first case ("{*nn*}"), the system is in a COMMON LISP break loop. You can recover from the error by typing the COMMON LISP expression `:resume` which returns the system to the normal command evaluation loop or `:panic` which executes the normal code for saving the modified views and then exits the system. Naturally, the circumstances of such an error should be noted and passed on to the developers of *Pan*. (Mail to pan-bug@sequoia.berkeley.edu)

The second case ("*nn* ⇒") is more serious. In fact, the session is almost over. All that you can do is to type `:panic`.

4 Using Textual Views

This section describes the basic text-oriented services that are available in *Pan*'s textual views. These correspond in many ways to traditional text editors, and users of *Emacs* will find much that is familiar. *Pan*'s language-based services (also available in textual views) are described in Section 6.

4.1 Text Cursor Motion

Announce-Text-Cursor-Info	`^X =`

The command Announce-Text-Cursor-Info can be used to display status information in the information panel about the text cursor in the active window.

Moving the Cursor With the Mouse

Oplevel-Cursor-To-Mouse	`^C Mouse-Left`
Cursor-To-Mouse	`Mouse-Left`
Cursor-To-Mouse	Cursor-To-Mouse *at level* "Character"
Mouse-Select-Fullword	Cursor-To-Mouse *at level* "Word"
Mouse-Select-Line	Cursor-To-Mouse *at level* "Line"

The left button of the mouse is bound to the command Cursor-To-Mouse which sets the cursor to the character selected by the mouse icon. This command does not affect the current selection.

The corresponding operand level command Oplevel-Cursor-To-Mouse is normally bound to the key sequence "`^C Mouse-Left`". When the operand level is set to "Character", it invokes the command Cursor-To-Mouse. At different operand levels, Oplevel-Cursor-To-Mouse selects the operand under the mouse and places the text cursor at the beginning of the selection.

Moving Forward and Backward

Oplevel-Cursor-Forward	`^C ^F`

Oplevel-Cursor-Forward	Right-Arrow
Next-Character	^F
Next-Character	Cursor-Forward *at level* "Character"
Next-Word	Esc f
Next-Word	Cursor-Forward *at level* "Word"
Next-Line	^N
Next-Line	Cursor-Forward *at level* "Line"
Oplevel-Cursor-Backward	^C ^B
Oplevel-Cursor-Backward	Left-Arrow
Previous-Character	^B
Previous-Character	Cursor-Backward *at level* "Character"
Previous-Word	Esc b
Previous-Word	Cursor-Backward *at level* "Word"
Previous-Line	^P
Previous-Line	Cursor-Backward *at level* "Line"
Oplevel-Cursor-In	^C ^I
Oplevel-Cursor-In	Down-Arrow
Next-Line	Cursor-In *at level* "Character"
Next-Line	Cursor-In *at level* "Word"
Next-Line	Cursor-In *at level* "Line"
Oplevel-Cursor-Out	^C ^O
Oplevel-Cursor-Out	Up-Arrow
Previous-Line	Cursor-Out *at level* "Character"
Previous-Line	Cursor-Out *at level* "Word"
Previous-Line	Cursor-Out *at level* "Line"

The cursor can also be moved using cursor motion commands shown above. If the operand level were "Word", then **Oplevel-Cursor-Forward** would move the cursor to the word following the word containing the cursor and **Oplevel-Cursor-To-First** would move the cursor to the first word in the view. The "**Next-**" and "**Previous-**" commands use the numeric prefix argument to determine the number of units to move.

Note that the generic commands **Cursor-In** and **Cursor-Out** (bound by default to "`Down-Arrow`" and "`Up-Arrow`" respectively) have little meaning for ordinary textual editing. They are bound to **Next-Line** and **Previous-Line** respectively at all three textual operand levels.

Moving Around in the Text Stream

Oplevel-Cursor-To-First	^C Esc <
Move-To-Bos	Esc <
Move-To-Bos	Cursor-To-First *at level* "Character"
Move-To-First-Word	Cursor-To-First *at level* "Word"
Move-To-Bos	Cursor-To-First *at level* "Line"
Oplevel-Cursor-To-Last	^C Esc >

Move-To-Eos	Esc >
Move-To-Eos	Cursor-To-Last *at level* "Character"
Move-To-Last-Word	Cursor-To-Last *at level* "Word"
Move-To-Last-Line	Cursor-To-Last *at level* "Line"
Move-To-Bol	^A
Move-To-Eol	^E
End-Of-Word	Not bound
First-Non-Blank	Esc m
Goto-Line	^X 1

Move-To-Bol moves the cursor to the first position on the current line; Move-To-Eol moves the cursor to the last position on the current line. To move to the beginning or end of the view being edited, use Move-To-Bos or Move-To-Eos, respectively

End-Of-Word moves the cursor to the end of the word that encloses the cursor. Finally, First-Non-Blank moves the cursor to the first character (that is not white space) on the current line.

The command Goto-Line moves the cursor to the beginning of the line specified by the numeric prefix argument. If there is no prefix argument, Goto-Line prompts for a line number. Internally, *Pan* treats the first line of a file as line number 0. If the option Zero-Index-Lines is false, the argument to Goto-Line is treated as a 1-indexed line number and is converted appropriately.

Mark Commands

Set-Mark	^@
Pop-Mark	Not bound
Push-Mark	Not bound
Swap-Dot-And-Mark	^X ^X
Dot-To-Mark	Not bound

Set-Mark and Push-Mark both push the location of the cursor to the top of the mark stack of the active view.Pop-Mark pops the mark stack of the active view. The commands Swap-Dot-And-Mark and Dot-To-Mark move the text cursor to the position indicated by the top of the mark stack. They differ in that the first exchanges the cursor's position with the top mark, while the second pops stack.

4.2 The Current Operand Level

Set-Oplevel-To-Character	^C c
Set-Oplevel-To-Word	^C w
Set-Oplevel-To-Line	^C 1

The current operand level is a *mode* which affects the subsequent operation of operand level commands (a.k.a. level-sensitive commands), see Section 4.3. The level does *not* affect the operation of any other commands: in particular, text may be entered and manipulated freely, independent of level.

The operand level may be set by using these commands or selected using "Mouse-Right" over the menu in the information panel where the current level is always visible. You can leave the operand level at "Character", and *Pan* will operate much like *Emacs*.

Other operand levels related to languages are described in Section 6.4.

4.3 Operand Level Commands

Oplevel-Cursor-Forward	`^C ^F`
Oplevel-Cursor-Forward	`Right-Arrow`
Oplevel-Cursor-Backward	`^C ^B`
Oplevel-Cursor-Backward	`Left-Arrow`
Oplevel-Cursor-In	`^C ^I`
Oplevel-Cursor-In	`Down-Arrow`
Oplevel-Cursor-Out	`^C ^O`
Oplevel-Cursor-Out	`Up-Arrow`
Oplevel-Cursor-To-First	`^C Esc <`
Oplevel-Cursor-To-Last	`^C Esc >`
Oplevel-Cursor-To-Mouse	`^C Mouse-Left`
Oplevel-Select	`^C Backspace`
Oplevel-Mouse-Extend	`^C Mouse-Middle`
Oplevel-Delete	`^C ^D`
Oplevel-Cursor-Search-Forward	`^C ^S`
Oplevel-Cursor-Search-Forward	`L9`
Oplevel-Cursor-Search-Backward	`^C ^R`
Oplevel-Replace-All	`^C Esc r`
Oplevel-Query-Replace-All	`^C Esc ^R`
Oplevel-Menu	`^C Mouse-Right`

These are generic commands whose behavior depends on the current operand level and on operand level bindings (both command and menu). They may be bound to different commands at any operand level in any given scope. Note that the key bindings for these commands are the same as the key bindings for the analogous character level commands prefixed by the key sequence "^C".

The first five commands control cursor movement relative to the operand level; see Section 4.1 for more detail. Oplevel-Select selects the operand under the edit cursor. Oplevel-Mouse-Extend extends the selection to include the mouse position; see Section 4.4. Oplevel-Delete deletes the operand under the edit cursor. The "Search" and "Replace" commands are discussed in Section 4.13.

The operand level menu is specific to each particular operand level and usually contains all of the commands which are bound to the generic commands by default at that operand level.

4.4 The Textual Selection

Oplevel-Cursor-To-Mouse	`^C Mouse-Left`
Oplevel-Mouse-Extend	`^C Mouse-Middle`
Oplevel-Select	Not bound
Cursor-To-Mouse	`Mouse-Left`
Select-Region-Dot-To-Mark	`Esc ^W`
Select-Region-Dot-To-Mouse	`Mouse-Middle`
Select-Region-Dot-To-Mouse	Mouse-Extend *at level* "Character"
Select-Word	`Esc @`
Select-Line	Select *at level* "Line"
Select-Fullword	Select *at level* "Word"
Select-Full-Line	Not bound
Select-Text-Stream	`^X h`
Mouse-Select-Word	Not bound
Mouse-Select-Line	Cursor-To-Mouse *at level* "Line"
Mouse-Select-Fullword	Cursor-To-Mouse *at level* "Word"
Mouse-Select-Fullword	`Esc Mouse-Left`
Mouse-Select-Full-Line	Not bound
Mouse-Extend-Selection-Fullword	`Esc Mouse-Middle`
Mouse-Extend-Selection-Full-Line	Not bound
Mouse-Extend-Oplevel-Text	Mouse-Extend *at level* "Word"
Mouse-Extend-Oplevel-Text	Mouse-Extend *at level* "Line"
Next-Line-Select	Not bound
Previous-Line-Select	Not bound
Select-Expr	`Esc ^@`
Null-Select	Not bound
Deselect-Region	Select *at level* "Character"
Deselect-Region	`Esc ^D`

Each textual view has a single textual selection. shared by all windows. It may be set in any window, but it is visible in all windows. Any alteration of the text stream deselects the textual selection. The text selection is generally set by the commands Select-Region-Dot-To-Mouse. Oplevel-Cursor-To-Mouse, Oplevel-Mouse-Extend, and Select-Region-Dot-To-Mark. Select-Region-Dot-To-Mouse is bound to "`Mouse-Middle`" and selects the region between the text cursor and the mouse. Oplevel-Cursor-To-Mouse is bound to the key sequence "`^C Mouse-Left`" and selects one unit at the current operand level beneath the mouse cursor. Oplevel-Mouse-Extend is normally bound to the key sequence "`^C Mouse-Middle`".When the level is "Character", this command selects the region between the text cursor and the mouse. At other levels, it selects the region that *includes* both the current selection and the operand (relative to the current operand level) beneath the mouse cursor. Select-Region-Dot-To-Mark selects the implicit region between the top mark on the mark stack and the text cursor.

"-**Fullword**" commands select the entire word back to the first letter. Likewise, "-**Full-Line**" commands select the entire line from the first character in the line.

The command **Select-Word** selects the region from the text cursor to the end of the word surrounding the text cursor, while **Mouse-Select-Fullword** selects the full word beneath the mouse cursor. **Mouse-Extend-Selection-Fullword** extends the text selection to include the full word beneath the mouse cursor. **Select-Text-Stream** selects all the text in the view.

When the cursor is positioned on a left brace, bracket, or parenthesis, **Select-Expr** selects the region from that character to the matching right brace, bracket, or parenthesis .

Null-Select creates a selection with one blank at the cursor.

The commands **Select-Line** and **Select-Full-Line** consult the numeric prefix and select that number of lines. The commands **Next-Line-Select** and **Previous-Line-Select** also consult the numeric prefix and move that number of lines forward or backward before selecting one line.

The current selection can be cleared using **Deselect-Region**.

4.5 Entering Text

Self-Insert	most printable characters
Quote-Character	`^Q`
Newline-And-Indent	`LineFeed`
Insert-Newline	`Return`
Indent-Like-Previous-Line	`Esc Tab`
Center-Line	Not bound
Open-Line	`^O`
Split-Line	`Esc ^O`
Insert-Parentheses	`Esc (`
Insert-File	`^X Tab`
Insert-File	Text Edit⇒File: `Insert Text from...`

Typing a printable character generally causes that character to be inserted into the text at the position of the cursor. When printable characters are typed consecutively, the **Self-Insert** commands are merged into a single action for the purpose of **Undo** operations. **Quote-Insert** inserts the next ASCII character typed even if it is a control character.

Newline-And-Indent is bound to the "`LineFeed`" character; the next line will be indented to the level of the previous line by inserting tabs and blanks. **Center-Line** centers the current line between the beginning of the line and the value of the **Text-Line-Length**. **Indent-Like-Previous-Line** simply reindents the current line to the level of the previous line.

Open-Line inserts "`newline`" characters after the cursor; the number of "`newline`" characters inserted is determined by the value of the numeric prefix argument (default 1). **Split-Line** does the same thing, but also indents any text following the cursor to its original horizontal position.

The command **Insert-Parentheses** inserts a pair of matching parentheses at the cursor, and positions the cursor between them.

Insert-File prompts for a file name and copies the contents that file into the active view at the position of the text cursor.

4.6 Filling Text

Set-Text-Line-Length	^X f
Toggle-Text-Fill	^X ^A
Insert-Space-Fill	Space
Insert-Newline-Fill	Return
Fill-Selected-Lines	Not bound
Set-Text-Fill-Prefix	^X .
Text-Fill-To-Blank-Line	Esc q

To **fill** text means to move text from line to line so that all the lines are approximately the same length. *Pan* has a rudimentary mechanism for filling text lines as you type them. When the Text-Fill option is on, the flag "↩" appears in the information panel and the keys "Space" and "Return" are bound to special procedures. These procedures compare the current horizontal position of the cursor with the value of Text-Line-Length. If the line is too long, it will be broken where appropriate; if not, the procedures act like Self-Insert. Use Toggle-Text-Fill to turn on text filling and again to turn it back off. When filling is on, you can type text continuously without worrying about line length.

Use Set-Text-Line-Length (with a numeric prefix argument) to set the maximum line length used by auto-filling.

The commands Fill-Selected-Lines and Text-Fill-To-Blank-Line fill more than one line at a time. The first fills the selection; the second fills all lines from the cursor to the first blank line following the cursor .

Set-Text-Fill-Prefix sets the line prefix to the characters before the cursor on the line with the cursor. This prefix is then added to the beginning of each new line as it is started. This is useful for indenting an entire section of text or for prefixing each line with a fixed string of characters.

4.7 Deleting Text

Oplevel-Delete	^C ^D
Delete-Character	^D
Delete-Character	Delete *at level* "Character"
Delete-Previous-Character	Delete
Delete-Previous-Character	Backspace
Delete-Word	Delete *at level* "Word"
Delete-Fullword	Not bound
Delete-Previous-Word	Not bound
Delete-Line	Delete *at level* "Line"
Delete-Selected-Region	Not bound
Delete-Region-Dot-To-Mark	Not bound
Delete-Blank-Lines	^X ^O
Delete-Horizontal-Space	Esc \
Just-One-Space	Esc Space
Delete-Indentation	Esc ^

Deleted text can be recovered by issuing an "Undo" command immediately after the deletions, but in no other way. Deleted text is *not* retained in the kill ring. The standard bindings reflect this limitation by using "Kill" commands when removing large regions. *Pan* merges deletions that are contiguous in space and time into a single undo-able action.

Oplevel-Delete deletes one unit at the current operand level. Thus, if the operand level is "Character", Oplevel-Delete deletes one character. Delete-Character deletes the character under the cursor. Delete-Previous-Character deletes the character before the cursor. The pair of commands Delete-Word and Delete-Previous-Word delete from the cursor to the end (beginning) of the word enclosing the cursor, while Delete-Fullword deletes the entire word enclosing the cursor. The commands Delete-Selected-Region and Delete-Region-Dot-To-Mark operate on the selection and the implicit selection, respectively.

There are several ways to delete white space around the cursor. Delete-Blank-Lines deletes vertical and horizontal white space, leaving exactly one blank line at the cursor. Delete-Horizontal-Space deletes white space surrounding the cursor on the same line as the cursor; Just-One-Space does the same thing, but leaves exactly one space at the cursor. Delete-Indentation removes any leading white space on the line containing the cursor.

4.8 Killing Text

Kill-Word	`Esc d`
Kill-Previous-Word	`Esc Del`
Kill-To-Eol	`^K`
Kill-Expr	`Esc ^K`
Kill-Selected-Region	`^W`
Kill-Selected-Region	Text Edit: `Kill`
Kill-Region-Dot-To-Mark	Not bound
Copy-Selection-As-Kill	`Esc w`
Yank-From-Kill-Ring	`^Y`
Yank-From-Kill-Ring	Text Edit: `Yank`
Cycle-Yank	`Esc y`
Cycle-Kill	Not bound
Show-Kill	`^X ?`
Cycle-Show-Kill	`^X !`

Like the deletion commands of the previous section, commands that kill text remove the text from a view. Unlike deletion commands, however, these also copy the removed text into the kill ring.

The pair of commands Kill-Word and Kill-Previous-Word kill from the cursor to the end (beginning) of the word enclosing the cursor. The command Kill-Expr kills the text of the next word or of the balanced bracket expression following the text cursor. The commands Kill-Selected-Region and Kill-Region-Dot-To-Mark kill the current textual selection and the implicit selection, respectively. Kill-To-Eol kills all characters up to the end of the line.

Text in the kill ring can be recovered using the command Yank-From-Kill-Ring which copies the contents of the top item in the kill ring into the view at the current cursor position. If a prefix argument is present, then Yank-From-Kill-Ring will *replace* the current selection with the copied item.

Cycle-Yank cycles the kill ring (see Section 2.4) before yanking the top of the kill ring. Copy-Selection-As-Kill copies the current selection to the kill ring without removing it from the text stream.

The command Show-Kill displays the first item in the kill ring. The commands Cycle-Kill and Cycle-Show-Kill both cycle the kill ring; Cycle-Show-Kill also shows the new top item.

The maximum number of items stored in the kill ring is determined by the option Killring-Max-Size. If the option Kills-To-Clipboard is set then all kill commands use the global clipboard instead of the view-specific kill rings.

4.9 The Clipboard

Cut-To-Clipboard	Clipboard: `Cut`
Cut-To-Clipboard	`L10`
Copy-To-Clipboard	Clipboard: `Copy`
Copy-To-Clipboard	`L6`
Paste-From-Clipboard	Clipboard: `Paste`
Paste-From-Clipboard	`L8`
Replace-From-Clipboard	Not bound
Cycle-Clipboard	Not bound
Show-Clipboard	Clipboard: `Show Contents`
Show-Clipboard	`Esc ?`
Cycle-Paste	Not bound
Cycle-Show-Clipboard	Clipboard: `Cycle and Show`
Cycle-Show-Clipboard	`Esc !`

These commands manipulate the contents of the global clipboard shared by all views. Cut-To-Clipboard deletes the current textual selection and places it onto the clipboard. Copy-To-Clipboard places a copy of the current selection onto the clipboard. Paste-From-Clipboard inserts a copy of the top item of the clipboard at the text cursor. If a prefix argument is present, then Paste-From-Clipboard will *replace* the current selection with the top item of the clipboard. Finally, Replace-From-Clipboard replaces the selected region with the top item of the clipboard.

The command Show-Clipboard displays the first item of the clipboard in the help view. Cycle-Clipboard cycles the clipboard using the prefix argument to determine the number of entries to move, while Cycle-Show-Clipboard combines the two actions. Cycle-Paste-Clipboard cycles the clipboard and pastes the new top element into the text stream at the cursor.

The maximum number of items in the clipboard is determined by the option Clipboard-Max-Size.

4.10 Copying and Moving Text

Copy-Selection-To-Cursor	`Esc ^Y`

Copy-Selection-To-Cursor	`Text Edit: Copy To Cursor`
Move-Selection-To-Cursor	`Esc Return`
Move-Selection-To-Cursor	`Text Edit: Move To Cursor`

Text can copied or moved within a textual view by using either the clipboard or the local kill ring. However, the above commands are useful short cuts. Both use the current selection as the source to copy or move, and the text cursor to mark the destination. These commands operate only within a view; copying and moving between views requires the clipboard.

4.11 Changing Case

Capitalize-Word	`Esc c`
Lowercase-Word	`Esc l`
Uppercase-Word	`Esc u`
Capitalize-Selection	`Esc ^C`
Lowercase-Selection	`Esc ^L`
Uppercase-Selection	`Esc ^U`

These commands are use to change cases within a word or region. The word-oriented commands operate on the region from the cursor to the end of the word and leave the cursor at the end of the word when done. The selection-oriented commands leave the cursor at the beginning of the affected selection.

4.12 Transposing Text

Transpose-Characters	`^T`
Transpose-Characters-At-Cursor	Not bound
Transpose-Lines	`^X ^T`

Transpose-Characters exchanges the character at the cursor and the character before the cursor unless the cursor is at the end of a line, in which case it transposes the previous two characters. Transpose-Characters-At-Cursor the character at the cursor and the character before the cursor even if the cursor is at the end of a line. Transpose-Lines exchanges the line containing the cursor with the line before it.

4.13 Searching Text

Pan provides commands for searching for regular expressions and for matching balanced brackets.

Regular Expressions

Oplevel-Cursor-Search-Forward	L9
Oplevel-Cursor-Search-Forward	^C ^S
Re-Search-Forward	^S

Re-Search-Forward	Cursor-Search-Forward *at level* "Character"
Re-Search-Forward	Cursor-Search-Forward *at level* "Line"
Oplevel-Cursor-Search-Backward	`^C ^R`
Re-Search-Backward	`^R`
Re-Search-Backward	Cursor-Search-Backward *at level* "Character"
Re-Search-Backward	Cursor-Search-Backward *at level* "Line"
Oplevel-Query-Replace-All	`^C Esc ^R`
Query-Replace-All	`Esc ^R`
Query-Replace-All	Query-Replace-All *at level* "Character"
Query-Replace-All	Query-Replace-All *at level* "Line"
Oplevel-Replace-All	`^C Esc r`
Replace-All	`Esc r`
Replace-All	Replace-All *at level* "Character"
Replace-All	Replace-All *at level* "Line"

These commands prompt for an expression argument and then search for text matching the standard UNIX regular expressions. For a description of those expressions, see the ED(1) manual page of the UNIX Programmer's Manuals. *Pan* is unable to search for patterns which contain embedded "`newline`" characters. The most recently specified regular expression is shared by all views.

The "Oplevel-Cursor-Search" and "Oplevel-Replace" commands step through each unit at the given level and try to match the argument pattern to the given unit. This has more meaning when you are using the operand levels associated with a programming language (see Section 6.4). When you are using a program operand level, the pattern must match the entire operand unless a numeric prefix is present, in which case it may match a subset of the operand. The "Character" and "Word" levels allow the pattern match to span more than one operand. When text matching a pattern is found, the text cursor is moved to the first character in the match, and the matched text is selected.

Both Re-Search-Forward and Re-Search-Backward, the text level search commands, process the numeric prefix argument idiosyncratically: the *presence* of a prefix argument causes the command to search using the last regular expression specified. For instance, "`^U ^S`" invokes Re-Search-Forward using the most recent search pattern—and the command will match the *next* occurrence of the pattern. Alternatively, supplying an empty string as the regular expression causes the previously specified expression to be used.

When the option Autowrap-Search is true, searches wrap from one end of the view to the other; if that option is false, searches terminate when finding the beginning or end of the view.

The "Replace" commands search for a string and replace all instances of it with the specified replacement string. Oplevel-Query-Replace-All asks the user whether to replace, ignore, or cancel the search at each instance of the sample string.

The set of replacements made during a "Replace" command are grouped together as a single action for the purpose of "Undo" operations. However, the Sub-Undo command allows you to undo the individual replacements one at a time (see Section 3.7).

Balanced Bracket Commands

Backward-Expr	`Esc ^B`
Forward-Expr	`Esc ^F`
Select-Expr	`Esc ^@`
Kill-Expr	`Esc ^K`
Show-Match	`Esc %`

These commands use character set definitions to operate on balanced bracket expressions. The set match-characters contains all of the characters which are defined to have have matches. Both Forward-Expr and Backward-Expr move the cursor. The Select-Expr command selects the balanced bracket expression surrounding the cursor, and the command Kill-Expr kills it.

If the cursor character is in the set match-characters. Show-Match moves the cursor to the matching bracket. pauses for the value of the option Pause-Ticks internal ticks. and returns the cursor to its original position. If the option Auto-Show-Match is set then Show-Match is called every time a right bracket from the match-characters set is typed.

5 Using Graphical Views

Zoom-In	`i`
Zoom-In	"`in`" button in control panel
Zoom-In	Window: `Zoom In`
Zoom-Out	`o`
Zoom-Out	"`out`" button in control panel
Zoom-Out	Window: `Zoom Out`
Zoom-Reset	`a`
Zoom-Reset	"`all`" button in control panel
Zoom-Reset	Window: `Zoom All`
Global-Image-Toggle	`g`
Global-Image-Toggle	Window: `Toggle Global Image`
Global-Image-Enlarge	`e`
Global-Image-Enlarge	Window: `Enlarge Global Image`
Global-Image-Shrink	`s`
Global-Image-Shrink	Window: `Shrink Global Image`

A graphical view can be created to represent the internal tree representation of a program or other structure-based view. The textual label on the graph nodes vary depending on which command was used to generate the view. This view functions only as a display and can not be used to alter the contents of the textual view from which it was generated. Other graphical views are anticipated. but not yet implemented.

Currently, the graphical views can be navigated only by zooming in and out via the commands Zoom-In and Zoom-Out. which are bound to the in and out buttons on the control panel, and scrolling with the scroll bars on the window frame. The Zoom- commands scale the view up or down by a factor of Graph-Window-Zoom-Factor (whose default value is 0.1). The "Zoom-"

commands take a numeric prefix and effectively zoom in or out that many times to produce more drastic scale changes. Only the middle button of the mouse functions for scrolling in a graph view. The left and middle buttons of the mouse have no effect when the mouse is over the display area, but the right button still invokes a menu.

The global image shows the entire graph being viewed and marks the portion of the graph which is visible in the window. It appears in the upper left corner of the graph view window. It may be resized using Global-Image-Enlarge and Global-Image-Shrink and it may be toggled on and off using the command Global-Image-Toggle.

6 Language-Oriented Services

In addition to its more conventional text-based services, *Pan* provides facilities for viewing and modifying textual objects whose underlying structure can be described by formal languages , for example programs. These services require the loading of one or more *Pan* language descriptions, as discussed in sections 2.7 and 7.1. In no case, however, does the presence of a language description inhibit the operation of *Pan*'s text facilities; users need incur no loss of convenience to benefit from *Pan*'s more advanced features.

The basic interface provided by *Pan* for language-oriented editing is uniform across languages. It is also configured specially for each language and can be customized further for any particular language and for any style of interaction. Finding an appropriate balance between uniformity and specialization is encouraged by *Pan*'s configuration mechanisms, but by no means assured. This is a matter of user interface design on the part of the author of *Pan*'s language descriptions, and is the subject of ongoing research.

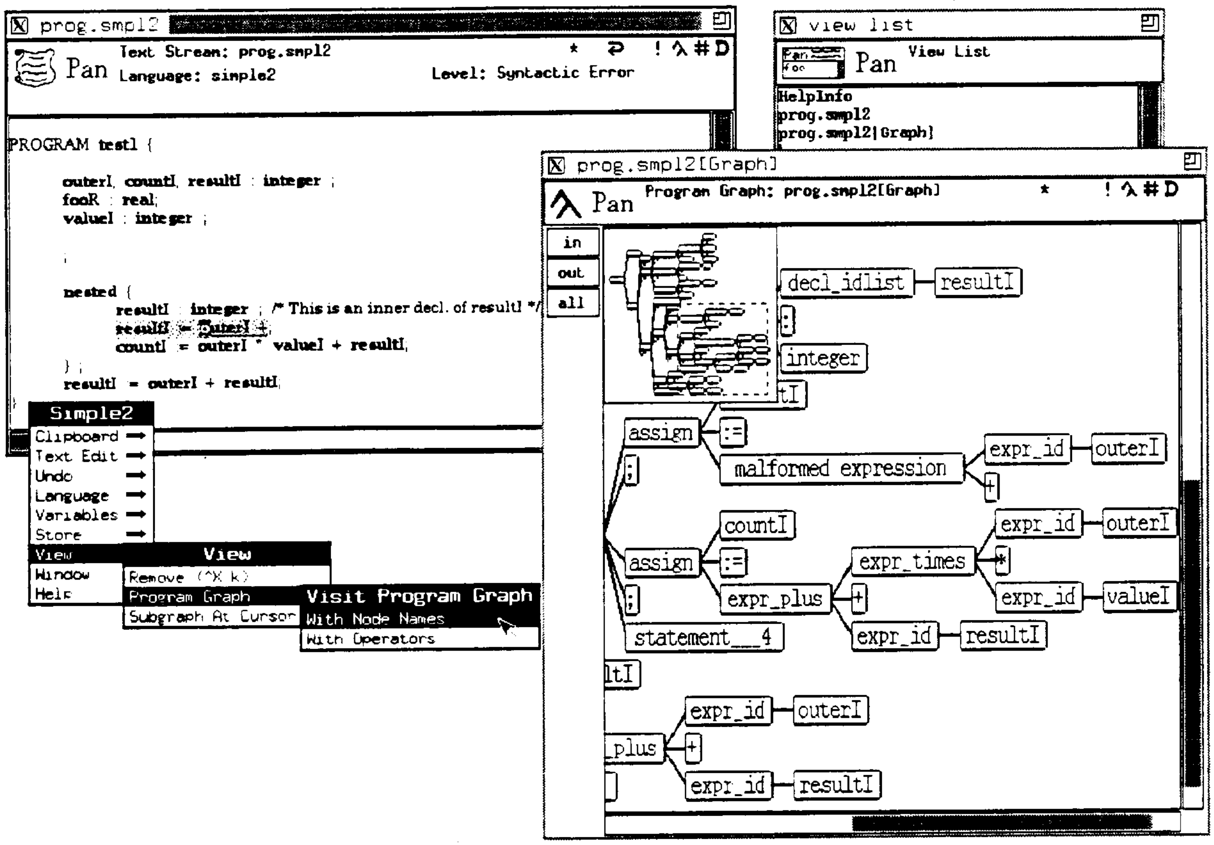
This section introduces *Pan*'s basic language-oriented editing features. Many of these are experimental, and more are under development. A more thorough discussion of these features appears elsewhere [8].

All interaction with a program takes place in the context of a view on that program, where both textual and graphical views are supported in the current implementation. It is intended, however, that ordinary programming take place in the context of a primary textual view, a view that operates very much like an ordinary text editor but with many extra language-based services available.

Pan's basic language-oriented services include a number of program views that will be of primary interest to system extenders and especially to authors of language descriptions, see Section 6.12. For example, different tree views can be created which contain subtrees of the entire structure or which display different information at the tree nodes. Views can also be created which display information about the lexical stream or the semantic database. These alternate views are usually updated every time the program is reanalyzed.

Ladle syntax descriptions have been written for Modula-2[9], Pascal, Ada, *Ladle*, *Colander*, and ASPLE[4]. ASPLE is a simple example language used for demonstrations and for learning *Pan*. Other language descriptions, including *C*, C^{++}, and FIDIL[6], are under development. A *Colander* semantic description has been written for Modula-2, as well as some small demonstration languages, including TINY and SIMPLE. SIMPLE2 is a second language description for the language SIMPLE which provides additional and somewhat different services to the user.

Figure 3 shows a *Pan* session involving two views on a SIMPLE2 program: one textual and one graphical.



```
PROGRAM testI {

    outerI, countI, resultI : integer ;
    fooR : real;
    valueI : integer ;

    ;

    nested {
        resultI : integer ; /* This is an inner decl. of resultI */
        resultI = outerI + ;
        countI = outerI * valueI + resultI;
    } ;
    resultI = outerI + resultI;
}
```

Figure 3: Two language-based views on a program

In contrast to earlier examples, the "Language:" field in the information panel now reads "SIMPLE2", revealing that the language description has been loaded and is being used for this view. The default menu has been augmented: new submenus **Language** and **Variables** appear and the **View** menu contains additional submenus **Program Graph** and **Subgraph At Cursor**. The **Variables** menu provides access to commands which allow you to query or rename a variable or to visit its definition, while the additional **View** menus provide quick access to the graphical language-based views. As with text views, many of these commands are also available from the keyboard.

6.1 Language-Based Textual Views

Most user interaction with programs takes place in the context of what appears at first glance to be an ordinary *Pan* textual view, for example the view whose window appears at the upper left of Figure 3 on page 35. In fact, all of the conventional text-based support provided by *Pan* continues to available at all times with no restrictions. The language-based information derived by *Pan*'s analyzers is kept behind the scenes. The information is used to support a variety of user services, but only when those services are requested. Whenever structural information is required for execution of a command. incremental syntactic analysis (parsing) updates the internal tree structure. Most of the time. this transformation is hidden from the user — it occurs automatically as operations like "delete the selected subtree" are invoked. Whenever possible, the language-based services provided by *Pan* are similar in form, name. and default key binding to analogous text operations.

The information panel in windows owned by language-based views differs slightly from those for purely text-based views. For example, the name of the language description being used appears in place of "Text" in the "Language:" field.

Two additional flags reveal the presence and status of derived information:

- The "^" (Parse-Is-Current?) flag is visible. but gray, when there are textual changes that have not yet been incorporated into the tree by the syntactic analyzer, that is when the tree is present but inconsistent with the text. The flag appears solid when text and structure are consistent.

- The "D" (Database-Updated?) flag is visible. but gray, when there are changes that have not yet been incorporated into the semantic database. This flag is absent entirely when there is no *Colander* component to the language description being used. The flag appears sold when the database is consistent with text and structural information.

Pan's default behavior at present for language errors (that is, for situations where a program violates part of the language's definition) is to show the user two categories of error, reflecting *Pan*'s underlying implementation. In the default configuration two additional flags reveal the presence of language errors:

- The "!" (Syntax-Errors-Present?) flag appears when there are lexical or syntactic errors in the program being edited.

- The "#" (Semantic-Errors-Present?) flag appears when there are semantic errors in the program being edited.

It is possible, however, to configure a language description so that the user only sees one category of error in place of the two. Section 6.8 discusses this topic in more detail.

6.2 Language-Based Analysis

Analyze-Changes	Language: Analyze
Analyze-Changes	^C a
Visit-And-Check-File	Not bound

Language-based analysis is the process of deriving information from text based on an underlying description of the structure of the language, a set of contextual constraints, and possibly other information.

The analysis method used is incremental—only the areas affected by the changes are reanalyzed. Analysis occurs whenever the derived information is out of date with respect to the text and when a language-oriented operation takes place, for example when the user invokes a tree-oriented navigation command. Analysis can also be invoked explicitly, with the command **Analyze-Changes**. This command is also used internally to invoke analysis if there have been any changes in the contents of the view. **Visit-And-Check-File** performs the same function as **Visit-File** but also analyzes the view's contents.

Syntactic analysis incorporates changes in a view's contents into the tree that represents a program. Syntactic analysis is a two-stage process. In the first stage, the text stream is broken into larger fragments called **lexemes**. Lexemes are the basic symbols in the language being edited, e.g., keywords, identifiers, constants, and comments.

When a view is lexically analyzed, various classes of lexemes are given different visual images using fonts. The following table defines the relationship between font codes and characters in lexemes. These codes permit the assignment of specific fonts (via the font map mechanism, see Section 7.5) to each category for each language[5].

Class	Example	Font
Unanalyzed characters	inserted text	0
Ignored by the lexical analyzer		1
Fixed-length lexemes	keywords	2
Recognized but not analyzed	comments	3
Variable-length lexemes	identifiers	4

Semantic analysis checks a program against a set of contextual constraints defined in the *Colander* component of the language description. These constraints may be based on the language definition, for example type checking, on the intended use, for example naming conventions, and many other restrictions as needed. At the same time, semantic analysis records facts about the program in the semantic database that are used to support various services.

6.3 Consistency and Inconsistency

Unlike syntax directed editors, which don't permit you make a mistake or restrict your options when you do, *Pan* allows the text to be modified without restriction at all times. When text has been changed since last analysis, the derived information is said to be **inconsistent**: it should be considered unreliable and may be incomplete. In this situation, the **Parse-Is-Current?** and **Database-Updated?** flags appear gray and newly entered unanalyzed text is displayed using the default font 0. Any text which has previously been analyzed and assigned a non-default font remains in that font until it is reanalyzed. Also any text which has been highlighted as a syntactic or semantic error remains highlighted until it is reanalyzed. When derived information becomes inconsistent, the structure cursor is cleared (see Section 6.5).

Pan's current implementation requires consistency for any structural operation. Therefore, reanalysis takes place whenever any structural information is needed. Work is underway to loosen this restriction.

Note that derived information may be consistent or inconsistent whether or not there are language errors (*Pan* separates the two), see Section 6.8.

[5]No single combination of font assignments seems to be best for all languages. Designing a font map is part of the user interface design work for the author of a *Pan* language description.

6.4 Operand Levels

Set-Oplevel-To-Lexeme	^C x
Set-Oplevel-To-Syntactic-Error	^C !
Set-Oplevel-To-Semantic-Error	^C #
Set-Oplevel-To-Query	^C q
Set-Oplevel-To-Node	Not bound
Oplevel-Menu	^C Mouse-Right

Unlike simple textual views in which only the three textual operand levels are available, the list of operand levels available in a language-based text view is part of *Pan*'s configuration for the particular language, defined by **Operand-Level-Choices**. This list defines what components of a program (more accurately, of *Pan*'s representation of a program) that the user "sees" and can manipulate.

Some of the operand levels are standard across all languages, for example the three textual levels and the lexical level. Some levels have the same or similar names as analogous levels in other languages (e.g. statement, expression), but their internal definitions differ according to the underlying language description.

These are the operand levels for the example language, SIMPLE2: "**Lexeme**", "**Expression**", "**Statement**", "**Declaration**", "**Placeholder**", "**Syntactic Error**", "**Unsatisfied Constraint**", and "**Query**". Figure 4 on page 39 shows the set of operand levels defined for SIMPLE2.

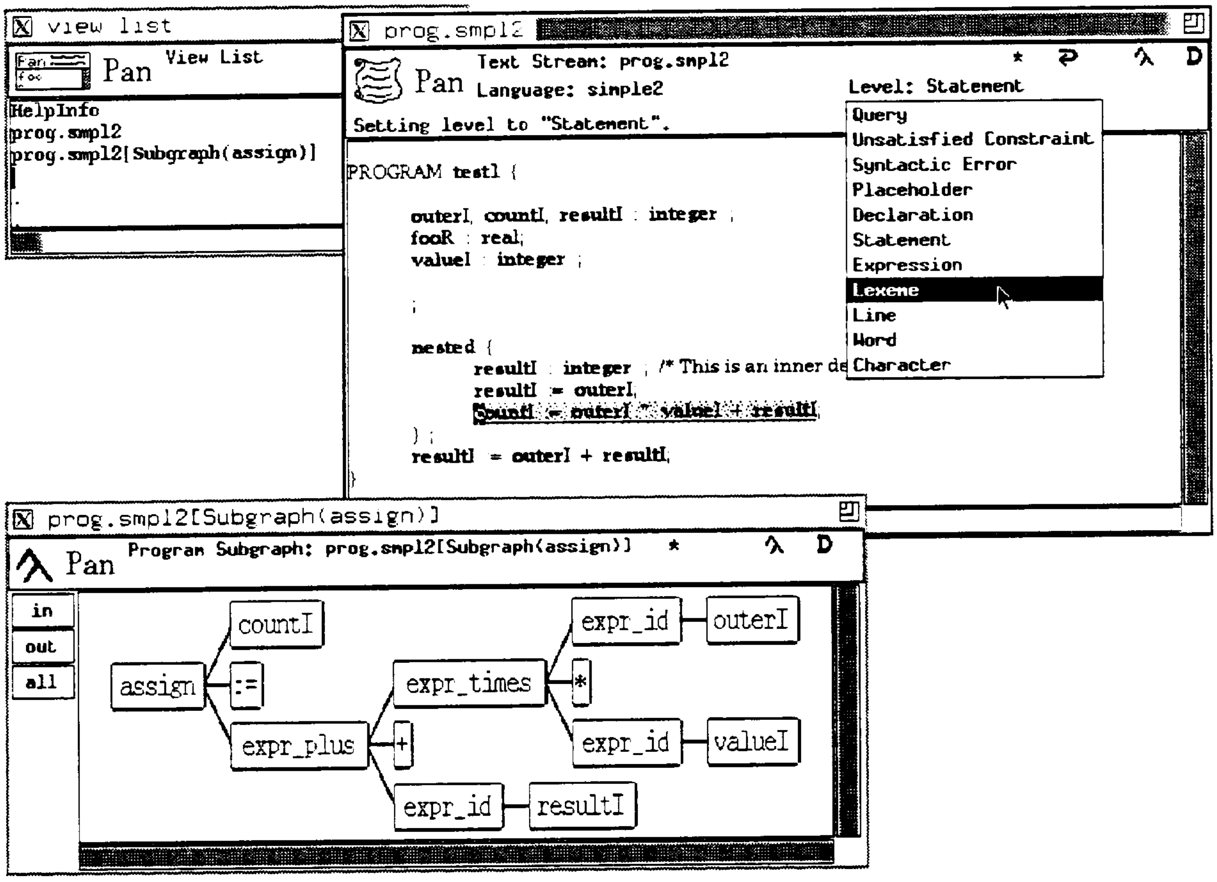
All of the previously defined **Oplevel** commands may have bindings at these levels. Thus cursor motion, selection, deletion, and searches may all be effected relative to the structure of the program. The operand levels for a language are related to nodes in the *Ladle* description of the language. They must be specified in the language-mode file which is loaded in and executed when a view in that language is edited. (See **Auto-Load** and **Auto-Exec** in Section 7.1) To see the available operand levels for a language, simply inspect the panel "Level:" menu. There are also key bindings designed to permit level selection from the keyboard: standard bindings for the standard levels, language-specific ones for the language-specific levels.

There are menus available for each level, executable by the command **Oplevel-Menu**, which make available many of the same generic commands that have key bindings. In some cases, the level-specific menus may be extended in ways specific to each language.

The command **Set-Oplevel-To-Node** is used for debugging. It sets the operand level to all nodes of the internal tree, whereas most operand levels define useful subsets of the internal tree. Note however that this command, like all **Set-Oplevel-** commands, works only if the specified level is permitted in the view, as controlled by option **Operand-Level-Choices**.

6.5 The Structure Cursor

Clear-Structure-Cursor	Esc ^D
Cursor-To-Token	Not bound
Announce-Structure-Cursor-Info	^C ^X =
Announce-Structure-Cursor-Node-Rule	Not bound



HelpInfo
prog.smpl2
prog.smpl2[Subgraph(assign)]

Text Stream: prog.smpl2
Language: simple2
Level: Statement
Setting level to "Statement".

```
PROGRAM testI {

    outerI, countI, resultI : integer ;
    fooR : real;
    valueI : integer ;

    ;

    nested {
        resultI : integer ; /* This is an inner de
        resultI := outerI;
        countI := outerI * valueI + resultI;
    } ;
    resultI := outerI + resultI;
}
```

prog.smpl2[Subgraph(assign)]
Program Subgraph: prog.smpl2[Subgraph(assign)]

Figure 4: The operand levels for SIMPLE2

The **structure cursor** is a reference to one component in the internal tree representation of a structured object: it is shared by all views on a program. At any point the structure cursor may or may not be present. Currently, the structure cursor is only usable when the derived information is consistent with the text. When an operand level command is invoked and the operand level corresponds to a program structure type (such as "Lexeme" or "Expression"), the structure cursor is set to the current node at that operand level. Commands which operate on a structure node, such as "Visit-Program-Subgraph-" commands, take the structure cursor's node as their argument.

Whenever the structure cursor is set, the textual selection will also be set to the region of text which corresponds to the structure cursor and the text cursor in the active window will be moved to the beginning of that region.[6] If the option Highlight-Structure-Cursor is set, then the region of text in the program which corresponds to the structure cursor will be visible as a light blue highlighted region. The highlight color for the structure cursor may be set to any color by setting the option Text-Window-Bg-Colormap in the appropriate view (see Section 7.5). The text cursor

[6]Setting or clearing the text selection explicitly clears the structure cursor as a side effect.

may be moved away from the structure cursor without clearing it, but any alterations to the text stream render the derived information inconsistent and clear the structure cursor.

In some cases at certain operand levels (this is configurable), an announcement may accompany positioning the structural navigation at a node, for example error diagnostics (see Section 6.8)

Clear-Structure-Cursor clears the structure cursor without clearing the textual selection. Cursor-To-Token sets the cursor to be the token which contains the text cursor regardless of the current operand level. Announce-Structure-Cursor-Info displays information about the node at the structure cursor in the information panel. Announce-Structure-Cursor-Node-Rule displays information in the information panel about the reduction rule in the language for the node at the structure cursor (generally used for debugging).

6.6 Setting The Structure Cursor

Oplevel-Cursor-To-Mouse	`^C Mouse-Left`
Oplevel-Mouse-Extend	`^C Mouse-Middle`
Oplevel-Select	`^C Backspace`
Mouse-Select-Lexeme	Cursor-To-Mouse *at level* "Lexeme"
Mouse-Select-Oplevel-Node	Cursor-To-Mouse *at level* "Any Structure Level"
Mouse-Extend-Lexeme	Mouse-Extend *at level* "Lexeme"
Mouse-Extend-Oplevel-Node	Mouse-Extend *at level* "Any Structure Level"
Select-Lexeme	Select *at level* "Lexeme"
Select-Oplevel-Node	Select *at level* "Any Structure Level"

Selection during language-oriented editing relies on the notion of operand levels (section 2.6). In a language-oriented view, the set of operand levels is much richer than in the text world. The operand levels for text editing are included, as well as levels corresponding to basic abstractions in the language being edited (see Section 6.4).

As with text, the command Oplevel-Cursor-To-Mouse, bound to `^C Mouse-Left`, selects the operand beneath the mouse cursor. The structure node which will be designated by the structure cursor and the region of text actually chosen are determined by the operand level. Thus if the mouse cursor is over the character "*" in Figure 4 on page 39 when the left button is clicked, the selected object might be the underlying lexeme "`*`", expression "`outerI * valueI`", or statement "`countI := outerI * valueI + resultI`" depending on whether the operand level is "Lexeme", "Expression", or "Statement" respectively.

What happens if the object beneath the mouse cursor is not an element of the class of objects specified by the current operand level? Then *Pan* uses a heuristic to find an object close to the mouse cursor that is an element of that class. This behavior is fairly predictable, although in some cases it leads to unforeseen selections.

To select arbitrary portions of a structure, use the "Character" level commands and operate on the textual representation.

6.7 Structural Navigation

Oplevel-Cursor-Forward	`^C ^F`

Oplevel-Cursor-Forward	`Right-Arrow`
Oplevel-Cursor-Backward	`^C ^B`
Oplevel-Cursor-Backward	`Left-Arrow`
Oplevel-Cursor-To-First	`^C Esc <`
Oplevel-Cursor-To-Last	`^C Esc >`
Oplevel-Cursor-To-Mouse	`^C Mouse-Left`
Oplevel-Cursor-In	`^C ^I`
In-Oplevel-Node	Cursor-In *at level* "Any Structure Level"
Oplevel-Cursor-Out	`^C ^O`
Out-Oplevel-Node	Cursor-Out *at level* "Any Structure Level"
Oplevel-Menu	`^C Mouse-Right`
Next-Lexeme	Cursor-Forward *at level* "Lexeme"
Next-Oplevel-Node	Cursor-Forward *at level* "Node"
Prev-Lexeme	Cursor-Backward *at level* "Lexeme"
Prev-Oplevel-Node	Cursor-Backward *at level* "Node"
First-Lexeme	Cursor-To-First *at level* "Lexeme"
First-Oplevel-Node	Cursor-To-First *at level* "Node"
Last-Lexeme	Cursor-To-Last *at level* "Lexeme"
Last-Oplevel-Node	Cursor-To-Last *at level* "Node"

Structural navigation of a program allows you to move the structure cursor from one node of a given type to another where type is defined in the language description by operand levels. Simple navigation involves the "Oplevel-" operations Oplevel-Cursor-Forward and Oplevel-Cursor-Backward. They perform preorder and reverse-preorder tree walking operations relative to the current operand level. For example, if the operand level setting is "Expression", the command Oplevel-Cursor-Forward moves the structure cursor to the "next" expression node. Oplevel-In and Oplevel-Out move the structure cursor to the nearest enclosed or enclosing node, again relative to the current operand level. Oplevel-Cursor-To-First and Oplevel-Cursor-To-Last move the structure cursor to the "first" and "last" instances of the current operand level respectively. Oplevel-Cursor-To-Mouse moves the structure cursor to the instance of the operand level which is closest to the position of the mouse.

All of the operand level navigation commands are available from the operand level menu as well. This menu can be invoked by the command Oplevel-Menu which is normally bound to the key sequence "`^C Mouse-Right`".

6.8 Language Errors

The operand levels "Syntax Error" and "Unsatisfied Constraint" are preset by default in most language descriptions and are of special significance: they are used to locate errors in a structured document and to move the structure cursor from one error node to another. The standard set of "Oplevel-" commands are bound at the "Syntax Error" and "Unsatisfied Constraint" levels to allow quick and easy navigation between errors. The presence of errors in a program in no way interferes with normal text editing. In *Pan*, the identification and diagnoses of language errors is just another kind of derived information; as much service as possible will be supplied in their presence.

Some language descriptions may combine these two types of language errors into a single operand level or may split different types of syntax errors or different unsatisfied constraints into separate levels. The two operand levels and their corresponding flags described here are used in most of the existing language descriptions.

After lexical analysis, provided that there are no lexical errors, the syntactic analyzer updates the internal structured representation.

The syntactic analyzer checks the structure (or syntax) of the program against the *Ladle* description of the language. If the syntactic analyzer encounters syntactic errors, the number of errors discovered during the analysis is displayed on the annunciator line, and the Syntax-Errors-Present? flag is set. This flag appears as a "!" on the information panel. When the syntactic analyzer detects an error, the subtrees involved in the error are gathered into an "error subtree". Selecting the subtree rooted at an error node causes the error message from the syntactic analyzer to be displayed on the annunciator line. If the option Highlight-Syntax-Errors is set then the text associated with the syntax error node will be displayed in red ink. Text colors may be changed by setting the option Text-Window-Fg-Colormap (see Section 7.5).

The options that control highlighting and color text rendering for languages are described in Figure 5.

Option	Configured By	Default
Highlight-Syntax-Errors	Ink (foreground color) 1	Red
Highlight-Query-Results	Ink (foreground color) 2	Blue
Highlight-Semantic-Errors	Shading (background color) 1	Pale Red
Highlight-Structure-Cursor	Shading (background color) 2	Pale Blue

Figure 5: The options that control structural highlighting

Figure 3 on page 35 shows the display of a syntax error as well as a graphical view displaying the internal tree structure for the error.

The semantic analyzer checks that the program satisfies a set of contextual constraints. for example type restrictions (based on the underlying language definition) and naming conventions (based on intended usage). If the semantic analyzer detects any semantic errors, the number of errors discovered during the analysis is displayed on the annunciator line, and the Semantic-Errors-Present? flag is set. This flag appears as a "#" on the information panel. The semantic errors or unsatisfied constraints are represented as annotations on the internal tree. If the option Highlight-Semantic-Errors is set then the text associated with the semantic error node will be highlighted in red ink. The highlight colors may be set to any set of colors by setting the option Text-Window-Bg-Colormap in the appropriate view (see Section 7.5).

6.9 Editing

Editing structured views is quite simple in *Pan*. Actual editing is implemented by text operations, but navigation and selection may be optionally driven by language-based information.

All insertions use the text-level commands used for text editing[7]. Deletions are accomplished using either text-level commands, or using the **Oplevel-Delete** command. **Oplevel-Delete** will delete the region of text under the structure cursor at the current operand level. Other editing, using the clipboard and the kill ring, function the same as for text editing.

Undoing edit actions restores the text without restoring the structured representation. Thus undoing currently requires reanalysis.

6.10 Searching in Programs

Lexeme-Search-Forward	Cursor-Search-Forward *at level* "Lexeme"
Replace-Lexemes	Replace-All *at level* "Lexeme"
Query-Replace-Lexemes	Query-Replace-All *at level* "Lexeme"

In addition to ordinary textual search, which is always available along with all textual services, regular expression searching may be applied to structural components and particular operand levels. At the moment this is only implemented at the lexical level.

The search commands apply the match pattern to each lexeme except for comments (which are not regarded as lexemes). If a prefix argument is not present then the entire lexeme must match the pattern. Otherwise, the pattern may match a subset of the lexeme. If the option Case-Sensitive-Lexeme-Search is set then the match must be case sensitive.

6.11 Queries

The effect of a query is to mark a set of nodes in the internal tree which have some specified property. For example, in SIMPLE2 a variable may be queried. When a variable has been queried. the text associated with the tree nodes representing the declaration and all of the uses of that variable is displayed in blue. (Text colors may be changed by setting the option **Text-Window-Fg-Colormap**.See Section 7.5) You may then set the operand level to "**Query**" and navigate among these uses of the variable with the normal operand level commands.

The current prototype implementation of queries insists that object protection be turned on while displaying a query result. This means that you must manually clear a query (by toggling the object protection) before you make further modifications. Work is underway to remove this restriction.

6.12 Debugging Features

These features of *Pan* are not generally useful for programming in *Pan*, but are very useful to designers of *Pan* language descriptions.

[7]The language description SIMPLE2 includes the a rudimentary prototype for the template-expansion style of syntax directed editing. These operations are also implemented textually, but the fact is somewhat hidden from the user since a newly expanded template is always immediately incrementally analyzed, and thereby promoted into structure

Graphical Views

Visit-Program-Graph-View	View⇒Program Graph: With Node Names
Visit-Program-Subgraph-View	View⇒Subgraph At Cursor: With Node Names
Visit-Program-Graph-Operator-View	View⇒Program Graph: With Operators
Visit-Program-Subgraph-Operator-View	View⇒Subgraph At Cursor: With Operators
Visit-Program-Graph-Address-View	Not bound
Visit-Program-Subgraph-Address-View	Not bound
Visit-Program-Graph-Context-View	Not bound
Visit-Program-Subgraph-Context-View	Not bound
Visit-Program-Graph-Parse-Change-View	Not bound
Visit-Program-Subgraph-Parse-Change-View	Not bound
Visit-Program-Graph-Parse-Status-View	Not bound
Visit-Program-Subgraph-Parse-Status-View	Not bound

The Visit-Program-Graph- commands all bring up a graphical representation of the internal tree representation for the program. The Visit-Program-Subgraph- commands generate a representation for the subgraph of the internal subtree which is rooted at the currently selected node of the graph. The tree is laid out horizontally, with the root at the left and at every node the first child above the second child which is above the third child, etc.

A graphical view is redrawn after every reanalysis of the structure. Subgraph views are removed if a reanalysis ever causes the associated node to be deleted.

The views created by the different variations of these commands are graphically similar: they differ in the way that a textual label is created for each node. In the simplest version, Visit-Program-Graph-View, each node is simply named, but other versions add extra information useful for various kinds of debugging.

The colors and line thicknesses of the graph are configurable options.

Other Language-Oriented Views

Visit-Database-View	Not bound
Visit-Node-Semantics-View	Not bound
Visit-Lexeme-Internal-Data-View	Not bound
Visit-Worklist-View	Not bound
Visit-Tree-Internal-Data-View	Not bound
Visit-Subtree-Internal-Data-View	Not bound

These textual views are primarily useful for debugging *Ladle* and *Colander* language descriptions. They are *not* maintained incrementally during text editing. Instead, the first textual modification after analysis causes the view to be marked dirty. As long as the information in the view is inconsistent with the text of the program, it will be displayed in gray. It is then redrawn the next time there is an analysis to reflect the new information.

These views display the internal data representation for the structure of a program. Visit-Lexeme-Internal-Data-View creates a view which displays a description of the lexical stream internal representation. Visit-Tree-Internal-Data-View and Visit-Subtree-Internal-Data-View both create a view which continually displays a textual description of the internal tree representation.

These views display information derived from the semantic analyzer. Visit-Database-View creates a view which contains the contents of the semantic database. Visit-Node-Semantics-View creates a view which continually displays the contents of the semantic database for the tree node of the tree cursor at the time the command is executed. Visit-Worklist-View creates a view which displays the semantic worklist (currently unsatisfied constraints).

Exploring the Tree Structure

Tree-Up	Not bound
Tree-Down	unbound
Tree-Left	Not bound
Tree-Right	Not bound

This set of navigation commands for textual language-based views is used for debugging. It includes Tree-Up, Tree-Down, Tree-Left, and Tree-Right. These are the usual tree-oriented commands. They function in the text view of the program. From the current node, Tree-Up moves the structure cursor to the parent, Tree-Down moves it to the leftmost child of the current node, Tree-Left and Tree-Right move the structure cursor to the appropriate sibling in the tree. These commands can be used to explore the actual tree structure, as opposed to the tree structure imposed by the operand hierarchy mechanism[8].

7 Simple Customization

Pan can be customized by altering option values and bindings, extended by defining new options, flags, and commands or by introducing new code at hooks or notifiers, and broadened by defining new, formal languages by using the language definition language *Ladle* and the semantic definition language *Colander*. This section provides a brief introduction to the facilities for tailoring and extending the system.

7.1 Start-Up Processing

Load-File	^X ^L
Load-From-Text-Stream	Esc ^X
Load-From-Selection	Esc ^S

At start-up, a run-command file named ".panrc" is loaded automatically into *Pan*. The ".panrc" file should be a file of COMMON LISP and *Pan* commands located either in your working or your home directory.

[8]One could make the same kind of navigation possible by adding the oplevel "Node" to those available on a view and then using the Oplevel-Cursor-Forward, Oplevel-Cursor-Backward, Oplevel-Cursor-In, and Oplevel-Cursor-Out commands.

Pan loads the "`.panrc`" file using the command Load-File. All commands that load files use the search path specified by the option Editor-File-Search-List. The default value of the option Editor-File-Search-List is set to

```
("." "~" "/usr/local/lib/pan/")
```

Pan can be instructed to automatically load files other than "`.panrc`". One way is to include Load-File directives in the "`.panrc`" file. Such files will be loaded once at start-up. This method can be used to ensure that a certain selection of libraries will always be loaded. A second way is to use the Auto-Load command described in the next section.

`(Load-File` "*filename*")

While running *Pan* you can explicitly load commands from any file with the Load-File command which prompts for a file name or from any view in *Pan* with the Load-From-Text-Stream or Load-From-Selection commands.

Language-Based Configuration

Display-Language-List	Help⇒Pan: `Language Descriptions Loaded`
Auto-Load *file-name regular-expression*	
Auto-Exec *function-name regular-expression*	
Display-Auto-Load	Help⇒Pan: `Filename Auto-Load Map`
Display-Auto-Exec	Help⇒Pan: `Filename Auto-Exec Map`

The basic textual views on programs all use the standard **text-edit-view-style**, so language-specific configuration must be done at the view-instance level (the `:view` scope). Typically, this is achieved by using the Auto-Exec mechanism. When a file in a given language is opened for editing, an auto-exec function, named <*language*>-mode by default, is executed. These functions and all supporting code are in modules named "`<`*language*`>-mode.cl`" by default. Loading one of these modules loads all aspects of the language description needed: *Ladle* description, *Colander* description, editing interface configuration and support. *The Pan Engineering Manual*[5] contains more information about configuration and language-based information in particular.

These modules may be preloaded in a dumped *Pan*, or they will be auto-loaded when needed. To see a list of all of the languages for which a *Ladle* syntactic description or a *Colander* semantic description have been loaded, use the command Display-Language-List.

The commands Display-Auto-Load and Display-Auto-Exec display the list of Auto-Load and Auto-Exec commands which have been defined. The Auto-Load command instructs *Pan* to ensure that a file has been loaded whenever a file whose name matches a given UNIX file expression is created. If the Auto-Load is set up properly, then the language mode for a file should be loaded when a view is created for the file. The file is loaded at most once as a result of Auto-Load.

For instance, `(Auto-Load "c-mode" "*.[hc]")` tells the system to load the file "`c-mode`" the first time that a file whose name matches "`*.[hc]`" is edited. The file "`c-mode`" can be either lisp code or compiled lisp code; if both "`c-mode.cl`" and a "`c-mode.fasl`" are found in the same directory, the most recently modified version is chosen.

Similar to Auto-Load, the command Auto-Exec instructs *Pan* to execute a given *function* whenever a view having a name that matches a given pattern is created. Taken together, Auto-Load and Auto-Exec can be used to create minor modes.

A **minor mode** is a collection of commands and bindings useful while editing views of a given type. For instance these commands can be used to create a minor mode for TEX input:

```
(Auto-Load "tex-mode" "*.tex")
(Auto-Exec 'tex-mode "*.tex")
```

The parameterless function tex-mode is defined in the library file "tex-mode.cl" to set up a specialized collection of bindings. The file "tex-mode.cl" also defines a number of commands useful for manipulating TEXnical text.

7.2 Using Scopes

With-View-Style-Scope *view-style (commands)*

With-View-Scope *view (commands)*
With-Buffer-Scope *buffer (commands)*

To set options or create bindings within a given scope (other than :global), the scope must be specified before the command to set the option or create the binding is executed. The default scope for most bindings is :global.

Most commonly, the :view-style scope is used for setting non-global defaults. For example. to set up the normal key binding for "f" in the directory editor view-style, dired-view-style, you could use this lisp code:

```
(With-View-Style-Scope (view-style dired-view-style)
   (Bind-Key 'Dired-Visit "f" :view-style))
```

The other two "-Scope" macros are not often used. Usually, if you want to make a change within a view, you would make the change from within that view or from within an Auto-Exec function, and then you don't need to mention the scope explicitly.

7.3 Packaging

Pan's implementation uses the COMMON LISP package system, so every symbol (in particular every command, function, option, etc.) is defined in some package; almost nothing is defined in the default user package.

For convenience, all of *Pan*'s commands, functions, options, etc. are imported automatically into the default user package. This means that configuration files (e.g. ".panrc"), which typically are left in the user package, need not contain package qualifiers for these names (the qualifiers are optional).

The help system by default does not display the package qualifiers for these names; option Package-Symbol-Names requests that the qualifiers be displayed.

7.4 Creating Bindings

Pan provides several configuration mechanisms in the form of bindings. Keystrokes, menu items, and generic commands may all be bound to *Pan* commands. All bindings are scoped, with local bindings taking precedence over global bindings. This section describes how to find out what your current bindings are and how to set up new default bindings with your "`.panrc`" file.

When you **shadow** a binding for an object in a given scope, it effectively removes any binding for that object inherited from an enclosing scope if any such binding exists.

It is possible to invoke a command without binding it by using the commands Execute-Lisp-Line or Execute-Command (Section 7.8 provides more details.).

Creating Key Bindings

Display-All-Key-Bindings	Help⇒This View⇒Keys: `Display All`
Bind-Key *command key-sequence [scope]*	

Key bindings associate keystroke sequences with commands. The command Display-All-Key-Bindings prints the key bindings for the current view into the help view. Key bindings are established or altered using the command Bind-Key. The default scope of the change is `:global`; specifying `:view` or `:view-style` within the proper scope makes the change in the local environment. The syntax for Bind-Key is

(`Bind-Key` *'function "key sequence" [scope]*)

where *'function* is a quoted function name, *"key sequence"* is a COMMON LISP string specifying a keystroke sequence, and *scope* is either `:view`, `:view-style`, or `:global`. The default value for *scope* is `:global`.

Pan allows you to bind any key sequence to any command. This includes special keys, function keys, mouse buttons, and keys modified by shift or control. Figure 6 shows some of the special keyboard keys (and pseudo-keys, which is how mouse button events are handled in *Pan*) that are known to *Pan* along with their names and default bindings. Most of the names for special keys are derived from and correspond to X11 "keysyms." Not all of the keys are generated by every keyboard. The default bindings of the "`L`" function keys are inspired by their labeling on Sun keyboards.

When specifying a keystroke sequence, control characters such as "`Control ?`" are denoted by the two-character sequence "`^?`"; the "`Escape`" prefix is denoted by "`Esc`". For example,

```
(Bind-Key 'Delete-Character "^D" :global)
```

establishes the default binding for Delete-Character.

Key	Key Name	Binding
" "	Space	Insert-Space-Fill
"^I"	Tab	Self-Insert
"^J"	Newline	Newline-And-Indent
"^M"	Return	Insert-Newline-Fill
"^H"	Backspace	Delete-Previous-Character
"Escape"	Esc	Not bound
"●○○"	Mouse-Left	Cursor-To-Mouse
"○●○"	Mouse-Middle	Select-Region-Dot-To-Mouse
"○○●"	Mouse-Right	Execute-Menu
"^●○○"	Control-Mouse-Left	Oplevel-Cursor-To-Mouse
"Shift-●○○"	Shift-Mouse-Left	Oplevel-Cursor-To-Mouse
"^○○●"	Control-Mouse-Right	Oplevel-Menu
"Shift-○○●"	Shift-Mouse-Right	Oplevel-Menu
"←"	Left-Arrow	Oplevel-Cursor-Backward
"→"	Right-Arrow	Oplevel-Cursor-Forward
"↑"	Up-Arrow	Oplevel-Out
"↓"	Down-Arrow	Oplevel-In
"Begin"	Begin	Oplevel-Cursor-To-First
"End"	End	Oplevel-Cursor-To-Last
"Prior"	Prior	Oplevel-Cursor-Backward
"Next"	Next	Oplevel-Cursor-Forward
"Find"	Find	Oplevel-Cursor-Search-Forward
"L1"-"L3"	L1-L3	Not bound
"L4"	L4	Undo
"L5"	L5	Not bound
"L6"	L6	Copy-To-Clipboard
"L7"	L7	Not bound
"L8"	L8	Paste-From-Clipboard
"L9"	L9	Oplevel-Cursor-Search-Forward
"L10"	L10	Cut-To-Clipboard
"F1"-"F10"	F1-F10	Not bound
"R1"-"R15"	R1-R15	Not bound
"Home"	Home	Visit-View-List
"Help"	Help	Visit-Help-View
"Insert"	Insert	Not bound
"Menu"	Menu	Not bound
"Cancel"	Cancel	Not bound
"Break"	Break	Not bound

Figure 6: Bindings and names for special keys

Creating Menu Bindings

Display-Default-Menu Help⇒This View: `Default Menu`
Bind-Menu *menu-name bindings*
Rebind-Menu *menu-name old-label new-item [new-label]*
Create-Menu *menu-being-added title bindings*
Copy-Menu *old-name new-name [new-title]*

A menu binding associates a menu item with a command or another menu.[9] The command Display-Default-Menu prints the menu bindings for the current view in the help view. Menu bindings are created via the macros Bind-Menu, Copy-Menu, Create-Menu, and Rebind-Menu. All menus are global. Any change to a menu affects the global description of that menu. To establish a binding for a menu item in an existing menu, use

(`Bind-Menu` *menu-name bindings*)

where *bindings* is a list of menu items of the form

(*item ["Selection Name"] [position]*)

The *item* being bound to the menu may be either a command or another menu. The *"Selection Name"* must be a COMMON LISP string. If *"Selection Name"* is omitted, the name of the command or menu is used. The optional argument *position* is an integer - the position in the menu at which to insert the item. The first item in the menu has position 1. For example,

```
(Bind-Menu help-view-style-menu
   (Document-Symbol "Describe" 1))
```

sets up the default binding for Document-Symbol as the first item in the Help menu and

```
(Bind-Menu text-edit-view-style-menu
   (global-help-menu "Help"))
```

sets up the default binding for the Help sub-menu in the Text menu.

The macro Create-Menu creates a new menu with the given name, title, and bindings. The format for Create-Menu is:

(`Create-Menu` *menu-name menu-title bindings*)

For example, the default global Help menu is created by the following COMMON LISP code:

[9] A menu item may also be a lisp form.

```
(Create-Menu global-help-menu "Help"
   (this-view-help-menu "This View")
   (help:Apropos-String "Apropos")
   editor-help-menu)
```

Rebind-Menu allows you to change an existing menu item. Its format is:

(Rebind-Menu *menu-name old-label new [new-label]*)

For example. you could change the menu item This View: Options to print the option documentation with the command Display-Option-Documentation by the following code:

```
(Rebind-Menu this-view-help-menu
   "Options" Display-Option-Documentation "Option Docs.")
```

Creating Operand Level Bindings

Display-Operand-Level-Bindings	Help⇒This View⇒Operand Cmds.: By Level
Display-Operand-Command-Bindings	Help⇒This View⇒Operand Cmds.: By Command
Display-Operand-Level-Menus	Help⇒This View: Operand Menus
Display-Operand-Level-Documentation	Not bound
Display-Operand-Command-Documentation	Not bound
Oplevel-Menu	^C Mouse-Right
Execute-Oplevel-Menu	Menu *at level* "Most Operand Levels"

Bind-Oplevel-Command-List *operand-command-command-pair-list level [scope]*
Bind-Oplevel-Menu *level menu-name [scope]*

Operand level command bindings associate an operand level and a generic command with a *Pan* command. Operand level menu bindings associate an operand level with a menu. The commands Display-Operand-Level-Bindings, Display-Operand-Command-Bindings, and Display-Operand-Level-Menus print into the help view the appropriate bindings in the current view. Display-Operand-Level-Documentation and Display-Operand-Command-Documentation display documentation about the operand levels and generic "Oplevel-" commands respectively.

Bind-Oplevel-Command-List allows you to create a set of operand level command bindings at a given operand level. Its format is:

```
(Bind-Oplevel-Command-List
   ((operand-command1 command1)
    (operand-command2 command2)
         .
         .
    (operand-commandN commandN))
   level [scope])
```

For example, the standard cursor-motion bindings for the operand level "Word" are established by the following code:

```
(Bind-Oplevel-Command-List
   ((Oplevel-Cursor-Forward text:Next-Word)
    (Oplevel-Cursor-Backward text:Previous-Word)
    (Oplevel-Cursor-To-First text:Move-To-First-Word)
    (Oplevel-Cursor-To-Last text:Move-To-Last-Word)
    (Oplevel-Cursor-To-Mouse text:Mouse-Select-Fullword))
   word-level)
```

The operand level menu contains, by default, all of the commands which are bound at that level. Operand level menus may be created and altered in exactly the same fashion as other menus. The function Bind-Oplevel-Menu binds a menu to an operand level. Its format is:

```
(Bind-Oplevel-Menu level menu-name [scope])
```

For example, this code binds the standard **word-oplevel-menu** to the operand level "Word" in the global scope:

```
(opl:Bind-Oplevel-Menu 'word-level 'word-oplevel-menu)
```

The command Oplevel-Menu is a bindable generic command. It is usually bound to the command Execute-Oplevel-Menu which executes the menu that is bound to the current operand level. It is possible to rebind Oplevel-Menu to a different command for a given operand level; this allows for a highly customizable environment, used at present only for experimental features in SIMPLE2.

7.5 Getting and Setting Options

Announce-Option-Variable	Not bound
Set-Global-Option-Variable	Help⇒This View⇒Set Option: Global
Set-View-Style-Option-Variable	Help⇒This View⇒Set Option: View Style
Set-View-Option-Variable	Help⇒This View⇒Set Option: View Only
Set-Buffer-Option-Variable	Not bound
Display-Option-Variables	Help⇒This View: Options

Display-Option-Documentation Not bound

Much of *Pan*'s behavior may be modified by setting options. The command Announce-Option-Variable is used to retrieve the value of an option in the current view. The command prompts for the name of the option and then announces its value in the message line.

The Set- commands listed above allow you to set the value of an option in the given scope while running *Pan*. They all prompt for the name of the option and then for its new value, which you must specify in a form acceptable to the COMMON LISP reader.

To set an option's default value to *value*, use the lisp form in your ".panrc" file

```
(setf (variable option-name scope) value)
```

In this case, *scope* must specify either `:view-style` or `:global`. For instance, the expression

```
(setf (variable Window-Close-With-Icon :global) nil)
```

sets the value of the option Window-Close-With-Icon to be `nil`. To set any option in a particular view-style, use the macro With-View-Style-Scope to specify the view-style (see below). A list of all of the view styles is in Appendix G.

Setting Font Maps

Since the Text-Window-Fontmap option is a scoped variable, the macro With-View-Style-Scope must be used to set the font for a particular view-style as described in Section 7.2. For example, the help view uses the view-style help-view-style; thus a new font map for the help view could be specified by the following code:

```
(With-View-Style-Scope (view-style help-view-style)
   (setf (variable Text-Window-Fontmap :view-style)
      '("-adobe-times-medium-i-*--12-*-*-*-*-*-*-*"
        "-adobe-new century schoolbook-medium-r-*--10-*-*-*-*-*-*-*"
        "-adobe-times-bold-r-*--12-*-*-*-*-*-*-*")))
```

The X tool XFONTSEL is useful for determining the exact font you are looking for and getting its full name.

Setting Color Maps

Text-Window-Fg-Colormap
Text-Window-Bg-Colormap
Panel-Bg-Color
Panel-Flag-Default-Fg-Color
Panel-Flags-Bg-Color
Panel-Logo-Fg-Color
Panel-Logo-Bg-Color

Panel-View-Logo-Fg-Color
Panel-View-Logo-Bg-Color

Colors are represented in *Pan* as dotted pairs of strings which represent color names, such as `("red"."black")`. The first color will be used on a color monitor if the option Window-Use-Color is set, otherwise the second color is used. Figure 5 on page 42 shows the uses and default values for the text colormaps in structure-based documents.

Each of the "Panel-" options has the value of a single pair of colors one of which is used for the appropriate area of the panel. You can set a color option by any of the methods you use to set other options. For example, this code would change the Panel-Flag-Default-Fg-Color to blue on color screens:

```
(setf (variable Panel-Flag-Default-Fg-Color :global) '("blue"."black"))
```

The Text-Window-Fg-Colormap is used for displaying colored or greyed text in textual views. The Text-Window-Bg-Colormap is used for displaying colored or greyed background highlight for text in textual views. Each of these two options is an indexed list of color pairs. When a region of text is highlighted or colored in *Pan*, it is assigned an index into the appropriate colormap and displayed with that color.

The X tool XCOL will give you a display of the colors that are available on your system.

7.6 Character Sets

Display-Char-Sets	Help⇒This View: `Character Sets`
Display-Char-Set-Documentation	Not bound

Set-Char-Set *char-set-name char-list [scope] [operation]*
Set-Char-Match *left-char right-char [scope] [operation]*

These are the normal help commands. Display-Char-Sets lists all of the character sets and their contents in the current view. Display-Char-Set-Documentation lists the character sets with a description and their default global values.

One particular character set, **match-characters**, contains all of the matched characters such as right and left braces. Whenever *Pan* looks for a balanced expression it tries to find the match for the character under the cursor.

The functions Set-Char-Set and Set-Char-Match are useful for creating character sets and altering the contents of existing character sets. Set-Char-Set allows you to add, delete, or shadow characters in a character set. Its format is:

`(Set-Char-Set` *char-set-name char-list [scope] [operation]*`)`

The *char-list* has the form of a COMMON LISP string of characters. The operation may be one of `:add`, `:delete`, or `:shadow`; it defaults to `:add`. For example, here is the lisp code to add the character "-" to the character set **word-characters**:

```
(Set-Char-Set 'word-characters '"-" )
```

Set-Char-Match allows you to add, delete, or shadow pairs of match characters to the match-character set. Its format is:

(Set-Char-Match *left-char right-char [scope] [operation]*)

For example, here is code to add the characters ">" and "<" to the match-characters set:

```
(Set-Char-Match #\< #\> )
```

7.7 Creating and Modifying Flags

Display-Flags
Window-Modify-Flag-Collection

Help⇒This View: Flags

A flag in *Pan* is implemented as an option which can be true or false (in COMMON LISP, `t` or `nil`) and an associated bitmap. The command **Display-Flags** displays all of the flags defined in the current view.

Flags may be added to or removed from any scope with the function Window-Modify-Flag-Collection. Its format is:

(Window-Modify-Flag-Collection *[scope]*
  [:add '(*add-flag-list*)*]*
  [:delete '(*delete-flag-list*)*]*
  [:shadow '(*shadow-flag-list*)*]*)

where *delete-flag-list* is a list of variables in the current collection of flags and *add-flag-list* is a list of flag descriptors of the form:

(variable
  [(on-bitmap [[on-background-color] on-foreground-color])
  [(off-bitmap [[off-background-color] off-foreground-color])]]

The bitmap variables both default to Panel-Flag-Default-Bitmap, the *on-foreground-color* defaults to Panel-Flag-Default-Fg-Color, and the background color variables both default to Panel-Flags-Bg-Color. The *off-foreground-color* defaults to Panel-Flag-Default-Fg-Color if the *off-bitmap* is set and Panel-Flags-Bg-Color if it is not.

All bitmaps and colors used in the descriptor must be defined as variables. For example, to create a new bitmap for the syntax error flag and assign colors and bitmaps for its on and off representations, variables representing all of these pieces of information would have to be defined and set in your "`.panrc`" file:

```
(setf (variable Syntax-Errors-Present-Bitmap :global)
   "~/syntax-error.12x12")


(Define-Option-Variable Error-On-Color '("red" .  "black")
   "The color to use for the error flags."
   :bindable-scopes :global)
(Define-Variable-Cache Error-On-Color
   'win-sys:color-compute-cache)


(Define-Option-Variable Error-Off-Color '("mediumseagreen" .  "black")
   "The color to use for the no error flag."
   :bindable-scopes :global)
(Define-Variable-Cache Error-Off-Color
   'win-sys:color-compute-cache)


(Define-Option-Variable No-Error-Bitmap "~/no-error.12x12"
   "The bitmap which represents the no error flag."
   :bindable-scopes :global)
(Define-Variable-Cache No-Error-Bitmap
   'win-sys:bitmap-compute-cache)
```

See Section 7.8 for more information on defining new options. Then the following code would be included in the appropriate auto-load files:

```
(win:Window-Modify-Flag-Collection :view
   :add
      '((otree:Syntax-Errors-Present?
         (Syntax-Errors-Present-Bitmap Error-On-Color)
         (No-Error-Bitmap Error-Off-Color))))
```

The X tool BITMAP is useful for designing flag bitmaps.

7.8 Lisp-Oriented Commands

Execute-Lisp	Esc Esc
Execute-Command	Esc x
Load-File	^X ^L
Load-From-Selection	Esc ^S
Load-From-Text-Stream	Esc ^X

These commands are mostly for the use of people extending *Pan*, although sometimes you'll want to use one to see what a command does. They are included here for completeness.

Execute-Lisp prompts for a COMMON LISP form to evaluate: the resulting value is printed on the message line. If you want to execute a bindable *Pan* command, there are two methods. The simplest is to invoke Execute-Command and respond to the prompt with the name of the command, e.g. Next-Character. Alternatively, one can invoke Execute-Lisp and respond to the prompt with the expression `(Next-Character)`. The parentheses are required in the latter case, since commands are implemented as COMMON LISP functions.

Load-File loads a file of COMMON LISP and *Pan* commands into the system. Load-From-Text-Stream loads the contents of the entire text stream in the current view and evaluates the COMMON LISP and *Pan* commands. Load-From-Selection loads and evaluates the COMMON LISP and *Pan* commands in the current text selection.

Defining Variables and Options

Define-Option-Variable *option [initial-value [documentation [:apropos] [:notifier]]]*
Define-Variable *variable [initial-value [documentation [:apropos] [:option] [:notifier]]]*

You can create variables and options simply by defining them as COMMON LISP variables in your "`.panrc`" file. The macro Define-Variable allows you to include documentation and apropos information, add notifiers, or make your variable into an option variable known to the help system. The macro Define-Option-Variable is the same as Define-Variable with `:option` set to `t`. As an example, here is COMMON LISP code to create the option variable Number-Of-Views-Created:

```
(Define-Option-Variable Number-Of-Views-Created 0
   "the number of views that have been created so far"
   :notifier #'view-num-notifier
   :bindable-scopes :global
   :initial 'nil)
```

Hooks and Notifiers

Display-Hooks	Not bound
Display-Hook-Documentation	Not bound
Display-Notifiers	Not bound

Define-Hook-Function *hook scope function [arguments] body*
Define-Hook *hook hookable-scopes arguments [documentation] [:apropos]*
Perform-Hook *hook arguments*

add-variable-notifier *variable notifier*

If you really want to dig into *Pan*'s internals and change things significantly, you may be interested in using hooks and notifiers. This is for ambitious users only!

A **notifier** is a function which is called every time the value of a given variable is changed. Most *Pan* variables and options have notifiers. You can add a notifier to a variable with the function add-variable-notifier or you can list the notifier when you declare the variable. Here is COMMON LISP code for a notifier to display the value of the variable in your console window (note that this notifier was listed in the variable definition):

```
(defun view-num-notifier ( foo scope-kind bound new old )
   ( declare ( ignore scope-kind bound old ))
   ( format t "~A is ~A.~%"
     foo new))
```

A **hook** is a place within a function where you can insert new code. The Define-Hook-Function macro allows you to add code at an existing hook. Here is an example of a function to increment the option Number-Of-Views-Created (defined above) attached to the hook `%view-construction-hook%` which is called immediately after a view is created:

```
(Define-Hook-Function bufview:%view-construction-hook%
   :global
   add-to-view-num
   ()
   ( incf ( variable Number-Of-Views-Created :global)))
```

8 Acknowledgments

Pan is the work of many people. Professor Susan Graham has directed the project since its inception. Robert Ballance was the original architect and continued with the project until completing his Ph.D. Michael Van De Vanter joined the project in its early stages and has a been a principal member of the project through the present. Christina Black, Jacob Butcher, Bruce Forstall, Mark Hastings, Darrin Lane, Bill Maddox, Ethan Munson, Tim Wagner, and Robert Wahbe have all made substantial contributions. Finally, we wish to acknowledge the community of "editor people" with whom we have interacted over the past several years. Many of their best ideas appear somewhere within *Pan*.

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9 Glossary

Active View The view that owns the active window.

Active Window The active window is the window in which the most recent keystroke or mouse action occurred, although the active window may change as the result of a command, for example Visit-File.

Apropos A Help command for browsing documentation gathered during definition of *Pan*'s commands, flags, and options For instance. (`Apropos "Cursor"`) lists all of the commands dealing with the cursor.

Auto Load The Auto-Load command instructs *Pan* to ensure that a specified file has been loaded whenever a view is created onto a file whose name matches a specified UNIX file expression.

Auto Exec The command Auto-Exec instructs *Pan* to execute a specified *function* whenever creating a view having a name that matches a specified pattern.

Backup A copy of the file being visited that records the state of the file before any changes are made using *Pan*. You may visit the backup of a file with the command Visit-Backup. You may restore a view of a file to its backed-up state with the command Revert-Object-To-Backup.

Binding An association between an event (key-sequence, mouse action, menu selection) and a *Pan* command, used by *Pan*'s command dispatcher to determine the appropriate response to each user event. Every binding is made at a *scope*: global, for a specified *view style*, or for a specific view instance.

Character Set A named set of ASCII characters, scoped as with all other *Pan* bindings. Character sets are used to define simple structural attributes of ordinary text: words, white-space, matching brackets, and the like.

Checkpoint A copy of a file being visited that records an intermediate, modified state of the file. *Pan* makes a checkpoint periodically as the text in a view is modified; each checkpoint replaces the previous one. You may visit separately the most recent checkpoint of a file with the command Visit-Checkpoint. You may restore a view of a file to its most recently checkpointed state with the command Revert-Object-To-Checkpoint.

Clipboard A ring, shared by all views, that contains one or more regions of text. The clipboard supports copy, cut, and paste among views, or between *Pan* and other processes.

Command An operation that may be invoked directly by users through bindings to keystroke sequences and menus. *Pan* commands are defined using Define-Command. They are implemented as and may also be called as COMMON LISP functions.

Current Operand Level See *Operand Level.*

Cut Remove a region of text from the active text stream and push it onto the clipboard.

Cycle Make the current top item in a ring become the oldest item, moving all other values up—the second youngest becoming the new top item.

Default Font The first element in the font list specified by option Text-Window-Fontmap. When any other slot in a map is unspecified, the default font is used.

Delete Remove a region of text from the active text stream, keeping no copies other than possibly in undo history.

Deselect Ensure that there is no selection in the active view, without affecting the view's contents.

Directory Editor A *Pan* view style for browsing and operating upon UNIX file system directories.

Dot An anachronistic internal name for *Pan*'s text cursor. The function Dot returns the integer offset (in characters, zero-based) of the text cursor from the beginning of the file.

Edit Object Whatever can be displayed and possibly manipulated by a *Pan* view, closely related to the *Emacs* notion of "buffer." A *Pan* session instantiates an edit object for each text file, program or directory being viewed; each edit object comprises a copy of the data being edited, one or more views, and other information.

Edit Window That area of a *Pan* window in which part of the object being edited is displayed to the user.

Expression A balanced bracket expression is a string of characters enclosed within matched left and right braces, brackets, parentheses, or other matched characters, and which may contain nested pairs of balanced match characters. Character set declarations specify which characters are to be treated as matching characters.

Fill Rearrange lines of text so that all are of approximately the same length, as controlled by option Text-Line-Length.

Flag A *Pan* variable that has been configured specially in some scope so that its (boolean) value appears on the information panel of all windows in that scope. At the flag's panel location will appear one specified graphical appearance when the variable's (scoped) value is on (non-`nil`) and another specified graphical appearance when the variable's value is off (`nil`).

Font Map A zero-indexed list of font names, containing from 1 to 8 names, that specifies how font codes stored in *Pan*'s internal text representation are to be interpreted during display operations.

Frame The outer surrounding edge of a window that responds to X window protocols.

Generic Operation A *Pan* command, such as **Cursor-Forward** or **Delete**, whose behavior is determined dynamically by dispatch on the current operand level of the active window and by operand bindings.

Global Image A small inset within a *Pan* graphical window that summarizes the entire graph being viewed, regardless of zoom and scroll state. It also marks specially that portion of the entire graph that is visible in the rest of the window. The global image can be resized by the user and can be toggled on or off.

Graphical View A *Pan* view that displays information in terms of boxes (possibly containing text) and lines that connect them.

Help View A special *Pan* view used for displaying help information.

Hook A place within *Pan*'s thread of control where new code can be inserted conveniently. The **Define-Hook** creates a hook, **Define-Hook-Function** adds code to the hook, and **Perform-Hook** executes the hook's code.

Implicit Selection The text region between the text cursor and the top mark of the mark stack. This is distinct from and secondary to the visible selection in each view.

Information Panel The upper portion of every *Pan* window, which contains information about the current view, such as the language, the operand level, and displayed flags.

Internal Tree *Pan*'s internal representation for programs and other language-structured objects. It is generated by the syntactic analyzer (parser) from the lexical stream. The details are generally hidden from users and are revealed only through the operand level mechanisms.

Key Binding An association between a sequence of keyboard (or mouse button) events and a *Pan* command, used by *Pan*'s command dispatcher to determine the appropriate response to each user event. In some cases (prefix keys) the response may be to wait for another keyboard event. Every key binding is made at a *scope*: global, for a specified *view style*, or for a specific view instance.

Kill Remove a region of text from the active text stream and push it onto the active view's kill ring (or to the clipboard, depending on option **Kills-To-Clipboard**).

Kill Ring A ring, local to each view, that contains one or more regions of text. The kill ring supports copy, cut, and paste within a single textual view.

Load Read into *Pan*'s execution image a collection of COMMON LISP and *Pan* commands, executing top level forms.

Lexeme The smallest unit known to the syntactic analyzer. Lexemes include variable names, arithmetic and assignment operators, and keywords.

Lexical Analysis The process of reading a text stream and constructing an appropriate stream of lexemes, according to an underlying language description. Lexical analysis in *Pan* is incremental, only making changes to the lexical stream where needed because of changes to the text stream since the previous analysis.

Mark A character position in a text stream that is guaranteed to remain in the stream, even when an underlying character is deleted (in which case the mark is moved rightward). A mark is attached to a character, not an offset, so deletions before a mark do not affect the character to which a mark refers.

Mark Stack Each *Pan* text stream provides for a stack of marks, the top element of which is known as simply "the mark". These values may be popped and pushed as in any stack.

Menu Binding An association between a menu or submenu title and a *Pan* command, used by *Pan*'s command dispatcher to determine the appropriate response to each menu operation by the user. Every key binding is made at a *scope*: global, for a specified *view style*, or for a specific view instance.

Message Line The lowermost part of the information panel in each *Pan* window, used to display a single line of text containing various information: incomplete key sequences, information about time consuming operations being performed, and the output of some commands.

Minor Mode A collection of bindings that may be added to particular view instances, providing a slight variation on one of *Pan*'s established view styles.

Mouse Icon A graphical token that shows the location of the mouse on the workstation screen. The mouse icon is normally an arrow when the mouse is positioned within a *Pan* window, as specified by option Window-Default-Mouse-Icon. Different mouse icons appear when *Pan* is busy working (not responding to user events) or to suggest a different function for the mouse in a region.

Node A structural component of *Pan*'s internal tree representation, used to represent a meaningful part of a program or other structured document.

Notifier A function that may be associated with a *Pan* variable, using either the *Lisp*:notifier keyword with Define-Variable and Define-Option-Variable or the function *Lisp*add-variable-notifier. Whenever the value of a *Pan* variable in a particular scope changes, all associated notifiers are called with information about the old and new values.

Numeric Prefix An optional (default 1) integer argument to each *Pan* command invocation, supplied by special sequences of prefix keyboard events. Not all commands use the numeric prefix, and some check only for its existence and not its value.

Operand Level An element of *Pan* window state, always visible in the panel, which modulates the behavior of certain generic (or *level-sensitive*) operations like Cursor-Forward or Delete. The current level is selected by the user, from among those specified by option Operand-Level-Choices, using either the panel menu or by invoking level-specific commands such as Set-Oplevel-To-Character, and Set-Oplevel-To-Declaration.

Operand Level Binding A three-way association of an operand level (for example Character *at level* ")", a generic (or level-sensitive) operation (for example Cursor-Forward), and a *Pan* command (for example Next-Character). These bindings are used by *Pan*'s command dispatcher to determine the appropriate response to each user invocation of a generic command. Every binding is made at a *scope*: global, for a specified *view style*, or for a specific view instance.

Operand Level Menu A menu associated with a particular operand level; the command Oplevel-Menu by default presents the user with the menu appropriate to the current level. These menus normally display all of the operand level bindings for the generic commands at the given level.

Option A user-definable, user-modifiable, typed *Pan* variable. Every value is assigned at a *scope*: global, for a specified *view style*, or for a specific view instance. Many of the customizations available to a user are provide via predefined options. Option values may be made visible in *Pan*'s windows; see *flags*. Options may be made "active values" by the addition of *notifiers*.

Parsing See *syntactic analysis*.

Paste Copy a region of text from the top of the clipboard into the current text stream.

Pop-Up Window A small window which appears on the screen to accept a textual argument to a command or to obtain a response to a question.

Prefix Keys Keyboard events that are not bound to a command but which form prefixes to sequences which are bound. Any key may be a prefix in *Pan*; the keys "Escape", "^X", "^C", and "^Z" are used as prefix keys for in *Pan*'s default key bindings.

Protected The contents of a file, directory, or other editable object which is protected may not be altered.

Region A contiguous sequence of characters in a *Pan* text stream. Most text operations involve regions either as source, destination, or both.

Replace 1. A "Replace-" command searches for instances of a given pattern and replaces them with a given string. 2. A region of text may be replaced by another region of text from the kill ring or clipboard.

Ring A circular bounded stack. Adding an item to a ring pushes the other items just like a bounded stack. The oldest value in the stack may be discarded to preserve the boundedness. Rings can also be cycled.

Scope The scope of an option or binding determines the set of *Pan* views in which the option or binding is effective. Normal configurations occur in one of three scopes: global, for a specified *view style*, or for a specific view instance.

Scroll Bars The scroll bars are found on the borders of a *Pan* window and allow you to scroll the window with the mouse.

Scrolling Scrolling a window moves the region of the view which is currently visible in the window vertically or horizontally.

Search *Pan* provides commands which search for strings that match specified regular expressions.

Selection A specially designated region in textual views, distinguished by underlining in all text windows. There is at most one selection per view.

Semantic Analysis The process of analyzing a program and its associated database of derived information, according to the *Colander* portion of an underlying language description. Results of semantic analysis include facts asserted in the database and diagnosis of program components at which *Colander* constraints (typically including, but not limited to, the static semantics of the language) are not satisfied. Semantic analysis in *Pan* is incremental, only making changes to the database where needed because of changes to the internal tree since the previous analysis. The Database-Updated? is on in a view if and only if semantic analysis has been performed since the most recent textual or database change.

Shadow When you shadow a binding in a given scope, it effectively removes any binding inherited from an enclosing scope if any such binding exists.

Structural Cursor A reference to some component in the internal tree representation of a structured object, shared by all views on that object.

Syntactic Analysis The process of reading a lexical stream and constructing an appropriate internal tree, according to an underlying language description (also known as parsing). Syntactic analysis in *Pan* is incremental, only making changes to the internal tree where needed because of changes to the lexical stream since the previous analysis. The flag Parse-Is-Current? is on in a view if and only if lexical and syntactic analysis have been performed since the most recent textual change.

Text Cursor The location where alterations to a text stream can occur, displayed as an inverted box in all text windows. Characters are inserted or deleted at the character position to the left of the character designated by the cursor.

Undo Return the state of an edit object to a state it was in before a recent modification.

Unsatisfied Constraints Contextual constraints from the *Colander* description of the underlying language which are not met in the program.

View A view is a format for viewing an object. Any object may have several views. For example, a program may have a text view, a tree view, a subtree view, and a database view. A view may have more than one window. Each view has associated state information which is shared by all windows on that view.

View List A *Pan* view style for browsing and operating on the list of all view instances in a *Pan* session. Quitting the view list terminates *Pan*.

View-Style A configurable editing context. *Pan* has several different view-styles and every view must belong so some view-style.

Window The equivalent of a window in *Emacs*, a window displays a view. Each text window has its own text cursor but all other state is shared by other windows on the same view.

Yank Copy a region of text from the top of the kill ring into the current text stream.

A Default Key Bindings

A.1 Bindings by Command Name in a Text View

Announce-Text-Cursor-Info	`^X =`
Backward-Expr	`Esc ^B`
Backward-Vscroll-Current-Window	`Esc V`
Backward-Vscroll-Current-Window	`Esc v`
Capitalize-Selection	`Esc ^C`
Capitalize-Word	`Esc C`
Capitalize-Word	`Esc c`
Close-Current-Window	`^X 0`
Copy-Selection-As-Kill	`Esc W`
Copy-Selection-As-Kill	`Esc w`
Copy-Selection-To-Cursor	`Esc ^Y`
Copy-To-Clipboard	`L6`
Cursor-To-Mouse	`Mouse-Left`
Cut-To-Clipboard	`L10`
Cycle-Paste	`Esc L8`
Cycle-Show-Clipboard	`Esc !`
Cycle-Show-Kill	`^X !`
Cycle-Yank	`Esc Y`
Cycle-Yank	`Esc y`
Delete-Blank-Lines	`^X ^O`
Delete-Character	`^D`
Delete-Horizontal-Space	`Esc \`
Delete-Indentation	`Esc ^`
Delete-Previous-Character	`Backspace`
Delete-Previous-Character	`Delete`
Deselect-Region	`Esc ^D`
Display-Objects	`^X ^B`
Editor-Error	`Esc ^G`
Editor-Error	`^C ^G`
Editor-Error	`^C Cancel`
Editor-Error	`^G`
Editor-Error	`^X ^G`
Editor-Error	`^X Cancel`
Editor-Error	`^Z ^G`
Editor-Error	`^Z Cancel`
Editor-Error	`Cancel`
Editor-Error	`Esc Cancel`
Execute-Command	`Esc X`
Execute-Command	`Esc x`
Execute-Lisp	`Esc Esc`
Execute-Menu	`Mouse-Right`
Exit-Editor	`^X ^C`
First-Non-Blank	`Esc M`
First-Non-Blank	`Esc m`
Forward-Expr	`Esc ^F`
Forward-Vscroll-Current-Window	`^V`
Goto-Line	`^X L`
Goto-Line	`^X l`
Indent-Like-Previous-Line	`Esc Tab`
Insert-File	`^X ^I`
Insert-Newline-Fill	`Return`
Insert-Parentheses	`Esc (`
Insert-Space-Fill	`Space`
Interrupt-Editor	`^X ^Z`
Just-One-Space	`Esc Space`
Kill-Expr	`Esc ^K`
Kill-Previous-Word	`Esc Delete`
Kill-Selected-Region	`^W`
Kill-To-Eol	`^K`
Kill-Word	`Esc D`
Kill-Word	`Esc d`
Left-Hscroll-Current-Window	`^X <`
Load-File	`^X ^L`
Load-From-Selection	`Esc ^S`
Load-From-Text-Stream	`Esc ^X`
Lowercase-Selection	`Esc ^L`
Lowercase-Word	`Esc L`
Lowercase-Word	`Esc l`
Mouse-Extend-Selection-Fullword	`Esc Mouse-Middle`
Mouse-Select-Fullword	`Esc Mouse-Left`
Move-Selection-To-Cursor	`Esc Return`
Move-To-Bol	`^A`
Move-To-Bos	`Esc <`
Move-To-Eol	`^E`
Move-To-Eos	`Esc >`
Newline-And-Indent	`Newline`
Next-Character	`^F`
Next-Line	`^N`
Next-Message-Current-Window	`Esc N`
Next-Message-Current-Window	`Esc n`
Next-Word	`Esc F`
Next-Word	`Esc f`
Open-Another-Window-In-View	`^X 2`
Open-Line	`^O`
Oplevel-Cursor-Backward	`Left-Arrow`
Oplevel-Cursor-Backward	`^C ^B`
Oplevel-Cursor-Backward	`Prior`
Oplevel-Cursor-Forward	`Right-Arrow`
Oplevel-Cursor-Forward	`^C ^F`
Oplevel-Cursor-Forward	`Next`
Oplevel-Cursor-In	`^C ^I`
Oplevel-Cursor-In	`Down-Arrow`
Oplevel-Cursor-Out	`^C ^O`
Oplevel-Cursor-Out	`Up-Arrow`
Oplevel-Cursor-Search-Backward	`^C ^R`
Oplevel-Cursor-Search-Forward	`^C ^S`
Oplevel-Cursor-Search-Forward	`Find`

Oplevel-Cursor-Search-Forward	`L9`
Oplevel-Cursor-To-First	`^C Esc <`
Oplevel-Cursor-To-First	`^C <`
Oplevel-Cursor-To-First	`Begin`
Oplevel-Cursor-To-Last	`^C Esc >`
Oplevel-Cursor-To-Last	`^C >`
Oplevel-Cursor-To-Last	`End`
Oplevel-Cursor-To-Mouse	`Control-Mouse-Left`
Oplevel-Cursor-To-Mouse	`Shift-Mouse-Left`
Oplevel-Cursor-To-Mouse	`^C Mouse-Left`
Oplevel-Delete	`^C ^D`
Oplevel-Menu	`Control-Mouse-Right`
Oplevel-Menu	`Shift-Mouse-Right`
Oplevel-Menu	`^C Mouse-Right`
Oplevel-Mouse-Extend	`Control-Mouse-Middle`
Oplevel-Mouse-Extend	`Shift-Mouse-Middle`
Oplevel-Mouse-Extend	`^C Mouse-Middle`
Oplevel-Query-Replace-All	`^C Esc ^R`
Oplevel-Replace-All	`^C Esc R`
Oplevel-Replace-All	`^C Esc r`
Oplevel-Select	`^C Backspace`
Paste-From-Clipboard	`L8`
Prefix	`^U`
Preserve-All-Objects	`^X Return`
Prev-Message-Current-Window	`Esc P`
Prev-Message-Current-Window	`Esc p`
Previous-Character	`^B`
Previous-Line	`^P`
Previous-Word	`Esc B`
Previous-Word	`Esc b`
Protected-Visit-File	`^X ^R`
Query-Replace-All	`Esc ^R`
Quote-Character	`^Q`
Re-Search-Backward	`^R`
Re-Search-Forward	`^S`
Redo	`^X R`
Redo	`^X r`
Redraw-Current-Window	`^L`
Remove-View	`^X K`
Remove-View	`^X k`
Replace-All	`Esc R`
Replace-All	`Esc r`
Revert-Object	`^X Backspace`
Right-Hscroll-Current-Window	`^X >`
Save-Object-Copy-As	`^X ^W`
Save-Object	`^X ^S`
Select-Expr	`Esc ^@`
Select-Region-Dot-To-Mark	`Esc ^W`
Select-Region-Dot-To-Mouse	`Mouse-Middle`
Select-Text-Stream	`^X H`
Select-Text-Stream	`^X h`
Select-Word	`Esc @`
Self-Insert	`!to~`
Self-Insert	`Tab`
Set-Mark	`^@`
Set-Oplevel-To-Character	`^C c`
Set-Oplevel-To-Line	`^C l`
Set-Oplevel-To-Word	`^C w`
Set-Text-Fill-Prefix	`^X .`
Set-Text-Line-Length	`^X F`
Set-Text-Line-Length	`^X f`
Show-Clipboard	`Esc ?`
Show-Kill	`^X ?`
Show-Match	`Esc %`
Split-Line	`Esc ^O`
Swap-Dot-And-Mark	`^X ^X`
Text-Fill-To-Blank-Line	`Esc Q`
Text-Fill-To-Blank-Line	`Esc q`
Toggle-Object-Protection	`^X ^Q`
Toggle-Text-Fill	`^X ^A`
Transpose-Characters	`^T`
Transpose-Lines	`^X ^T`
Undo	`L4`
Undo	`^X U`
Undo	`^X u`
Uppercase-Selection	`Esc ^U`
Uppercase-Word	`Esc U`
Uppercase-Word	`Esc u`
Visit-Directory	`^X D`
Visit-Directory	`^X ^D`
Visit-Directory	`^X d`
Visit-File	`^X ^F`
Visit-Help-View	`Help`
Visit-Symbol-Definition	`Esc .`
Visit-View	`^X B`
Visit-View	`^X b`
Visit-View-List	`Home`
Visit-View-List	`R7`
Yank-From-Kill-Ring	`^Y`

A.2 Bindings by Key in a Text View

`^@`	Set-Mark
`^A`	Move-To-Bol
`^B`	Previous-Character
`^C ^B`	Oplevel-Cursor-Backward
`^C ^D`	Oplevel-Delete
`^C ^F`	Oplevel-Cursor-Forward
`^C ^G`	Editor-Error
`^C Backspace`	Oplevel-Select
`^C ^I`	Oplevel-Cursor-In
`^C ^O`	Oplevel-Cursor-Out
`^C ^R`	Oplevel-Cursor-Search-Backward
`^C ^S`	Oplevel-Cursor-Search-Forward
`^C Esc ^R`	Oplevel-Query-Replace-All
`^C Esc <`	Oplevel-Cursor-To-First
`^C Esc >`	Oplevel-Cursor-To-Last
`^C Esc R`	Oplevel-Replace-All
`^C Esc r`	Oplevel-Replace-All
`^C <`	Oplevel-Cursor-To-First
`^C >`	Oplevel-Cursor-To-Last
`^C c`	Set-Oplevel-To-Character
`^C l`	Set-Oplevel-To-Line
`^C w`	Set-Oplevel-To-Word
`^C Mouse-Left`	Oplevel-Cursor-To-Mouse
`^C Mouse-Middle`	Oplevel-Mouse-Extend
`^C Mouse-Right`	Oplevel-Menu
`^C Cancel`	Editor-Error
`^D`	Delete-Character
`^E`	Move-To-Eol
`^F`	Next-Character
`^G`	Editor-Error
`Backspace`	Delete-Previous-Character
`Tab`	Self-Insert
`Newline`	Newline-And-Indent
`^K`	Kill-To-Eol
`^L`	Redraw-Current-Window
`Return`	Insert-Newline-Fill
`^N`	Next-Line
`^O`	Open-Line
`^P`	Previous-Line
`^Q`	Quote-Character
`^R`	Re-Search-Backward
`^S`	Re-Search-Forward
`^T`	Transpose-Characters
`^U`	Prefix
`^V`	Forward-Vscroll-Current-Window
`^W`	Kill-Selected-Region
`^X ^A`	Toggle-Text-Fill
`^X ^B`	Display-Objects
`^X ^C`	Exit-Editor
`^X ^D`	Visit-Directory
`^X ^F`	Visit-File
`^X ^G`	Editor-Error
`^X Backspace`	Revert-Object
`^X ^I`	Insert-File
`^X ^L`	Load-File
`^X Return`	Preserve-All-Objects
`^X ^O`	Delete-Blank-Lines
`^X ^Q`	Toggle-Object-Protection
`^X ^R`	Protected-Visit-File
`^X ^S`	Save-Object
`^X ^T`	Transpose-Lines
`^X ^W`	Save-Object-Copy-As
`^X ^X`	Swap-Dot-And-Mark
`^X ^Z`	Interrupt-Editor
`^X !`	Cycle-Show-Kill
`^X .`	Set-Text-Fill-Prefix
`^X 0`	Close-Current-Window
`^X 2`	Open-Another-Window-In-View
`^X <`	Left-Hscroll-Current-Window
`^X =`	Announce-Text-Cursor-Info
`^X >`	Right-Hscroll-Current-Window
`^X ?`	Show-Kill
`^X B`	Visit-View
`^X D`	Visit-Directory
`^X F`	Set-Text-Line-Length
`^X H`	Select-Text-Stream
`^X K`	Remove-View
`^X L`	Goto-Line
`^X R`	Redo
`^X U`	Undo
`^X b`	Visit-View
`^X d`	Visit-Directory
`^X f`	Set-Text-Line-Length
`^X h`	Select-Text-Stream
`^X k`	Remove-View
`^X l`	Goto-Line
`^X r`	Redo
`^X u`	Undo
`^X Cancel`	Editor-Error
`^Y`	Yank-From-Kill-Ring
`^Z ^G`	Editor-Error
`^Z Cancel`	Editor-Error
`Esc ^@`	Select-Expr
`Esc ^B`	Backward-Expr
`Esc ^C`	Capitalize-Selection
`Esc ^D`	Deselect-Region
`Esc ^F`	Forward-Expr
`Esc ^G`	Editor-Error
`Esc Tab`	Indent-Like-Previous-Line
`Esc ^K`	Kill-Expr
`Esc ^L`	Lowercase-Selection
`Esc Return`	Move-Selection-To-Cursor
`Esc ^O`	Split-Line

Esc ^R	Query-Replace-All
Esc ^S	Load-From-Selection
Esc ^U	Uppercase-Selection
Esc ^W	Select-Region-Dot-To-Mark
Esc ^X	Load-From-Text-Stream
Esc ^Y	Copy-Selection-To-Cursor
Esc Esc	Execute-Lisp
Esc Space	Just-One-Space
Esc !	Cycle-Show-Clipboard
Esc %	Show-Match
Esc (	Insert-Parentheses
Esc .	Visit-Symbol-Definition
Esc <	Move-To-Bos
Esc >	Move-To-Eos
Esc ?	Show-Clipboard
Esc @	Select-Word
Esc B	Previous-Word
Esc C	Capitalize-Word
Esc D	Kill-Word
Esc F	Next-Word
Esc L	Lowercase-Word
Esc M	First-Non-Blank
Esc N	Next-Message-Current-Window
Esc P	Prev-Message-Current-Window
Esc Q	Text-Fill-To-Blank-Line
Esc R	Replace-All
Esc U	Uppercase-Word
Esc V	Backward-Vscroll-Current-Window
Esc W	Copy-Selection-As-Kill
Esc X	Execute-Command
Esc Y	Cycle-Yank
Esc \	Delete-Horizontal-Space
Esc ^	Delete-Indentation
Esc b	Previous-Word
Esc c	Capitalize-Word
Esc d	Kill-Word
Esc f	Next-Word
Esc l	Lowercase-Word
Esc m	First-Non-Blank
Esc n	Next-Message-Current-Window
Esc p	Prev-Message-Current-Window
Esc q	Text-Fill-To-Blank-Line
Esc r	Replace-All
Esc u	Uppercase-Word
Esc v	Backward-Vscroll-Current-Window
Esc w	Copy-Selection-As-Kill
Esc x	Execute-Command
Esc y	Cycle-Yank
Esc Delete	Kill-Previous-Word
Esc Mouse-Left	Mouse-Select-Fullword
Esc Mouse-Middle	Mouse-Extend-Selection-Fullword
Esc Cancel	Editor-Error

Esc L8	Cycle-Paste
Space	Insert-Space-Fill
!to~	Self-Insert
Delete	Delete-Previous-Character
Mouse-Left	Cursor-To-Mouse
Mouse-Middle	Select-Region-Dot-To-Mouse
Mouse-Right	Execute-Menu
Control-Mouse-Left	Oplevel-Cursor-To-Mouse
Control-Mouse-Middle	Oplevel-Mouse-Extend
Control-Mouse-Right	Oplevel-Menu
Shift-Mouse-Left	Oplevel-Cursor-To-Mouse
Shift-Mouse-Middle	Oplevel-Mouse-Extend
Shift-Mouse-Right	Oplevel-Menu
Home	Visit-View-List
Left-Arrow	Oplevel-Cursor-Backward
Up-Arrow	Oplevel-Cursor-Out
Right-Arrow	Oplevel-Cursor-Forward
Down-Arrow	Oplevel-Cursor-In
Prior	Oplevel-Cursor-Backward
Next	Oplevel-Cursor-Forward
End	Oplevel-Cursor-To-Last
Begin	Oplevel-Cursor-To-First
Find	Oplevel-Cursor-Search-Forward
Cancel	Editor-Error
Help	Visit-Help-View
L4	Undo
L6	Copy-To-Clipboard
L8	Paste-From-Clipboard
L9	Oplevel-Cursor-Search-Forward
L10	Cut-To-Clipboard
R7	Visit-View-List

A.3 Special Key Bindings in the View List

`^B`	Previous-Line-Select
`^F`	Next-Line-Select
`^N`	Next-Line-Select
`^P`	Previous-Line-Select
`f`	Visit-Selected-View
`x`	Remove-Selected-View
`Mouse-Left`	Mouse-Select-Full-Line
`Mouse-Middle`	Mouse-Select-Full-Line
`Left-Arrow`	Previous-Line-Select
`Up-Arrow`	Previous-Line-Select
`Right-Arrow`	Next-Line-Select
`Down-Arrow`	Next-Line-Select

A.4 Special Key Bindings in the Help View

`Mouse-Left`	Mouse-Select-Fullword
`Mouse-Middle`	Mouse-Extend-Selection-Fullword
`Left-Arrow`	Previous-Character
`Right-Arrow`	Next-Character

A.5 Special Key Bindings in a Directory Editor

`^B`	Previous-Line-Select
`^D`	Dired-Mark-Selection
`^F`	Next-Line-Select
`^N`	Next-Line-Select
`^P`	Previous-Line-Select
`^R`	Dired-Visit-Read-Only
`Escape Mouse-Left`	Mouse-Select-Full-Line
`Escape Mouse-Middle`	Mouse-Extend-Selection-Full-Line
`#`	Dired-Mark-Editor-Files
`D`	Dired-Mark-Selection
`F`	Dired-Visit
`G`	Revert-Object
`Q`	Remove-Object
`U`	Dired-Unmark-Selection
`X`	Dired-Delete-Files
`d`	Dired-Mark-Selection
`f`	Dired-Visit
`g`	Revert-Object
`q`	Remove-Object
`u`	Dired-Unmark-Selection
`x`	Dired-Delete-Files
`Mouse-Left`	Mouse-Select-Full-Line
`Mouse-Middle`	Mouse-Extend-Selection-Full-Line
`Left-Arrow`	Previous-Line-Select
`Up-Arrow`	Previous-Line-Select
`Right-Arrow`	Next-Line-Select
`Down-Arrow`	Next-Line-Select
`L10`	Dired-Mark-Selection

A.6 Special Key Bindings in a Language-Based View (SIMPLE2)

`^C ^X =`	Announce-Structure-Cursor-Info
`^C !`	Set-Oplevel-To-Syntactic-Error
`^C #`	Set-Oplevel-To-Semantic-Error
`^C =`	Announce-Structure-Cursor-Node-Name
`^C @`	Set-Oplevel-To-Simple2-Placeholder
`^C a`	Analyze-Changes
`^C d`	Set-Oplevel-To-Simple2-Declaration
`^C e`	Set-Oplevel-To-Simple2-Expression
`^C p`	Set-Oplevel-To-Simple2-Placeholder
`^C q`	Set-Oplevel-To-Query
`^C s`	Set-Oplevel-To-Simple2-Statement
`^C x`	Set-Oplevel-To-Lexeme
`Escape ^D`	Clear-Structure-Cursor

A.7 Special Key Bindings in a Graphical View

`a`	Zoom-Reset
`e`	Global-Image-Enlarge
`g`	Global-Image-Toggle
`i`	Zoom-In
`o`	Zoom-Out
`s`	Global-Image-Shrink

B Default Menu Bindings

B.1 Bindings in an Ordinary Text View by Command Name

Append-Selection-To-File	Text Edit⇒File: `Append Selection To...`
Apropos-String	Help: `Apropos`
Close-Current-Window	Window: `Close`
Copy-Selection-To-Cursor	Text Edit: `Copy To Cursor`
Copy-To-Clipboard	Clipboard: `Copy`
Cut-To-Clipboard	Clipboard: `Cut`
Cycle-Show-Clipboard	Clipboard: `Cycle and Show`
Display-All-Key-Bindings	Help⇒This View⇒Keys: `Display All`
Display-Auto-Exec	Help⇒Pan: `Filename Auto-Exec Map`
Display-Auto-Load	Help⇒Pan: `Filename Auto-Load Map`
Display-Bug-Report-Info	Help⇒Pan: `How To Report Bugs`
Display-Char-Sets	Help⇒This View: `Char. Sets`
Display-Commands	Help⇒Pan: `Commands Available`
Display-Default-Menu	Help⇒This View: `Default Menu`
Display-Flags	Help⇒This View: `Flags`
Display-Key-Bindings-For-Command	Help⇒This View⇒Keys: `Command - Key>`
Display-Key-Binding	Help⇒This View⇒Keys: `Key - Command>`
Display-Language-List	Help⇒Pan: `Language Descriptions Loaded`
Display-Objects	Help⇒Pan: `Objects Being Viewed`
Display-Operand-Command-Bindings	Help⇒This View⇒Operand Cmds.: `By Command`
Display-Operand-Level-Bindings	Help⇒This View⇒Operand Cmds.: `By Level`
Display-Operand-Level-Menus	Help⇒This View: `Operand Menus`
Display-Option-Variables	Help⇒This View: `Options`
Display-Version	Help⇒Pan: `Version`
Insert-File	Text Edit⇒File: `Insert Text From...`
Kill-Selected-Region	Text Edit: `Kill`
Move-Selection-To-Cursor	Text Edit: `Move To Cursor`
Open-Another-Window-In-View	Window: `Open Another`
Paste-From-Clipboard	Clipboard: `Paste`
Redo	Undo: `Redo`
Redraw-Current-Window	Window: `Redraw`
Remove-View	View: `Remove`
Revert-Object	Store: `Revert`
Save-Object-Copy-As	Store: `Save Copy As...`
Save-Object	Store: `Save`
Scroll-To-Cursor-Current-Window	Window: `Scroll to Cursor`
Set-Global-Option-Variable	Help⇒This View⇒Set Option: `Global`
Set-View-Option-Variable	Help⇒This View⇒Set Option: `View Only`
Set-View-Style-Option-Variable	Help⇒This View⇒Set Option: `View Style`
Show-Clipboard	Clipboard: `Show Contents`
Sub-Redo	Undo: `Sub-Redo`
Sub-Undo	Undo: `Sub-Undo`
Toggle-Object-Protection	Text Edit: `Toggle Protection`
Undo	Undo: `Undo`
Visit-File	Store: `Visit New...`
Write-Selection-To-File	Text Edit⇒File: `Write Selection To...`
Yank-From-Kill-Ring	Text Edit: `Yank`

B.2 Bindings in an Ordinary Text View by Menu

Clipboard: `Cut`	Cut-To-Clipboard
Clipboard: `Copy`	Copy-To-Clipboard
Clipboard: `Paste`	Paste-From-Clipboard
Clipboard: `Show Contents`	Show-Clipboard
Clipboard: `Cycle and Show`	Cycle-Show-Clipboard
Text Edit: `Kill`	Kill-Selected-Region
Text Edit: `Yank`	Yank-From-Kill-Ring
Text Edit: `Copy To Cursor`	Copy-Selection-To-Cursor
Text Edit: `Move To Cursor`	Move-Selection-To-Cursor
Text Edit: `File`	Insert-File
Insert Text From... Text Edit⇒File: `Write Selection To...`	Write-Selection-To-File
Text Edit⇒File: `Append Selection To...`	Append-Selection-To-File
Text Edit: `Toggle Protection`	Toggle-Object-Protection
Undo: `Undo`	Undo
Undo: `Redo`	Redo
Undo: `Sub-Undo`	Sub-Undo
Undo: `Sub-Redo`	Sub-Redo
Store: `Save`	Save-Object
Store: `Save Copy As...`	Save-Object-Copy-As
Store: `Revert`	Revert-Object
Store: `Visit New...`	Visit-File
View: `Remove`	Remove-View
Window: `Close`	Close-Current-Window
Window: `Open Another`	Open-Another-Window-In-View
Window: `Scroll to Cursor`	Scroll-To-Cursor-Current-Window
Window: `Redraw`	Redraw-Current-Window
Help⇒This View⇒Keys: `Display All`	Display-All-Key-Bindings
Help⇒This View⇒Keys: `Key - Command>`	Display-Key-Binding
Help⇒This View⇒Keys: `Command - Key>`	Display-Key-Bindings-For-Command
Help⇒This View: `Default Menu`	Display-Default-Menu
Help⇒This View⇒Operand Cmds.: `By Level`	Display-Operand-Level-Bindings
Help⇒This View⇒Operand Cmds.: `By Command`	Display-Operand-Command-Bindings
Help⇒This View: `Operand Menus`	Display-Operand-Level-Menus
Help⇒This View: `Options`	Display-Option-Variables
Help⇒This View⇒Set Option: `View Only`	Set-View-Option-Variable
Help⇒This View⇒Set Option: `View Style`	Set-View-Style-Option-Variable
Help⇒This View⇒Set Option: `Global`	Set-Global-Option-Variable
Help⇒This View: `Flags`	Display-Flags
Help⇒This View: `Char. Sets`	Display-Char-Sets
Help: `Apropos`	Apropos-String
Help⇒Pan: `Objects Being Viewed`	Display-Objects
Help⇒Pan: `Language Descriptions Loaded`	Display-Language-List
Help⇒Pan: `Commands Available`	Display-Commands
Help⇒Pan: `Filename Auto-Load Map`	Display-Auto-Load
Help⇒Pan: `Filename Auto-Exec Map`	Display-Auto-Exec
Help⇒Pan: `Version`	Display-Version
Help⇒Pan: `How To Report Bugs`	Display-Bug-Report-Info

B.3 Additional Menu Bindings in the View List

View List: `Visit View`	Visit-Selected-View
View List: `Remove View`	Remove-Selected-View
View List: `Visit New...`	Visit-File
View List: `New Scratch`	Scratch-View
View List: `Exit-Editor`	Quit

B.4 Additional Menu Bindings in the Help View

Help View: `Describe`	Document-Symbol
Help View: `Visit Definition`	Visit-Symbol-Definition
Help View: `Apropos`	Apropos-String
Help View: `Reset`	Reset-Help

B.5 Additional Menu Bindings in a Directory Editor

Dired: `Visit`	Dired-Visit
Dired: `Visit Read Only`	Dired-Visit-Read-Only
Dired: `Mark`	Dired-Mark-Selection
Dired: `Unmark`	Dired-Unmark-Selection
Dired: `Delete marked files`	Dired-Delete-Files
Dired: `Mark backup files`	Dired-Mark-Editor-Files
Dired: `Reread directory`	Revert-Object
Dired: `Undo`	Undo

B.6 Additional Menu Bindings in a Language-Based View (SIMPLE2)

Language: `Analyze`	Analyze-Changes
Variables: `Show Declaration and Uses`	Query-Simple2-Variable
Variables: `Goto Declaration`	Goto-Simple2-Variable-Declaration
Variables: `Rename Variable`	Rename-Simple2-Variable
View⇒Program Graph: `With Node Names`	Visit-Program-Graph-Name-View
View⇒Program Graph: `With Operators`	Visit-Program-Graph-Operator-View
View⇒Subgraph At Cursor: `With Node Names`	Visit-Program-Subgraph-Name-View
View⇒Subgraph At Cursor: `With Operators`	Visit-Program-Subgraph-Operator-View

B.7 Additional Menu Bindings in a Graphical View

Window: `Toggle Global Image`	Global-Image-Toggle
Window: `Enlarge Global Image`	Global-Image-Enlarge
Window: `Shrink Global Image`	Global-Image-Shrink
Window: `Zoom In`	Zoom-In
Window: `Zoom Out`	Zoom-Out
Window: `Zoom All`	Zoom-All

C Operand Level Bindings in a Language-Based View (SIMPLE2)

Level: "Character"	OPERAND LEVEL BINDINGS
Oplevel-Cursor-Backward:	Previous-Character
Oplevel-Cursor-Forward:	Next-Character
Oplevel-Cursor-In:	Next-Line
Oplevel-Cursor-Out:	Previous-Line
Oplevel-Cursor-Search-Backward:	Re-Search-Backward
Oplevel-Cursor-Search-Forward:	Re-Search-Forward
Oplevel-Cursor-To-First:	Move-To-Bos
Oplevel-Cursor-To-Last:	Move-To-Eos
Oplevel-Cursor-To-Mouse:	Cursor-To-Mouse
Oplevel-Delete:	Delete-Character
Oplevel-Menu:	Execute-Oplevel-Menu
Oplevel-Mouse-Extend:	Select-Region-Dot-To-Mouse
Oplevel-Query-Replace-All:	Query-Replace-All
Oplevel-Replace-All:	Replace-All
Oplevel-Select:	Deselect-Region

Level: "Word"	OPERAND LEVEL BINDINGS
Oplevel-Cursor-Backward:	Previous-Word
Oplevel-Cursor-Forward:	Next-Word
Oplevel-Cursor-In:	Next-Line
Oplevel-Cursor-Out:	Previous-Line
Oplevel-Cursor-To-First:	Move-To-First-Word
Oplevel-Cursor-To-Last:	Move-To-Last-Word
Oplevel-Cursor-To-Mouse:	Mouse-Select-Fullword
Oplevel-Delete:	Delete-Fullword
Oplevel-Menu:	Execute-Oplevel-Menu
Oplevel-Mouse-Extend:	Mouse-Extend-Oplevel-Text
Oplevel-Select:	Select-Fullword

Level: "Line"	OPERAND LEVEL BINDINGS
Oplevel-Cursor-Backward:	Previous-Line
Oplevel-Cursor-Forward:	Next-Line
Oplevel-Cursor-In:	Next-Line
Oplevel-Cursor-Out:	Previous-Line
Oplevel-Cursor-Search-Backward:	Re-Search-Backward
Oplevel-Cursor-Search-Forward:	Re-Search-Forward
Oplevel-Cursor-To-First:	Move-To-Bos
Oplevel-Cursor-To-Last:	Move-To-Last-Line
Oplevel-Cursor-To-Mouse:	Mouse-Select-Line
Oplevel-Delete:	Delete-Line
Oplevel-Menu:	Execute-Oplevel-Menu
Oplevel-Mouse-Extend:	Mouse-Extend-Selection-Full-Line
Oplevel-Query-Replace-All:	Query-Replace-All
Oplevel-Replace-All:	Replace-All
Oplevel-Select:	Select-Line

Level: "Lexeme"

	Operand Level Bindings
Oplevel-Cursor-Backward:	Prev-Lexeme
Oplevel-Cursor-Forward:	Next-Lexeme
Oplevel-Cursor-Search-Forward:	Lexeme-Search-Forward
Oplevel-Cursor-To-First:	First-Lexeme
Oplevel-Cursor-To-Last:	Last-Lexeme
Oplevel-Cursor-To-Mouse:	Mouse-Select-Lexeme
Oplevel-Delete:	Delete-Lexeme
Oplevel-Menu:	Execute-Oplevel-Menu
Oplevel-Mouse-Extend:	Mouse-Extend-Lexeme
Oplevel-Query-Replace-All:	Query-Replace-Lexemes
Oplevel-Replace-All:	Replace-Lexemes
Oplevel-Select:	Select-Lexeme

Level: "Expression"

	Operand Level Bindings
Oplevel-Cursor-Backward:	Prev-Oplevel-Node
Oplevel-Cursor-Forward:	Next-Oplevel-Node
Oplevel-Cursor-In:	In-Oplevel-Node
Oplevel-Cursor-Out:	Out-Oplevel-Node
Oplevel-Cursor-To-First:	First-Oplevel-Node
Oplevel-Cursor-To-Last:	Last-Oplevel-Node
Oplevel-Cursor-To-Mouse:	Mouse-Select-Oplevel-Node
Oplevel-Delete:	Delete-Oplevel-Node
Oplevel-Menu:	Execute-Oplevel-Menu
Oplevel-Mouse-Extend:	Mouse-Extend-Oplevel-Node
Oplevel-Select:	Select-Oplevel-Node

D Options Defined in *Pan*

Apropos-Documentation-Sub-Type-List OPTION
Type: `list`
Default Value: `(:option-variable :command :view-style)`
Scopes: `global`
If non-nil, the apropos commands list only symbols defined with a documentation sub-type in this list.

Arrow-Mouse-Icon OPTION
Type: `dotted pair of strings`
Default Value: `("left_ptr" . "left_ptr")`
Scopes: `view object view-style global`
Arrow mouse icon.

Auto-Show-Match OPTION
Type: `boolean`
Default Value: `t`
Scopes: `view object view-style global`
If T, insert of a right bracket shows matching left bracket.

Auto-Show-Match-Limit OPTION
Type: `integer`
Default Value: 2000
Scopes: `view object view-style global`
Bound on number of characters to scan when Auto-Show-Match is on.

Autowrap-Search OPTION
Type: `boolean`
Default Value: `t`
Scopes: `view object view-style global`
If T, search wraps around at Eos back to cursor; else to Eos only.

Backup-Object? OPTION
Type: `boolean`
Default Value: `t`
Scopes: `object global`
When true, the first time an object is saved, the original is backed up.

Case-Sensitive-Lexeme-Search OPTION
Type: `boolean`
Default Value: `nil`
Scopes: `view object view-style global`
When attempting to peform regular expression matching on lexemes, should comparisions be case sensitive?

Checkpoint-Modification-Interval OPTION
Type: `integer`
Default Value: 250
Scopes: `object global`
Checkpoint after this many modifications without saving or checkpointing.

Clipboard-Max-Size OPTION
Type: `integer`
Default Value: `8`
Scopes: `global`
Maximum number of clips in clipboard.

Default-Line-Style OPTION
Type: `list`
Default Value: `("line-solid" "line-solid")`
Scopes: `view object view-style global`
Default line style for objects displayed in graph window. Possible values are line-solid, line-on-off-dash or line-double-dash. All values are expressed as strings.

Demo OPTION
Type: `boolean`
Default Value: `nil`
Scopes: `global`
Controls special configuration modes suitable for demos.

Dired-Ls-Flags OPTION
Type: `string`
Default Value: `"-a"`
Scopes: `global`
String containing flags for /bin/ls command used in Directory Editor. The string must begin with the "-" prefix. The flag -l is supplied automatically, so need not be included. Any of the flags -acrFt may be used. Don't use any of the flags -dfgisR.

Editor-File-Search-List OPTION
Type: `list`
Default Value: `("." "~" "/usr/local/lib/pan/")`
Scopes: `global`
A list of directory names, specified as strings, to search when loading and requiring editor files. May include standard directory naming conventions like ".", "~", and "~user" where **user** must be a valid user name in the system. Used by Load-File, editor-load, and editor-require.

Editor-Files-Pattern OPTION
Type: `string`
Default Value: `".#Pan."`
Scopes: `global`
Regexp pattern matching files created by Editor for backup and checkpointing.

Fast-Draw-Color OPTION
Type: `dotted pair of strings`
Default Value: `("midnight blue" . "black")`
Scopes: `view object view-style global`
Color to use when fast drawing outlines.

Global-Image-Initial-Height OPTION
Type: `real`
Default Value: `0.2`
Scopes: `view object view-style global`
Initial height of global image as percentage of the graph window height.

Global-Image-Initial-On? OPTION
Type: `boolean`
Default Value: `t`
Scopes: `view object view-style global`
Determines whether global image is initially displayed.

Global-Image-Initial-Width OPTION
Type: `real`
Default Value: `0.2`
Scopes: `view object view-style global`
Initial width of global image as percentage of the graph window width.

Global-Image-Outline-Color OPTION
Type: `dotted pair of strings`
Default Value: `("forest green" . "black")`
Scopes: `view object view-style global`
Color to use for box around global image.

Graph-Window-Zoom-Factor OPTION
Type: `real`
Default Value: `0.1`
Scopes: `view object view-style global`
Multiplier for zooming operations.

Graphical-Tree-Hbox-Background-Color OPTION
Type: `dotted pair of strings`
Default Value: `("white" . "white")`
Scopes: `view object view-style global`
Background color for a horizontal box

Graphical-Tree-Hbox-Border-Color OPTION
Type: `dotted pair of strings`
Default Value: `("midnight blue" . "black")`
Scopes: `view object view-style global`
Line color for a horizontal box

Graphical-Tree-Hbox-Border-Style OPTION
Type: `dotted pair of strings`
Default Value: `("line-solid" . "line-solid")`
Scopes: `view object view-style global`
Line style for a horizontal box

Graphical-Tree-Hbox-Border-Thickness OPTION
Type: `integer`
Default Value: `3`
Scopes: `view object view-style global`
Line border for a horizontal box

Graphical-Tree-Hbox-Text-Color OPTION
Type: `dotted pair of strings`
Default Value: `("black" . "black")`
Scopes: `view object view-style global`
Text color for a horizontal box

Graphical-Tree-Horiz-Node-Spacing OPTION
Type: `integer`
Default Value: `15`
Scopes: `view object view-style global`
Horizontal spacing between parent and child nodes

Graphical-Tree-Line-Arrow-Filled? OPTION
Type: `integer`
Default Value: `1`
Scopes: `view object view-style global`
Directed edge arrow filled in?

Graphical-Tree-Line-Arrow-Length OPTION
Type: `integer`
Default Value: `6`
Scopes: `view object view-style global`
Directed edge arrow length

Graphical-Tree-Line-Arrow-Width OPTION
Type: `integer`
Default Value: `4`
Scopes: `view object view-style global`
Directed edge arrow width

Graphical-Tree-Line-Color OPTION
Type: `dotted pair of strings`
Default Value: `("midnight blue" . "black")`
Scopes: `view object view-style global`
Edge line color

Graphical-Tree-Line-Style OPTION
Type: `dotted pair of strings`
Default Value: `("line-solid" . "line-solid")`
Scopes: `view object view-style global`
Edge line style

Graphical-Tree-Line-Thickness OPTION
Type: **integer**
Default Value: 2
Scopes: **view object view-style global**
Edge line thickness

Graphical-Tree-Node-Border OPTION
Type: **integer**
Default Value: 4
Scopes: **view object view-style global**
Border ('whitespace') around a node

Graphical-Tree-Node-Type OPTION
Type: **integer**
Default Value: 0
Scopes: **view object view-style global**
Symbolic constant for the drawing figure for nodes

Help-View-At-Startup OPTION
Type: **boolean**
Default Value: **t**
Scopes: **global**
If non-nil, create an empty help view at startup.

Highlight-Query-Results OPTION
Type: **boolean**
Default Value: **t**
Scopes: **view object view-style global**
When t, visually highlight text associated with all components resulting from the most recent structural query.

Highlight-Semantic-Errors OPTION
Type: **boolean**
Default Value: **t**
Scopes: **view object view-style global**
When t, visually highlight the text associated with all components having unsatisfied semantic constraints.

Highlight-Structure-Cursor OPTION
Type: **boolean**
Default Value: **t**
Scopes: **view object view-style global**
When t, visually highlight text associated with the structure cursor's location.

Highlight-Syntax-Errors OPTION
Type: **boolean**
Default Value: **t**
Scopes: **view object view-style global**
When t, visually highlight the text associated with all components resulting from syntactic error recovery.

Indent-With-Tabs OPTION
Type: `boolean`
Default Value: `nil`
Scopes: `view object view-style global`
If T, use tabs when performing computed indentations; else just spaces.

Killring-Max-Size OPTION
Type: `integer`
Default Value: `16`
Scopes: `view object view-style global`
Maximum number of elements retained in kill-ring.

Kills-To-Clipboard OPTION
Type: `boolean`
Default Value: `nil`
Scopes: `view object view-style global`
If true, kill commands use the global clipboard instead of the local kill-ring.

Lisp-Mouse-Icon OPTION
Type: `dotted pair of strings`
Default Value: `("star" . "star")`
Scopes: `view object view-style global`
Lisp mouse icon.

Load-Verbose OPTION
Type: `boolean`
Default Value: `t`
Scopes: `global`
When non-nil, Load-File, editor-load, and editor-require write messages to standard output.

Modula2-Src-Dir OPTION
Type: `boolean`
Default Value: `nil`
Scopes: `global`
Directory containing source files for Modula2 standard modules. When present, semantic analysis imports information from them by visiting and analyzing imported modules.

Object-Modified? OPTION
Type: `boolean`
Default Value: `nil`
Scopes: `object`
True when the current object is modified.

Object-Protected? OPTION
Type: `boolean`
Default Value: `nil`
Scopes: `object`
True when the current object is protected.

Operand-Level-Choices OPTION
Type: `boolean`
Default Value: `nil`
Scopes: `view object view-style global`
A list of currently visible operand levels from which the user may select one to be "current". The default is the first in the list.

Package-Symbol-Names OPTION
Type: `boolean`
Default Value: `nil`
Scopes: `global`
If non-nil, help and other tools will attempt to print symbol names with their packages when that package is not user. Otherwise, tools will usually not print package names.

Panel-Bg-Color OPTION
Type: `dotted pair of strings`
Default Value: `("white" . "white")`
Scopes: `view object view-style global`
Background color for window's panel.

Panel-Flag-Default-Bitmap OPTION
Type: `string`
Default Value: `"asterisk.12x12"`
Scopes: `view object view-style global`
The default bitmap for panel flags. Assigning this variable does not affect current flags.

Panel-Flag-Default-Fg-Color OPTION
Type: `dotted pair of strings`
Default Value: `("black" . "black")`
Scopes: `view object view-style global`
The default foreground color for panel flags. Assigning this variable does not affect current flags.

Panel-Flags-Bg-Color OPTION
Type: `dotted pair of strings`
Default Value: `("white" . "white")`
Scopes: `view object view-style global`
Background color behind panel flags.

Panel-Logo-Bg-Color OPTION
Type: `dotted pair of strings`
Default Value: `("white" . "white")`
Scopes: `view object view-style global`
Background color for editor logo in panel.

Panel-Logo-Bitmap OPTION
Type: `string`
Default Value: `"pan-edit.31x22"`
Scopes: `view object view-style global`
Bitmap that specifies the editor logo; appears at left of every panel.

Panel-Logo-Fg-Color OPTION
Type: **dotted pair of strings**
Default Value: ("black" . "black")
Scopes: **view object view-style global**
Foreground color for editor logo in panel.

Panel-View-Logo-Bg-Color OPTION
Type: **dotted pair of strings**
Default Value: ("white" . "white")
Scopes: **view object view-style global**
Background color for view style logo in panel.

Panel-View-Logo-Bitmap OPTION
Type: **string**
Default Value: "graph-logo.32x32"
Scopes: **view object view-style global**
Bitmap that specifies the view style logo; appears at next to panel logo.

Panel-View-Logo-Fg-Color OPTION
Type: **dotted pair of strings**
Default Value: ("black" . "black")
Scopes: **view object view-style global**
Foreground color for view style logo in panel.

Pause-Ticks OPTION
Type: **integer**
Default Value: 50000
Scopes: **global**
Constant multiplier for Pause command.

Prefix-Arg-Multiplier OPTION
Type: **integer**
Default Value: 4
Scopes: **view object view-style global**
The multiplier value for prefix arguments.

Print-Stats-On-Termination OPTION
Type: **boolean**
Default Value: nil
Scopes: **global**
Print statistics information on termination of Pan.

Gc-Mouse-Icon OPTION
Type: **dotted pair of strings**
Default Value: ("box_spiral" . "box_spiral")
Scopes: **view object view-style global**
The mouse icon displayed during garbage collection.

Reticle-Outline-Color — OPTION
Type: `dotted pair of strings`
Default Value: `("dark orange" . "black")`
Scopes: `view object view-style global`
Color to use to show position of reticle.

Scratch-View-At-Startup — OPTION
Type: `boolean`
Default Value: `nil`
Scopes: `global`
If non-nil, create an empty scratch view at editor startup.

Text-Fill — OPTION
Type: `boolean`
Default Value: `nil`
Scopes: `view object view-style global`
Controls automatic line filling in text.

Text-Line-Length — OPTION
Type: `integer`
Default Value: `65`
Scopes: `view object view-style global`
Max line length for text filling.

Text-Window-Bg-Colormap — OPTION
Type: `dotted pair of strings`
Default Value: `(("white" . "white"))`
Scopes: `view object view-style global`
Non-empty list of color specifications for text rendering background shading, where each specification is a dotted pair of color names, the first to be used when performing color rendering, the second to be used when performing monochrome rendering. Slot positions specify colors for (0) background 1, (1) background 2, (2) backgrounds 1 and 2 together. Due to a text viewport implementation restriction, text with null background is always white. Unspecified slots default to the first.

Text-Window-Col-Popover — OPTION
Type: `integer`
Default Value: `16`
Scopes: `view object view-style global`
Minumum characters to move window when scrolling left/right.

Text-Window-Empty-Line-Char — OPTION
Type: `character`
Default Value: `#\.`
Scopes: `view object view-style global`
Character prefix for displaying empty lines in a text window.

Text-Window-Fg-Colormap OPTION
Type: **dotted pair of strings**
Default Value: (("black" . "black"))
Scopes: **view object view-style global**
Non-empty list of color specifications for text rendering ink colors, where each specification is a dotted pair of color names, the first to be used when performing color rendering, the second to be used when performing monochrome rendering. Slot positions specify ink colors 0 through 3. Unspecified slots default to the first.

Text-Window-Fontmap OPTION
Type: **list**
Default Value: ("fixed")
Scopes: **view object view-style global**
List of font specifications, where each font specification is either a single font name or a dotted pair of font names.

Text-Window-Init-Cols OPTION
Type: **integer**
Default Value: 78
Scopes: **view object view-style global**
Number of columns in a text window when created.

Text-Window-Init-Rows OPTION
Type: **integer**
Default Value: 30
Scopes: **view object view-style global**
Number of rows in a text window when created.

Text-Window-Proportional-Scroll OPTION
Type: **boolean**
Default Value: **t**
Scopes: **view object view-style global**
If T, vertical scroll moves proportional to distance between mouse and top of scrollbar, else fixed screenful at a time.

Text-Window-Row-Popup OPTION
Type: **integer**
Default Value: 4
Scopes: **view object view-style global**
Minimum number rows to move window when scrolling up/down.

Text-Window-Tabwidth OPTION
Type: **integer**
Default Value: 8
Scopes: **view object view-style global**
Number of characters to display for a tab character.

OPTION

Think-Mouse-Icon
Type: `dotted pair of strings`
Default Value: `("watch" . "watch")`
Scopes: `view object view-style global`
Think mouse icon.

OPTION

Undo-Size
Type: `integer`
Default Value: 20
Scopes: `object global`
The size of the undo history.

OPTION

Window-Alert-Style
Type:
Default Value: `:bell`
Scopes: `view object view-style global`
Style for alerting user. The only style currently supported is :bell.

OPTION

Window-Bg-Color
Type: `dotted pair of strings`
Default Value: `("alice blue" . "white")`
Scopes: `view object view-style global`
Default background color of window.

OPTION

Window-Close-With-Icon
Type: `boolean`
Default Value: `t`
Scopes: `view object view-style global`
Determines if an icon is created when the window is closed.

OPTION

Window-Default-Mouse-Icon
Type: `dotted pair of strings`
Default Value: `("left_ptr" . "left_ptr")`
Scopes: `view object view-style global`
Specifies the default mouse icon.

OPTION

Window-Icon-Name
Type: `string`
Default Value: `"Untitled"`
Scopes: `view object view-style global`
Title of icon representing the window.

OPTION

Window-Initial-Pixel-Height
Type: `integer`
Default Value: 500
Scopes: `view object view-style global`
Initial height, in pixels, of window.

Window-Initial-Pixel-Width OPTION
Type: `integer`
Default Value: 500
Scopes: `view object view-style global`
Initial width, in pixels, of window.

Window-Initial-X-Position OPTION
Type: `integer`
Default Value: 0
Scopes: `view object view-style global`
Initial X position of top left hand corner of window.

Window-Initial-Y-Position OPTION
Type: `integer`
Default Value: 0
Scopes: `view object view-style global`
Initial Y position of top left hand corner of window.

Window-Message-History-Size OPTION
Type: `integer`
Default Value: 32
Scopes: `view object view-style global`
The number of window messages saved for reviewing.

Window-Name OPTION
Type: `string`
Default Value: `"Untitled"`
Scopes: `view object view-style global`
Title of window.

Window-Use-Color OPTION
Type: `boolean`
Default Value: `t`
Scopes: `view object view-style global`
If operating on a color monitor, then setting Window-Use-Color to t specifies that Pan is to use color settings. If a monochrome monitor is being used, this option variable has no effect.

Zero-Index-Lines OPTION
Type: `boolean`
Default Value: `nil`
Scopes: `view object view-style global`
If T, arguments to Goto-Line are interpreted as 0-indexed, else 1-indexed.

E Flags Defined in *Pan*

Database-Updated? FLAG
Presentation: "D"
Behavior: `gray when cleared`
Maps: On: `D.12x12`
Off: `gray-D.12x12`
Set when semantics of tree have been analyzed and database updated.

Object-Modified? FLAG
Presentation: "⋆"
Behavior: `invisible when cleared`
Maps: On: `asterisk.12x12[firebrick]`
Off: *no map*
True when the current object is modified.

Object-Protected? FLAG
Presentation: "⊘"
Behavior: `invisible when cleared`
Maps: On: `read-only.12x12`
Off: *no map*
True when the current object is protected.

Parse-Is-Current? FLAG
Presentation: "⅄"
Behavior: `gray when cleared`
Maps: On: `tree.12x12`
Off: `gray-tree.12x12`
Set when language file has been parsed.

Semantic-Errors-Present? FLAG
Presentation: "#"
Behavior: `invisible when cleared`
Maps: On: `crosshatch.12x12`
Off: *no map*
Nil if there are no semantic errors, the number of unsatisfied constraints if there are.

Syntax-Errors-Present? FLAG
Presentation: "!"
Behavior: `invisible when cleared`
Maps: On: `exclamation-point.12x12`
Off: *no map*
Nil if there are no parse errors, the number of error nodes if there are.

Text-Fill FLAG
Presentation: "↩"
Behavior: `invisible when cleared`
Maps: On: `text-fill.12x12`
Off: *no map*
Controls automatic line filling in text.

F Character Sets in a Text View

filename-terminators CHARACTER SET
Elements: `(Tab)(Newline)(Space)\`
Characters that terminate filenames in output from "ls".

identifier-characters CHARACTER SET
Elements: `0123456789ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz`
Identifier characters.

indentation-characters CHARACTER SET
Elements: `(Tab)(Space)`
Indentation characters, a subset of whitespace-characters.

match-characters CHARACTER SET
Elements: `()[]{}`
The characters that are part of match pairs.

whitespace-characters CHARACTER SET
Elements: `(Tab)(Newline)(Space)`
Whitespace characters.

word-characters CHARACTER SET
Elements: `0123456789ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz`
Word characters.

G View-Styles

base-view-style — VIEW STYLE
The View List style.

database-view-style — VIEW STYLE
The Colander database view style.

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